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# I. Telephone Numbers

**Telephone Numbers**

Area Code 406. If dialing from an on-campus phone, "994" should be excluded.

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<thead>
<tr>
<th>Department</th>
<th>Address</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic Affairs</strong></td>
<td>212 Montana Hall</td>
<td>994-4371</td>
</tr>
<tr>
<td><strong>Administration and Finance</strong></td>
<td>201 Montana Hall</td>
<td>994-4361</td>
</tr>
<tr>
<td><strong>Admissions</strong></td>
<td>201 Strand Union Building</td>
<td>994-2452</td>
</tr>
<tr>
<td><strong>Agricultural Experiment station</strong></td>
<td>202 Linfield Hall</td>
<td>994-3681</td>
</tr>
<tr>
<td><strong>Agriculture, College of</strong></td>
<td>202 Linfield Hall</td>
<td>994-3681</td>
</tr>
<tr>
<td><strong>Alumni Relations</strong></td>
<td>Foundation/Alumni Center, 11th Ave. and Lincoln St.</td>
<td>994-2401</td>
</tr>
<tr>
<td><strong>Arts and Architecture, College of</strong></td>
<td>217 Cheever Hall</td>
<td>994-4405</td>
</tr>
<tr>
<td><strong>ASK US Information Center</strong></td>
<td>280A Strand Union Building</td>
<td>994-4636</td>
</tr>
<tr>
<td><strong>Allen Yarnell Center for Student Success</strong></td>
<td>177 Strand Union Building</td>
<td>994-7627</td>
</tr>
<tr>
<td><strong>ASMSU</strong></td>
<td>221 Strand Union Building</td>
<td>994-2933</td>
</tr>
<tr>
<td><strong>ASMSU Day Care Center</strong></td>
<td>1295 W. Garfield St.</td>
<td>994-4370</td>
</tr>
<tr>
<td><strong>Athletics</strong></td>
<td>145 Fieldhouse</td>
<td>994-4221</td>
</tr>
<tr>
<td><strong>Bookstore</strong></td>
<td>125 Strand Union Building</td>
<td>994-2811</td>
</tr>
<tr>
<td><strong>Business, College of</strong></td>
<td>Jabs Hall 302</td>
<td>994-4423</td>
</tr>
<tr>
<td><strong>Career, Internship &amp; Student Employment Services</strong></td>
<td>177 Strand Union Building</td>
<td>994-4353</td>
</tr>
<tr>
<td><strong>University Communications</strong></td>
<td>437 Culbertson Hall</td>
<td>994-4571</td>
</tr>
<tr>
<td><strong>Conference Services</strong></td>
<td>211 Strand Union Building</td>
<td>994-3081</td>
</tr>
<tr>
<td><strong>Counseling and Psychological Services</strong></td>
<td>211 Swingle Health Center</td>
<td>994-4531</td>
</tr>
<tr>
<td><strong>Dean of Students</strong></td>
<td>174 Strand Union Building</td>
<td>994-2826</td>
</tr>
<tr>
<td><strong>Disability, Re-entry, and Veteran’s Services</strong></td>
<td>180 Strand Union Building</td>
<td>994-2824</td>
</tr>
<tr>
<td><strong>Education, Health and Human Development, College of</strong></td>
<td>250 Reid Hall</td>
<td>994-4133</td>
</tr>
<tr>
<td><strong>Engineering, College of</strong></td>
<td>212 Roberts Hall</td>
<td>994-2272</td>
</tr>
<tr>
<td><strong>Extended University</strong></td>
<td>128 EPS Building</td>
<td>994-6550</td>
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<tr>
<td><strong>Extension Service</strong></td>
<td>203 Culbertson Hall</td>
<td>994-1750</td>
</tr>
<tr>
<td><strong>Facilities Services</strong></td>
<td>Physical Plant, S. 6th Ave. and Grant St.</td>
<td>994-2001</td>
</tr>
<tr>
<td><strong>Family Housing</strong></td>
<td>1502 W. Garfield St.</td>
<td>994-3730</td>
</tr>
<tr>
<td><strong>Financial Aid Services</strong></td>
<td>183 Strand Union Building</td>
<td>994-2845</td>
</tr>
<tr>
<td><strong>Foundation, MSU</strong></td>
<td>Foundation/Alumni Center, 11th Ave. and Lincoln St.</td>
<td>994-2053</td>
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<tr>
<td><strong>Fraternity/Sorority Life</strong></td>
<td>174 Strand Union Building</td>
<td>994-2826</td>
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<tr>
<td><strong>Gallatin College</strong></td>
<td>101 Hamilton Hall</td>
<td>994-5536</td>
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<tr>
<td><strong>Graduate School</strong></td>
<td>9 and 108 Montana Hall</td>
<td>994-4145</td>
</tr>
<tr>
<td><strong>Health Service</strong></td>
<td>121 Swingle Health Center</td>
<td>994-2311</td>
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<tr>
<td><strong>Honors College</strong></td>
<td>104 Quad F</td>
<td>994-4110</td>
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<tr>
<td><strong>Human Resources</strong></td>
<td>920 Technology Boulevard Suite A</td>
<td>994-3651</td>
</tr>
<tr>
<td><strong>University Information Technology</strong></td>
<td>49 Renne Library</td>
<td>994-3042</td>
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<tr>
<td><strong>International Programs</strong></td>
<td>400 Culbertson Hall</td>
<td>994-7150</td>
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<tr>
<td><strong>KGLT Radio</strong></td>
<td>376 Strand Union Building</td>
<td>994-3001</td>
</tr>
<tr>
<td><strong>KUSM Television</strong></td>
<td>183 Visual Communications Building</td>
<td>994-3437</td>
</tr>
<tr>
<td><strong>Letters and Science, College of Library, Renne</strong></td>
<td>2-205 Wilson Hall</td>
<td>994-4288</td>
</tr>
<tr>
<td><strong>Museum of the Rockies</strong></td>
<td>600 W. Kagy Blvd.</td>
<td>994-2251</td>
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<tr>
<td><strong>Native American Studies</strong></td>
<td>2-179 Wilson Hall</td>
<td>994-3881</td>
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<tr>
<td><strong>Nursing, College of</strong></td>
<td>115 Sherrick Hall</td>
<td>994-3783</td>
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<tr>
<td><strong>Office of Activities and Engagement</strong></td>
<td>222 Strand Union Building</td>
<td>994-6902</td>
</tr>
<tr>
<td><strong>Office of Financial Education</strong></td>
<td>177 Strand Union Building</td>
<td>994-4388</td>
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<tr>
<td><strong>Office of Institutional Equity</strong></td>
<td>118 Hamilton Hall</td>
<td>994-2042</td>
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<tr>
<td><strong>Orientation Office</strong></td>
<td>103 Strand Union Building</td>
<td>994-2827</td>
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<tr>
<td><strong>Outdoor Recreation Center</strong></td>
<td>1401 W. Lincoln St</td>
<td>994-3621</td>
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<tr>
<td><strong>Parent/Family Association</strong></td>
<td>174 Strand Union Building</td>
<td>994-3739</td>
</tr>
<tr>
<td><strong>Police, Campus</strong></td>
<td>Huffman Building</td>
<td>994-2121</td>
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<tr>
<td><strong>Post Office, Campus</strong></td>
<td>Culbertson Hall</td>
<td>994-2672</td>
</tr>
<tr>
<td><strong>President’s Office</strong></td>
<td>211 Montana Hall</td>
<td>994-2341</td>
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<tr>
<td><strong>Provost</strong></td>
<td>212 Montana Hall</td>
<td>994-4371</td>
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<tr>
<td><strong>Recreational Sports and Fitness</strong></td>
<td>120 Hosaeus Fitness Center</td>
<td>994-5000</td>
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<tr>
<td><strong>Registrar</strong></td>
<td>101 Montana Hall</td>
<td>994-6650</td>
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<tr>
<td><strong>Research, Creativity and Technology Transfer</strong></td>
<td>207 Montana Hall</td>
<td>994-2891</td>
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<tr>
<td><strong>Residence Life and Food</strong></td>
<td>31 Hedges Complex Services</td>
<td>994-2661</td>
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<tr>
<td><strong>Strand Union Building Administration</strong></td>
<td>223 Strand Union Building</td>
<td>994-3082</td>
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<td>Service</td>
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<tr>
<td>-------------------------------</td>
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<tr>
<td>Summer Session</td>
<td>318 Montana Hall</td>
<td>994-7136</td>
</tr>
<tr>
<td>University Business Services</td>
<td>102 Montana Hall</td>
<td>994-1991</td>
</tr>
<tr>
<td>University Police</td>
<td>Huffman Building, 7th Avenue and Kagy Blvd.</td>
<td>994-2121</td>
</tr>
<tr>
<td>University Studies</td>
<td>130 Gaines Hall</td>
<td>994-3532</td>
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<tr>
<td>Vice President for Student Success</td>
<td>174 Strand Union Building</td>
<td>994-2828</td>
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<tr>
<td>Women's Center</td>
<td>372 Strand Union Building</td>
<td>994-3836</td>
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<tr>
<td>WWAMI/Division of Health Services</td>
<td>308 Leon Johnson Hall</td>
<td>994-4411</td>
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**MSU - Billings**

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<thead>
<tr>
<th>Service</th>
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<tbody>
<tr>
<td>Toll free</td>
<td>800-565-6782</td>
</tr>
<tr>
<td>Admissions and Records</td>
<td>657-2158</td>
</tr>
<tr>
<td>Business Services</td>
<td>657-2301</td>
</tr>
<tr>
<td>Extended Campus</td>
<td>896-5890</td>
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<tr>
<td>Financial Aid</td>
<td>657-2188</td>
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<tr>
<td>Graduate Studies and Research</td>
<td>657-2238</td>
</tr>
<tr>
<td>Registrar</td>
<td>657-2158</td>
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**Great Falls College - MSU**

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<tr>
<th>Service</th>
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<tr>
<td>Toll Free</td>
<td>800-446-2698</td>
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<tr>
<td>Admissions</td>
<td>771-4420</td>
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<tr>
<td>Business and Finance</td>
<td>771-4321</td>
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<tr>
<td>Community and Continuing</td>
<td>771-4303</td>
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<tr>
<td>Education</td>
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<tr>
<td>Distance Education Coordinator</td>
<td>771-4444</td>
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<tr>
<td>Financial Aid</td>
<td>771-4334</td>
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<tr>
<td>Registrar</td>
<td>771-5128</td>
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**MSU - Northern (Havre)**

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<tr>
<td>Toll Free</td>
<td>800-662-6132</td>
</tr>
<tr>
<td>Admissions</td>
<td>265-3704</td>
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<tr>
<td>Business Services</td>
<td>265-3733</td>
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<tr>
<td>Extended University</td>
<td>265-3730</td>
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<tr>
<td>Financial Aid</td>
<td>265-3787</td>
</tr>
<tr>
<td>Graduate Studies</td>
<td>265-3738</td>
</tr>
<tr>
<td>Registrar</td>
<td>265-3703</td>
</tr>
</tbody>
</table>
II. Directory

Directory

Board of Regents of Higher Education
Governor, Steve Bullock, ex officio member
Superintendent of Public Instruction, Elsie Arntzen, ex officio member
Commissioner of Higher Education, Clayton Christian, ex officio member
Fran M. Albrecht, Chair
Chase Greenfield, Student Regent
Casey Lozar
Robert A. Nysten, Vice Chair
Martha Sheehy
Paul Tuss

Central Administration
President’s Office
Waded Cruzado, Ph.D., President of Montana State University

Academic Affairs
Robert L. Mokwa, Ph.D., Executive Vice President for Academic Affairs and Provost
David Singel, Ph.D., Associate Provost
Tamela Eitle, Ph.D., Interim Associate Provost
I. Miley Gonzalez, Interim Associate Provost of International Programs

Student Success
Chris Kearns, Ph.D., Vice President for Student Success
Matthew Caires, Ed.D., Dean of Students
Ronda Russell, M.Ed., Director of Admissions
Tony Campeau, M.S., Registrar
Carina Beck, Ed.D, Director of the Office of Student Success Programs
James Broscheit, Director of Financial Aid
Joe Schumacher, B.A., Director of Disability, Re-entry & Veterans’ Services
Jim Mitchell, M.B.A., Director of Student Health Service
Elizabeth Asserson, Ph.D., Director of Counseling & Psychological Services

Research and Creative Activities
Renee Reijo Pera, Ph.D., Vice President for Research and Economic Development
Leslie Schmidt, B.S., Assistant Vice President for Research, Creativity and Technology Transfer

Administration and Finance
Terry Leist, M.B.A., C.P.A., Vice President for Administration and Finance
Daniel Stevenson, B.S., Associate Vice President for University Services
Laura Humberger, B.S., C.P.A., Assistant Vice President for Financial Services

Colleges
Agriculture
Charles Boyer, Ph.D., Vice President and Dean of Agriculture
Tracy Dougher, Ph.D., Associate Dean

Arts and Architecture
Royce W. Smith, Ph.D., Dean
Nora Smith, Ph.D., Assistant Dean

Jake Jabs College of Business & Entrepreneurship
Kregg Aytes, Ph.D., Dean
Myleen Leary, Ph.D., Interim Associate Dean
Brenda Truman, M.P.A., Director of Student Services

Education, Health, and Human Development
Alison Harmon, Ph.D., RN, LN, Dean
Katy Kaminski, M.A., Assistant Dean

Norm Asbjornson College of Engineering
Brett Gunnink, Ph.D., Dean
Anne K. Camper, Ph.D., Associate Dean
Christine M. Forman, Ph.D., Associate Dean

Honors
Ilse-Mari Lee, D.M.A., Dean

Letters and Science
Nicol Rae, Ph.D., Dean
David Cherry, Ph.D., Associate Dean
Bridget Kevane, Ph.D., Associate Dean

Graduate School
Karlene A. Hoo, Ph.D., Dean

Administrative Offices
Academic Technology and Outreach
Kimberly Obbink, Ed.D., Executive Director

Admissions
Ronda Russell, M.Ed., Director

Alumni Relations
Kerry Hanson, Vice President of Alumni Relations

Athletics
Leon Costello, M.S., Director

Career Services
Carina Beck, Ed.D., Director

University Communications
Tracy Ellig, B.A., Executive Director

Counseling and Psychological Services
Elizabeth Asserson, Ph.D., Director

Facilities Services
Chris Carlett, MS, CRM, Interim Director, Facilities Services

MSU Foundation
Chris Murray, MBA, President, and CEO

Institutional Equity/Title IX Coordinator
Jyl Shaffer, M.A., Director
University Studies  
Diane Donnelly, M.Ed., Director

Human Resources  
Cathy Hasenpflug, B.S., Chief Human Resources Officer

University Information Technology  
Jerry Sheehan, M.S., Chief Information Officer

International Programs  
I. Miley Gonzalez, Interim Associate Provost

Legal Counsel  
Kellie Peterson, J.D.

Library  
Kenning Arlitsch, Dean  
Brian Rossmann, M.L.S., Associate Dean

Mail Services  
Jennie Miller, Manager

Museum of the Rockies  
Sheldon McKamey, B.S., Dean and Director

Native American Studies  
Walter Fleming, Ph.D., Director

Office of Planning & Analysis  
Chris Fastnow, Ph.D., Director

Registrar  
Tony Campeau, M.S., Registrar

Residence Life and Food Services  
Thomas Stump, C.P.A., Director of Auxiliary Services  
Jeff Bondy, M.P.A., Director of Residence Life  
Richard Huffman, Director of Culinary Services

Safety and Risk Management  
Ryan Brickman, M.S., CRM, Interim Director

Strand Union  
Frank Damberger, B.S., Director

Student Accounts  
Bonnie Holden, B.S., Director

Student Health Service  
James Mitchell, M.B.A., Director  
Ita Killeen, M.D., Associate Director

University Police  
Frank Parrish Jr., Police Chief

WWAMI/Division of Health Sciences  
Martin Teintze, Ph.D., Director

Women’s Center  
Betsy Danforth, B.A., Director
III. Academic Programs

Academic Programs

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• Business - BS (p. 277)
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Welcome to MSU

Montana State University inspires big ideas and bold adventures. At MSU, we believe in transforming lives through education and empowerment. Students learn through hands-on research and creative experiences, engage with community and service learning projects and make discoveries with the guidance of expert professors.

As Montana’s land-grant institution, Montana State University is dedicated to providing high-quality education in a broad range of subjects from technical to liberal arts. In fulfilling its land-grant mission, the Bozeman campus provides educational opportunities to more than 16,000 students from associate degrees and certificate programs to doctoral degrees.

MSU is Montana’s premier university with seven academic colleges and more than 225 academic options.

MSU Mission

Montana State University, the state’s first land-grant institution, educates students, creates knowledge and art, and serves communities by integrating learning, discovery and engagement.

MSU Vision

Montana State University is as remarkable as its setting. Created as a land-grant institution, it is a welcoming, adventurous community of students, faculty and staff distinguished by its commitment to address the world’s greatest challenges. The university energizes individuals to discover and pursue their aspirations. It inspires people to engage with the university to improve the human prospect through excellence in education, research, creativity and civic responsibility.

MSU At-A-Glance

- Degrees offered: Associate, Bachelor’s, Master’s and Doctoral
- Accreditation: Regionally accredited by Northwest Commission on Colleges and Universities (NWCCU); professional schools and departments approved by specialized accrediting organizations
- Student/Faculty ratio: 19:1
- Established: 1893
- Location: Bozeman, Montana
- Academic year: fall and spring semesters, summer sessions
- Average High School GPA: 3.53; Average ACT: 25.2; Average SAT: 1213
- Athletic conference: Big Sky Conference, NCAA Division I (Football Championship Subdivision–FCS)
- Varsity sports:
  - Men: football, basketball, NIRA rodeo, track, cross-country, Alpine and Nordic skiing, tennis and Spirit Squad
  - Women: volleyball, basketball, track, cross-country, tennis, NIRA rodeo, golf, Alpine and Nordic skiing and Spirit Squad
- Mascot: Bobcat
- School colors: Blue & Gold
- Geographic surroundings: 90 miles from Yellowstone National Park; 2.1 million acres of national forest and wilderness areas in the Gallatin National Forest, five mountain ranges, three rivers.
- Classroom to chairlift: 20 minutes to Bridger Bowl; 55 minutes to Big Sky; campus to camping: 25 minutes to Hyalite Canyon

Brief MSU History

- February 16, 1893: Montana State University was established as the Agricultural College of the State of Montana at Bozeman by an act of the State Legislature. The first term of instruction began on April 17 of that year.
- 1913: the name of the institution was changed to the State College of Agriculture and Mechanic Arts.
- 1920: the name was changed to Montana State College
- July 1, 1965: name became Montana State University
- February 16, 2018: MSU celebrates 125 years of excellence

Learning

MSU prepares students to graduate equipped for careers and further education. MSU’s low student to faculty ratio means accessible professors and hands-on learning opportunities. Working alongside world-class faculty mentors, students discover new knowledge that helps to improve the quality of life around the globe. This supportive and collaborative learning environment helps students succeed in competing for national and international scholarships and awards. MSU students have received prestigious awards including:

- Goldwater scholarships (math, science & engineering)
- Rhodes Scholarship (to study at Oxford University)
- Marshall Scholarship (grad school in the United Kingdom)
- Udall Scholarship (to pursue careers in the environment)
- Newman Civic Fellow (public leadership)
- Truman Scholarship (Leadership and public service)

Discovery

MSU is recognized nationally for its prominence in research among leading public research universities. MSU is among the top 3 percent of colleges and universities in the nation for research expenditures. This prolific research has led to many significant discoveries that are changing the world. MSU holds more than 264 active technology licenses. In addition, 75 patents and 34 plant variety certificates have been issued for MSU discoveries with many more pending.

Research expenditures at MSU typically exceed $100 million annually and top research departments include microbiology and immunology, chemistry and biochemistry, transportation, physics, and land resources and environmental sciences; with much of the research funding from the National Institutes of Health, Departments of Energy, Defense and Agriculture, and private sources. MSU is Montana’s largest research enterprise.

Engagement

Students, professors and staff at MSU work together with community partners to exchange and apply knowledge and resources that improve the world. MSU recently earned The Carnegie Foundation for the Advancement of Teaching’s engagement classification. The designation recognizes commitment to teaching that encourages volunteer service in communities and spreading of knowledge that benefits the public. In addition, through courses, clubs and organized events, students participate in many local, national and international service-learning projects that enable them to apply their education while strengthening communities. By integrating learning, discovery and engagement, and by working across disciplines, MSU is making great strides to improve the world.

Undergraduate Excellence

The Carnegie Foundation classifies MSU as an institution with a high undergraduate profile. Combined with its status as one of the top research universities in the nation, this gives MSU’s undergraduate students opportunities to do research of national importance on a variety of topics, opportunities that would typically be reserved for graduate students at other universities. That’s one reason why MSU is a national leader in producing winners of the Goldwater Scholarship, the nation’s premier award for
undergraduates in math and science fields. MSU ranks in the top 10 in the nation for producing Goldwater Scholars, tied with Johns Hopkins and ahead of Yale.

A Unique Learning Environment

MSU is the only university with easy access to Yellowstone National Park. For MSU students, Yellowstone is a 20 million-acre classroom, lab and adventure hub featuring hot springs, rivers, peaks and wildlife. Known as “The University of the Yellowstone,” MSU is located just 90 miles from the park. MSU students help research the ecology of our stunning natural environment, plus the microbes of the Park’s hot pools and the science behind avalanches. Our setting makes it possible to study things that would be impossible to examine anywhere else in the world.

Bozeman, MT - MSU’s Backyard

Bozeman is a small town with big energy. Perhaps best known for outdoor recreation, Bozeman also has the cultural amenities of a much larger city including concert venues, festivals, and theatre and ballet companies, as well as many locally-owned shops, restaurants and galleries that make downtown Bozeman vibrant. Skiing, hiking, camping, biking, climbing and fishing options are endless because Bozeman is surrounded by five mountain ranges including the Bridger, Tobacco Root, Big Belt, Gallatin and Madison ranges; and the Gallatin, Madison and Yellowstone Rivers are all within a half hour of campus. There is plenty of National Forest land to explore, and Yellowstone National Park is just 90 miles away.

Connect with MSU

Connect with Montana State University online to keep up with the latest news. Our MSU social media guide (http://www.montana.edu/web/socialmedia) has a general list of all things MSU so tune in with the Bobcat Bulletin, Facebook, Twitter, and MSUTube.

- Montana State University Class of 2023 Facebook group (https://www.facebook.com/groups/montanastate2022) - Meet and connect with other future MSU students.
- Montana State University (https://www.fb.com/montanastate) - Keep informed about projects, events, speakers and achievements at MSU with this Facebook page (https://www.fb.com/MontanaStateBobcats) page.
- Montana State University Athletics (http://www.msubobcats.com) - Find out about upcoming games and see the latest scores with this Facebook page. Go Cats!
- @AdmissionsMSU (https://twitter.com/AdmissionsMSU) - Get tweets from the Admissions crew.
- @montanastate (https://twitter.com/montanastate) - MSU news, events, and updates tweeted.
- Check out the #MontanaState hashtag on Twitter to see what people are saying about MSU.
- MSUTube (https://www.youtube.com/user/montanastateu) - Subscribe to MSU’s YouTube Channel to see recently uploaded videos.
- Subscribe to the Bobcat Bulletin (http://www.montana.edu/bobcatbulletin), a weekly e-newsletter with upcoming events and news from campus.

MSU Bobcat Parent and Family Program

http://www.montana.edu/parents/

All parents and family members of MSU students are given automatic membership in the Bobcat Parent and Family Program. The program offers several resources and events designed to encourage a strong relationship between families and the university. They include a Parent and Family Fall Weekend, Parent Handbook, scholarship fundraising and an Advisory Board.

Statewide Research, Educational Outreach and Service

As a land-grant institution, MSU is committed to state-focused activities with global impacts, while sharing its research discoveries with Montanans through educational outreach and service. These discoveries enhance communities and enterprises throughout Montana.

Agricultural Experiment Station

http://agresearch.montana.edu

The Montana Agricultural Experiment Station (MAES) conducts research in agricultural and natural resource systems addressing state, regional and national needs from multiple Montana locations: the main station (Bozeman), 7 research centers (Conrad, Corvallis, Creston, Havre, Huntley, Moccasin, Sidney), allied properties and on farms/ranches. The Agricultural Experiment Station is funded cooperatively through a legal partnership between federal and state governments. The Montana Agricultural Experiment Station is a unit of the Montana University System and is administered by the MSU campus.

Engineering Experiment Station

www.coe.montana.edu/eng_exp_station.html

The Engineering Experiment Station at Montana State University was created by the State Board of Education in 1924 to improve the economy, efficiency, and safety of engineering activity in Montana; to promote the conservation and utilization of Montana resources, and to encourage the development of new business activities in Montana.

Extension

http://www.msuextension.org/

Montana State University Extension provides research-based knowledge to strengthen the economic, social, and environmental well-being of Montana families, communities, and agricultural enterprises. Educational programs of MSU Extension are conducted on an informal, non-credit basis. The focal point for MSU Extension programs is the local Extension office. In Montana, these offices serve 56 counties and seven tribal reservations. Local county and reservation agents are backed by a staff of campus-based faculty who provide direct linkage with current research and a close working relationship with the Montana Agricultural Experiment Station. One of the functions of Extension is to provide input to the University on current Montana problems that are in need of research for their resolution.

Programs of MSU Extension address societal needs in the general areas of agriculture, family living, community and economic development, and youth development. One of Extension’s best-known programs is the 4-H youth development program. Another unit of MSU Extension is the Montana Fire Services Training School, which provides training for paid and volunteer firefighters throughout the state.

MSU Extension is a unit of the Montana University System and is administered by the MSU campus.

Extended University

http://eu.montana.edu

Extended University administers and coordinates on-and off-campus instruction in the form of distance-delivered and face-to-face courses, programs, institutes, and conferences that supplement the formal academic curriculum at MSU. Extended University services are organized into three
main categories: Montana State Online, Office of Continuing Education, and Burns Technology Center.

**Montana Public Television - KUSM**  
[www.montanapbs.org](http://www.montanapbs.org)

Montana Public Television is the primary public television provider for the state of Montana. PBS services, instructional and outreach activities are provided to viewers throughout Montana through over-the-air broadcast and cable distribution. Montana Public TV is a service of Montana State University and the University of Montana.

**Museum of the Rockies**  
[www.museumoftherockies.org](http://www.museumoftherockies.org)

The Museum of the Rockies is home to one of the largest collections of dinosaur fossils in the world. The museum’s primary objectives are to understand, preserve and interpret the natural and cultural history of the Northern Rocky Mountain region. It accomplishes its mission through research, collections, exhibits and programs for the education and entertainment of people of all ages.

**Accreditation**

Montana State University has been accredited by the Northwest Commission on Colleges and Universities (NWCCU) ([http://www.nwccu.org](http://www.nwccu.org)), an institutional accrediting body recognized by the Council for Higher Education Accreditation and the U.S. Department of Education, since 1932. Eligible professional academic and service programs within the University are accredited by the following agencies:

- Accreditation Association for Ambulatory Health Care (for Student Health Service)
- Accreditation Board for Engineering and Technology (ABET)
- Accreditation Council for Education in Nutrition and Dietetics (ACEND)
- American Psychological Association (for PhD level Internships in Counseling and Psychological Services) (APA)
- Association to Advance Collegiate Schools of Business (AACSB)
- Commission on Collegiate Nursing Education (CCNE)
- Council for Accreditation of Counseling and Related Educational Programs (CACREP)
- Council for the Accreditation of Educator Preparation (TEAC)
- National Architectural Accrediting Board (NAAB)
- National Association of Schools of Art and Design (NASAD)
- National Association of Schools of Music (NASM)
- National Collegiate Athletic Association (for Intercollegiate Athletics) (NCAA)
- Society of Range Management (SRM)

**Important Notice to All Students**

The following information pertains to student and institutional rights and responsibilities under this catalog:

This general catalog is published by Montana State University as a guide for students, faculty and others interested in the institution. Students are expected to be familiar with all University regulations and information set forth in this publication or any amendment to or modifications thereof.

Montana State University reserves the right to change regulations and to add or withdraw courses at any time during the period this publication is in effect. The institution, with the concurrence of the Board of Regents of Higher Education, also reserves the right to add or withdraw degree programs and to change fees at any time. Effective dates of changes will be determined by the proper authorities and shall apply to prospective students and to those who are already enrolled.

Montana State University places full responsibility upon the student for registering for the proper courses and for fulfilling all degree requirements as set forth in this catalog, as amended from time to time. No agent or employee of the University has the authority to warrant graduation, the attainment of any type of license, or attainment of any other career goal. The institution does not accept any responsibility for delays in graduation or attainment of career goals resulting from errors in registration, cancelled courses, schedule changes, degree requirement changes, or similar related changes, or for errors resulting from consultation with and reliance upon any information acquired from a University employee. Advisors' signatures on preregistration, drop-add or similar forms do not necessarily indicate agreement with or approval of the student’s choice of courses nor may they be construed in any way as a warranty that the student’s choice of courses is sufficient for graduation or attainment of any career goals.
## Academic Calendar

### Summer 2018

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classes Begin</td>
<td>May 14 Monday</td>
</tr>
<tr>
<td>Memorial Day Holiday</td>
<td>May 28</td>
</tr>
<tr>
<td>June Start Begins</td>
<td>June 11</td>
</tr>
<tr>
<td>Independence Day Holiday</td>
<td>July 4</td>
</tr>
<tr>
<td>July Start Begins</td>
<td>July 9</td>
</tr>
<tr>
<td>Late Summer Session begins</td>
<td>July 23- Aug 16</td>
</tr>
<tr>
<td>Semester Ends</td>
<td>Aug 16</td>
</tr>
</tbody>
</table>

### Fall 2018

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
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</thead>
<tbody>
<tr>
<td>Orientation &amp; Registration</td>
<td>Aug 22-24</td>
</tr>
<tr>
<td>Classes Begin</td>
<td>Aug 27 (Monday)</td>
</tr>
<tr>
<td>Labor Day Holiday</td>
<td>Sept 3</td>
</tr>
<tr>
<td>Election Day</td>
<td>Nov 6</td>
</tr>
<tr>
<td>Veterans' Day Holiday</td>
<td>Nov 12</td>
</tr>
<tr>
<td>Thanksgiving Day Holiday</td>
<td>Nov 21-23 (Wed-Fri)</td>
</tr>
<tr>
<td>Classes End</td>
<td>Dec 7</td>
</tr>
<tr>
<td>Final Exams</td>
<td>Dec 10-14</td>
</tr>
<tr>
<td>Semester Ends</td>
<td>Dec 14</td>
</tr>
<tr>
<td>Commencement</td>
<td>Dec 15 (Saturday)</td>
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</tbody>
</table>

### Spring 2019

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
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</thead>
<tbody>
<tr>
<td>Orientation &amp; Registration</td>
<td>Jan 7-8</td>
</tr>
<tr>
<td>Classes Begin</td>
<td>Jan 9 (Wednesday)</td>
</tr>
<tr>
<td>Martin Luther King Holiday</td>
<td>Jan 21</td>
</tr>
<tr>
<td>Presidents Day</td>
<td>February 18</td>
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<tr>
<td>Spring Break</td>
<td>Mar 18-22</td>
</tr>
<tr>
<td>University Day</td>
<td>April 19</td>
</tr>
<tr>
<td>Classes End</td>
<td>Apr 26</td>
</tr>
<tr>
<td>Final Exams</td>
<td>April 29- May 3</td>
</tr>
<tr>
<td>Semester Ends</td>
<td>May 3</td>
</tr>
<tr>
<td>Commencement</td>
<td>May 4 (Saturday)</td>
</tr>
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</table>

### Summer 2019

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</tr>
<tr>
<td>Veterans' Day Holiday</td>
<td>Nov 11</td>
</tr>
<tr>
<td>Thanksgiving Day Holiday</td>
<td>Nov 27-29 (Wed-Fri)</td>
</tr>
<tr>
<td>Classes End</td>
<td>Dec 6</td>
</tr>
<tr>
<td>Final Exams</td>
<td>Dec 9-13</td>
</tr>
<tr>
<td>Semester Ends</td>
<td>Dec 13</td>
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</tbody>
</table>

*Reviewed and approved by Faculty Senate, ASMSU, Deans' Council, PEC, Provost, and President.
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• Appeal of Admission Decisions (p. 22)

Admission as an Undergraduate Student
Undergraduate students are first-time college students, or those who have attempted college level credits during high school, or have attempted college level credits after graduating high school, and have not been awarded a bachelor’s degree. In addition, students who have already received a bachelor’s degree and are returning to school for another bachelor’s degree (post-baccalaureate) are also considered undergraduate students.

Applications for admission to undergraduate programs are processed by the Office of Admissions. The requirements for admission are described in the sections that follow. There are several options for obtaining MSU application forms.

Applications are accepted from resident, non-resident, and international students. Eligible undergraduate students may attend full-time or part-time. Montana State University retains the right to establish requirements which will ensure successful scholastic performance.

General Admission Information
Applicants are responsible for submitting applications and all other required credentials necessary for admission, financial aid, and housing; must provide verification of immunizations, must complete a tuberculosis screening form, and must register for a New Student Orientation session. Applicants should be aware of the following:

1. Applicants are requested to voluntarily provide their social security number which allows the school to distinguish between individuals with the same or similar names.

2. Students intending to apply for financial aid may obtain appropriate forms from their high school guidance office, online at www.fafsa.ed.gov (http://www.fafsa.ed.gov), or by contacting Financial Aid Services via email (finaid@montana.edu) or by calling 406-994-2845. MSU’s FAFSA school code is 002532.

3. Students with fewer than 30 credits of college level coursework completed after high school graduation are required to live in the residence halls. Additional information about residence life and family housing policies may be obtained by contacting the Residence Life Office via email (housing@montana.edu), by calling 406-994-2661, or by visiting the Residence Life (http://www.montana.edu/reslife) website.

4. Students must submit required immunization records and a tuberculosis screening form. This is done by logging onto the University Health Partners (http://www.montana.edu/health) website, selecting "Medical Services"; then "Forms", or students may download and complete the immunization and tuberculosis screening forms and submit them via email (immune@montana.edu) or fax at 406-994-2504. Students must submit proof of required immunizations and a tuberculosis screening form prior to class registration. Questions should be referred to University Health Partners via email (immune@montana.edu) or by calling 406-994-2311.

5. Students with a health condition or a disability which should be brought to MSU’s attention may submit a confidential letter of need to the Office of Disability Services (http://www.montana.edu/accsql/disability). Contact them via email (drv@montana.edu) or by calling 406-994-2824; they will also answer any questions about services for students with disabilities.

6. All admitted students must attend a New Student Orientation session prior to the beginning of the semester. Information about Orientation dates will be sent from the Office of Admissions after admission has been determined. Additional information can be obtained by visiting the Orientation (http://www.montana.edu/admissions/orientation) website or by calling 406-994-2827.

When to Apply
Applicants are encouraged to apply at least six to eight months prior to the first semester of attendance. Early application will allow adequate time for the student to request any academic credentials needed to complete the application file, make housing arrangements, process financial aid materials, and participate in a New Student Orientation session.

Applications should be on file in the Office of Admissions according to the following recommended dates:

- Fall semester - July 1
- Spring semester - December 1
- Summer session - May 1

Applicants will be notified as soon as possible after all credentials necessary to determine a student’s application status have been received by the Office of Admissions.

- All applications are kept on file at MSU for one full academic year from the original application term (e.g. an application for Fall 2018 may be updated to Fall 2019).
- An applicant may defer their term or update their application file during this one year period without having to re-apply. After the one year time period has passed, a new application, application fee, and any/all required academic documents must be re-submitted by the student.
- It is the applicant’s responsibility to inform the Office of Admissions of any changes to their original application.

To defer or update an application within a year from the original application term, contact the Office of Admissions (http://www.montana.edu/admissions) via email (admissions@montana.edu) or by calling 406-994-2452 or toll-free at 1-888-MSU-CATS.

 Obtaining Undergraduate Application Forms
Several application options are available to students interested in applying for undergraduate admission to MSU-Bozeman.

- Online Application Form: Freshmen, transfer, international, non-degree, and second-degree (post-baccalaureate) students may complete the online application form which is electronically submitted directly to MSU.
• Undergraduate Application Form: This is a large pdf file (1.45 MB) which can be downloaded and printed. A pdf file of instructions for completing the form is also available.

• International Undergraduate Application Form (http://www.montana.edu/international/admissions/docs/InternationalApplication.pdf): This undergraduate application should be completed by applicants who are not U.S. citizens or Permanent Residents of the U.S.

• MSU Transfer Application Form (http://www.montana.edu/admissions/applications/MSUTransferApplication.pdf): Complete this form if you are transferring from MSU-Billings, MSU-Northern, or Great Falls College MSU.

• MUS Transmittal Form (http://www.montana.edu/registrar/documents/pdfs/RequestForTransmittalOfApplicationMaterials.pdf): Complete this form if you are transferring from any of the University of Montana institutions or Montana community colleges.

• Form to Request Information (https://www.montana.edu/admissions/inforequest): Use this online form to request a mailed catalog, application form, and information about financial aid, housing, and student services.

For assistance with any of the applications, please contact the Office of Admissions (http://www.montana.edu/admissions) by email (admissions@montana.edu) or by calling 406-994-2452. For information on applying to graduate programs, please visit The Graduate School (http://www.montana.edu/gradschool)’s website.

Campus Visit Opportunities

Individual Campus Visits
A personal visit to the MSU campus will provide an opportunity to meet faculty, staff and students, and to explore campus life. Because selecting a college is such an important decision, families are welcome and encouraged to participate. As part of a campus visit, the Admissions staff can schedule any or all of the following for you: a campus tour, a residence hall information session, an appointment with an MSU Admissions Counselor, an academic department meeting, and a classroom visit (during the school year).

To schedule a visit, please call or complete the registration form (http://www.montana.edu/admissions/visit/schedule) at least two weeks in advance. Please contact the Campus Visit Coordinators in the Office of Admissions via email (campusvisit@montana.edu) or by calling 406-994-2452 or toll free at 1-888-MSU-CATS. “Drop-in” visits are also welcome.

MSU Fridays
MSU Friday, a comprehensive campus preview day held five times a year, gives prospective students and their families a chance to meet with faculty and students, explore academic facilities, tour the campus, and investigate possibilities and scholarships. It’s a great time to explore MSU! For more details, go to the MSU Friday website (http://www.montana.edu/msufriday).

New Student Orientation
All new students are required to attend New Student Orientation in order to register for classes. Summer Orientation programs are offered to new freshman and transfer students who enter in the fall semester. Additional Orientation sessions for freshman, transfer, veteran, and international students are offered prior to each semester.

At Orientation, students receive assistance with course selection, course registration, and become familiar with the location and use of campus facilities and services. New Student Orientation also highlights MSU’s academic assistance and other special services, as well as recreational and social programs. New Student Orientation assists all new students in their transition to MSU and increases students’ chances for academic success.

Contact the Orientation Office at 406-994-2827 or visit the Orientation website (http://www.montana.edu/admissions/orientation) for more information. International students should contact the Office of International Programs via email (international@montana.edu) or by calling +1-406-994-4031.

Freshman (First-Time Undergraduates)
Freshman students are those who have completed high school or its equivalent. Students who have attempted fewer than 12 quarter or semester college-level credits at another regionally accredited college or university after high school graduation are considered incoming freshmen. Students who have earned college-level course credit, Advanced Placement or International Baccalaureate credits before graduating from high school are also considered incoming freshmen.

Academic Eligibility
Students who do not meet the freshman admission requirements (listed below) are still encouraged to apply for admission and submit the necessary credentials. MSU is allowed a number of exemptions to the stated requirements and will examine each student’s credentials on an individual basis for admittance. Some students who do not meet the requirements may be admitted as Pre-University Studies (http://www.montana.edu/universitystudies/preuniversitystudies.html) students. Pre-University Studies students may be classified as full-time MSU students during their first semester by taking 12-14 credits of combined MSU courses and courses offered through Gallatin College MSU. Of these credits, students may register for a maximum of 7 MSU credits. In addition, with a combined total of 12 credits or more, students will be considered full-time students for financial aid purposes. Once a Pre-University Studies student has earned 7 MSU credits with a minimum cumulative grade-point average of 2.0, he/she will become a full-time MSU student.

Admission requirements (Resident and Non-Resident)
• Graduation from a high school accredited by the state accrediting agency, or a passing score on an approved high school equivalency exam such as HiSET or GED. Students who complete their secondary education through home schooling or at unaccredited secondary schools may be admitted as long as they have satisfactorily performed on the ACT or SAT test.

• MSU Academic Requirements:
  • A 2.5 cumulative high school grade-point average (on a 4.0 scale), OR
  • ACT Composite score of 22, OR
  • SAT Combined Critical Reading/Mathematics/Writing score of 1540, (prior to March 2016), OR
  • SAT Total Score of 1120 (after March 2016), OR
  • Rank in the upper half of the graduating class
    • AND

• Successful completion of a College Preparatory Curriculum. Non-resident applicants who have not completed the college preparatory requirements stated below may satisfy the requirements by providing evidence that they have completed a similar college preparatory program required by their home state.
  • Four years of English: courses should emphasize the development of written and oral communication skills and literature.
  • Three years of Mathematics: courses should include algebra I, geometry, and algebra II (or the sequential content equivalent of
these courses). Students are encouraged to take a math course in their senior year.

- Three years of Social Studies: courses should include one year of global studies (such as world history or world geography), American history, government, economics, Indian history, psychology, sociology, or other third-year courses.
- Two years of Laboratory Science: one year should be earth science, biology, chemistry, or physics, and the other year can be one of the above sciences or another approved college preparatory science.
- Two years of elective courses: foreign language (preferably two years), computer science, visual and performing arts, or approved vocational education units.

The following categories of students are exempt from the admissions requirements above:

- Non-Traditional age students (out of high school more than 3 years from graduation date or expected graduation date)
- Non-Degree undergraduate students

In order to begin a University Academic Plan at Montana State University, students must demonstrate readiness in areas of mathematics and writing. Typically, students demonstrate their readiness through scores earned on standardized examinations:

- Math: ACT Math of 22+ or SAT Math of 520+ (prior to March 2016) or SAT Math Test of 27.5+ (after March 2016).
- Writing: ACT English/Writing or ELA of 18+ or a minimum score of 7 on the Writing Subscore (prior to September 2015) or 19+ on the Writing Subject Score (effective September 2015). SAT Writing of 440+ or 7 on the Essay Subscore (prior to March 2016) or SAT Writing/Language Test of 25+ (after March 2016).

If a student does not demonstrate full readiness prior to his/her New Student Orientation, academic advisors will help the student register during orientation for the appropriate courses needed to move forward in his/her degree path.

**Application Procedure**

Receipt of the following credentials in the Office of Admissions constitutes a complete application for admission. Requests to have final credentials sent to MSU must be initiated by the applicant. Requests should be made by contacting the high school, the Registrar’s Office at the college/university, or agency. Credentials must be sent directly from the school/agency to the Office of Admissions. Credentials that have been opened, are emailed or are in an unscaled envelope are considered unofficial copies and will not be accepted as official documents.

Application materials and fees will be retained for one year from the original application term. To apply for a semester other than the one originally intended, notify the Office of Admissions as soon as possible.

Be sure to submit the following items (if applicable):

1. Admission Application: An application for admission (https://www.msuadmissions.org/application/index.cfm?&isndsl) may be submitted online or downloaded and printed; if completing the paper application, please return the completed and signed application form to the Office of Admissions. The application may also be obtained from a high school counselor or directly from the Office of Admissions.
2. Application Fee (non-refundable): $38 for the online application or $30 for the paper application. Checks should be made payable to Montana State University. The application fee will not be waived or refunded. The fee must be paid before the application for admission will be processed.
3. High School Transcript: After graduation, a complete and official transcript must be sent directly from the high school to the Office of Admissions. Courses completed, GPA (on a 4.0 scale), rank in class (if available), and official date of graduation must be indicated on the transcript.
4. Approved High School Equivalency Exam: If an approved high school equivalency exam was taken in lieu of high school graduation, an official score report/transcript must be sent directly to the Office of Admissions from the Department of Education from the state in which the exam was given.
5. ACT/SAT Scores: All first-time incoming freshmen are required to take either the ACT (MSU School code is 2420) or the SAT Test (MSU School code is 4488). MSU does not use the SAT Subject Tests (formally SAT II Subject Tests) for admissions purposes. Test scores are used to determine admission status, award certain scholarships, and to assist with academic planning. Non-traditional applicants who graduated three or more years prior to the semester in which they intend to enroll are not required to submit ACT/SAT test results. Arrangements to take the ACT test on campus may be made by contacting MSU Testing Services at 406-994-6984.
6. College/University Transcripts: Applicants who have attended another college or university, whether credit was earned or not, must have an official transcript sent directly from each institution to the Office of Admissions after all final grades have been posted. If the college or university participates in secure electronic transmission of official transcripts, the transcripts should be sent to: MSUadmissionstranscript@sympa.montana.edu. For more information on how college/university courses will transfer to MSU, refer to the "Evaluation of Transfer Credit (p. 18)" section.
7. Advanced Placement (AP): Applicants who have completed an Advanced Placement Examination should request that the official scores be sent directly to the Office of Admissions. Scores of 3 or higher on most AP Exams will earn college credit with a Pass grade for the equivalent courses. For more information on how AP courses will transfer to MSU, refer to the AP Course Equivalencies website (http://www.montana.edu/admissions/ap/ap.pdf).
8. International Baccalaureate (IB): Applicants who have completed an International Baccalaureate Examination should request that the official scores be sent directly to the Office of Admissions. Scores of 4 or higher on IB Exams (primarily Higher Level) will be granted college credit with a Pass grade for equivalent courses. For more information on how IB courses will transfer to MSU, refer to the IB Course Equivalencies website (http://www.montana.edu/admissions/ib/ib.pdf).

**Freshman Students Denied Admission**

Students interested in appealing the admission decision should refer to the "Appeal of Admission Decisions" section.

**Transfer Students**

A transfer student has graduated from high school or its equivalent and attempted 12 or more quarter or semester credits of college-level courses at a regionally accredited institution after high school graduation. Students who have previously been awarded a baccalaureate degree who wish to apply as a Second Bachelor’s Degree student (Post-Baccalaureate) are also considered transfer students. College-level work is defined as those courses that are applicable towards at least an associate degree. It does not include remedial, certificate or developmental courses.
Students who previously attended Montana State University and who are returning after attending another institution should refer to the Former MSU Students (p. 22) section.

**Academic Eligibility**

Applicants will be considered for admission based on transferable credits from all regionally accredited colleges or universities previously attended. As determined by the Office of Admissions, a 2.0 (or C average) cumulative transferable GPA (on a 4.0 scale) is required in order to be accepted for admission in good academic standing. Transfer students start with a new GPA upon enrolling at MSU.

Students who do not meet the 2.0 cumulative transferable GPA are still encouraged to apply for admission and submit the necessary credentials. Montana State University will examine each student’s credentials on an individual case for admissibility. Some students who do not meet the requirements may be admitted on University Probation and will need to earn a 2.0 or higher GPA upon completing the first term attended at MSU to be placed in good academic standing.

**Application Procedure**

Receipt of the following credentials in the Office of Admissions constitutes a complete application for admission. Requests to have final credentials sent to MSU must be initiated by the applicant. Requests should be made by contacting the Registrar’s Office at the college/university previously attended. Credentials must be sent directly from each institution or agency to the Office of Admissions. Credentials that have been opened, are emailed, or are in an unsealed envelope are considered unofficial working copies and will not be accepted as official documents.

Application materials and fees will be retained for one year from the original application term. To apply for a semester other than the one originally intended, notify the Office of Admissions as soon as possible.

Be sure to submit the following items (if applicable):

1. **Admissions Application**: An application for admission (https://www.msuadmissions.org/application/index.cfm?isndsl) may be submitted online or downloaded and printed; if completing the paper application, please return the completed and signed application form to the Office of Admissions. The application may also be obtained from the Office of Admissions.
2. **Application Fee (non-refundable)**: $38 for the online application or $30 for the paper application. Checks should be made payable to Montana State University. The application fee will not be waived or refunded. The fee must be paid before the application for admission will be processed.
3. **Official College/University Transcripts**: An official transcript must be sent directly to the Office of Admissions from each regionally accredited college or university attended. This academic information will be used to determine admission status as well as transfer credit. Applicants who are enrolled at a transfer school while applying to MSU will be considered for admission based on an incomplete official transcript showing all academic work completed and posted to date. A final official transcript must be received in the Office of Admissions by the 15th class day of the first term of attendance. If the college or university participates in secure electronic transmission of official transcripts, the transcripts should be sent to: MSUadmissionstranscript@sympa.montana.edu. Academic eligibility will be reviewed again upon receipt of that final transcript. For more information on how college/university courses will transfer to MSU, refer to the “Evaluation of Transfer Credit (p. 18)” section.
4. **Advanced Placement (AP)**: Applicants who have completed an Advanced Placement Examination should request that the official scores be sent directly to the Office of Admissions. Scores of 3 or higher on most AP Exams will earn college credit with a Pass grade for the equivalent courses. For more information on how AP courses will transfer to MSU, refer to the AP Course Equivalencies website (http://www.montana.edu/admissions/ap/ap.pdf).
5. **International Baccalaureate (IB)**: Applicants who have completed an International Baccalaureate Examination should request that the official scores be sent directly to the Office of Admissions. Scores of 4 or higher on IB Exams (primarily Higher Level) will be granted college credit with a Pass grade for equivalent courses. For more information on how IB courses will transfer to MSU, refer to the IB Course Equivalencies website (http://www.montana.edu/admissions/ib/ib.pdf).

Transfer students follow the Undergraduate Catalog in effect at the time of initial enrollment at MSU. Transfer students from community colleges and four year colleges in Montana may elect to follow the MSU catalog that was in effect when they began their freshman year at the above mentioned institution.

**Second Bachelor’s Degree (Post-Baccalaureate) Students**

Students who have earned an undergraduate bachelor’s degree and who would like to pursue another undergraduate bachelor’s degree are also considered transfer students.

Students who previously attended Montana State University and who are returning after attending another institution should refer to the Former MSU Students (p. 22) section.

**Academic Eligibility**

Applicants will be considered for admission based on transferable credits from all regionally accredited colleges or universities previously attended. As determined by the Office of Admissions, a 2.0 (or C average) cumulative transferable GPA (on a 4.0 scale) is required in order to be accepted for admission in good academic standing. Transfer students start with a new GPA upon enrolling at MSU.

Students who do not meet the 2.0 cumulative transferable GPA are still encouraged to apply for admissions and submit the necessary credentials. Montana State University will examine each student’s credentials on an individual basis for admissibility. Some students who do not meet the requirements may be admitted on University Probation and will need to earn a 2.0 or higher GPA during the first term attended at MSU to be placed in good academic standing.

**Application Procedure**

Receipt of the following credentials in the Office of Admissions constitutes a complete application for admission. Requests to have final credentials sent to MSU must be initiated by the applicant. Requests should be made by contacting the Registrar’s Office at the college/university previously attended. Credentials must be sent directly from each institution or agency to the Office of Admissions. Credentials that have been opened, are emailed, or are in an unsealed envelope are considered unofficial working copies and will not be accepted as official documents.

Application materials and fees will be retained for one year from the original application term. To apply for a semester other than the one originally intended, notify the Office of Admissions as soon as possible.

Be sure to submit the following items (if applicable):

1. **Admissions Application**: An application for admission (https://www.msuadmissions.org/application/index.cfm?isndsl) may be submitted online or downloaded and printed; if completing the paper application, please return the completed and signed application form to the Office of Admissions. The application may also be obtained from the Office of Admissions.
the Office of Admissions. The application may also be obtained from the Office of Admissions.

2. **Application Fee (non-refundable):** $38 for the online application or $30 for the paper application. Checks should be made payable to Montana State University. The application fee will not be waived or refunded. The fee must be paid before the application for admission will be processed.

3. **Official College/University Transcripts:** An official transcript must be sent directly to the Office of Admissions from each regionally accredited college or university attended. The first bachelor’s degree must be posted on the official transcript. If the college or university participates in electronic transmission of official transcripts, the transcripts should be sent to MSUadmissionstranscript@sympa.montana.edu (MSUadmissionstranscript@sympa.montana.edu). This academic information will be used to determine admission status as well as transfer credit.

Transfer credit of Second-Degree students is not evaluated on a course-by-course basis through the Admissions Office; total credits earned are posted to their student record. Second-Degree students should make an appointment with their departmental advisor to prepare an academic plan for their second bachelor’s degree; students should bring copies of their college transcripts to their appointment.

Second Degree students follow the Undergraduate Catalog in effect at the time of initial enrollment at MSU.

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**Evaluation of Transfer Credit**

*(Freshman and transfer students)*

Requests to have final credentials sent to MSU must be initiated by the applicant. Requests should be made by contacting the Registrar’s Office at the college, university or agency previously attended.

Credentials must be sent directly from each institution to the Office of Admissions. If the college or university participates in secure electronic transmission of official transcripts, the transcripts should be sent to: MSUadmissionstranscript@sympa.montana.edu. Credentials that have been opened, emailed, or are in an unsealed envelope are considered unofficial copies and will not be accepted as official documents. To see how courses may transfer, please visit our Transfer Course Equivalencies website (https://atlas.montana.edu:9000/pls/bzagent/hwzkxfer.p_selstate). If a course or institution is not listed it does not necessarily mean the course will not transfer; rather the information is not yet in our database.

- An official evaluation of transfer will be completed after final transcripts from each institution have been received and the student has been admitted to Montana State University. Upon completion, a copy of the credit evaluation will be mailed to the student.
- All college-level courses from colleges or universities in candidacy status or accredited by any of the six regional accrediting agencies at the time the courses were taken will be accepted for transfer. Courses from non-accredited schools will not be accepted for transfer.
- The Office of Admissions determines whether or not the transfer work is college-level, the appropriate grading and credit conversions on transfer work, and the applicability of transfer credit toward the MSU CORE 2.0 requirements. The academic department has the authority to substitute transfer courses for curriculum requirements. Transfer credit and CORE, if applicable, will be given for courses in which passing grades were received.
- College level courses which do not have an equivalent at MSU will be accepted as an elective or as an elective with CORE credit. The academic department will determine if the transfer electives satisfy specific curriculum requirements.
- Freshman/sophomore level courses taken at another college or university will generally not be evaluated as equivalent to junior/senior level courses at MSU. Also, junior/senior level courses will generally not be evaluated as equivalent to freshman/sophomore courses at MSU. Elective credit will be granted in these cases. If a lower-level elective is substituted for an upper-level course by an academic department, that credit may not be used to fulfill the University upper-level credit requirement.
- Credit is not granted for continuing education, correspondence, or extension courses.
- Applicants who have taken Advanced Placement (AP) Exams or International Baccalaureate (IB) Exams should request that the official scores be sent directly to the Office of Admissions. Most AP scores of 3 or higher and IB Exams with scores of 4 or higher (primarily Higher Level) will be granted college credit with a Pass grade for the equivalent courses. For more information on how AP and IB courses will transfer, refer to the AP Course Equivalencies website (http://www.montana.edu/admissions/ap/ap.pdf) or the IB Course Equivalencies website (http://www.montana.edu/admissions/ib/ib.pdf).
- College Level Examination Program (CLEP) credit may be awarded by the academic department for successful performance in certain subject exams. Credit awarded for the CLEP Exams will not count toward University Core requirements. Official results must be sent directly from the CLEP testing center to MSU Testing Services (http://www.montana.edu/ehhd/centers/testing).
- Military experience will be considered for credit upon receipt of official military transcripts and, based on ACE recommendations, will be evaluated as elective credit only. A maximum of 30 elective credits from military transcripts will be used.
- International coursework (except from institutions where English is the language of instruction) may require evaluation by a foreign credential evaluation company. Contact the Office of International Programs (globalstudy@montana.edu) or visit the Office of International Programs website (http://www.montana.edu/international) for further information.
- Applicants are encouraged to bring personal copies of their transcripts for advising purposes during Orientation. Catalogs and course syllabi describing previous coursework may also be of assistance to the academic advisor when determining appropriate course placement.

Students who wish to appeal a decision regarding acceptance of transfer credit should address their concern to the Graduation and Admissions Requirements Committee (http://www.montana.edu/registrar/CERCandGARC.html) (GARC). Students who wish to appeal the assignment of transfer credit to the University Core requirements should address their concern to the Core Equivalency Review Committee (http://www.montana.edu/registrar/CERCandGARC.html) (CERC).

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**International Undergraduate Students**

Students from countries other than the United States are welcome to apply to Montana State University as International freshman or International transfer students. Those who have attempted secondary school are considered freshmen; those who have completed university-level coursework equivalent to 12 credits or more (a semester of study) beyond secondary school are considered transfer students.

**Academic Eligibility**

**Freshman (First Time Undergraduates)**

Freshmen will be considered for admission on the basis of their secondary school record and their English proficiency. Applicants who can prove their
English language proficiency and have a minimum cumulative grade-point average of 2.5/4.0 on a U.S. scale will qualify for admission.

**Transfer Students**
Transfer students will be considered on the basis of their post-secondary education record and their English proficiency. Applicants who can prove their English proficiency and have a minimum cumulative transferable grade-point average of 2.0/4.0 on a U.S. scale will qualify for admission.

All application materials must bear the official school seal and signature, and be sent directly from the institution or agency to the Office of International Programs. Unofficial copies can be accepted for admission purposes. Students who are admitted are required to provide official transcripts and test scores. To provide time for evaluation and for notice of acceptance to reach the applicant in a timely manner, the application and required credentials must be received by the Office of International Programs according to the following dates.

- Fall Semester - July 1
- Spring Semester - November 15
- Summer Session - March 15

**International Credit Evaluation**
In conjunction with the Registrar, the Office of International Programs determines the appropriate grading and credit conversions. These evaluations are done in accordance with national norms articulated by the American Association of Collegiate Registrars and Admission Officers (AACRAO). Montana State University follows these norms for all international transfer credit conversions, including but not limited to the European Credit Transfer System. Requests for exception to this practice must be submitted in writing to the Office of the Provost and include supporting documentation. Students who are accepted for admission must list all courses taken and grades earned. Additionally, the student may obtain an official copy from the school, leave it in the school’s sealed envelope, and mail or carry it to MSU. Additional official certificates may be required to show completion of secondary school. Montana State University is required to provide a formal agreement with the post-secondary institution.

**Application Procedure**
Receipt of the following credentials in the Office of International Programs constitutes a complete application for admission. Please review the International Admissions (http://www.montana.edu/international/admissions) website for more information.

1. **International Undergraduate Application for Admission**: An International undergraduate application (https://www.msuadmissions.org/application/index.cfm?&isndsl) may be submitted online or a paper application form. The transcript must be sent directly from the school to the Office of International Programs. Alternatively, the student may obtain an official copy from the school, leave it in the school’s sealed envelope, and mail or carry it to MSU.

2. **Application Fee (non-refundable)**: $38 for the online application or $30 for the paper application. The fee must be in U.S. currency. The online application fee must be paid by credit card. Checks submitted with paper applications should be made payable to Montana State University and must indicate the U.S. banking codes. The fee will not be waived, deferred, or refunded. The fee must be paid before the application will be processed.

3. **Official Proof of English Language Proficiency**: Please visit the Options for Proving English Proficiency (http://www.montana.edu/international/admissions/englishproficiency.html) website to review approved examinations and intensive English programs, minimum required scores, and countries exempt from providing proof.

4. **Secondary School Academic Records**: For admission purposes, scanned or photocopies of academic records are acceptable. If admitted, students will be required to provide final and official secondary school records listing all courses and grades earned. The record must be sent directly from the secondary school to the Office of International Programs. Alternatively, the student may obtain an official copy from the school, leave it in the school’s sealed envelope, and mail or carry it to MSU. Additional official certificates may be required to show completion of secondary school.

5. **College/University Transcripts**: For admission purposes, scans or photocopies of academic records are acceptable. If admitted, students will be required to provide final and official school records for all post-secondary coursework completed. The transcript must be sent directly from each institution to the Office of International Programs and must list all courses taken and grades earned. Alternatively, the student may obtain an official copy from the school, leave it in the school’s sealed envelope, and mail or carry it to MSU. Additional official certificates may be required to show completion of secondary school.

6. **Translation of Academic Records**: An English translation is required for all non-English academic credentials.

7. **Evaluation of Foreign Credentials**: Final, official academic records and course descriptions are required in order to evaluate courses for transfer credit. Montana State University reserves the right to require a professional evaluation of non-U.S. academic credentials from applicants who have attended colleges/universities outside the United States and Canada (where English is not the language of instruction) unless MSU has a formal agreement with the post-secondary institution.

The Office of International Programs will issue the Form I-20 or DS-2019 (necessary for obtaining F-1 or J-1 visas) to international applicants who are accepted for admission. In order to create a Form I-20 or DS-2019, applicants need to send a copy of a bank statement and a signed, completed financial certificate (http://www.montana.edu/international/admissions/financial_certificate_Y16-17.pdf).

Students must submit completed immunization records and a tuberculosis screening form to University Health Partners (http://www.montana.edu/health). To access these forms, click on "Medical Services"; then "Forms". Completed forms may be submitted by fax, email (immune@montana.edu) or by mail to University Health Partners, Montana State University, PO Box 173260, Bozeman, MT 59717-3260. Students must submit proof of required immunizations and a tuberculosis screening form prior to registration of classes. Questions should be referred to University Health Partners.

Application materials and fees will be retained for one year from the original applied term. To defer admission to a later semester, the Office of International Programs must be notified well in advance of the intended semester of entry.

**Application Procedure for International Undergraduate Non-Degree-Seeking Students**
Students interested in taking a limited number of courses at MSU without pursuing a degree may apply for non-degree-seeking status by submitting the following.

1. **International Undergraduate Application for Admission**: An International undergraduate application (https://www.msuadmissions.org/application/index.cfm?&isndsl)
Programs. Transcripts and test scores received from students are unofficial and not acceptable. To provide time for evaluation and for notice of acceptance to reach the applicant in a timely manner, the application and required credentials must be received by the Office of International Programs according to the following dates.

- Fall Semester - July 1
- Spring Semester - November 15
- Summer Session - March 15

Receipt of the following credentials in the Office of International Programs constitutes a complete application for admission. Requests to have final credentials sent to MSU must be initiated by the applicant. To apply for a semester other than the one originally intended, notify the Office of International Programs as soon as possible.

**Application Procedure**

Receipt of the following credentials in the Office of International Programs constitutes a complete application for admission. Please review the International Admissions (http://www.montana.edu/international/admissions) website for more information.

1. **International Undergraduate Application for Admissions:**
   
   An International undergraduate application (https://www.msuadmissions.org/application/index.cfm?&sid=48) may be submitted online or a paper application form (http://www.montana.edu/international/admissions/docs/InternationalApplication.pdf) may be downloaded and printed. If completing the paper application, please return the completed and signed application form to the Office of International Programs. Contact the Office of International Programs by mail: Office of International Programs, Montana State University, PO Box 172260, Bozeman, MT 59717-2260, or by phone: +1-406-994-4031, or by fax: +1-406-994-1619, or by email (globalstudy@montana.edu).

2. **Application Fee (non-refundable):** $38 for the online application or $30 for the paper application. The fee must be in U.S. currency. The online application fee must be paid by credit card. Checks submitted with paper applications should be made payable to Montana State University and must indicate the U.S. banking codes. The application fee will not be waived, deferred, or refunded. The fee must be paid before the application will be processed.

3. **Official Proof of English Language Proficiency:**

   Please visit the Options for Proving English Proficiency (http://www.montana.edu/international/admissions/englishproficiency.html) website to review approved examinations and intensive English programs, minimum required scores, and countries exempt from providing proof.

4. **Letter of Intent:**

   Students must submit a letter of intent outlining educational objectives, purpose of study, and specific terms and dates of anticipated attendance at MSU.

   The Office of International Programs will issue the Form I-20 or DS-2019 (necessary for obtaining F-1 or J-1 visas) to international applicants who are accepted for admission. In order to create an I-20 or DS-2019, applicants need to send a copy of a bank statement and a signed, completed financial certificate (http://www.montana.edu/international/admissions/financial_certificate_Y16-17.pdf).

   Students must submit completed immunization records and a tuberculosis screening form to University Health Partners (http://www.montana.edu/health). To access these forms, click on “Medical Services”; then “Forms”. Completed forms may be submitted by fax, email (immune@montana.edu) or by mail to University Health Partners, Montana State University, PO Box 173260, Bozeman, MT 59717-3260. Students must submit proof of required immunizations and a tuberculosis screening form prior to registration of classes. Questions should be referred to University Health Partners.

   Application materials and fees will be retained for one year from the original applied term. To defer admission to a later semester, the Office of International Programs must be notified well in advance of the intended semester of entry.

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**Canadian Undergraduates**

**Academic Eligibility**

Freshman students (First time Undergraduates) will be considered for admission on the basis of their secondary school record, English proficiency and ACT/SAT test scores. Applicants who have a minimum cumulative grade-point average (GPA) of 2.5/4.0 on a U.S. scale, or have an ACT score of 22, or have an SAT score of 1540 (prior to March 2016) or SAT Total Score of 1120 (after March 2016) will qualify for admission.

Transfer students will be considered on the basis of their post-secondary education record and English proficiency. A minimum cumulative transferrable grade-point average (GPA) of 2.0/4.0 on a U.S. scale will qualify for admission.

All application materials must bear the official school seal and signature and be sent directly from the institution or agency to the Office of International Programs. Transcripts and test scores received from students are unofficial
6. **College/University Transcripts:** For admission purposes, scans or photocopies of academic records are acceptable. If admitted, students will be required to provide final and official school records for all post-secondary coursework completed. The transcript must be sent directly from each institution to the Office of International Programs and must list all courses taken and grades/marks earned. Alternatively, the student may obtain an official copy from the school, leave it in the school’s sealed envelope, and mail or carry it to MSU. Additional official certificates may be required to show completion of secondary school.

7. **Translation of Academic Records:** An English translation is required for all non-English academic credentials.

8. **Evaluation of Foreign Credentials:** Final, official academic records and course descriptions are required in order to evaluate courses for transfer credit. MSU reserves the right to require a professional evaluation of non-U.S. academic credentials from applicants who have attended colleges/universities outside the United States and Canada (where English is not the language of instruction) unless MSU has a formal agreement with the post-secondary institution.

The Office of International Programs will issue the Form I-20 or DS-2019 to international applicants who are accepted for admission. In order to create an I-20 or DS-2019, applicants need to send a copy of a bank statement and a completed financial certificate (http://www.montana.edu/international/admissions/financial_certificate_Y16-17.pdf). Students will need to present this document to Customs and Border Patrol officers at their Port of Entry.

Students must submit completed immunization records and a tuberculosis screening form to University Health Partners (http://www.montana.edu/health). To access these forms, click on "Medical Services”; then "Forms". Completed forms may be submitted by fax, email (immune@montana.edu) or by mail to University Health Partners, Montana State University, PO Box 173260, Bozeman, MT 59717-3260. Students must submit proof of required immunizations and a tuberculosis screening form prior to registration of classes. Questions should be referred to University Health Partners.

Application materials and fees will be retained for one year from the original applied term. To defer admission to a later semester, the Office of International Programs must be notified well in advance of the intended semester of entry.

**Notification of Admission**

Successful applicants will promptly be issued a letter of acceptance and a Form I-20 or DS-2019 necessary for obtaining an F-1 or J-1 visa. A packet of information regarding orientation, the registration process, a Form I-20 or DS-2019 necessary for obtaining an F-1 or J-1 visa. A Successful applicants will promptly be issued a letter of acceptance and Notification of Admission for the semester of entry.

International Programs must be notified well in advance of the intended start date and is granted permission to do so.

**Application Procedure**

Receipt of the following credentials in the Office of Admissions constitutes a complete application for admission. Requests to have final credentials sent to MSU must be initiated by the applicant. Requests should be made by contacting the high school, the Registrar’s Office at the college/university or testing agency.

1. **Admissions Application:** An application for admission (https://axiomw.msu.montana.edu/AXiomWebprod/Login.aspx?SourceID=13) may be submitted online or downloaded and printed; if completing the paper application, please return the completed and signed application form to the Office of Admissions. The application may also be obtained from a high school counselor or from the Office of Admissions.

2. **Application Fee:** An application fee is not required.

3. **High School Transcript:** An official transcript must be sent directly from the high school to the Office of Admissions. The transcript must post all courses completed and a minimum grade point average (GPA) of 3.25 or test scores listed below.

4. **ACT/SAT Scores:** An ACT Composite score of 27 or an SAT Composite score of 1820 (prior to March 2016) or an SAT Total Score of 1300 (after March 2016). Official ACT/SAT scores should be sent electronically directly to the Office of Admissions from the testing agency. The MSU school code for ACT is 2420; the MSU school code for SAT is 4488.

5. **Coursework:** Must have completed the majority of the College Preparatory coursework outlined under Freshmen Admission Requirements.

6. **Letters of Recommendation:** A letter must be submitted from the high school principal and/or guidance counselor recommending the student for Early Admission.

7. **University Professor Recommendation:** A letter from a faculty member in the university department in which the course is to be taken must state that the student is prepared to take the course in question and is granted permission to do so.

8. **Interview:** The MSU Early Admissions Committee must recommend acceptance in the Early Admission program. Applicants and their parents may be interviewed by the committee. Contact the Assistant Director of Admissions (406-994-2452) to schedule an interview.

**Dual Enrollment**

Dual enrollment is designed to provide Montana high school students with the opportunity to earn college credit through Gallatin College. Gallatin College MSU and local high schools work together to provide these opportunities to their students, as dual credit (high school and college credit simultaneously) or college credit only. Check with your high school counselor to see if your school offers dual enrollment with Gallatin College MSU.

**Application Procedure**

Receipt of the following credentials in the Office of Admissions constitutes a complete application for admission.

1. **Admissions Application:** Three forms are required for admission to the Dual Enrollment Program. An application for admission (https://axiomw.msu.montana.edu/AXiomWebprod/Login.aspx?SourceID=13) can be submitted online. The other required Dual Enrollment forms, the registration form and the student release form (http://gallatin.montana.edu/programs.dual.php), can be found online.
Click the link called “Dual Enrollment Application”. These forms should be submitted to Gallatin College MSU, c/o Dual Enrollment Coordinator, PO Box 170515, Bozeman, MT  59717-0515, or call 406-994-2646.

2. **Application Fee**: An application fee is not required.

3. **ACT/SAT Scores**: ACT/SAT scores may be required for placement or to fulfill prerequisite requirements for particular courses. Contact the Dual Enrollment Coordinator at 406-994-2646 to see if any tests are required for the course. Official ACT/SAT scores should be sent electronically to the Office of Admissions from the testing agency. The MSU school code for ACT is 2420; the MSU school code for SAT is 4488.

### Non-Degree Undergraduate Level

Non-degree undergraduate students are those who have not earned a baccalaureate degree and wish to take college courses, but who are not interested in pursuing a baccalaureate degree at Montana State University.

**Academic Eligibility**

- Students must have at least a high school diploma or equivalent and have not earned a baccalaureate degree.
- Students must be in good academic standing at their previous or current institution (including current students at MSU who wish to change their current status to non-degree).
- Non-degree students are not eligible for financial aid, family housing, or intercollegiate athletic competition.
- Credit earned in non-degree status may apply to a future undergraduate degree program. Academic departments determine how or if the credit will meet graduation requirements.

**Application Procedure**

Receipt of the following constitutes a complete application for admission.

1. **Admissions Application**: An application for admission (https://www.msuadmissions.org/application/index.cfm?c=msud) may be submitted online or downloaded and printed; if completing the paper application, please return the completed and signed application form to the Office of Admissions. The application may also be obtained from the Office of Admissions.

2. **Application Fee (non-refundable)**: $38 for the online application or $30 for the paper application. Checks should be made payable to Montana State University. The application fee will not be waived or refunded. The fee must be paid before the application for admission will be processed.

### Former MSU Students

Students are considered former/returning students when they have attended MSU, but not during the immediately preceding term. The Intent to Register Form (https://www.montana.edu/registrar/pdfs/Intent_to_Register.pdf) should be completed and returned to the Registrar’s Office a minimum of 30 days prior to the registration period for the term desired.

Students who have earned a bachelor’s degree at MSU, but are interested in taking additional work not applicable toward an advanced degree, should complete and file a Non-Degree Graduate Application with The Graduate School.

Students who have completed a bachelor’s degree at another institution since last attending MSU and are interested in pursuing another bachelor’s degree should file an Intent to Register form to declare a Second Bachelor’s Degree.

The following items are required of each former/returning student:

1. A completed **Intent to Register Form**.
2. An official transcript from each college or university attended since last attending Montana State University. After registration is complete, an evaluation of transfer credit will be provided.
3. Students submitting an intent should file it with the Registrar’s Office by the following dates:
   - Fall Semester - July 15
   - Spring Semester - December 15
   - Summer Session - May 1

Returning international students must contact the Office of International Programs to determine if a new Form I-20 must be obtained to renew a student visa.

For questions or to request the Intent to Register Form, contact the Office of the Registrar at 406-994-6650.

### Appeal of Admission Decisions

Applicants who wish to appeal the decision(s) made in the Office of Admissions relating to admission status, acceptance of transfer credit, granting of University Core designation, or Montana residency status are encouraged to contact the appropriate campus resource. Initial questions regarding admission decisions and transfer credit evaluations should be directed to the Office of Admissions. If an appeal is appropriate, information about the appeal process can be obtained from the Office of Admissions.

**Graduation and Admissions Requirements Committee**

[http://www.montana.edu/registrar/CERCandGARC.html](http://www.montana.edu/registrar/CERCandGARC.html)

The Graduation and Admissions Requirements Committee (GARC) considers appeals and petitions from students seeking waivers of established admission and graduation requirements. For admission appeals, the Committee is composed of the Associate Provost (chairperson), the Registrar, the Director of Admissions, and the Assistant Dean of the College in which the student is enrolled.

**Core Equivalency Review Committee**

[http://www.montana.edu/registrar/CERCandGARC.html](http://www.montana.edu/registrar/CERCandGARC.html)

The Core Equivalency Review Committee (CERC) considers appeals and petitions from students seeking re-evaluation of the assignment of transfer credit to meet University CORE requirements.

### Residency Appeals Committee

The Residency Appeals Committee considers appeals from students seeking reconsideration of Montana residency status for fee purposes based upon the Montana Board of Regents Policy. All incoming students should contact the Office of Admissions regarding the appeal process and submission of required documentation. Continuing or returning students who wish to appeal the initial residency classification should contact the Registrar’s Office and request a Student Guide to Montana’s Residency Policy brochure.
Special Academic Opportunities

Montana State University offers numerous opportunities for unique and special academic opportunities through classroom learning, research experiences, study abroad, internships, interdisciplinary programs, and community engagement opportunities.

MSU students learn in the classroom, lab, studio and field through a hands-on student centered curriculum that integrates learning, discovery and engagement in and out of the classroom.

Innovative and significant research and creative activities are a recognized hallmark of MSU, where faculty, students, and staff all participate in the creation of knowledge and art.

Engagement is the collaboration between MSU and its local, state, national, and global communities for the mutually beneficial exchange of knowledge and resources in a context of partnership and reciprocity (Carnegie Foundation, 2006). Engagement, a form of scholarship that bridges teaching, research, and service brings the university intellectual resources to bear on societal needs. (Association of Public and Land Grant University’s Council on Engagement and Outreach, APLU CEO).

Learning

Montana State University (MSU) students learn in the classroom, lab, studio and field through a hands-on student centered curriculum that integrates learning, discovery and engagement in and out of the classroom.

INTERLINK Language Center
http://www.montana.edu/international/admissions/language_instruction.htm

The INTERLINK Language Center (http://www.msu.interlink.edu) on the campus of Montana State University provides intensive English language training, cultural orientation, and academic preparation for students whose native language is not English. Offering six proficiency levels, the program helps students meet the English language admission requirements. Admission to the program is open to applicants who have completed secondary school with a C+ or higher average. The program is authorized to issue forms I-20 to students coming from outside the United States who wish to apply for an F-1 student visa and demonstrate that they can cover their educational and living expenses.

Working closely with the MSU Office of International Programs, INTERLINK also assists with conditional admission (https://interlink.edu/distinctions/conditional-admission) for academically qualified students. Students who satisfy all other admission requirements other than English language proficiency may qualify for full admission to the university, once they successfully complete the program and receive the Center Director’s recommendation.

For information, visit www.msu.interlink.edu (http://www.msu.interlink.edu) or contact the office at 1 (406) 994-3807.

Acoustic Atlas
http://www.acousticatlas.org

The Montana State University Library’s Acoustic Atlas is a free online archive of natural sounds of Montana and the American West. The Acoustic Atlas documents natural soundscapes that are increasingly impeded by human activity and connects people with the sounds of regional ecosystems and biodiversity. The collection and study of animal sounds informs research in the media arts, human health, education, engineering, philosophy, and the social sciences. Hear the rumbling snorts of bison, the murmurs of a Yellowstone mudpot, the eerie booming of a sage grouse and other amazing sounds.

Bob Miller Pavilion
http://animalrange.montana.edu/facilities/eqespav.html

The Bob Miller Pavilion provides indoor and outdoor equestrian facilities for MSU’s Equine program. The Pavilion is also home to the MSU Youth Horsemanship School each summer.

Bozeman Agricultural Research and Teaching Farm (BART Farm)
http://animalrange.montana.edu/facilities/

The Bozeman Agricultural Research and Teaching Farm is located west of the MSU campus, comprises 474 acres and includes: Towne’s Harvest Garden, The Oscar Thomas Nutrition Center, Miller Pavilion, Horseshoeing School and the MSU Horticulture Farm. BART also has a research feedlot, the Calan gate facility, a GrowSafe system, feedmill and an artificial insemination building. Surrounding pastures and hayfields help support the animals (beef cattle, sheep, horses) housed there. The farm is dedicated to the service and support of research, teaching and extension activities relating mainly to animals and animal management.

Bracken Center for Undergraduate Excellence
http://www.montana.edu/business/bracken/

The Bracken Center, in the Jake Jabs College of Business & Entrepreneurship (JJCBE) houses numerous programs that enable students to get the assistance they need to excel academically and professionally. The Center hosts many events focused on recruiting, networking and professional development such as:

• Student Organization Events - The Bracken Center supports six student clubs and organizations (Beta Alpha Psi/Accounting Club, Finance Club, International Business Club, LaunchCats - jointly with Blackstone LaunchPad, Management Club, and a new chapter of American Marketing Association at MSU). These groups host guest speakers, recruiting, and networking events.

• Bracken Business Communications Clinic (BBCC) - The clinic provides one-on-one written and oral communication support to students enrolled in any business course. Assistance includes basic grammar, punctuation, sentence structure, business themes, content and organization of material. These skills can be applied to writing resumes, executive summaries, memos, articles, papers and more.

• Meet the Recruiters/Meet the Accounting Recruiters Fairs - JJCBE hosts two recruiting fairs in the fall for all business students. These events provide a place to network with future employers and to secure interviews. Students dress professionally, network, and share resumes and business cards with prospective employers. More than 70 local and national companies, accounting firms and non-profit organizations are represented each year.

Cereal Quality Laboratory
http://plantsciences.montana.edu/cqlab/

The Montana State University Cereal Quality Laboratory (CQL) researches the end-use properties of cereal grains. Emphasis is on flour milling and bread-baking traits of hard red and hard white wheats. The CQL cooperates with wheat breeders, field technicians, research center scientists, and others to ensure that high-quality wheat is released and recommended by the Montana Agricultural Experiment Station.

The EMPower Minority Program
http://www.montana.edu/empower/
The Engineering Minority Program (EMPower) encourages the involvement of women and minorities in the field of engineering. EMPower provides services to groups underrepresented in engineering, including scholarships, tutoring, mentoring and seminars.

Academic Technology and Outreach
http://ato.montana.edu

Academic Technology and Outreach (ATO) assists MSU in advancing excellence in teaching, learning, research and public engagement. ATO services are organized into three main categories:

- **Teaching and Learning Technologies** supports students, instructors, and administrators by creating and maintaining rich environments promoting active learning. It continually improves existing technologies and enhanced learning spaces while exploring educational innovations for the future of MSU’s teaching and learning ecosystem.

- **Continuing, Professional and Lifelong Learning** offers several graduate degrees and select undergraduate courses online and via video conferencing. Non-traditional programs are offered in partnership with Extended University and MSU academic departments. Program offerings include a variety, certificate, degree and professional development programs.

- **Office of Continuing Education** courses extend the educational resources of the University to the citizens of Montana and beyond. Credit and non-credit courses are offered at various locations across the state. Increasingly, instruction is provided through the use of distance learning technologies, such as video conferencing and web-based online courses.

International Programs
http://www.montana.edu/international/

Responding to fundamental trends that further integrate the United States and Montana into the global marketplace and increase daily contact with other nations, Montana State University seeks to embed international education into the core of the university’s academic and cultural life. The Office of International Programs (OIP) offers a full range of programs and services for MSU students, faculty, and staff.

OIP is responsible for developing and maintaining a network of international partnerships that align with and advance MSU’s academic, research and outreach priorities. At present, MSU maintains active partnerships with over 100 universities throughout the world. These partnerships provide opportunities for study abroad and exchanges, collaborative research, and outreach and service learning opportunities around the globe. OIP provides high quality educational opportunities abroad for MSU students at 250 universities in more than 50 countries.

OIP facilitates programs and services that support the recruitment and retention of talented students from around the world. MSU encourages qualified students from other nations to enroll in its academic programs on a degree-seeking, non-degree, or exchange basis. International students enrich our campus by exposing MSU students, faculty and staff to the diverse cultures, traditions and ways of knowing of other nations. In order to enable international students to succeed at MSU, OIP offers advising on cultural adjustment, immigration regulations, and academic and personal matters; cultural-sharing programs designed to integrate international students with domestic students and the Bozeman community; and instruction in English as a second language through the INTERLINK Language Center.

OIP assists faculty to engage in the international and global dimensions of their academic discipline. OIP provides information and assistance to members of the faculty who wish to conduct research abroad, participate in a faculty exchange program, or develop international dimensions to their courses. OIP also provides employment-based immigration services to MSU’s academic and administrative units, enables MSU faculty to host international researchers, professors and scholars, and facilitates short-term training programs for international students and professionals. These programs serve to build and maintain long-lasting, cross-cultural relationships.

OIP reports to the Office of the Provost and works closely with the MSU International Programs Committee.

Montana Dietetics Internship
http://www.montana.edu/hhd/nondegree/program.html

Food and Nutrition students who want to pursue a career in dietetics have the opportunity to complete a post-baccalaureate level dietetic internship in Montana, the only program of its kind in the state.

MSU Library
http://www.lib.montana.edu

The MSU library is a hub for knowledge and resources including:

- **Library Workshops** - The library offers online and in-person workshops on library research, citation management, library databases, Microsoft Office, cloud computing, research impact and many other topics.

- **Tech Checkouts at the MSU Library** http://guides.lib.montana.edu/techcheckouts - The MSU Library offers a variety of technologies available for checkout to support your academic and adventurous needs, from laptops and digital recorders to video cameras and tripods.

- **Library Research Assistance** - The library offers the Research Assistance Program (RAP) for research consultations with your subject librarian. Work with an expert reference librarian to talk about ideas, search options, strategies, databases, citations, search terms and any other research questions you have.

- **IT Services in the Library** - The IT Services Desk in the Library Commons offers a one-stop resource for help connecting to all campus network resources: secure wireless network, student email, printing, file shares, as well as general software support. IT Services also offers hardware repair (Apple and Dell certified) for laptops.

- **ScholarWorks** http://scholarworks.montana.edu/omlieli - ScholarWorks is an open access institutional repository for the capture of the intellectual work of Montana State University in support of its teaching, research and service missions. MSU ScholarWorks is a central point of discovery for accessing, collecting, sharing, preserving, and distributing knowledge to the MSU community and the world.

Indian Leadership Education and Development (I LEAD) Project
http://www.montana.edu/education/ilead/

The I LEAD project recruits, educates, certifies and place American Indian educators into administrative positions in schools with high populations of Native American students. The program culminates with a graduate degree in Educational Leadership and certification as a school principal or superintendent. The curriculum focuses on local school improvement initiatives through problem-based learning assignments. Each candidate will be assigned a mentor who is an experienced administrator in schools with high populations of Native American students. Classes will be delivered during the school year using computer-based instruction and summer classes held on the MSU campus at Bozeman, Montana. All participants must agree to serve as administrators in schools serving Native American children for a period of time equal to the length of their education and training.

Math Learning Center
The Math Learning Center, a tutoring center for students taking some 100 and 200 level classes, employs qualified undergraduates as math tutors. The department also maintains a computer lab for student to use and employ undergraduates as staff for the lab.

National Student Exchange
http://www.montana.edu/universitystudies/nse/

The National Student Exchange (NSE), a consortium of nearly 200 universities, offers students the opportunity to study at another university for up to one year. By bringing together students from different areas of the country, the NSE encourages participants to broaden their academic, social and cultural awareness. Through a simplified admissions process, students are able to enroll at a host institution with the same financial benefits enjoyed by in-state residents. Credits and grades are recorded at Montana State University as part of the student’s permanent transcript.

Nursing Facilities and Equipment
http://www.montana.edu/nursing/

The College of Nursing offers state of the art simulation technology such as a 3G Simulation Mannequin at all campus sites in addition to extensive clinical experience in local hospitals and rural/under-served settings like the Fort Peck Reservation in northeast Montana.

Plant Growth Center
http://ag.montana.edu/pgc/index.html

The Plant Growth Center comprises 60,000 square feet with 29 glasshouse rooms that are light and temperature controlled. The center also houses the only bio-containment facility west of the Mississippi River for quarantining and testing insects and plant pathogens.

Summer Session
http://www.montana.edu/summer/

The MSU Summer Program provides a variety of classroom, outdoor, and online opportunities for students to advance or complete their educational goals. Offerings include undergraduate core classes, science and mathematics courses designed to meet the academic needs of pre-med students, summer master’s degree programs and outdoor courses in photography and wildlife.

TEAL Classrooms
http://www.montana.edu/us/psd/projects/allPrjs/
TechEnhancedActiveLearningClassroom/

The Technology Enhanced Active Learning (TEAL) classrooms enable undergraduate and graduate students from all eight of MSU’s colleges to collaborate on assignments during class hours in a high-tech space equipped with flat screens and data ports for laptop computers. A key feature of a TEAL classroom is the “flipped” structure of the course so students read or view lecture materials outside of class and actively solve problems in class. This innovative new teaching method and incorporation of technology helps students actively engage in their learning.

The Writing Center’s Peer Tutoring Program
http://www.montana.edu/writingcenter/

The Writing Center’s Peer Tutoring Program offers undergraduate students the opportunity to build their writing skills. In addition to working directly with student writers from across the university, peer tutors also collaborate with faculty, fellow tutors and Writing Center staff to develop resources for writers, provide course-specific writing support, participate in outreach projects and conduct original research. Tutors do intensive, ongoing training and development, and have the chance to engage in Writing Center scholarship, and travel to regional and national conferences.

Discovery

Innovative and significant research and creative activities are a recognized hallmark of MSU, where faculty, students, and staff all participate in the creation of knowledge and art.

American Indian Research Opportunities (AIRO)
http://www.montana.edu/wwwai/

AIRO is a consortium of Montana’s seven tribal colleges and Montana State University dedicated to increasing the number of Native Americans entering higher education and career fields where they are significantly underrepresented. AIRO provides Native students the opportunity to excel and serve as role models for their peers through two summer research experiences:

- The Bridges program builds a seamless educational experience between Montana’s seven reservation-based colleges and MSU and seeks to increase the number of Native American students successfully transferring from two-year tribal colleges to MSU and pursuing academic studies in biomedical and other health related sciences.

- The Montana Apprenticeship Program (MAP) is a six-week summer immersion for underrepresented minority high school students that provides rising sophomores, juniors and seniors their first taste of college life and hands-on science research experience with MSU faculty mentors. The goal of MAP is to inspire young people to pursue college degrees and increase the number of Native American and other underrepresented high school students entering the fields of science, technology, engineering, and math (STEM).

Architecture Fabrication Laboratory
http://arch.montana.edu/students/facilities.html

The School of Architecture has a wide array of digital fabrication equipment including two computer numerically controlled (CNC) milling machines, laser cutting machines, 3D printers, large format scanner and plotter as well as a fully equipped wood lab, welding space, glass kiln and plasma cutter.

The Center for Biofilm Engineering
http://www.biofilm.montana.edu/

The Center for Biofilm Engineering (CBE) has been a world leader in biofilm research for more than 20 years. The center’s emphasis on research, education, and industry continues to produce results and provides exciting opportunities for students, staff, and faculty—as well as industrial partners. Multidisciplinary research teams develop beneficial uses for microbial biofilms and find solutions to industrial problems—think dental plaque or gunk in pipes. In the CBE, students get a head start on their careers by working on research teams led by world-recognized biofilm experts.

The Experimental Program to Stimulate Competitive Research (EPSCoR)
http://mtnsfepscor.org/index.php

EPSCoR is a federally-funded program to promote the development of science and technology capacity in the United States. Funded by the National Science Foundation (NSF), Montana NSF EPSCoR supports capacity building by investing in researchers and institutions to better position them to compete for federal research funds. Students and faculty work together to build infrastructure and capacity for research programs that enhance learning and build the economy.

Health and Human Development
Health and Human Development has numerous unique equipment and facilities for student research projects:

- **Exercise Science** students work with professors to conduct ski research at Bridger Bowl Ski Resort and also help conduct fitness testing for alpine and cross-country ski teams.
- **The Bod Pod**, a piece of equipment that looks like a giant egg, is enabling professors and students in nutrition and exercise science to gather body composition data that may help people fight chronic diseases such as heart disease and diabetes.
- **The Movement Science Human Performance Lab** houses a giant treadmill, the largest in the northwest, capable of measuring Nordic ski performance.

**Image and Chemical Analysis Lab - iCAL**

iCAL is a user-oriented facility that supports basic and applied research and education in all science and engineering disciplines at MSU. The laboratory provides access to state-of-the-art equipment, professional expertise and individual training to government and academic institutions and the private sector. Laboratory instrumentation is dedicated to the characterization of materials through high-resolution imaging and spectroscopy. iCAL promotes interdisciplinary collaboration between the research, educational and industrial fields.

**Montana INBRE (IDeA Network for Biomedical Research Excellence)**

Montana INBRE is funded by the National Institutes of Health (NIH) and supports students’ biomedical research and student success through a statewide network. Montana INBRE focuses on increasing the biomedical research capacity of Montana by building research infrastructure, supporting faculty and student research, and fostering a state-wide collaboration.

**Montana Institute on Ecosystems**

The Institute on Ecosystems (IoE) is a multi-institutional community dedicated to understanding complex ecosystems and the interconnectedness of people and nature. IoE researchers study the vulnerability of landscapes and livelihoods to the effects of climate change, and the IoE supports students who explore the effects of climate change in sustaining healthy ecosystems and economic growth. The IoE has hubs at MSU and the University of Montana and collaborates with other Montana institutions and partners.

**Montana Space Grant Consortium (MSGC)**

The Montana Space Grant Consortium (MSGC) was established in 1991 as a component of NASA’s National Space Grant College and Fellowship Program. The Montana program is one of a national network of 52 consortia, working to strengthen aerospace research and education in the United States. Montana State University is the lead Institution of MSGC, which has eighteen additional academic affiliates across Montana, as well as other educational and industrial members. MSGC offers a variety of programs to support students and faculty wanting to pursue activities consistent with NASA’s interests.

**Museum of the Rockies**

The Museum of the Rockies seeks to understand, preserve and interpret the natural and cultural history of the Northern Rocky Mountain Region. Known for its vast collection of dinosaur fossils, the Museum houses some of the most famous dinosaur specimens in the world including Tyrannosaurus rex and Triceratops. The Museum of the Rockies is both a college-level division of Montana State University (http://www.montana.edu) and an independent 501(c)(3) nonprofit institution. Accredited by the American Association of Museums (http://www.aam-us.org), MOR is one of just 776 museums to hold this distinction from the more than 17,500 museums nationwide. The Museum is a Smithsonian Affiliate and a Federal Repository for Fossils.

**Robotics Lab**

Students interested in robotics have many exciting opportunities, whether they major in computer science or engineering. MSU students have won top awards in various competitions including, NASA’s Lunabotics competition and the Robo Olympics.

**The Space Science and Engineering Laboratory (SSEL)**

The Space Science and Engineering Laboratory (SSEL) enables students and faculty to design and build equipment that NASA has launched into space. Data has been collected from an MSU satellite in orbit since 2011 and from two launched in 2013. SSEL strengthens MSU’s solar-terrestrial physics, microelectronics, optics, composite and ultra-light structures, biofilms and remote sensing programs.

**The Spectrum Lab**

The Spectrum Lab advances the opto-electronic technologies emerging from the research laboratories of Montana State University and fosters their transition to Montana companies and in the process provides enhanced educational opportunities for undergraduate and graduate students. The Spectrum Lab:

- Performs advanced research and development on MSU grown photonic technologies.
- Establishes and maintains university-corporate partnerships to effect the transfer of these technologies into Montana companies.
- Provides enhanced educational and employment opportunities for Montana undergraduate and graduate students, enabling students to perform team-oriented, goal-driven, time-critical research and development.

**The Subzero Science and Engineering Research Facility**

The Subzero Science and Engineering Research Facility is a unique, state-of-the-art suite of labs used to study the effects of the cold on projects across many scientific disciplines. MSU is known worldwide for avalanche research, and this lab expands the study of how cold affects athletes, agriculture, transportation and rare life forms.

**Thermal Biology Institute (TBI)**

Thermal Biology Institute (TBI) is comprised of a multidisciplinary team of scientists and students focused on scientific discoveries in the unique thermal environments within Yellowstone National Park. Committed to furthering scientific understandings of the extreme limits of life on our planet, TBI works to ensure a sustainable future for research and outreach focused on the geothermal features of Yellowstone National Park. Discoveries in extreme environments have led to significant advances that
affect our daily lives in areas of genetics, medicine, bioremediation and alternative energy.

**The Western Transportation Institute (WTI)**
http://www.wti.montana.edu/

The Western Transportation Institute (WTI) is the country’s largest National University Transportation Center focused on rural transportation issues. The institute studies the critical roles that rural transportation plays in the lives of people, the environment and the economy. Integrated research groups create solutions for clients, sponsors and rural transportation research partners.

WTI studies ways to deploy advanced Intelligent Transportation Systems on rural roads, reduce wildlife-vehicle collisions and maintain roads in cold regions. Undergraduates benefit from research projects, field trips, student chapters of professional transportation associations and travel to national conferences.

**Engagement**

Engagement is the collaboration between MSU and its local, state, national and global communities for the mutually beneficial exchange of knowledge and resource in a context of partnership and reciprocity (Carnegie Foundation, 2006). Engagement, a form of scholarship that bridges teaching, research and service brings the university intellectual resources to bear on societal needs. (Association of Public and Land Grant University’s Council on Engagement and Outreach, APLU CEO).

**Activity Classes for Credit**
http://www.montana.edu/getfit

Activity Classes for Credit (ACT) held in the Recreational Sports & Fitness Center count for one academic credit for the student/faculty/staff participant. These classes are a way for students to learn new skills, get exercise, reduce stress, and meet new people. A variety of activity classes are offered such as racquetball, volleyball, yoga, soccer, cycling, tennis, weight lifting and others.

**Blackstone Launchpad**
http://www.montana.edu/launchpad/

The Blackstone Launchpad fosters connections between the university campus, business community and local entrepreneurs to create an environment that nurtures young entrepreneurs and provides them the skills and network necessary to succeed. The Launchpad introduces entrepreneurship as a viable career option and provides students with a network of venture coaches and entrepreneurial support to transform new ideas into sustainable companies.

**Community Design Center**
http://www.arch.montana.edu/cdc/

The Community Design Center (CDC) fosters a collaborative interdisciplinary community/university partnership approach to research and design of the built environment. The goals are to assist community groups and non-profit organizations representing underserved areas or under-funded projects and to work with state agencies, city departments and other regional governmental entities.

**Carnegie Engagement Classification**
http://www.montana.edu/news/9336/carnegie-recognizes-msu-excellence

MSU was awarded The Carnegie Foundation for the Advancement of Teaching’s community engagement classification. This designation recognizes MSU’s commitment to teaching that encourages volunteer service in communities and spreading of knowledge that benefits the public. Service and outreach projects are embedded in MSU’s coursework, research and extracurricular activities to enhance learning and improve lives around the world.

**Education Students**

Students in the education program have numerous opportunities to engage such as:

- **Travel** – Elementary and secondary education majors may choose to compete their student teaching experience in one of fifty countries. In addition, through Educators without Borders, there are opportunities to study in England, France, Mexico and Thailand as well as research opportunities in Russia.
- **Lab Classroom** – In partnership with Hyalite Elementary School, students spend the semester in engaging in the design and delivery of technology-rich instruction in a laboratory classroom environment. This innovative collaboration provides students invaluable opportunities to gain relevant experience in digital learning through working with expert practicing teachers and participating K-5 students.
- **Community**- In partnership with Hyalite Elementary School in Bozeman, students engage in the design and delivery of technology-rich instruction in a laboratory classroom environment. This innovative collaboration provides students invaluable opportunities to gain relevant experience in digital learning through working with expert practicing teachers and K-5 students.

**Humanities and Modern Languages and Literatures International Experiences**

Departments regularly offer study abroad trips to enhance learning. Recent trips have included a Shakespeare course in England, a philosophy course in Greece, a community service course in the Atlas mountains of Morocco and Modern language training in France and Mali.

**International Engineering Certificate**
http://www.cs.montana.edu/paxton/global/certificate.html

Computer science and engineering majors who earn the International Engineering Certificate gain an appreciation of the global environment into which he or she will graduate. Students with the certificate should be more marketable upon graduation, as well as a better global citizen — someone who can live, work and perform anywhere.

**The Jake Jabs College of Business and Entrepreneurship**
http://www.montana.edu/cob/

The Jake Jabs College of Business and Entrepreneurship offers additional hands on learning programs and professional development opportunities such as:

- **Student Clubs** - Students can join a variety of student clubs where they can build their professional skills and learn from experts in their fields, perform community service, collaborate on projects and compete at regional competitions. The Student Entrepreneurs in Action club gives back by helping link students with internship opportunities.
- **Service Learning Courses** – Students are paired with local businesses and community to gain real world experience. Courses such as Volunteer Income Tax Assistance (VITA) program enable students to become trained to assist lower income individuals file their tax returns.
- **Seminars** - Engage with local business experts and entrepreneurs through one-of-a-kind mentoring and face-to-face interactions with veteran business people and entrepreneurs.
- **Speaker Series** – Experts in business present at the Orser lecture each year.

**Music Concert Tours**
The School of Music offers concert tours, both foreign and domestic where students can perform music and see the world. The School of Music offers numerous opportunities for students interested in music such as choral performances in Venice, performing in a jazz band in Prague, or doing a half-time show with the Spirit of the West Marching Band in front of 20,000 fans.

**Nursing Students** have a variety of engagement opportunities such as:

- **International Opportunities**: Nursing students have the opportunity to travel nearly every semester to places like the Dominican Republic, Ecuador and Honduras. The College of Nursing partners with Timmy Global Health to provide global opportunities designed specifically for nursing students. Student nurses typically see up to 120 patients each day and provide basic health assessments, HIV screenings, wound care, dental screenings, health education and pre-natal care. [http://www.montana.edu/nursing/undergraduate/international.html](http://www.montana.edu/nursing/undergraduate/international.html)

- **Research and Creative Opportunities**: Students are able to join their professors in research and service projects across Montana and in partnership with Montana’s seven tribal nations. Some of the research interests within the college include end-of-life decision-making, health disparities, environmental health, oral health, and gerontology.

**Service Learning**

Students learn best when they engage with not only the material but also the broader community.

- **Domestic**: Students actively enhance their class and field experiences by getting involved in a variety of community organizations. Service learning opportunities exist with a number of local organizations including: Arts Without Boundaries, Big Brothers/Big Sisters, Heart of the Valley Animal Shelter, Gallatin Valley Food Bank, Montana Outdoor Science School and Cancer Support Community.

- **International Opportunities**: Service learning opportunities abound and many include international travel. Whether it is through a student organization, part of a class or a customized experience that meets your interests, service learning entails applying information from a class in authentic settings while addressing real community-identified needs.
  - Nursing Students provide basic health screenings in remote areas of South America
  - Engineering students construct wells for clean drinking water in Kenya
  - Architecture students build straw bale houses in Morocco.

**Study Abroad**

MSU encourages students to study abroad, both to build the international skills that are increasingly needed in all professions, and for the intrinsic educational value of studying outside one’s home country.

In addition to hundreds of study abroad options for individual students, numerous special programs are developed by MSU faculty members which allow groups of MSU students to travel and study abroad. Students earn full credit while participating in MSU-sponsored study abroad programs, and in most cases can maintain regular progress toward their MSU degree while studying abroad. Some MSU-approved study abroad experiences also satisfy the University Core Curriculum Multicultural/Global or Diversity requirement. These decisions will be made on a case-by-case basis.

Fees for many study abroad programs are based on MSU tuition rates, enabling students to study abroad for little additional cost than remaining on the Bozeman campus. In addition, students eligible for financial assistance may apply their aid package to meet study abroad costs.

**Towne’s Harvest Garden**

[http://townesharvest.montana.edu/](http://townesharvest.montana.edu/)

Students in sustainable food and bioenergy systems and food and nutrition gain hands-on experience at Towne’s Harvest Garden, the university’s teaching and research garden, growing local and sustainable produce for the community, the local food bank, and the community food truck.

**Women in Engineering**

The Women in Engineering (WIE) program provides female undergraduate and graduate students a supportive, vibrant community in which to learn and thrive, as professionals and individuals. WIE includes faculty and students from all engineering disciplines who share a passion for helping women engineers succeed at MSU and in their careers. Program benefits include scholarships, mentorship and opportunities to collaborate with role models in industry and academia.

[http://www.montana.edu/music/ensembles/](http://www.montana.edu/music/ensembles/)
Academic Support and Student Life

Make new friends in the residence halls, explore Bozeman’s back yard with the Outdoor Recreation Program, link up with like-minded people through one of the 300 plus student clubs and organizations, cheer the Cats to victory, or get résumé help at the Career, Internship & Student Employment Services Office. MSU has a vast array of programs and support services to make for an easy transition into college and to facilitate successful progression throughout your academic career. Explore all that MSU has to offer.

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Office of Student Engagement

The Office of Student Engagement (OSE) provides and facilitates student engagement opportunities for MSU students through a variety of programs, events, services, and activities. We are THE HUB for students interested in connecting with their fellow Bobcats through student government, student organizations, programs and events, and engaging in service to the community.

Student Government

http://www.montana.edu/asmsu/

The Associated Students of Montana State University (ASMSU) provides numerous services to its student members, who pay the student activity fee. ASMSU is the voice for student concerns to the MSU Administration, the Montana University System, the Board of Regents, the Montana Governor and Legislature. The Senate, the legislative governing body, consists of twenty-one students. The Senate annually allocates the student activity fee moneys to twenty programs. The programs are administered by an elected student body president and vice-president, and a business manager, who is appointed. ASMSU hires approximately 250 students a year. An educational experience in responsible management of student funds, knowledgeable decision making, and representation of student concerns, as well as experience in working with people, may be acquired through involvement in ASMSU.

Community Engagement

http://www.montana.edu/engagement/communityengagement/index.html

Contribute and invest your time, energy and talents by volunteering in one of our local and global community service opportunities. Our office hosts a variety of programs to help you connect to the area community. Get involved in the following programs:

- Service Saturdays are monthly service projects that are held on the first Saturday of each month, September through April from 10am-12pm at various non-profit locations in the community.
- MSU BreaksAway is a spring break service trip program, which sends MSU student groups across the U.S. to volunteer during their spring break to meet community needs.
- The fall and spring Involvement and Study Abroad Fair offers a one stop shop for all MSU students, faculty, and staff to engage their local and global community! Hosted by the Office of Student Engagement and the Office of International Program- Study Abroad (http://www.montana.edu/international/studyabroad).
- Rockin’ the M on Mount Baldy the weekend before Homecoming each year involves 100 students in a hike and painting project on our beloved “M”.
- Can the Griz Food Drive competition between MSU and U of M to see who can collect the most food for their local food bank in conjunction with the Cat/Griz football game.
- Catapalooza is our fall welcome event for all MSU students and their families to introduce MSU, student organizations, and the Bozeman area business and non-profit communities.
- Day of Student Recognition is a campus-wide awards ceremony held each spring recognizing students for their outstanding achievements in both service and leadership.

Student Organizations

http://www.montana.edu/engagement/organizations/index.html

Join or start a student organization. MSU hosts more than 250 Registered Student Organizations that reflect the diverse interests of our student body-everything from club sports to cultural organizations. The OSE serves as a resource to campus student organizations providing student leader and faculty/staff advisor training and support.

Campus Programs and Events

http://www.montana.edu/engagement/campus-programs-events/index.html

Participate in an exciting variety of campus programs and events brought to you by your student fee dollars. Students plan concerts, comedians, homecoming activities, and more!

Additional serviced supported by your student fees include:

Student Legal Services

http://www.montana.edu/engagement/campus-programs-events/StudentLegalServices.html

The Associated Students of Montana State University (ASMSU) and Cromwell Law are excited to offer limited scope (http://www.cromwellpllc.com/practice-areas/limited-scope-representation) legal assistance services to MSU-Bozeman and Gallatin Valley College students. If you are a student taking 7 or more credits a semester, you are entitled to extremely affordable legal services.

MSU Student Airport Shuttle

http://www.montana.edu/engagement/campus-programs-events/breakshuttle.html

Montana State University and Karst Stage have teamed up to provide a low-cost shuttle service to the Bozeman Yellowstone International Airport (BZN) for MSU students, year-round!

MSU Office of Sustainability

http://www.montana.edu/sustainability/

The student government office for sustainability at MSU engages students in the process of making the university more environmentally and socially responsible. The Center offers student employment and internship...
opportunities developing outreach programs, events, and strategic initiatives in addition to ongoing services, such as recycling.

Streamline Transit
http://www.streamlinebus.com/
A public bus system provided through a student bus fee. Commuter route buses arrive throughout the day in front of the Strand Union Building. Shuttle route buses also provide transportation to the downtown business area and the Main Mall. Schedules are available at the ASK-US Desk and the ASMSU Office. For further information, call 406-587-2434 or visit www.streamlinebus.com (http://www.streamlinebus.com).

Streamline Latenight
This program coordinates with Streamline Transit to provide late night transportation Thursday, Friday and Saturday from 8 P.M. to 3 A.M. For further information call 406-994-2933 or visit www.streamlinebus.com (http://www.streamlinebus.com).

ASMSU Day Care Center
http://www.montana.edu/engagement/campus-programs-events/Daycare.html
The Day Care Preschool is supported by ASMSU and the University. It is located in the Family and Graduate Housing Louise Shunk Daycare Community Center. Children aged 2 ½ until entrance into kindergarten, of MSU students, staff and faculty are eligible, with priority given to students. Applications are available in SUB 221, on the Day Care Center website or call the Day Care Center at 406-994-4370 for more detailed information.

ASMSU Exponent
http://msuexponent.com/
The ASMSU Exponent, an independently student run newspaper, is published weekly during the academic year. The ASMSU Exponent and is produced by and for the students of Montana State University. Student positions offer experience in publication design, professional editing, journalistic writing, ad campaign creation, and professional management. Call 406-994-2224 or email the editor at editor@exponent.montana.edu (editor@exponent.montana.edu) for more information.

ASMSU KGLT
KGLT FM is a non-commercial, alternative public radio station broadcasting from the campus of Montana State University since 1968. KGLT offers diverse, music-based programming with a staff of 80+ volunteer DJs comprised of students, staff and community members and provides DJ opportunities by offering an apprentice class three times per year. KGLT produces 2,000 public service announcements yearly and is the Emergency Alert System for Gallatin County. The station is supported by ASMSU, Federal and Private Grants, listeners and local businesses. More information on the web at www.kglt.net (http://www.kglt.net).

Recreational Sports and Fitness
http://www.montana.edu/getfit/
The ASMSU Intramurals and Recreation office is located in room 120 of the Hosaeus Fitness Center (HFC). Objectives of the program are to provide activities which promote physical fitness, social contact, improved self-esteem, and foster a permanent interest in wellness through organized recreation. The program provides opportunities for participation in both team and individual sports, offering about seventy different activities throughout the academic year. Currently over eighty percent of the student body takes advantage of this program! Call 406-994-5000 for more information or check out our Web page at http://www.montana.edu/getfit/intramurals-5.html

Students taking 7 credits or more may access the HFC and participate in the Intramural Sports and Open Recreation Programs with no additional fees. Other programs include Personal Training, Group Fitness (75 classes per week), and the Instructional Program. The HFC features 6 gymnasiums, 9 racquetball courts, 4 Group Fitness rooms, a combatives room, a 14,000 sq. ft. fitness area with 70+ cardio machines, a running track, a bouldering gym and more. For more information, please call 994-5000 or visit www.montana.edu/getfit

ASMSU Outdoor Recreation Program
http://www.montana.edu/outdoorrecreation/
The ASMSU Outdoor Recreation Program offers a variety of services including equipment rental, group outings, resource area, bicycle & ski workshop, non-credit instructional classes and other activities. The Outdoor Recreation Center is located on West Lincoln Street, adjacent to the Rosie Hall parking lot and the Intramural Fields. Further information may be obtained at 994-3621.

The Procrastinator Theater
http://www.montana.edu/engagement/campus-programs-events/Procrastinator.html
The Procrastinator Theater is MSU’s student-run second run theatre located in SUB 287. The Procrastinator shows movies six night a week (closed Wednesdays for student and community groups to use the theatre) during the academic year, with two films nightly. All movies are $2.

Arts and Exhibits
http://www.montana.edu/engagement/campus-programs-events/ExitGallery.html
ASMSU Arts and Exhibits features contemporary art and ideas to educate and challenge MSU students and the community through exhibitions, lectures, and workshops in the visual arts. The Arts & Exhibits program exists to educate and enlighten the Montana State University student body, faculty, staff, and the Bozeman community. By sharing the work of MSU students, alumni, faculty, departments, and guilds through exhibitions and receptions, and by partnering with MSU departments to host professional artists who share lectures and demonstrations in conjunction with exhibition of their work, we strive to challenge our community to learn about and connect with contemporary art and ideas.

ASMSU Student Political Action Committee
http://www.montana.edu/engagement/campus-programs-events/PoliticalActionCommittee.html
ASMSU ensures that student voices and concerns are heard and acted upon by the MSU administration, the local community, the Board of Regents, and the State of Montana. The ASMSU Student Political Action Committee exists primarily to lobby the state legislature. Student input is always welcomed, particularly during state legislative sessions. Students interested in serving on this committee should contact the ASMSU Senate Office in 221 SUB, 406-994-2933.

ASMSU Leadership Institute
http://www.montana.edu/leadership/
The Leadership Institute is charged with providing leadership opportunities and inspirations to MSU students. The Institute works towards developing leaders and problem solvers who effectively empower both self and others. Our objective is to work on a system wide basis providing, coordinating, planning and organizing leadership opportunities for students, faculty, staff and community members throughout MSU and Montana. For more information call 406-994-7275 or visit www.montana.edu/leadership.

Student Engagement Global Ambassadors (SEGA)
SEGAs are current MSU students that are involved in activities on campus, in the local community, and in the global community. SEGAs share their experiences, the importance of being an involved student, and most importantly will help students develop an individual engagement portfolio that aligns with their personal and professional goals.

**MSU Debut**
http://www.montana.edu/msudebut/

The first year is pivotal in the academic, social, and emotional development of students entering their undergraduate career. In particular, experiences encountered in the first six weeks significantly influence a student’s academic commitment and engagement with the university community. MSU Debut was built with the intention of advancing student engagement opportunities, better integrating the myriad of university programs and services to optimize the undergraduate experience, and guiding students to craft their identity as a college student.

There were 14 signature events in 2017 which included:

- First Meal
- Hypnotist
- Catapalooza
- Convocation
- Target After Dark Shuttle
- Movie on the Wall
- SUBTACULAR
- The Freshman Class "M" Photo
- Bobcat Block Party
- Ask Me Tent
- Rec Sports Amazing Race
- Pool Party at Bozeman Hot Springs
- Convocation Service Saturday
- Cat Kick-Off Tailgate

For more information about anything here please contact us in the MSU Office of Student Engagement by calling (406) 994-2933, email us at engagement@montana.edu, come by our office in room 221/222 of the Strand Union Building (SUB), or check us out on the web at www.montana.edu/engagement.

**Computer Resources**

MSU places high priority on the use of information technology to enhance the educational experience, with a wide variety of technology resources available to students and faculty.

**Student IT Services**

Visit Student IT Services (http://www.montana.edu/itcenter/student-services.html) to learn about the software and services available to MSU students and how to access them.

**University Information Technology (UIT) and Service Desk Support**

University Information Technology (UIT) and the IT Community is dedicated to providing the MSU campus with the technology and services that support and promote student success. UIT builds and maintains the technological infrastructure at MSU which includes the campus network, computing devices and virtual desktops in campus labs, MSU email and the campus telephone system, classroom technology, and the online learning platform, Brightspace.

The UIT Service Desk, housed in the Renne Library Commons, provides IT support to campus by assisting with ID and password questions, account setup, IT security concerns, software installations, Wi-Fi and more. Contact the Service Desk at 994-1777, helpdesk@montana.edu or visit them in the Library.

**On-Campus Student Computer Labs**

Students have access to over 600 computers in collaborative workspaces and labs in residence halls, academic halls, and the Renne Library. Lab computers offer specialized and industry-standard software packages for technology-specific assignments, including Microsoft Office, Adobe products, AutoCAD, SAS, SPSS, and MCAD. Visit http://studentlabs.montana.edu/ for more information.

**Residence Hall Internet and Technical Assistance for Residents**

ResNet (http://www.montana.edu/resnet) connects more than 2700 residence hall rooms and family and graduate-student housing units with internet access. The ResNet Help Desk (http://www.montana.edu/resnet/help_desk.html), located in South Hedges provides technical assistance to students living on campus that includes virus removal, software installs, and computer and mobile device support.

**Student Email**

Students receive an MSU email account (http://www.montana.edu/email) while enrolled at Montana State. Students are required to check email at least twice a week in order to receive and not risk missing official University communications (like financial aid, registration and advisor info, etc.) and other MSU-related announcements. See the Student Electronic Communication Policy (http://www.montana.edu/policy/student электронных коммуникаций) for details.

**Classroom Technology**

Numerous classrooms are technology-enhanced with equipment to support instruction and enrich student learning. MSU has three TEAL (Technology Enhanced Active Learning) classrooms. Each of these spaces is designed and equipped with technology and furniture that create an active collaborative learning environment.

**Intercollegiate Athletics**

Montana State University Department of Intercollegiate Athletics strives to foster excellence in academic and athletic performance while providing excitement and pride on-campus and among all who support the University.

MSU sponsors 15 sports and is a NCAA Division I member institution, with football competing in the Football Championship Sub-Division (FCS). The department offers a variety of ways for all students to enhance the college experience through supporting the Bobcats, either as a participant or a fan.

Montana State is an active member of the Big Sky Conference where it has the opportunity to participate in the following championships: Football, Men’s and Women’s Basketball, Women’s Volleyball, Men’s and Women’s Cross Country, Men’s and Women’s Indoor Track & Field, Men’s and Women’s Outdoor Track and Field, Men’s and Women’s Tennis, and Women’s Golf. Men’s and Women’s Nordic and Alpine Skiing participate in the Rocky Mountain Intercollegiate Skiing Association. Bobcat Athletics also sponsors a Spirit Squad, which consists of cheer and dance.

Montana State University is committed to promoting student-athlete well-being, ethical conduct, sportsmanship, equal opportunity, and financial responsibility while striving to be the best in the Big Sky Conference.
Traditionally, MSU hosts the largest home crowds within the conference supported by both the student body and the Bozeman and statewide communities and annually finishes near the top of the Big Sky Conference’s All Sports Trophy, which acknowledges the best overall athletic program in the Big Sky by measuring athletic and academic success.

In pursuit of athletic excellence, the Montana State Bobcats have claimed eleven national championships and 46 conference titles in its history; most recently Big Sky Conference crowns in women’s basketball 2016-17, men’s tennis 2013, and football 2010, 2011 and 2012. The Bobcat ski team is a nationally renowned program and placed fourth in the country at the 2016 NCAA Championships. The ski team finished sixth in the nation in 2017 paced by women’s standout Benni Lyche, who captured the NCAA Giant Slalom title. In addition, MSU is traditionally ranked among the Big Sky Conference’s best in numbers of academic all-conference selections.

Student-athletes and the entire department are strongly committed to give back to the community. Student-athletes can often be found in the local schools and at community organizations and events promoting local causes.

Bobcat Athletics strives to develop campus leaders and engaged student-athletes. The department provides support programs designed to enhance the student-athlete experience by supporting the academic, athletic, and personal growth of all student-athletes. The department has an Athletic Academic Center, Strength and Conditioning program and Sports Medicine program designed to assist student-athletes in these areas.

To learn more about Bobcat Athletics, please visit www.msubobcats.com (http://www.msubobcats.com). Students may attend Bobcat Athletic home events for free by presenting a valid Cat Card. GO CATS!

Library and Information Resources

Dean
Kenning Arlitsch
Library Administration, Renne 124
406-994-3119

Research Assistance
The Research Desk is located in the Renne Library Commons
406-994-3171
Email or Chat (http://www.lib.montana.edu/services/research-and-instruction)

The Library
The Library’s mission is to facilitate student and faculty success by providing access to information and knowledge. It supports the University’s commitment to teaching and research through its information resources (most of which are electronic), research assistance to students and faculty, and by providing technology-rich learning and study spaces.

Students in need of help locating information resources for assignments or research projects may drop by the Research Desk or schedule an appointment with a librarian (http://www.lib.montana.edu/forms/rapreq.php). Knowledgeable and friendly faculty librarians and staff provide assistance using the collections, accessing online information resources, and delivering instruction to individuals and groups. Each discipline on campus has its own subject librarian.

The Renne Library is one of the busiest buildings on campus receiving approximately 30,000 visits in a typical mid-semester week. It offers a variety of study options for students, including group study rooms that can be reserved, group collaboration areas, and quiet spaces. Wi-Fi is available throughout and computer workstations are plentiful. Laptops and other tech hardware are available for check-out.

The Library maintains the University’s open access institutional repository – ScholarWorks (http://scholarworks.montana.edu/smlui) – which captures the intellectual work of the Institution. It offers data management and curation services to researchers, and provides access to local digital collections (http://www.lib.montana.edu/digital), including historical papers, MSU theses and dissertations, and photographs.

Special Collections and Archives (http://www.lib.montana.edu/archives) holds unique primary source and original materials in the areas of Montana agriculture and ranching, Yellowstone National Park and its ecosystem, Montana history, Native Americans, trout and salmonid fish, and author Ivan Doig’s archives.

Additionally, the Library is home to the Information Technology Help Center (http://www.montana.edu/itcenter), a satellite location of the Writing Center (http://www.montana.edu/writingcenter), and Testing Services (http://www.montana.edu/ehhd/centers/testing).

The Brewed Awakening coffee shop offers a variety of beverages and snacks for sale.

Courses Offered

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSCI 121</td>
<td>Library Research Skills</td>
<td>2</td>
</tr>
<tr>
<td>LSCI 290R</td>
<td>Undergraduate Research</td>
<td>1-6</td>
</tr>
<tr>
<td>LSCI 316</td>
<td>Bus Info Research Skills</td>
<td>3</td>
</tr>
<tr>
<td>LSCI 490R</td>
<td>Undergraduate Research</td>
<td>1-6</td>
</tr>
<tr>
<td>LSCI 492</td>
<td>Independent Study</td>
<td>1-3</td>
</tr>
<tr>
<td>LSCI 498</td>
<td>Internship</td>
<td>1-12</td>
</tr>
</tbody>
</table>

Additionally, Research Librarians and Library staff provide research assistance, deliver many course-specific instruction sessions, and teach workshops on a wide range of topics.

University Health Partners

Following an integrated, collaborative model, University Health Partners (UHP) unites the components of health and well-being for MSU students including prevention, health promotion, public health, medical services, dental services, and counseling & psychological services.

UHP Medical Services, Dental Services and Counseling & Psychological Services are located in the Swingle Building just east of the Strand Union Building. The Office of Health Advancement is located in two houses at 1102 and 1106 S. 6th Ave. The VOICE Center is located in 370 Strand Union Building (SUB) on the third floor above Leigh Lounge and Avogadros Number.

- Medical Services
- Dental Services
- Health Advancement
- Counseling & Psychological Services
- The VOICE Center

Medical Services
montana.edu/health/medical

UHP Medical Services provides primary health care to eligible MSU students and spouses. In addition to primary health care, UHP has a clinical laboratory, x-ray, pharmacy, and nutrition services. UHP is accredited by the Accreditation Association for Ambulatory Health Care and is a
Internships to allow students the opportunity to apply theory to practice wellness related topics. The Office of Health Advancement offers paid positive stress management and healthy sleep hygiene habits among other positive body image, healthy nutrition, the development of resiliency, approach to alcohol, tobacco and drug use, promote safe sexual practices, to be successful academically and personally. We take a harm reduction programs, activities and educational campaigns designed to allow students making healthy choices. Health Advancement uses evidence-informed health approach which works to create an environment that supports community to thrive through a balanced lifestyle. We employ the public Health Advancement Educates, Empowers and Energizes the MSU montana.edu/oha/ provided within certain limits. For appointments or more information call 406-994-2311.

All MSU students are required to show proof of current immunizations against the following vaccine-preventable diseases: measles, mumps, and rubella (two doses of each unless born before 1957). New students must also complete the Student Health Service’s tuberculosis screening form. Students identified by the screening process as high risk for tuberculosis must be tested. Students will not be permitted to register for classes until the Student Health Services receives verification of immunizations, screening, and (if required) tuberculosis testing.

Immunizations
montana.edu/health/immunization

All MSU students are required to show proof of current immunizations against the following vaccine-preventable diseases: measles, mumps, and rubella (two doses of each unless born before 1957). New students must also complete UHP’s tuberculosis screening form. Students identified by the screening process as high risk for tuberculosis must be tested. Students will not be permitted to register for classes until the UHP receives verification of immunizations, screening, and (if required) tuberculosis testing. For questions or information call 406-994-2311.

Health Insurance
health insurance for students (http://www.montana.edu/health/medicalservices/eligibilityfeesandinsurance/msainsurance.html)

Montana State University students who carry six or more credits are required to carry health insurance. Health insurance is available for all MSU students through a university-sponsored health insurance program. Students who have adequate health insurance may waive participation in the University plan. Students can contact the Insurance Coordinator at 406-994-3199.

Dental Services
montana.edu/dental

UHP Dental Services provides preventive and emergency care for urgent dental needs. Routine cleanings and emergency treatment can be provided for most students in addition to complete examinations, fillings, and crowns. Other dental treatments such as night guards, tooth whitening, custom fit athletic mouth guards, root canals and extractions can be provided within certain limits. For appointments or more information call 406-994-2314.

Health Advancement
montana.edu/oha/

Health Advancement Educates, Empowers and Energizes the MSU community to thrive through a balanced lifestyle. We employ the public health approach which works to create an environment that supports making healthy choices. Health Advancement uses evidence-informed programs, activities and educational campaigns designed to allow students to be successful academically and personally. We take a harm reduction approach to alcohol, tobacco and drug use, promote safe sexual practices, positive body image, healthy nutrition, the development of resiliency, positive stress management and healthy sleep hygiene habits among other wellness related topics. The Office of Health Advancement offers paid internships to allow students the opportunity to apply theory to practice while still in school and works collaboratively with other campus and community partners. For more information, please call 406-994-4380

Counseling and Psychological Services
montana.edu/counseling

Counseling & Psychological Services (CPS) provides culturally sensitive services to MSU’s diverse student population. Services at CPS are free and confidential. CPS sees students for a variety of concerns including adjustment difficulties, academic struggles, depression, anxiety, relationships, substance use, eating disorders, current/past trauma or abuse, problematic behaviors, identity concerns and many others.

In addition to counseling services, CPS staff offer outreach and prevention programming, including suicide prevention, and consultation and training to student organizations, faculty and staff.

CPS is staffed by licensed psychologists and counselors, as well as advanced graduate students and is accredited by the International Association of Counseling Centers. The training program is accredited by the American Psychological Association.

Students can reach CPS at 406-994-4531 to schedule an appointment. There are various crisis resources available to students after hours including the 24-hour crisis line at 406-586-3333, National Lifeline at 1-800-273-8255, and National Crisis Text Line at 741741.

The VOICE Center
montana.edu/voice

The VOICE Center provides free confidential support, advocacy, and referral services to survivors of rape, sexual assault, relationship violence, and stalking. Trained student advocates and professional staff work with faculty, other campus professionals, and the Bozeman community to provide advocacy and education. The VOICE Center has walk-in hours as well as a 24-hour crisis line. Students of any age or gender are invited to stop in or call for information: 406-994-7069.

Student Services

- Office of the Dean of Students (p. 34)
- Allen Yarnell Center for Student Success (p. 34)
- Office of Financial Education (p. 36)
- Career, Internship & Student Employment Services (p. 35)
- Disabled Student Services (p. )
- Re-entry Student Services (p. 36)
- The Veteran Support Center (p. 36)
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Office of the Dean of Students
www.montana.edu/wwwds

The Dean of Students office acts as an advocate for students, consults and works with individual students and student groups, and works with other campus offices in creating a sense of community at MSU. Assistance is available on a “drop-in” basis or by appointment. Services offered by the office include:

- Consulting with students to help mitigate conflicts on campus
- Supporting MSU’s fraternities and sororities
- Supporting MSU’s parent and family relationship program
- Coordinating conduct hearings
- Providing general information or assistance
- Administering and interpreting the Student Conduct Code

The Office of the Dean of Students is located in Student Union Building (SUB) room 174. Call 406-994-2826 for more information.

Allen Yarnell Center for Student Success
www.montana.edu/aycss

The Allen Yarnell Center for Student Success believes in students and their potential. Students who visit the office learn to take an active role in owning and directing their education and future. The Allen Yarnell Center for Student Success offers several programs and services aimed at helping students succeed at MSU. These offices and programs include:

Offices within AYCSS
Office of Student Success (http://www.montana.edu/aycss/success)

- Student Success Advisors & Learning Strategist - Student success advisors are expert learning strategists who meet one-on-one with students to teach them tools they can use to improve their academic performance. Topics covered in meetings include:
  - organization
  - time management
  - how to improve grades
  - prioritization and meeting deadlines
  - other techniques to help keep students on the path to graduation

- Students who meet with our student success advisors are more aware of how they learn and how they can better themselves to ensure a successful academic career. Our student success advisors are committed to assisting students and helping them get connected to the campus resources they need to utilize to be successful MSU students.

- Student Early Alert System - Students are referred to our office in a number of different ways, but most often through the Early Alert System. When faculty members are concerned about an individual student’s classroom performance, attendance, or course progress, they can submit the student’s name to our office through the Early Alert System. The Office of Student Success personally connects referred students with student success advisors who provide them with tools to improve their performance and help them formulate a success plan for the remainder of the semester. Advisors can also answer questions about how academic performance may affect financial aid, living arrangements, and academic standing and point students towards the right resources to address those concerns and achieve greater success at MSU.

- Workshops - The Office of Student Success offers free workshops that help students become organized, learn the ins and outs of MSU, and connect with other students. These workshops include:
  - The Five Keys to College Success
  - Developing Your Study Skills
  - Managing Your Time
  - Effective Test Preparation
  - How to Manage Fear of Tests
  - How to Think Like a College Student
  - And lots more!

- ChampChange - ChampChange rewards undergraduate students for engaging in events and programs at MSU and in the Bozeman community. Students earn points by attending special lectures, attending Residence Hall programs, meeting with a student success advisor, financial coach, or career coach, voting in ASMSU elections, volunteering for service projects sponsored by the Office of Community Involvement, playing intramural sports, meeting with a SmartyCats tutor, and so much more.

  - Students can also swipe their CatCards and receive ChampChange points any time they visit one of these permanent reader locations:
    - Student Tickets
    - Allen Yarnell Center for Student Success
    - Student Athletic Events
    - Writing Center - Wilson Hall
    - Writing Center - Renne Library
    - Fitness Center
    - BBCC Writing Center
    - Gallatin College Help Center
    - Math Learning Center
    - Chemistry Help Center
    - SUB Rec Center
    - Physics Help Center
    - Library Main Door
    - ITC Help Desk
    - CatCard Office
    - Veteran Support Center
    - Academic Advising Center
The Career, Internship, & Student Employment Services office, located in the lower level of the Strand Union Building (177 SUB), offers a full range of career planning and employment services to students, alumni, the campus community, and employers. A primary goal of the office is to help students identify purposeful and fulfilling career paths and to gain experience and career skills which will clarify goals and facilitate entry into the job market. Students concerned about choice of major or career, who have questions about career options or graduate school, or who need help searching for jobs should visit the office. To learn more about Career, Internship & Student employment services, visit www.montana.edu/careers or call 406-994-4353. Our primary services are listed below.

- **Career Fairs** - Annually, we host at least four career fair events on campus. These include Student Employment Job Fairs, the Fall Career Fair, the “Almost” Spring Job & Internship Fair, and the Teach Montana Educators Fair. These career fairs offer opportunities for students and alumni to network and build relationships with employers and organizations.

- **Workshops and Events** - The office offers a range of events and workshops preparing students for the world of work by identifying their interests and matching them with exciting opportunities and career choices. Workshops and events include:
  - Margaret Alderson Etiquette Dinner
  - Professional Skills Studio
  - Executive Closet
  - Meet the Employers Networking Event
  - Career Fair Preparation
  - Careers Under the Big Sky Networking Event
  - Careers in Demand Workshops
  - Resume Critiques
  - Resumes for Government Jobs
  - Diversity Coffee Networking Event
  - Veterans Networking Event
  - What Can I DO with a Major in…?
  - What Can I DO with a Career in…?
  - Help! I’m Still Undecided! Finding a Career That Matches Your Skills and Interests

- **Career Coaching** - Our experienced professional Career Coaches assist individuals with their choice of major, career opportunities, job search preparation, and career changes. The coaches work with students to use career assessment tools such as career interest inventories, computerized guidance systems, and personality indicators in order to prepare them for the world of work. Additionally, coaches assist with career preparation through job and internship searches, resume critiques, and practice job interviews.

- **HireABobcat.com** - This free job and internship portal is exclusively for MSU students and alumni to search for full- or part-time employment, internships, and other interesting opportunities. Employers can access HireABobcat.com (http://www.hireabobcat.com) to post job openings and opportunities for students and alumni.

- **Professional Skills Studio** - MSU’s Professional Skills Studio was developed in response to our employer partners’ identified need for interns and employees trained in the “soft skills” necessary to succeed and perform at a high level in the workplace. Completing the professional skills studio signals to employers that you recognize the importance of these skills and are taking steps to acquire them and positions you for success from day one in your first job, helping you to advance in your career.

- **Bobcat Mentoring** - The MSU Alumni Foundation and MSU Career, Internship & Student Employment Services are proud to host the MSU Bobcat Mentoring Program, designed specifically to connect students with outstanding MSU alumni ready to share their stories, networks, and experiences in order to help students navigate their future possibilities. Mentors and mentees are matched for a year but build relationships that will last indefinitely. These alumni are willing to share their stories so students can build theirs. http://www.montana.edu/mentor

- **Internships** – Utilizing www.HireABobcat.com, students are able to view and apply for internships in a variety of fields. It is recommended
that students complete at least one, preferably two, internships before graduation. Surveys conducted through our office indicate that the number one reason why a graduate gets a job is because of the valuable experiences they earned while interning in their area of interest.

- **On-Campus Interviews** - The office also hosts on-campus interviews for summer opportunities, internships, and career positions with a variety of employers in business, industry, government, and education.

- **Credential Files** - Teachers and graduate school candidates may set up credential files which contain personal, educational, and employment data as well as letters of recommendation. They may access and update this information for future employment and educational opportunities.

**Office of Financial Education**

http://www.montana.edu/aycss/financialedu/

- **The Office of Financial Education** provides resources to MSU students and MSU alumni to help them gain financial independence and learn techniques to achieve their life goals. We educate and support our students to ensure that they can manage debt and develop sound budgeting skills. We offer students opportunities to improve their financial management skills through one-on-one financial coaching, workshops and events, and informational materials.

**Return-to-Learn**

http://www.montana.edu/aycss/return2learn/

- **Return-to-Learn** helps returning students navigate the re-enrollment process, understand the value of their return to school, and successfully reach their educational goals. A Return-to-Learn specialist is assigned to each student to check in periodically to ensure that returning to MSU is simple and seamless. Return-to-learn staff and student success advisors help students arrange financial aid, connect with an academic advisor, register for classes, find tutoring, and much more.

**Re-entry Student Services**

- **Non-traditional-age students (25 and over)** can find direction, support, and assistance in this office. Consumer information is available. Re-entry Student Services is located in 180 Strand Union. Students may also contact the office by phone, 406-994-4316 or by e-mail, R2L@montana.edu

**Office of Disability Services**

www.montana.edu/wwwres/disability

- **The Office of Disability Services** determines eligibility for specific disability accommodations, assure the provision of approved accommodations, and provide direction, advice, and referral services for persons with verified disabilities. Students seeking accommodations for a disability must request services through Disabled Student Services, 180 Strand Union Building. Students may also contact the office by phone, 406-994-2824, by TDD, 406-994-6701, by fax, 406-994-3943, or by email, DRV@montana.edu.

**MSU Hilleman Scholars Program** (http://www.montana.edu/ hillemanscholars)

http://www.montana.edu/hillemanscholars/

Montana State University is pleased to offer the MSU Hilleman Scholars Program to honor the legacy of Dr. Maurice Hilleman. Dr. Hilleman was one of the most respected and important scientists of the twentieth century. His tenacious research and discovery over a 40-year career led to many of the vaccines we use today, improving public health and saving the lives of millions. The MSU Hilleman Scholars Program provides worthy high school graduates from Montana with exceptional financial and academic support throughout their four years at MSU so that they, too, can realize their full potential and actively contribute to their communities.

Montana State University is committed to using unparalleled and innovative programs to advance the futures of the residents we serve. We know there are more emerging world-class scientists, teachers, artists, engineers, counselors, nurses, writers, doctors, farmers, ranchers, and entrepreneurs in our towns, cities, and countryside who want to fully realize their potential, just like Dr. Hilleman. As the state’s land-grant institution, we believe the future of our Treasure State rests in our sons and daughters and their ability to advance and shape Montana, the nation, and the world as we will come to know it.

The Veteran Support Center

www.montana.edu/veteran

The Veteran Support Center provides service and assistance for veterans, dependents, and members of the guard and selected reserve who receive educational benefits from the U.S. Department of Veterans’ Affairs (DVA). DVA educational benefits recipients must have school enrollment certified each term by the MSU certifying official. Applications for the MUS Honorable Discharged Veteran Fee Waiver (see Special Exemptions for full fee waiver information) are also reviewed by the certifying official for approval. The Veteran Support Center is located in 185 Strand Union Building. Students may also contact the office by phone, 406-994-2824, by TDD, 406-994-6701, by fax, 406-994-3943, or by email, vets@montana.edu or bywork@montana.edu.

Women’s Center

www.montana.edu/wwwwomen

The Women’s Center is open to all students, faculty, staff, and community members considering returning to school, and facilitates student and academic success at MSU through involvement with educational co-curricular programs and services. Located in room 372 of the Strand Union Building, the Center is open 9 a.m. to 4 p.m., Monday through Friday, when school is in session. Services and resources include: weekly Sack Lunch Seminars, events celebrating National Women’s History Month, the Women and Their Futures film series, the Shannon Weatherly Memorial Lecture Series, a quarterly newsletter, a lending library with resources addressing women’s and gender concerns, career and scholarship information, and various other resources and programs. The Women’s Center also offers volunteer and internship opportunities.

Diversity Awareness Office

www.montana.edu/diversity

The Diversity Awareness Office (DAO) provides information and support to the university community in the areas of multicultural awareness and community building, prejudice education, and practical resources relating to diversity issues. The DAO sponsors, produces and promotes events that encourage and foster diversity awareness around issues of gender, class, religion, sexual orientation, and ethnicity. Awareness of diversity is examined through lectures, movies, discussion groups and social events. The DAO provides a safe supportive environment in which students can begin to understand the diversity they experience on campus as well as the larger global community.

Part of the vision of the DAO is to foster and support the growth of understanding and tolerance of difference throughout the university and in the surrounding community. We seek the existing diversity as a valuable resource towards this goal, and seek to involve students in all steps of the process. From this, we hope to add to the leadership skills of those
students interested in the processes of raising visibility and understanding of difference and multiple perspectives.

The Diversity Awareness Office manages programs such as Expanding Horizons, Sustained Dialogue, and Safe Zone. The DAO collaborates with student groups, departments, and community organizations to deliver lectures, activities and events that address issues of diversity on campus, within the state, and in the world at large. For more information, please visit www.montana.edu/diversity or visit us in Strand Union Building room 368.

**Cat Card**

www.montana.edu/catcard

The Cat Card is your MSU Student ID, an optional on-campus debit card, and after hour access card to the residence halls. The Cat Card also serves as a meal pass card and is used to gain entrance to Marga Hosaetis H&PE Center and student functions such as athletic events.

The magnetic strip on the back of the Cat Card contains information about the student’s current status. When swiped at various locations on campus, this information determines, if the student is permitted to participate in the services or activities at a specific location.

Deposits can be made at the Cat Card and Meal Pass Offices to use the card as an on-campus debit card. You can also manage your account and make deposits online at www.montana.edu/catcard. The Cat Card can then be used to make purchases in all food areas, MSU Bookstore, Health Service, Dental Service, Strand Union retail areas, copy machines, laundry machines in the residence halls, parking areas, and other areas on campus that accept Cat Cards.

Your Cat Card is your “key” to the campus. For more information about the Cat Card visit the Cat Card Office in the lower level of the Strand Union Building or call 994-CARD. You may also visit our Website at www.montana.edu/catcard.

**Strand Union (SUB)**

www.montana.edu/sub

The Strand Union Building (SUB) is truly the center of campus activity at MSU. The SUB provides daily services, amenities and out-of-the-classroom opportunities for informal interaction among members of the MSU community. The Strand Union strives to provide students with a space for personal development and fulfillment through opportunities in student government, community service groups, and employment as well as recreational events and activities. The SUB also fills the role of conferencing center for hundreds of meetings and conferences every year.

Focused on serving the needs of students, faculty, staff and guests to the university, the SUB offers two student managed, student staffed service centers: the Ask Us Desk and the Rec Center. The Ask Us Desk is the information center for the building, connecting people to campus information, handling lost and found, stamps sales, affordable fax services, and is a Tickets West ticket sales outlet. Visit www.montana.edu/askus for MSU events and schedules, and other information.

The Recreation Center provides a social gathering place and stress relief with bowling, billiards, foosball, shuffleboard, big screen TVs, special late night events, Wii and PlayStation 2, and of course, snacks! A limited number of lockers in the SUB are available for rental through the Rec Center. Each semester, bowling and billiard classes are offered and can be registered for through the Health and Human Development Department. For more information and hours, visit www.montana.edu/subrec.

The SUB Building offers meeting rooms (seating from 10-1,350) through Conference Services, and houses the MSU Bookstore, full-service banking, student lounges and a variety of ATMs. There are also copy and postal services and a FedEx drop box in the building. Strand Union Food Services include sandwiches and wraps at Avogadro’s Number, burgers and pizza from the Bobcat Court, delicious espresso drinks from S.R.O., treats and smoothies from The Sweet Shop and Freshens, a variety of other meal choices from the Union Market, and University Catering for special events.

The SUB is also home to the Associated Students of Montana State University (ASMSU Student Government, Campus Entertainment, the Exit Gallery, Student Legal Services, the Leadership Institute, KGLT Community Radio), Admissions, the MSU Veteran’s Center, the Office of Community Involvement, the Cat Card Office, Financial Aid, Copy Cats, the VOICE Center and the Procrastinator Theater. The Division of Student Success has the following offices and departments located in the SUB: The Vice President for Student Success, Dean of Students Office, Office of Students Success/Career Internship Services, First Year Initiative, Disability, Re-entry and Veteran Services, the Office of Student Activities, The Women’s Center and the Diversity Awareness Office.

The Strand Union Administration Office, located in room 223 (directly behind the Ask Us desk), houses the offices of the Director, the Marketing Manager and the SUB Administration Office Manager. Visit www.montana.edu/sub or call 406-994-3082 for more information.

**Computer Services**

The Information Technology Center operates microcomputer facilities for student use in Reid, Roberts, and Cheever Halls. A wide variety of software packages are available, including word processing, spreadsheets, database managers, and drawing and design packages.

**University Printing Services**

www.montana.edu/printshop

Located in the basement of Culbertson Hall, University Printing Services provides copying and a large variety of specialized printing services for all university departments, faculty, staff, students, and university organizations. University Printing Services strives to provide the highest quality printing and copying in a timely fashion at a price below on- or off-campus services. See www.montana.edu/cpa/printshop for more information.

**Copying Service**

The Renne Library has a copy service in the basement and coin-operated copiers in lobby areas. Copy Cats (http://www.montana.edu/copycats) and University Printing Services (http://www.montana.edu/printshop) also offer complete copy services. Links: www.montana.edu/copycats and www.montana.edu/cpa/printshop.

**Graphic Services**

Complete professional graphic design, typesetting, print production, photography, and darkroom services are available from MSU Creative Services, 427 Culbertson Hall, a branch of University Communications. Graphics and web design, scanning, and color output services are also available from Strand Union Graphics.

**Audio Video Listening and Viewing**

The Renne Library has facilities for listening to audio cassettes, phonograph records, and compact discs, as well as viewing video cassettes and slides.

**Campus Post Office**

www.montana.edu/wwwmail
A full-service post office is located in Culbertson Hall on Harrison Street. All services are available Monday through Friday from 8:30 a.m. to 4:00 p.m. Stamp sales and a letter drop-off are available at the Ask-Us desk in Strand Union; weekday pickup is at 8:45 a.m. and 2:00 p.m. A USPS mailbox with 3:00 p.m. Monday - Saturday pickup is located outside the Strand Union south entrance. Priority Mail, stamp sales, and a letter drop are also available at Cards ‘N’ Copies, which has a 2:00 p.m. weekday pickup.

Testing Services
www.montana.edu/ehhd/testing

The Testing Service coordinates the scheduling and administration of national testing programs such as the College-Level Examination Program (CLEP), the ACT, the Proficiency Examination Program (PEP), the General Educational Development Program (GED), the Graduate Record Examination (GRE), Law School Admission Test (LSAT), Medical College Admission Test (MCAT), and the Graduate Management Admission Test (GMAT). The Testing Service proctors the High School Days scholarship test, correspondence course exams, and exams for professors and resource students with disabilities who qualify for special test considerations. Contact Testing Services at (406) 994-6984.

The Arts
Music
www.montana.edu/wwwmusic

Opportunities exist for all interested students to participate in a variety of ensembles and classroom activities in the School of Music. Many music courses are specifically designed for non-majors and several satisfy University Core requirements.

School of Music concert ensembles are open to all university students, and some ensembles require students to audition. Three choral ensembles-- The Montanans, Chorale, and University Chorus-- provide performance opportunities for vocalists. Instrumentalists may choose from five performing bands—Wind Ensemble, Symphonic Band, Marching Band, Jazz Lab I, and Jazz Ensemble II; two orchestras—Chamber Orchestra and the Bozeman Symphony Orchestra; a percussion ensemble; and numerous faculty-coached chamber music groups. Many students also enroll in private or class instruction with faculty and instructors in piano, voice, guitar, and all band and orchestral instruments.

Howard Hall, home of the School of Music, is equipped with a number of private teaching studios, classroom facilities, and an electronic piano laboratory. In addition to a 265-seat recital hall, Howard Hall contains a large ensemble rehearsal room and several acoustically-efficient practice rooms.

On-campus performances occur frequently. Recitals by faculty and guest artists, and concerts by musical organizations are scheduled throughout the year. Informal musical entertainment, special musical events, appearances by musical organizations at athletic events, statewide tours, and performances for professional conferences are other features of the music program.

Students seeking additional information should contact the School of Music, Howard Hall, 406-994-3562 or visit www.montana.edu/wwwmusic.

Theatre Arts
http://sfp.montana.edu/

Each academic year, the School of Film & Photography faculty and student produce stage and media-based productions, and the School offers upper-

division classes in theatre production and stagecraft. Additionally, the MSU Black Box Theatre provides the home base for Montana Shakespeare in the Parks staff during the academic year and the acting troupe during the summer months.

Classroom opportunities in theatre arts are under the direction of an academically and professionally qualified faculty. Any enrolled student is eligible to participate in theatre arts productions regardless of major, providing the student has the interest, ability, and sufficient time. For students who are interested in pursuing theatre arts on an academic basis, a Bachelor of Arts in Film and Photography is offered. Information regarding the theatre arts production and academic programs can be obtained from the School of Film & Photography in the Visual Communication Building, 406-994-2484 or visit http://sfp.montana.edu/

Visual Arts
www.montana.edu/art

The School of Art is home to the Helen E. Copeland Gallery, the University’s professional fine arts gallery. The Copeland Gallery offers a dynamic exhibition schedule that includes exhibitions of student and faculty work, original exhibitions curated by the School of Art, and national touring exhibitions. All exhibits in the Copeland Gallery are free and open to the public. All MSU students, regardless of major, are also welcome to submit work for exhibition in the annual undergraduate juried art show.

The School of Art is also home to the Waller-Yoblonsky Gallery, located in the Melvin Graduate Art Studios. Committed to the encouragement of artistic experimentation in a diverse variety of mediums, the Waller-Yoblonsky Gallery is overseen by the School of Art’s MFA students.
Housing

University Housing is made up of smaller departments including Residence Life and Family & Graduate Housing. These two departments work collaboratively with Culinary Services and Residential Networking departments to provide a comfortable and safe environment for those students and families living on-campus at Montana State University. We encourage you to look at the additional tabs for more information pertaining to these various departments and entities.

Residence Life

www.montana.edu/reslife

Residence Halls

Montana State University offers convenient and affordable on-campus housing for students. The Residence Life Department is committed to providing an environment which is socially stimulating while enhancing the academic experience of the students who live on campus. Students with fewer than 30 earned credit hours (while in a residence hall setting) are required to live in the residence halls. Prospective students are urged to submit an application at the earliest possible date since assignments are made in the order they are received. A limited number of single rooms are available.

Living Options

There are many living options available that encompass academic and social enrichment for our residents; however, living options do change from year to year, based on student need, academic interest areas, and national trends. Our current living options are listed below.

1. All Female Halls (Hannon/Hapner)
2. All Male Hall (Langford)
3. Co-Ed Halls: Co-ed living environments are comprised of both men and women living on either separate floors or separate wings of the same hall (Headwaters Complex, Johnstone Center, Mullan, South Hedges, North Hedges, Residence Life Apartments, Roskie, and Yellowstone Hall).
4. Living Learning Communities (LLCs): Dedicated to academic success, Residence Life offers floors designed to assist students with common majors or lifestyles. Currently, Business, Creative Arts, Emerging Leaders, Engineering, Honors, Sense of Place, and Well-Being are scattered throughout all of the residence halls.
   a. Business LLC: The Business Living Learning Community is designed to provide career exploration and exposure to other majors/minors that allow for a career in the business field. Residents will have access to in-hall academic advising, study sessions, and evening presentations by business faculty and local business leaders. This living option is co-educational. (South Hedges)
   b. Creative Arts LLC: The Creative Arts Living Learning Community is open to any student interested in the creative arts. Recently, the lounge space was remodeled to accommodate a workspace for creating models and completing art projects. This living option is co-educational. (South Hedges)
   c. Emerging Leaders LLC: The Emerging Leaders Living Learning Community is a space for residents to explore their role as an emerging leader. As a member of this community residents will have the unique opportunity to learn and practice their individual style of leadership. This is a collaboration between Residence Life and the Leadership Institute to provide programming and mentorship throughout the year. This living option is co-educational. Students living on the floor must enroll in the Leadership Fellows program and enroll in a special section of UC 102 during the fall semester. (South Hedges)
   d. Engineering LLC: The Engineering Living Learning Community is designed to give residents an edge in their demanding and competitive engineering majors. Residents are provided with programs and workshops that supplement their in-class experience, as well as in-hall study sessions and faculty presentations. This living option is offered for males in Langford and females in Hannon. (Hannon/Langford)
   e. Honors LLC: Housed in The Quads and one floor in South Hedges, Hannon, and Langford, these options are for students enrolled in the Honors College. These spaces provide an ideal setting for the study sessions and spontaneous discussions that foster the growth of an Honors student. (Quads/South Hedges/Hannon/Langford)
   f. Sense of Place LLC: The Sense of Place Living Learning Community is a brand new community which focuses on residents establishing an understanding of their self and their place in the world. This community was developed for students unsure about what they want to study and what their futures hold. This living option is co-educational. Students living on the floor must enroll in a special section of US 103 during the spring semester. (South Hedges)
   g. Well-Being LLC: At Montana State University, we encourage students to find a balance between their personal and academic well-being. As a member of the Well-Being Living Learning Community, students will have the opportunity to explore their own best self as well as have direct access to professionals on campus to depend their understanding of all aspects of health. Connect with peers, explore opportunities for self-care and advocate for health and well-being with others who share a common passion. (Yellowstone)
5. Mixed Gender Housing: Montana State University is committed to creating a culture of intellectual and personal growth. Because learning is enhanced when topics are examined from diverse perspectives and because individuals possess unique outlooks which reflect the world around us, Montana State University is dedicated to creating an inclusive community that embraces a rich mix in the composition of its student body, staff, and faculty. We have listed some details below about the living option:
   a. Mixed Gender Housing (MGH) for the 2018-19 academic year is a new pilot program at Montana State University that allows students to live in a suite, regardless of their sex or gender. This means that you may be in a suite with another student who identifies as a man, a woman, gender-nonconforming, or any other gender identity.
   b. Students will have the opportunity to participate in a number of hall and campus programs including Safe Zone Training, American Indian Heritage Day, Black History Month, India Night, Coming Out Day, International Food Bazaar as well as a number of other campus programs that are hosted throughout the year.
   c. The community will have more optional programs and resources provided throughout the year around various topics of diversity including race, gender, age, language, socioeconomic status, religion, political affiliation, geographical background, gender identity, sexual orientation, national origin, and ability status.
   d. Students that live in this community will be required to provide feedback to the Residence Life department and the University...
about their overall satisfaction and suggestions for improvement to the living option in the future.

e. Students will reside in one of our suite style residence halls and the room & board rate will be listed and determined similar to all other room & board rates.

f. Please feel free to contact James Tobin, Assistant Director of Residence Life at (406) 994-2661 or at jftobin@montana.edu to understand all of the living options available to you or to discuss any questions that you may have. Our goal is to provide a welcoming community for all students and the earlier we can discuss and address any of your concerns, the more flexibly we will have in assisting you with exploring different housing options.

6. Sophomore & Above and/or 21+: (Johnstone)

7. Sophomore and Above Deluxe Floors: Roskie Hall is the home of the University’s newly remodeled sophomore and above floors. These floors consist of single rooms with the same square footage as a double room in Roskie. This quiet, yet active, living option provides an opportunity for students who want a change of pace from the traditional freshmen energy.

8. Sophomore and Above Halls: The Headwaters Complex, Johnstone Center and Residence Life Apartments are designed to meet the needs of all second year students by creating programs that deal directly with the issues they are currently facing.

Please visit the Residence Life website, www.montana.edu/reslife, contact the Residence Life Office at 406-994-2661, or email housing@montana.edu for the specific halls and floors which provide the living options outlined above.

Facilities

Room Equipment and Furnishings

All rooms have closets, extra-long twin beds (except Quads and Roskie), chests of drawers, study desks, waste baskets, chairs, and window coverings. Each room is wired for cable television, secure wired, and wireless internet connections. Also, a linen service is available for residents, providing sheets and pillow cases. These items can be exchanged once a week for a clean set of linens. It is the responsibility of the residents to maintain order and cleanliness in their rooms.

Laundry

Laundry rooms are in every hall with the exception of the Madison and Jefferson Halls in the Headwaters Complex and are equipped with Cat Card-operated automatic washers and dryers. Ironing boards and a limited number of irons are available at the hall desks.

Residence Hall Association (RHA)

All students residing in the residence halls are members of the Residence Hall Association. Organized on floor, hall, and inter-hall levels with programming, judicial, and governmental committees, RHA strives to uphold and promote the interests of students residing in the residence halls and to provide an active voice in residence hall administrative policy and operating procedures.

Visitation Policy

Members of the opposite sex may visit in the privacy of individual rooms. Cohabitation is prohibited.

- Definition of a resident, as it pertains to this policy: A student who has contracted with the university to live in a specifically assigned hall and room for a designated period of time.
- Definition of visitor: Visitors are in the room for less than overnight periods. They may use the facilities in a manner in which they would not be considered regular hall residents. They do not sleep in the room. Visitors are subject to university regulation.
- Definition of guest: Guests are non-residents staying with a student resident for a period not to exceed three (3) days. Guests are to present a photo ID and be registered at the hall front desk and are subject to university policies and regulations.

In an effort to accommodate a variety of student lifestyles, the residence halls offer twenty-four hour visitation, in which residents may have visitors at their discretion and with the consent of their roommate.

Personal Funds and Property

Students are urged to help safeguard their personal funds by establishing local checking accounts. All other valuable personal property should be adequately protected. Montana State University is not insured nor responsible for the loss or destruction of any personal property of students. Students are encouraged to carry their own personal property insurance. Montana State University has strict regulations regarding firearms on campus; contact the Office of Residence Life for details.

Board Charges and Meal Plans

All residence hall students are required to participate in a meal plan. Meals are served in the dining halls during Thanksgiving Break and Spring Break on a modified schedule. Meals are not served in the dining halls during Winter Break, which is reflected in the meal plan charges.

Student meal plans can be viewed on the Residence Life website. (https://www.montana.edu/reslife)

In addition to these meal plans, off-campus students (only) have the option to purchase a variety of commuter meal plans, which can be viewed on the Culinary Services webpage (http://www.montana.edu/culinaryservices/residence_dining_commons/meal_plans/commuter_meal_plans.html).

Semester Charges

Prices for the current academic year/semester can be obtained through the Residence Hall Room & Board rates page (http://www.montana.edu/reslife/charges).

Note: Charges listed are estimates for the academic year/semester and are subject to change without notice.

Payment of Charges

Room and board fees, ResNet, and the RHA social fee are paid in full at the beginning of each semester during the fee payment period. Installment payments for room and board must be arranged in advance with the Office of Student Accounts. There are no deductions for room or board for late arrivals (at the beginning of the semester) or for early departures (at the end of the semester).

Application for Housing

Apply online at www.montana.edu/reslife.

Prepayment

A $300 non-refundable prepayment is required when submitting a Residence Hall Application. The University will not process housing requests until the student has submitted a completed housing application and the $300 nonrefundable prepayment. The $300 will be applied to the total housing costs upon payment of fees.

Prepayment Forfeiture

Failure to occupy the room or cancellation of the contract before or during the contract period will result in the forfeiture of the $300 prepayment.
Refunds of Room and Board Payments

Students who terminate class registration during a semester will receive a prorated refund of their room and board payments unless they are suspended by the university.

There are no refunds for early departures at the end of the semester or late arrivals at the beginning of the semester. Rooms are held until the first hour of classes on the first class day of the semester.

A student who is absent from his/her residence hall for one or more weeks of consecutive meals due to his/her own illness or participation in University-sponsored activities will be refunded based on a pro-rated system, provided the student notifies Culinary Services in advance of the University-sponsored activity. Requests for refunds based on absence due to illness must be submitted in writing to Culinary Services, accompanied by a statement from the Director of Student Health Services, or the student’s own doctor, indicating required hospitalization or home care.

Exemptions from On Campus Living

All incoming freshmen with fewer than 30 credits earned in a university residential setting are required to live on campus for their first two academic semesters. However, there are some criteria that, if met, may qualify a student for an exemption from living on campus. Qualifications for exemption are as follows:

1. Marriage.
2. Physical custody of a dependent child.
3. Have completed one full academic year at another college/university while living in a residence hall.
4. Will be taking 5 or fewer credit hours.
5. Will be living with an immediate family member (mother, father, brother, sister, grandmother, grandfather) or legal guardian.
6. Will be taking 6 to 9 credits.
7. Will be living at home with an immediate family member.
8. Will be taking 10 or more credit hours.
9. Have other extenuating circumstances.

To initiate the exemption process, you must submit the required written documentation. This must be received by the Residence Life Office prior to the academic period requested. Exemptions received after the start of any term will be considered, but rarely approved. Requests for Exemption from On Campus Living can be found online.

Students must be enrolled as a student of the University and must take no fewer than 12 undergraduate or 9 graduate credits to live in the residence halls. All students taking 9 to 11 credits will be placed on Residence Hall probation. Any student taking 6 to 9 credits will need to request permission from the Director of Residence Life to live in the residence halls and, if approved, will be placed on Residence Hall probation. If a student is taking less than 6 credits or is no longer enrolled in the University, they are not eligible to live in the residence halls. Please contact the Residence Life Office at 406-994-2661 for more information.

The specific opening/closing dates for the residence halls will be sent to students with their room assignments. If this information is needed earlier, please contact the Residence Life Office at 406-994-2661, housing@montana.edu, or www.montana.edu/reslife.

Although the residence halls officially close during Winter break students are able to stay on campus. Students living in some halls may be required to temporarily move during the break period. There is an additional charge for students who stay on campus during Winter break housing; these costs are not assessed to students who do not utilize the services. Only authorized individuals are allowed in the residence halls during breaks, therefore guests are not permitted as this is a service that we can provide to hall residents only.

Hall residents will be able to stay in their assigned rooms during Thanksgiving and Spring breaks with no additional cost.

Work Opportunities

For students needing to work while attending Montana State University, there are a number of employment opportunities available in residence halls, at front desks, and with the various food services on campus.

Information regarding employment may be obtained by contacting the Residence Life Office and Culinary Services or through the Employment webpage (http://www.montana.edu/reslife/staff). Work study/financial aid status is not necessary to qualify for student employment.

Work Opportunities include:

• Academic Peer Mentors
• Desk Clerks
• Culinary Services
• Resident Advisors
• Weekend Student Custodians

Family & Graduate Housing

www.montana.edu/fgh

The Family & Graduate Housing Office is pleased to offer convenient, affordable housing as a service to enable families, married couples, graduate students, second degree undergraduates, single parents, and those in a legally dependent relationship to continue their education.

Family & Graduate Housing consists of 541 units in one, two, and three bedroom apartment/house configurations in eight different communities, located both on campus and within walking distance to all campus buildings and amenities. While each apartment complex varies, available options include: washer/dryer hookups, free laundry (in apartment complexes without washer/dryer connections), ResNet connection, dishwashers (in several Julia Martin, Paisley, and Branegan units), storage areas, playground equipment, picnic tables, barbecues, and cable television.

Electric and gas utility costs are included in all units except McIntosh, Paisley, and the West Side Houses. Water, sewer, and garbage costs are included in the rental price of all units.

As a benefit to our residents, the Family & Graduate Housing Office offers a variety of services to assist with making the transition to campus-life: a newsletter is published monthly to inform residents of upcoming campus and community events; a staff of community assistants (CA’s) is available to provide activities and programs and answer questions; ASMSU Day Care Center is available for children 2-1/2 years through kindergarten; events and programs catered to adults, children, and families are conducted throughout the year; a staff of skilled craftsmen are available to assist with any maintenance problems; a 24-hour call-out service is available to assist with emergencies.

To receive a brochure, application, or to inquire about Family & Graduate Housing’s eligibility requirements, please contact:

Family & Graduate Housing Office
1502 West Garfield
Bozeman, MT 59715
406-994-3730
University Culinary Services

Meal Plan Options

Our meal plans offer students the flexibility and freedom to eat what, where, and when they want with the convenience of two locations across campus. Students living in the Residence Halls may choose between a 5-Day Meal Plan (Mon-Fri) or one of the 7-Day Meal Plans (Sun-Sat) options. All plans allow for unlimited entry and unlimited food at any of the two locations during hours of operations.

Residence Dining Commons Hours of Operation

Subject to change based on staffing availability

Miller Dining Commons
Monday - Friday 7am - 10pm
Saturday - Sunday 7am - 7pm

New Dining Pavilion
Sunday - Thursday 7am - 7pm
Friday - Saturday 7am - 7pm

Choosing A Meal Plan

Bobcat Anytime Gold
This plan provides unlimited access to the all-you-care-to-eat residential dining venues seven (7) days per week during operating hours and a $150 balance in CatCash per semester.

Bobcat Anytime Silver
This plan provides unlimited access to the all-you-care-to-eat residential dining venues seven (7) days per week during operating hours per semester.

Bobcat Anytime Copper
This plan is designed for students who will not be on campus on the weekends. It provides unlimited access to the all-you-care-to-eat residential dining venues five (5) days per week (Monday-Friday) during operating hours and a $150 balance in CatCash per semester.

Bobcat Anytime Bronze
This plan is designed for students who will not be on campus on the weekends. It provides unlimited access to the all-you-care-to-eat residential dining venues five (5) days per week (Monday-Friday) during operating hours per semester.

CatCash can be used at:
- Any of the campus retail food operations
- Bookstore
- Concessions
- Dining Commons
- All laundry facilities in the Residence Halls
- WEPA Print Kiosks

Notes:

- A student who is absent from his/her residence hall for one or more weeks of consecutive meals due to his/her own illness or participation in University-sponsored activities will be refunded based on a pro-rated system, provided the student notifies Culinary Services in advance of the University-sponsored activity. Requests for refunds based on absence due to illness must be submitted in writing to Culinary Services, accompanied by a statement from the Director of Student Health Services, or the student’s own doctor, indicating required hospitalization or home care.

ResNet

The MSU Residential Network (ResNet) is a campus network that provides secure wired and wireless connections for students living in the Residence Halls and in Family & Graduate Housing. ResNet is available as part of the room and board plan. If you own a computer, laptop, tablet or smart phone or plan to purchase one, you will be able to browse the Web from the comfort of your own room. For those residents not bringing a computer to school, ResNet also provides computing facilities with ResNet access, Microsoft Office software, and high speed printing in six computer labs located in the Residence Halls.

Help Desk

ResNet provides a full service help desk to those students living on campus. If you are experiencing any network related problems, general technical issues, or have questions about your service, ResNet’s technicians are available 6 days a week as part of your room and board plan.
Expenses

- Estimated Expenses (p. 43)
- Fee Schedule and Other Charges (p. 44)
- Special Fees and Charges (p. 45)
- Special Exemptions (p. 45)
- Refund of Fees (p. 46)
- Financial Aid and Student Employment (p. 46)
- Fee Description (p. 47)

The Board of Regents of Higher Education approves all student fee charges. Fees are subject to change at any time.

Student charges and refunds are posted under the student’s name, not the parent’s. Therefore, all fee statements and bill notifications are emailed to the student, not the parents. Student refunds are Direct Deposited or mailed to the student if the student has not signed up for Direct Deposit. (Exception: Refund checks generated as a result of a Parent PLUS loan are mailed to the parents unless the Financial Aid Office has written authorization to disburse the funds to the student.)

Students are personally responsible for meeting their financial obligations at the times stated in the term calendar. A student’s registration is not complete until all fees are paid.

All students are urged to safeguard their personal funds by establishing checking accounts. It is most helpful for a student to be able to write checks for exact amounts for fees, room and board, and other necessary expenses. A local bank account is also good identification while on campus.

A check presented to MSU which is subsequently returned by the bank for insufficient funds or other reasons may cause the cancellation of a student’s registration, reporting to federal agencies, and/or a request to terminate room and board. A returned check service charge of $25 is assessed for all returned checks.

Estimated Expenses

2018/2019 Montana State University Undergraduate Cost of Attendance

The expenses shown below reflect estimated costs for a student carrying a full-time load (12 or more credits) for fall and spring semesters, 2018/2019. These expenses include fees and other charges. Actual fees may vary based on specific program fees or the number of credits carried each semester. These figures are subject to change at any time and should be regarded as estimates only.

Undergraduate Resident Students

<table>
<thead>
<tr>
<th>Category</th>
<th>Semester</th>
<th>Academic Year</th>
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<tbody>
<tr>
<td>Tuition/Fees¹</td>
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<td>$7,150</td>
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<td>Room/Board²</td>
<td>$4,625</td>
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<tr>
<td>Books/Supplies³</td>
<td>$675</td>
<td>$1,350</td>
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<tr>
<td>Personal/Transportation⁴</td>
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<td></td>
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<tr>
<td>Total</td>
<td>$8,875</td>
<td>$17,750</td>
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Undergraduate Non-Resident Students

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<thead>
<tr>
<th>Category</th>
<th>Semester</th>
<th>Academic Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition/Fees¹</td>
<td>$12,150</td>
<td>$24,300</td>
</tr>
<tr>
<td>Room/Board²</td>
<td>$4,625</td>
<td>$9,250</td>
</tr>
</tbody>
</table>

Books/Supplies³ $675 $1,350
Personal/Transportation⁴ $17,450 $34,900

1. MSU’s undergraduate tuition rate applies to undergraduate students at all class levels (Freshmen, Sophomore, Junior, and Senior). There is not a higher rate for Junior and Senior students. These figures do not include the health insurance fee which is required of students who do not have their own health insurance coverage.

2. For on campus residents, these costs include in-room high speed internet service, unlimited entry into residence hall dining areas, cable TV and unlimited local phone service. Room and Board above is based on a double room, 7 day meal plan. This figure also represents an amount reasonably incurred for off-campus housing and food costs. Food and housing costs will vary depending on a student’s living arrangements and lifestyle.

3. The actual cost of books and supplies will vary depending upon curriculum.

4. Financial Aid budgets include a personal/transportation/miscellaneous figure of $1,725 per semester ($3,450 per year). Personal/miscellaneous expenses will vary depending on individual circumstances.

2018/2019 Gallatin College Undergraduate Cost of Attendance

The expenses shown below reflect estimated costs for a student carrying a full-time load (12 or more credits) for fall and spring semesters, 2017/2018. These expenses include fees and other charges. Actual fees may vary based on specific program fees or the number of credits carried each semester. These figures are subject to change at any time and should be regarded as estimates only.

Undergraduate Resident Students: Gallatin College

<table>
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<tr>
<th>Category</th>
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<tr>
<td>Tuition/Fees</td>
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<td>Room/Board¹</td>
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<td>Books/Supplies²</td>
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<td>Personal/Transportation³</td>
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<tr>
<td>Total</td>
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Undergraduate Non-Resident Students: Gallatin College

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</thead>
<tbody>
<tr>
<td>Tuition/Fees</td>
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<td>$11,500</td>
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<tr>
<td>Room/Board¹</td>
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<tr>
<td>Books/Supplies²</td>
<td>$675</td>
<td>$1,350</td>
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<tr>
<td>Personal/Transportation³</td>
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</tr>
<tr>
<td>Total</td>
<td>$11,050</td>
<td>$22,100</td>
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</table>

1. For on campus residents, these costs include in-room high speed internet service, unlimited entry into residence hall dining areas, cable TV and unlimited local phone service. Room and Board above is based on a double room, 7 day meal plan. This figure also represents an amount reasonably incurred for off-campus housing and food costs. Food and housing costs will vary depending on a student’s living arrangements and lifestyle.

2. The actual cost of books and supplies will vary depending upon curriculum.
Financial Aid budgets include a personal/transportation/miscellaneous figure of $1,725 per semester ($3,450 per year). Personal/miscellaneous expenses will vary depending on individual circumstances.

2018/2019 Montana State University Graduate Cost of Attendance

The expenses shown below reflect estimated average costs for a graduate student enrolled in 6 or more credits for both fall and spring semesters, 2017-2018. These expenses include fees and other charges. Actual fees may vary based on specific program or course fees or the number of credits carried each semester. These figures are subject to change at any time and should be regarded as estimates only.

### Graduate Resident Students

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<tr>
<td>Books/Supplies³</td>
<td>$510</td>
<td>$1,020</td>
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<tr>
<td>Personal/Transportation⁴</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>$7,835</td>
<td>$15,670</td>
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### Graduate Non-Resident Students

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<tr>
<th>Category</th>
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<th>Academic Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition/Fees¹</td>
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<tr>
<td>Room/Board²</td>
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<tr>
<td>Books/Supplies³</td>
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<td>$1,020</td>
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<tr>
<td>Personal/Transportation⁴</td>
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<tr>
<td><strong>Total</strong></td>
<td>$13,110</td>
<td>$26,220</td>
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</table>

¹ These figures do not include a supplemental health insurance fee required of students who do not have proof of insurance coverage.

² For on campus residents, these costs include in-room high speed internet service, unlimited entry into residence hall dining areas, cable TV and unlimited local phone service. Room and Board above is based on a double room, 7 day meal plan. This figure also represents an amount reasonably incurred for off-campus housing and food costs. Food and housing costs will vary depending on a student’s living arrangements and lifestyle.

³ The actual cost of books and supplies will vary depending upon curriculum.

⁴ Financial Aid budgets include a personal/transportation/miscellaneous figure of $1,725 per semester ($3,450 per year). Personal/miscellaneous expenses will vary depending on individual circumstances.

### Exemptions from Payment of Certain Fees

- **Tuition:** Undergraduate students receiving the MUS high school honors scholarship, American Indian scholarships, and Montana citizens sixty-five years of age or older are exempt from tuition. Undergraduate students with merit scholarships may be exempted from the tuition, in amounts to be determined by the scholarship committee depending upon funds available for this purpose.
- **Permanent staff** employed at least three-quarter time are exempt from tuition for six credits only.
- **Dependents of employees** with five or more years of service employed at least three-quarter time are exempt from 50% of their tuition when seeking a first undergraduate degree.
- **Student Activity and Health Service Fees:** Students who are required by the university to complete their entire semester’s work off campus and more than fifty miles from Bozeman are exempt from Student Activity and Health Service Fees as are professional staff and non-professional staff employed at least three-quarter time.
- **In Absentia:** Students registered in absentia pay only the registration fee.

### Other Charges

The following fees are in addition to those listed in the fee schedule. Fees are subject to change at any time. Non-matriculated students pay the same fees as regularly enrolled students. See also Course Fees.

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<thead>
<tr>
<th>Fee Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residence Hall Social Fee, per semester, to defray costs of activities and projects</td>
<td>$15.00</td>
</tr>
<tr>
<td>Late Payment assessed the first day after regular payment</td>
<td>$40.00</td>
</tr>
<tr>
<td>Additional late fee after 15th day of class</td>
<td>$40.00</td>
</tr>
<tr>
<td>Nursing Students</td>
<td></td>
</tr>
<tr>
<td>Uniforms and shoes (estimate)</td>
<td>$200.00</td>
</tr>
<tr>
<td>Doctoral Dissertation, for microfilming and publication of abstract in &quot;Dissertation Abstracts&quot;</td>
<td>$55.00</td>
</tr>
<tr>
<td>Exams given by special request (May include Graduate Record, College Entrance and Placement, GED, Miller Analogy, Doppelt, and Minnesota Engineering exams.)</td>
<td>$2.50 to $55.00</td>
</tr>
<tr>
<td>Course Materials Fee</td>
<td>Consult the department</td>
</tr>
<tr>
<td>(For materials furnished in some courses offered by Departments of Animal and Range Science, Health and Human Development, Medical Science, Earth Sciences, Nursing, Physics, Education, Biology, Architecture, Microbiology, and Music.)</td>
<td></td>
</tr>
<tr>
<td>Field Trip Fee</td>
<td>Consult the department</td>
</tr>
</tbody>
</table>
Applications for non-matriculated enrollment should be made through the Registrar, who will provide a form for approval by the instructor. An adult not regularly enrolled at Montana State University may, with permission of the instructor, register for a non-laboratory class upon the payment of the same fees as students enrolled for credit. The person so registered may not participate in class discussion or take examinations.

Non-matriculated Fees

An adult not regularly enrolled at Montana State University may, with permission of the instructor, register for a non-laboratory class upon the payment of the same fees as students enrolled for credit. The person so registering may not participate in class discussion or take examinations. Applications for non-matriculated enrollment should be made through the Registrar, who will provide a form for approval by the instructor.

Special Fees and Charges

Application Fee

A $30 application fee must accompany all applications for admission. This fee is not refundable nor is it applied toward the payment of any other fee. The application fee is honored for one year from the semester for which the student is applying.

Additional Fees Paid by Graduate Students

Graduate students will be charged fees at a higher rate than undergraduates. (Please see the Fee Schedule.)

Additional Fees Paid by Out-of-State Students

Resident or non-resident status for fee purposes is determined by Montana statutes and regulations of the Board of Regents. A copy of these regulations may be obtained by visiting or writing the Office of Admissions. Students of legal age and minors whose parents have not established residence for fee purposes are required to pay the non-resident fees. See Residency Requirements for Fee Purposes.

Non-matriculated Fees

An adult not regularly enrolled at Montana State University may, with permission of the instructor, register for a non-laboratory class upon the payment of the same fees as students enrolled for credit. The person so registering may not participate in class discussion or take examinations. Applications for non-matriculated enrollment should be made through the Registrar, who will provide a form for approval by the instructor.

Auditor’s Fee

Regularly enrolled students who register for courses without credit pay the same fees as students enrolled for credit.

Testing Fees

The Montana State University Testing Service administers certain testing and examination programs for which fees are charged. The fees are established by testing agencies (companies) other than MSU.

Nursing Students

Nursing students are charged a program fee each semester which covers such costs as mandatory liability insurance while taking clinical courses, pre-NCLEX testing fees, fingerprinting costs, specialized equipment, and distance delivery support.

Costs for board, room and transportation will vary in relation to the facilities available in the community where assigned for upper division. If a student does not have a car, she/he must make arrangements for transportation.

Health Insurance

Students carrying six or more credits are automatically enrolled in the student insurance plan each semester. Students carrying fewer than six credits must contact the Student Insurance Office if they desire coverage. Students wishing to apply for exemption from the insurance plan must do so online.

Complete information on student insurance may be obtained from the Student Insurance Office in the Swingle Student Health Center.

Special Fees and Charges for Foreign Students

An additional administrative fee will be charged to all foreign students who come to the University.

Special Exemptions

Honorably Discharged Veteran Tuition Waiver

A veteran who meets all of the following conditions is eligible for a waiver of tuition:

1. “Honorable” discharge (“General Under Honorable Conditions” will not be accepted) from any branch of the U.S. Armed Forces for service on active duty for other than training purposes.
2. Bona fide resident of Montana for tuition and fee purposes.
3. At some time eligible for VA education benefits but benefits were exhausted or have expired (VEAP eligible veterans who withdrew a portion of their VEAP contribution before benefits expired are not eligible for the tuition waiver).
4. Qualifies under one of the following:
   a. Served any time prior to May 8, 1975. Waiver available to all otherwise qualified undergraduate and graduate students; or
   b. Working on initial undergraduate degree and has been awarded an Armed Forces Expeditionary Medal; or
   c. Working on initial undergraduate degree and received the Southwest Asia Service Medal for service in the Persian Gulf between August 2, 1990 and April 11, 1991; or
   d. Working on initial undergraduate degree and has been awarded the Kosovo Campaign Medal; or served in a combat theater in Afghanistan or Iraq after September 11, 2001, and received either the Global War on Terrorism Expeditionary Medal, the Afghanistan Campaign Medal, or the Iraq Campaign Medal.
Qualified recipients must maintain satisfactory academic progress.

Application for this waiver must be made through the MSU Office of Veterans’ Services, Montana State University, P.O. Box 173960, Bozeman, MT 59717-3960 at least two weeks before fee payment for the semester in which the recipient expects to qualify. Phone 406-994-3661 for additional information.

State Benefits
The tuition is waived at any of the units of the Montana University System for children of members of the United States armed forces who served on active duty during World War II, the Korean, Vietnam, Iraq or Afghanistan conflicts and who, at the time of entry into service, had legal residence in Montana and who were killed in action or who died as a result of injury, disease, or other disability incurred while in the service. Children who desire to study under the “War Orphans” educational law must enter any of the Montana University System institutions before the age of twenty-five to be eligible for a waiver of tuition. Application for the waiver of tuition must be made, well in advance of the date of anticipated enrollment, to the Commissioner of Higher Education (2500 Broadway, Helena, Montana 59620-3101), who will determine eligibility and notify the student and the Office of Financial Aid Services of the institution.

American Indian Tuition Waiver
Montana Residents of one-fourth American Indian blood or more, or enrolled members of a state or federally recognized Indian Tribe which is located within the boundaries of the State of Montana, are eligible for a tuition waiver upon demonstration of financial need. Contact Financial Aid Services for more information.

Senior Citizen Tuition Waiver
In state tuition may be waived for Montana citizens who are (65) sixty-five years of age or older. The application for Senior Citizen Tuition Waiver may be found at www.montana.edu/wwwfa/forms.html or at Financial Aid Services located in Room 183 Strand Union Building (SUB). Submit the completed application and supporting documentation to Financial Aid Services for processing. A completed application is required for each semester of attendance.

Faculty and Staff Tuition Waiver
Permanent staff employed at least three-quarter time for the entire term are eligible for a waiver of resident tuition for up to six credits. The Faculty & Staff Tuition Waiver Request form may be downloaded at www.montana.edu/wwwfa/forms.html These forms are also available at Financial Aid Services. Once this form is completed and signed by the required parties, it can be submitted to Financial Aid Services for processing. A completed application is required for each semester of attendance and due by the 15th class day. This waiver does not apply to self-supporting courses offered by Extended University.

Dependent Partial Tuition Waiver
Dependents of employees with five or more years of service employed at least three-quarter time are exempt from 50% of their resident tuition. The tuition waiver does not apply to non-credit, continuing education or other self-supporting courses. Dependents may utilize the tuition waiver to take courses in any two-year or certificate program, and to obtain a first baccalaureate degree at any unit of the Montana University System. Employees who utilize the faculty and staff tuition waiver are not eligible for a dependent tuition waiver during the same academic term. Only one dependent may utilize the dependent tuition waiver in an academic term. Electronic application instructions can be found at http://www.montana.edu/wwwfa/dptw.html.

Refund of Fees

Drop/Add
Students dropping courses during the first fifteen class days are currently given a full refund for those courses. Fees for courses dropped after the fifteenth class day will not be refunded. The drop refund policy is subject to change. For summer term, please see the refund schedule located here.

The health, dental, and athletic activity fees will not be refunded to students dropping to a credit load of less than seven credits if services have been provided.

University Withdrawal
Fees except those listed below will be refunded based upon a predetermined refund schedule unless otherwise required by the Higher Education Act of 1965 as amended. The refund schedule for the full part of term is listed below. The detailed refund schedule which delineates the multiple parts of term (for students registered in courses within a specific part of term other than the full term can be found through the link below. The Office of Student Success records will establish the date used for refunding. Refunds will not be granted for withdrawals after the completion of the term.

Non-refundable fees are: registration fee, ID fee, orientation fee, late fee, tuition payment plan fees, social fees, foreign student fee, dorm deposit, new student fee, and transfer student fee.

If health and/or dental services have been provided, NO refunds of those fees will be given.

If health and/or dental services have NOT been provided, the refund amount will be based upon the following schedule:

<table>
<thead>
<tr>
<th>Days of Instruction</th>
<th>Percent Refunded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration Day</td>
<td>100</td>
</tr>
<tr>
<td>1-5</td>
<td>90</td>
</tr>
<tr>
<td>6-10</td>
<td>75</td>
</tr>
<tr>
<td>11-15</td>
<td>50</td>
</tr>
<tr>
<td>16-on</td>
<td>0</td>
</tr>
</tbody>
</table>

A detailed refund schedule including the details for alternative parts of term can be found at http://www.montana.edu/registrar/semesterwithdrawalrefundsschedule.html

Financial Aid and Student Employment

Office of Financial Aid Services
The Office of Financial Aid Services at Montana State University administers federal, state, and institutional aid programs designed to help eligible students pay for their educational expenses. Amounts of awards vary and depend upon the student’s financial need as well as the amount of funds available for distribution.

To apply for financial aid, students and parents of dependent students must file the Free Application for Federal Student Aid (FAFSA) each year. The FAFSA can be filed electronically at www.fafsa.gov (http://www.fafsa.gov).

To be eligible for financial aid, an individual must be a citizen or permanent resident of the United States and have applied for admission to the University as a degree-seeking student. Priority consideration is given to students who file the FAFSA by MSU’s financial aid priority filing date, which is December 1 of the preceding year (e.g., Dec 1, 2017 for the academic year beginning in Fall Semester 2018).

Students applying for financial assistance are considered for all aid programs for which they are eligible. Assistance is offered in the form of
grants, scholarships, tuition waivers, student and parent loans, and work opportunities.

Publications describing the different programs, eligibility criteria, satisfactory progress, and application procedures are available via the Internet at www.montana.edu/wwwfa/, or at the Office of Financial Aid Services, 183 Strand Union, P.O. Box 174160, Bozeman, MT 59717-4160. Our telephone number is: (406) 994-2845.

Both undergraduate and graduate students may apply for aid. Assistance to graduate students is generally limited to long-term loans and work opportunities. Information on graduate fellowships, scholarships, and assistantships may be obtained from The Graduate School.

Although student expenses will vary according to differences in courses of study, residency status, housing arrangements, transportation costs, and other factors, the table of estimated expenses may be used to determine the projected cost of education for a school year (two semesters). In estimating costs, between-semester expenses should not be overlooked.

Please remember that policies and procedures governing financial assistance at MSU are subject to change at any time, without prior notification or publication, due to changes in university, state, and/or federal guidelines and regulations.

The Office of Financial Aid Services is open Monday through Friday from 8:00 AM to 5:00 PM or as otherwise posted. The office is located in Room 183 in the Strand Union Building which is equipped with an elevator for disabled students.

### Fee Descriptions

**Registration Fee** is a flat non-refundable processing fee of $30.00 charged to each student.

**The Tuition and Fees** on the student bill is the total of the tuition fee, registration fee, building fees, information technology fee, computer fee, student equipment fee, health and dental fees, ASMSU fees, athletic fee, and SFEP fee. The Tuition and Fees for more than 12 (twelve) credits is the same as for 12 (twelve) credits.

**Tuition** is a mandatory per credit hour fee based on the number of credits selected and the status of the student (resident, non-resident, Western Undergraduate Exchange Program, or graduate). On the fee chart, the Non-Resident Tuition Fee consists of the Resident Fee (paid by resident students) plus the Non-Resident Fee, which is the portion of the Tuition Fee covered on behalf of resident students by Montana state taxes.

**Building Fees** are mandatory per credit hour fees and are used to repay bonds that financed the construction and/or remodeling of university buildings. Students have also voted to continue paying some building fees for major maintenance needs after the bonds have been repaid. The Building Fees for state resident students include: Student Building Fee; Academic Building Fee; PE Complex; Health Operations; Strand Union Operations; and PE Building Fee. The Building Fees for non-resident students include all of those for resident students plus the Non-Resident Building Fee. The Non-Resident Building Fee is that portion of bonds that are covered on behalf of resident students by Montana state taxes.

**Computer Fee** is a mandatory per credit hour fee used to provide and enhance student computer labs and access.

**Student Equipment Fee** is a mandatory per credit hour fee used to provide and enhance classroom and student lab equipment.

**Information Technology Fee** is mandatory per student fee for partial funding of the student administrative software.

**Health and Dental Fees** are mandatory fees charged to all students registered for seven (7) credits or more. These fees are for maintaining the Student Health and Dental Clinic.

**The Associated Students of Montana State University (ASMSU) Fees** are mandatory fees charged to all students registered for seven (7) credits or more. ASMSU Fees are set by student vote. Payment of the ASMSU Activity Fee entitles the student to participate in ASMSU student government and use of the gym, swimming, weight room facilities, day care facilities, legal aid, tutoring, and other sponsored activities.

**ASMSU Activity Fee** provides for the operation of the student government (ASMSU) and its committees.

**ASMSU Intramural Fee** contributes to the operational cost of the intramural facilities and programs.

**ASMSU Bus Fee** funds a local bus system for students.

**ASMSU Student Leadership Fee** provides funding to the MSU Leadership Institute.

**ASMSU Student Sustainability Fee** contributes to the promotion and implementation of sustainable practices.

**ASMSU Student Organization Fee** supports registered student organizations.

**ASMSU Student Press Fee** funds the student newspaper, The Exponent.

**ASMSU Outdoor Recreation Fee** funds the Outdoor Recreation Program.

**ASMSU Recreational Facilities Project Fee** funds the construction of a synthetic turf field and supporting infrastructure, and operations/maintenance after construction.

**Athletic Fee** is a mandatory fee charged to students registered for seven (7) credits or more that is used to support the Bobcat Athletic program.

**SFEP Fee** includes funds pledged for debt service on the Student Facilities Enhancement Project, as well as Operations & Maintenance fee for the Health & PE Complex.

**Student Medical Insurance Fee** is a mandatory medical insurance program (by ASMSU vote) for all students registered for six (6) credits or more. Students may waive the insurance if they have other medical insurance. Dependent coverage is available by contacting the Student Insurance Office at 104 Swingle or 994-3199.
Curriculum, Enrollment, and Graduation

- Catalog and Curriculum (p. 48)
- Registration (p. 48)
- Examinations (p. 50)
- Credits and Grades (p. 51)
- Dean’s List and President’s List (p. 53)
- Undergraduate Student Scholastic Probation and Suspension (p. 53)
- Credits for Degree Completion (p. 54)
- Graduation Requirement for Baccalaureate Degrees (p. 55)
- Graduation Procedures (p. 55)
- Student Records (p. 56)
- Name Change (p. 56)
- Transcript of Record (p. 56)

Catalog and Curriculum

Catalog in Effect

MSU-Bozeman undergraduates may elect to follow the catalog in effect when they first enroll at MSU, or any subsequent catalog, if there has not been a break of more than one academic year in their attendance and if they fall within the six-year catalog limitation policy. Undergraduate students transferring from any regionally accredited United States college or university may follow the MSU catalog which was in effect when they first entered the institution from which they transferred, or any subsequent catalog in effect prior to graduation, provided there has been no break in attendance. The six-year catalog limitation policy applies to transfer students, also.

MSU undergraduates who change majors may follow the catalog in effect when they began their freshman year at MSU or any subsequent catalog in effect prior to their graduation, provided there has been no break in attendance of more than one academic year. In these instances, too, the six-year catalog limitation policy applies. In either case (transferring or changing majors), it may be necessary to make course substitutions within the department curricular requirements, due to changes in tabulations from year to year; students should consult with their academic advisors about this. The curriculum advisor and department certifying officer make the official check on degree-specific requirements for graduation. The Registrar provides the final check on university requirements: CORE, total credits earned, grade point, cumulative grade point average earned at MSU, as well as university-wide requirements.

Six-Year Catalog Limitation Policy

Each MSU-Bozeman catalog covers a specific time period beginning fall semester of the first year and ending the following summer session. From the time a student enters Montana State University, he or she has six years to fulfill the curricular requirements stated in the catalog in effect when he or she entered. If a student does not complete the requirements in six years, he or she must select a subsequent catalog. This policy applies to all students, including undergraduates who change curriculum and transfer students.

Change of Major/Curriculum

A Curriculum & Catalog Changes form may be obtained from the Registrar’s Office, the college dean’s office, or online. A change of curriculum becomes official when the form is filed with the Registrar’s Office.

Second Major

A student may declare a second major by completing a Curriculum & Catalog Changes form. A student may earn a second major by fulfilling the curricular requirements of that major in addition to the requirements of the primary major. The student is not required to complete additional core requirements for the second major since these requirements will be fulfilled with the primary major.

The department of the second major will assign an advisor to assist the student in meeting all the second major’s requirements. The second major will be posted on the student’s transcript at the time of graduation and upon verification by the Registrar that all curricular and procedural requirements have been met.

Second Bachelor’s Degree

There are two distinct methods for obtaining more than one bachelor’s degree:

A student who has already completed requirements for one bachelor’s degree must complete a minimum of thirty additional credits (nine of which must be upper division), all curriculum requirements of the second degree, and two semesters in residence at Montana State University after receiving the first degree. All courses listed on the student’s transcript at the time the first degree is granted are considered as required for and/or applied toward the first degree. None of the credits on the student’s transcript at the time the first degree was awarded may count toward the 30 additionally required credits. A second degree student will not be required to complete additional University Core requirements, with the exception of students who have international degrees.

A student may work concurrently toward receipt of two bachelor’s degrees. These degrees may be awarded at the same time. In this case, the student must complete the courses required in both curricula and at least 30 credits beyond the larger number of credits required for the two degrees he or she is seeking. Fifty-one credits (forty-two credits for the first degree; nine for the second) of the total minimum number of credits required for both degrees must be upper division. A student working under this option must declare his or her intentions by submitting a completed Curriculum & Catalog Changes form.

Minors

A student must declare his or her intentions of seeking a minor(s), by submitting a completed Curriculum & Catalog Changes form prior to submitting a graduation application. Minor’s must be linked to a baccalaureate degree. A student must be seeking or have already received an MSU baccalaureate degree to declare a minor(s). The minimum number of credits required for a minor is twenty-one, with nine of those being upper-division credits. A student may not receive a minor in the same discipline as their major(s). There are two categories of minors:

Teaching Minors

Teaching minors must be approved by the certifying officer in the Education Department.

Non-Teaching Minors

Non-teaching minors must be approved by the certifying officer in the related department.

Registration

Dates for Registration

The dates for registration are published in the Registration Handbook, which is printed prior to registration and is available online, via MyInfo,
or from the Registrar’s Office. See the Registration Handbook for detailed registration instructions and for fee payment dates.

A currently enrolled student in good standing will receive registration information, including alternate PIN, from his or her advisor. Before meeting with an advisor, all students should review their degree progress using DegreeWorks (through MyInfo), plan a schedule of classes by consulting the MyInfo Schedule of Classes, and make an appointment to meet with an advisor. Additionally, all outstanding fees and holds must be resolved before registration, and students must pay all new fees at the scheduled time.

**Academic Advisors**

Academic advisors are available to help students plan their programs of study and make informed choices about courses. Although students are fully responsible for their academic decisions, they should recognize the advantages of close cooperation and understanding between themselves and their advisors.

Because academic advisors are usually associated with a students’ major department or field, students should contact their major departmental offices or the offices of their college deans to determine the names and locations of their advisors. Some programs—University Studies, Native American Studies, University Honors, pre-health professions, WWAMI—offer additional advising assistance.

**Classification of Students**

- **Freshman**: an undergraduate student who has earned less than thirty credits.
- **Sophomore**: an undergraduate student who has earned thirty to fifty-nine credits.
- **Junior**: an undergraduate student who has earned sixty to eighty-nine credits.
- **Senior**: an undergraduate student who has earned ninety or more credits.
- **Post-Baccalaureate**: an undergraduate student who has already earned one or more baccalaureate degrees and is seeking another.
- **Non-Degree Undergraduate**: a student taking courses for special interest, but not planning on using the credit toward a degree.
- **Non-Degree Graduate**: a student with at least a baccalaureate degree but not seeking another degree.
- **Graduate**: a student who has at least a baccalaureate degree and has been accepted into The Graduate School.

**Drop/Add Regulations and Procedures**

**Add Procedure**

Students may add classes online using MyInfo through the 5th day of the semester. After the 5th semester day, all adds require the instructor’s and the advisor’s signatures on an Add/Drop form. After the 10th semester day, all adds require the additional signature of the Assistant Dean of the student’s major curriculum on an Add/Drop form.

**Drop Procedure**

Students may drop classes online using MyInfo through the 10th day of the semester. After the 10th semester day, all drops require the instructor’s and the advisor’s approval communicated through signatures on an Add/Drop form. Between the 15th and 60th semester days, students may continue to drop courses, with the approval of the instructor and of the advisor, though the student will receive a “W” (withdrawn) grade.

**Drop for Extraordinary Reasons**

From the 60th day of the semester through the 70th class day (generally Friday before finals), students may only drop for extraordinary reasons. To complete this process the student is required to document the extraordinary reasons submit that documentation along with an advisor and instructor approved (signed) Add/Drop form to the Dean of the College of their primary degree. Upon review, approval, and signature of the Dean the form must be submitted to the Office of the Registrar for processing.

**Drop/Add (courses with alternative start/stop dates)**

Courses within a specialized part of term follow the drop/add calendar specific to that part of term. Students registered in courses with multiple parts of term or in courses that fall outside a specified part of term will follow the drop/add calendar for the “full semester.” However, students are not allowed to drop any course after the final scheduled day (including exams) for any course.

Add/Drop forms are available online or through the Office of the Registrar. If the student has confirmed attendance or paid fees and wishes to drop all courses, a University Withdrawal must be obtained through the Office of Student Success. Graduate students seeking a complete withdrawal must contact The Graduate School. Each student is responsible for fees upon registration. Contact the Student Accounts Office for partial-refund dates.

**Taking Courses for Zero Credit**

**Auditing Course**

Registered students may, with the permission of the instructor, audit a course and earn zero credit. A student must submit a signed Add/Drop form, by the 10th semester day, indicating the course is for audit. Auditors pay the same fees as students enrolled for credit.

**Absence from Classes**

When students enroll in a course, they enter a contractual agreement with the instructor for the duration of the course, and both the student and the instructor are expected to honor the specified terms of that agreement. It is important, therefore, for the student to understand the attendance requirements in each course. The instructor should communicate these requirements during the first or second class meeting in writing via the course syllabus.

Absences from classes are handled exclusively within the purview of the individual instructor. If a student has an accident, falls ill, or suffers some other emergency over which he or she has no control, the student should gather available documentation (e.g., copies of repair or tow bills, prescriptions, accident reports, or statements from physicians) to show to instructor. In some instances, the student may wish to petition the instructor for I grades.

The provisions for making up missed class work may vary from one instructor to another. Most but not necessarily all instructors provide for some opportunity to make up missed work; for example, if a student is absent from campus to participate in a university-sponsored event. Students involved in such activities should advise their instructors of these events in advance and determine what arrangements are available to make up missed class work.

**Class Rolls**

During the third day of University instruction and thereafter, those students who have registered but have not attended class may be required by the instructor to drop the course when space and/or equipment is limited and other students have requested to add that class. Students are not automatically dropped; this action requires a student-initiated drop/add form.
University Withdrawal

If a student must withdraw from all classes after he or she has confirmed attendance or paid fees, he or she must initiate the withdrawal through the Office of the Registrar. Graduate students must initiate the withdrawal through the Graduate School.

Students who withdraw before the end of the fifteenth day of instruction will not receive grades for any registered courses. Thereafter through the last day of instruction a grade of W shall be assigned in all courses for which the student is registered unless an appeal is approved by the Dean of Students. The decision of the University is final. The Dean of Students Office also indicates the official date of the university withdrawal in these instances.

Students who leave the campus without withdrawing through regular channels or who withdraw late without extraordinary reasons will receive F grades in all course work for that semester.

Retroactive University Withdrawal Policy

A retroactive university withdrawal may be an option for students who were unable to complete a standard university withdrawal during the semester of their departure from the university. A retroactive university withdrawal is an extraordinary remedy that is available only for the reasons set forth below. Students who are granted a retroactive university withdrawal receive W grades in all courses for the semester in which they apply for the retroactive withdrawal. Requests for retroactive withdrawals must be submitted no later than three years from the last day of the semester for which the withdrawal is sought.

Students who leave the campus without applying at the Dean of Students Office for a university withdrawal during the semester of departure or who fail to withdraw through regular channels or who fail to withdraw for extraordinary reasons may apply for a retroactive university withdrawal only if they can provide evidence of the following:

1. The student had a debilitating illness or injury that significantly limited his/her capacity to withdraw in a timely manner; or
2. The student was forced to leave the University abruptly due to a health or safety emergency within his/her immediate family; or
3. The student has been recommended to apply for a retroactive university withdrawal by the University Scholastic Appeals Board and meets the other criteria for a retroactive university withdrawal.

For undergraduate students: To apply for a retroactive university withdrawal, students must submit a written request to the Dean of Students, Strand Union Building (SUB) Room 174, no later than three years from the last day of the semester for which the withdrawal is sought.

Requests for retroactive withdrawals must be submitted no later than three years from the last day of the semester for which the withdrawal is sought.

For graduate students: Students enrolled in graduate degree programs and those enrolled as non-degree graduates are subject to the same parameters and must follow the same process as described above except that the written request is submitted to the Dean of The Graduate School, Montana Hall Room 108. If the request is denied, the student may further appeal to the University Provost. The Provost’s decision is the final decision of the University.

Undergraduate Student Petitions for Registration and Reservation of Certain Courses

Generally, courses are applied to the student record associated with the academic level (undergraduate or graduate) of the student at the time the course was taken. Students may petition to reserve certain classes in a certain situation to be applied to an academic level other than their current status. For example: register for and reserve undergraduate or graduate credits for possible application to a graduate degree; register for a graduate course for use toward an undergraduate degree, register while a graduate student for use toward an undergraduate degree, register for a graduate class as a foreign exchange student with no intent to use the credit toward an MSU degree.

To reserve a course a student must complete the Petition to Reserve/ Register for Credits form available through the graduate school. A successful petition must meet all of the following criteria:

1. The student is of senior or post baccalaureate standing.
2. The student has a cumulative grade-point average of at least 3.25.
3. All prerequisites for the course(s) have been completed.
4. Credits reserved for a graduate degree may not exceed nine (9) in total.
5. For reserved credits to be applied to the graduate transcript the student must earn a minimum grade of a B.
6. The petition may not include any internship or independent study courses for either registration or reservation.
7. The petition is filed prior to registering for the course.

A graduate-level course approved by petition may be used either for fulfilling undergraduate or graduate program requirements, but not for both. The student must indicate on the petition form the intended use of the registered/reserved course credits.

Undergraduate senior students with financial aid should be aware that credits reserved for future application to a graduate program may affect their current financial aid eligibility.

Examinations

Common Hour Exams

Common hour exams are given during the semester for multi-section courses. Dates and times are posted online at www.montana.edu/registrar/Schedules. These exams take the place of one class meeting and are included in the student’s commitment to the course upon enrolling in it. For the complete Common Hour Exam Policy, please go to the Code of Conduct Policies, Regulations, & Reports (p. 58) section of the catalog.

Final Exams

Final examinations in one-credit courses are given during regular class periods. Final examinations for all other courses are scheduled by the Registrar and published online, and may not be rescheduled or given prior to the start of the final examination period. According to University policy, the examination period is instructional time, and it is expected that some instructional use is made of this period if a final examination is not given. When a final examination is given it must be given at the time shown in the examination schedule. Exception: no formal laboratory classes are held during final examination days.

A student who has three or more final examinations on any one day should first contact the instructors of the courses to see if one exam can
be rescheduled. If this rescheduling cannot be resolved, then the student should contact the assistant dean of his or her college at least one week before the beginning of final examination week to assist in resolving the conflict.

**Credits and Grades**

**Definitions**

- **Course.** A course is a unit of instruction in a subject-matter area offered in a single university semester. Resident courses (courses for which resident credit is granted) are those listed in the Schedule of Classes. Continuing education courses are arranged through Extended University. General guidelines follow:
  - **Lecture-LEC:** Presentation of course material by the instructor, utilizing the lecture method. Final Exam Assigned.
  - **Laboratory-LAB:** Instructing and supervising students in laboratory investigations.
  - **Studio-STU:** Instructing and supervising students in studio investigations. Final Exam Assigned.
  - **Recitation-RCT:** Presentation of course materials designed to involve students in recitation and/or discussion.
  - **Seminar-SEM:** Students share, with the instructor, responsibility for preparation and presentation of course material. Final Exam Assigned.
  - **Independent Study-IND:** Directed study and/or research on an individual basis, under the supervision of an instructor.
  - **Lecture/Lab Combo-LECLAB:** Combines the elements of Lecture (LEC) and Laboratory (LAB) in one meeting time. Final Exam Assigned.

- **Credit.** A credit is the unit used in recording an amount of work and engaged effort represented in learning outcomes and verified by evidence of student achievement. Each credit hour represents a minimum of three class-oriented work hours (50 minutes of classroom instruction and an additional two hours of out-of-class engaged effort and work per student) each week during a 15-week (minimum) semester. One credit of achievement should approximate 45 hours of combined instruction and student work/engaged effort. At least an equivalent amount of work and engaged effort is required regardless of pedagogical format (lab, web-enhanced, on-line, condensed coursework, internships, studio, independent study, etc.).

- **Credit Load.** Undergraduate students who are enrolled for twelve or more credits and graduate students for nine or more credits, will be certified and reported as full-time students. Completion of a 120-credit undergraduate curriculum in four years requires students to complete an average of fifteen credits each semester.

- **Curriculum.** A curriculum is a combination of courses that constitutes a program of study leading to the completion of an academic program.

- **Semester.** Montana State University operates on a semester system consisting of two semesters and a summer session. The Term Calendar gives the dates of each semester.

- **Grades.** The quality of the student’s work in each course is denoted by a letter grade according to the following tabulation. In computing scholastic averages, each letter grade is assigned a specific number of grade points for each credit. Final grades are due within forty-eight hours after the final examination in each course and are generally posted to the student record by the end of the week following finals. No grade or credit will be given to students in courses for which they are not properly registered.

**Minimum Competency Requirements**

The Montana Board of Regents has established a common policy on minimum course grades across all campuses in the system. According to the policy, a grade of C- or better is required to satisfy requirements for pre-requisite and required courses in majors, minors, and certificate programs and for all core requirements. Further, a grade of C- or better is required in all courses that will be counted toward the 42 upper-division credits required in all degrees. Courses with a passing grade of D-, D, or D+ may only be counted toward the overall 120 credit requirement. This policy creates a minimum requirement, which may be superseded by more stringent requirements within specific majors. Any such requirements are explained within the descriptions of those curricula.

**Passing Grades**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Quality of Work</th>
<th>Grade Points for Each Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
<td>4.0</td>
</tr>
<tr>
<td>A-</td>
<td>Good</td>
<td>3.7</td>
</tr>
<tr>
<td>B+</td>
<td>Good</td>
<td>3.3</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
<td>3.0</td>
</tr>
<tr>
<td>B-</td>
<td>Fair</td>
<td>2.7</td>
</tr>
<tr>
<td>C+</td>
<td>Good</td>
<td>2.3</td>
</tr>
<tr>
<td>C</td>
<td>Fair</td>
<td>2.0</td>
</tr>
<tr>
<td>C-</td>
<td>Fair</td>
<td>1.7</td>
</tr>
<tr>
<td>D+</td>
<td>Fair</td>
<td>1.3</td>
</tr>
<tr>
<td>D</td>
<td>Fair</td>
<td>1.0</td>
</tr>
<tr>
<td>D-</td>
<td>Fair</td>
<td>0.7</td>
</tr>
<tr>
<td>N</td>
<td>Continuing (self-paced)</td>
<td>Math, 590, 690 courses only</td>
</tr>
<tr>
<td>P</td>
<td>Pass</td>
<td>0</td>
</tr>
<tr>
<td>S</td>
<td>Satisfactory (CEU only)</td>
<td>0</td>
</tr>
<tr>
<td>W</td>
<td>Withdraw</td>
<td>0</td>
</tr>
<tr>
<td>Au</td>
<td>Audit</td>
<td>0</td>
</tr>
<tr>
<td>NR</td>
<td>Missing Grade</td>
<td>0</td>
</tr>
</tbody>
</table>

**Non-passing Grades**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Quality of Work</th>
<th>Grade Points for Each Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Failure</td>
<td>0</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete</td>
<td>0</td>
</tr>
</tbody>
</table>

**Grade-Point Average**

The general quality of a student’s work is expressed in terms of a grade point average (GPA). Only credits taken at MSU Bozeman are used to compute the cumulative grade point average. GPA is used to determine academic standing including: University probation, suspend warning, or suspended. The grade-point average is computed by dividing the sum of grade points earned by the sum of credits carried, except that neither the credits nor the grade points shall be counted for courses passed on a pass/fail basis.

**Repeated Coursework GPA**

For repeated courses, only the most recent credits and grades received will be used in the calculation of the cumulative grade-point average, and only the most recent credits received will be included in the credits counted for graduation. However, all grades received will be listed on the transcript. Repeated courses will be noted on the transcript with an “E” (when the course grade is excluded from GPA calculation). The most recent attempt(s) at the course will be noted with an “I” and included in GPA calculation. Courses with both honors and standard course-numbers will be treated as the same course in terms of GPA calculations and repeat processing, for example: CHMY 151 can be replaced with CHMY 141 (and vice versa). Excluding a grade from a previous semester does NOT affect
the calculation of academic standing for that semester. Academic standing remains as it was originally earned.

W Grade Eligibility

After the 15th day of the semester, students may drop courses and receive a grade of W (withdrawal) only if approved by the academic advisor and course instructor. Approval is not guaranteed, and no refund is given. Until one week past the last day of the official registration period for the following semester, students use a Drop/Add form to drop courses with a W. The W grade is non-punitive; it counts in credits attempted but not in earned credits or in quality points toward the GPA. If a student repeats the course in a subsequent semester, the new grade will count in the GPA but the original W grade will remain on the transcript.

I Grade (Incomplete)

Instructors may assign a grade of “I” (Incomplete) when students have been unable to complete their academic obligations because of circumstances beyond their control. The University takes the position that when students register, they commit themselves to completing their academic obligations as their primary responsibility. Therefore, the instructor may assign an I grade only in cases when students have suffered extreme personal hardship or unusual academic situations.

An instructor may assign an I grade in cases of personal hardship when students have been unable to fulfill their commitments because of illness, death or illness in the immediate family, family emergencies, or military orders. The Dean of Students will verify personal hardship cases at the instructor’s request. The instructor may assign an I grade to a student for personal hardship, provided the student has completed three-fourths of the work of the course with a passing grade. If the student has not satisfactorily completed three-fourths of the course work the instructor must provide written justification for assigning an I grade.

An instructor may also assign an I grade, subject to the department head’s approval, in cases when a student has been unable to complete course requirements for reasons such as apparatus or equipment failure, death or disease in experimental animals, delays in material shipments from suppliers, or in other unusual academic circumstances which are clearly beyond the student’s control. In these situations, the student must have completed three-fourths of the work of the course with a passing grade. If the student has not satisfactorily completed three-fourths of the course work the instructor must provide written justification for assigning an I grade.

In each instance qualifying for an I grade, the instructor must prepare an I-Grade Authorization form. On this form, the instructor will list the makeup requirements and the date beyond which the I will revert to a F grade.

To change the I grade after the make-up work has been completed, the instructor will complete and submit the Grade Change available through the Registrar’s Office. Unless an alternate time is specified by the instructor, an I grade shall be made up no later than the end of the following semester (excluding summer session). An instructor may extend the specified completion time by submitting the required documentation to the Registrar’s Office before the reversion grade takes effect. An I grade may not be extended beyond one calendar year. An I grade not made up in the prescribed length of time or within one calendar year lapses to a failure (F).

Make-Up of I Grades

An I Grade make-up is reported to the Registrar on a Grade Change Form. No fee is charged. These grades are not included on the next semester grades.

During the time allowed for the completion of the unfinished work leading to the I grade, the student may have access to university resources (e.g., library) necessary to complete the work.

N Grade

An N grade may be assigned to students enrolled in specified continual or on-going courses only (for example: BFIN 317, 590 and 690 thesis courses, or self-paced pre-college math courses). This grade indicates that, though students have made progress, they have not completed the course objectives successfully. These students must re-enroll in the course immediately in order to continue with the course work and complete the course objectives. The N grade does not affect the GPA.

Pass/Fail Registration

Undergraduate students may take some of their University elective courses on a pass/fail basis subject to the following restrictions:

1. Students may elect the pass/fail option only for courses that are not specifically required for their academic program. Pass/fail courses may not be applied toward completion of Core requirements. This restriction does not apply to (ACT) activity courses.
2. A student may not register for more than one pass/fail elective course per semester, excluding one-credit (ACT) activity courses.
3. Undergraduate students may take a maximum of twelve credits of pass/fail elective courses. This maximum does not include courses that are offered only on a pass/fail basis.
4. Students register for pass/fail courses in the same manner as for other courses, but they must have written permission from their advisors, college deans, and the instructors of the course. The Registrar has forms for this purpose.
5. The instructor’s requirement to obtain a grade of P in the course must be submitted with the Request for Pass/Fail form.
6. Students may only change a pass/fail registration to a regular registration, or a regular registration to a pass/fail registration, prior to the end of the tenth day of instruction. Students will follow the regular drop-add procedures, except that students changing to a pass/fail registration must also secure the written permission of the instructor and adviser (see 4 above).
7. Pree requisites apply for all courses taken on a pass/fail basis.

Pass/Fail Grading

As a general policy, courses at Montana State University are graded by the letter grades, A, A-, B+, B, etc. However, in certain courses, pass/fail grading may be more appropriate. Courses may be offered on a pass/fail basis for all students registered in the course, with the approval of the department head and college dean. Courses offered on a pass/fail basis will be identified in the Schedule of Classes. Permission to offer a course on a pass/fail basis is limited to one academic year; if the permission is not renewed, the course reverts to a letter-grade basis.

In pass/fail grading, passing work will receive a P grade on the student’s transcript, but it will not count in the grade point average. However, the course credit will count toward the number of credits required for graduation. Failing work will receive an F grade and will count in the grade-point average.

Grade Changes

Once a grade has been reported by the instructor to the Registrar, it cannot be changed except in case of clerical error or unless it was fraudulently obtained. All grades and credits will stand as recorded in the Registrar’s official record if changes are not reported in writing to the Registrar within five years of the last day of the semester in which the course was taken.

A change of final grade does not mean allowing additional time to complete the work of a course or allowing the student to submit work or to take or to retake examinations after the conclusion of the semester. A change of grade is not a substitute for an I grade when an I grade cannot be justified.
A change of grade may be made only with the approval of the department head. If the grade being changed was given more than one academic year previously, the college dean must also approve the change.

**Fresh Start Policy**

A former Montana State University undergraduate who returns to the University after a minimum absence of five years will have the opportunity to petition to begin a new cumulative (or Fresh Start) GPA as follows:

1. After returning to Montana State University, a student must complete thirty credits of academic study with a minimum cumulative GPA of 2.5 for the new course work before petitioning for a Fresh Start GPA.
2. A student who is eligible for a Fresh Start GPA must petition for a new cumulative GPA during the semester following that in which he or she meets the requirements stated in #1.
3. A student may begin a Fresh Start GPA only once.
4. Student petitions will be considered on a case-by-case basis by the Admission and Graduation Requirements Board. The decisions of the Board will be final.
5. When the new GPA is started, all previous grades and credits earned at Montana State University are excluded; it is not possible to select some grades and credits to exclude while retaining others. Only Montana State University grades and credits will be excluded.
6. The new GPA begins the first semester the student is re-enrolled. The transcript will state that a new GPA has been started. The old grades will remain on the transcript. Although old credits will appear on the transcript, they may not be used to fulfill any University requirements.

Students wishing to petition for a Fresh Start GPA should contact the Registrar's Office to initiate the process.

**Dean's List and President's List**

Any undergraduate student who passes twelve or more college-level credits and attains a 3.50 grade-point average or better for any one semester is placed on the Dean’s List. A student who receives a 4.00 grade-point average and is taking twelve college-level credits or more is placed on the President’s List. Developmental courses do not count towards the twelve credits required. The names of the students making the Dean’s List and President’s List are announced by the Registrar at the end of each semester. These lists apply only to undergraduate students.

**Undergraduate Student Scholastic Probation and Suspension**

When an Undergraduate student’s semester or cumulative grade-point average falls below 2.0, the record of the student’s performance is reviewed by the University Scholastic Appeals Board, which is composed of the Senior Vice Provost for Academic Affairs, the Dean of Students, and the dean or assistant dean of the college concerned. The board meets between semesters and at other times as needed to act upon individual cases recommended for either suspension or transfer out of a curriculum. This board has the authority:

1. to suspend a student from the University for scholastic reasons,
2. to reinstate a student who has been suspended for scholastic reasons, and
3. to require a student to transfer out of a curriculum with the consent of both colleges involved.

The chairperson of this board will notify students in writing of the action. (The designation probation, suspension warning, or suspension will be entered on the student’s permanent record.) Semester grade reports indicate the status of students, and it is the individual student's responsibility to review his or her grade report each semester.

**Appeal of Suspension**

A student who has been suspended may appeal the suspension if he or she believes there were extraordinary circumstances beyond the student's control of which the University Scholastic Appeals Board was unaware when it reached its decision. Appeal forms are available from the offices of academic deans.

**Reinstatement**

A student who was suspended for the first time may be reinstated after one semester has elapsed (exclusive of Summer Session). In order to enroll again at MSU, however, a suspended student must submit an Intent to Register form to the Registrar’s Office. After a second suspension, one academic year must elapse before the student will be reinstated, again with submission of an Intent to Register. Students may complete their intent to register online through their MyInfo account. Completed Intent to Register submissions must be received by the following approximate deadline dates (check with the Registrar’s Office for current deadline dates).

<table>
<thead>
<tr>
<th>For Reinstatement</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td>August 1</td>
</tr>
<tr>
<td>Spring Semester</td>
<td>January 1</td>
</tr>
<tr>
<td>Summer Session</td>
<td>May 1</td>
</tr>
</tbody>
</table>

Students who have received more than two suspensions must petition for reinstatement through their academic dean to the University Scholastic Appeals Board. Petitions are available from the academic deans and must be submitted in accordance with the deadlines listed above.

Reinstated students will be on "probation" when they re-enroll. When students achieve a term and cumulative GPA of 2.00 and above, the "probation" designation is removed. Students must have a 2.00 term and cumulative GPA to graduate.

For information regarding Graduate Student Scholastic Probation and Suspension, please visit the Graduate Homepage. [http://www.montana.edu/gradschool/](http://www.montana.edu/gradschool/)

**Guidelines Used by the University Scholastic Appeals Board**

**Grade Point Average (TGPA = Term GPA, CGPA = Cumulative GPA)**

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<tr>
<th>Previous Status</th>
<th>TGPA</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Standing</td>
<td>0 ≤ TGPA &lt; 1</td>
<td>0 ≤ CGPA &lt; 2</td>
</tr>
<tr>
<td>Continuing College Probation</td>
<td>2 ≤ TGPA &lt; 2 and 0 ≤ CGPA &lt; 2</td>
<td></td>
</tr>
<tr>
<td>University/College Probation</td>
<td>2 ≤ TGPA &lt; 4 and 0 ≤ CGPA &lt; 4</td>
<td></td>
</tr>
</tbody>
</table>

* These academic actions appear on the student’s transcript.

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Reinstated students will be on “probation” when they re-enroll. When students achieve a term and cumulative GPA of 2.00 and above, the “probation” designation is removed. Students must have a 2.00 term and cumulative GPA to graduate.

For information regarding Graduate Student Scholastic Probation and Suspension, please visit the Graduate Homepage. [http://www.montana.edu/gradschool/](http://www.montana.edu/gradschool/)

**Guidelines Used by the University Scholastic Appeals Board**

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<td>2 ≤ TGPA &lt; 4 and 0 ≤ CGPA &lt; 4</td>
<td></td>
</tr>
</tbody>
</table>

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Good Standing
A student has both a term GPA and cumulative GPA of at least 2.00 or better or is a new student (transfer students may be admitted on university probation).

College Probation
A student in “good” standing has received the first term GPA between 1.00 and 1.99.

Continuing College Probation
A student previously on College Probation has raised the term GPA above 2.00 but the cumulative GPA is not above 2.00.

University Probation
A student previously on University Probation has raised the term GPA above 2.00 but the cumulative GPA is not above 2.00, or has received a term GPA between 0.00 and 0.99 after being in “Good” standing.

Suspension Warning
A student has received a term GPA less than 2.00 for the past two terms. One more term with a GPA less than 2.00 will result in suspension.

Suspension
Students will be required to sit out one term on their first suspension and one year on their second suspension. Third suspensions will be handled on an appeal basis only.

All students in either College Probation, University Probation, or Suspension Warning status remain in some form of probationary status until both their most recent term GPA and their cumulative GPA are above 2.0.

Credits for Degree Completion

Credits
A candidate for the bachelor’s degree must complete the minimum number of credits required for the degree selected. The minimum number of credits must be composed of credits earned for graduation. The required number of credits varies among the four-year curricula leading to the bachelor’s degree.

Credits Earned for Graduation
Credits earned for graduation include the total number of credits for which passing grades (A through C-, and P) have been received in courses numbered 100 or above. If students repeat courses in which they have passing grades, the most recent grade will be the effective grade for graduation. A course taken by an undergraduate or a non-degree student may not later be repeated and applied toward requirements for a graduate degree. For further credit-use restrictions, see Special Topics and Individual Problems, or refer to the Course Descriptions for maximum allowable credit limits placed on certain courses.

Upper-Division Credit Requirement
A minimum of forty-two credits for the first degree and at least nine additional credits for the second degree must be earned in courses numbered 300 and above (upper-division courses). As required by the Minimum Competency Requirements, a grade of C- or better is required in all courses to be counted toward the upper division credits required in all degrees.

Note: The curricula for specific majors may have more stringent requirements.

Special Topics and Individual Problems Courses
No more than twelve credits of Special Topics 291 or 491 combined in each rubric will count toward graduation. No more than six credits of 492 Independent Study in each rubric will count toward graduation. Some departments have established lower limits than these, and students are responsible for checking course listings to ensure that they do not exceed the allowable number of credits in each category.

Transfer Student Credit Requirements at MSU-Bozeman
To graduate with a baccalaureate degree from Montana State University, transfer students must earn not less than thirty MSU credits and a minimum 2.0 cumulative GPA, as well as meet the curriculum requirements for a degree. Furthermore, twenty-three of the last thirty credits earned to meet graduation requirements must be MSU credits. For an associate degree, transfer students must earn at least 15 credits at MSU with a minimum 2.0 cumulative GPA.

Correspondence Credits and Extension Courses
No more than thirty semester credits earned by correspondence, extension, or continuing education from accredited colleges or universities may be counted toward graduation. However, special circumstances may warrant consideration, and approval of such courses is on a case-by-case basis.

Advanced Standing
Under certain circumstances, if students can demonstrate mastery of course work not taken at the University, they may receive advanced standing and University credit for the course. Two mechanisms are available for obtaining advanced standing:

1. College Level Examination Program (CLEP). Montana State University awards credit toward graduation for successful performance in certain Subject Examinations of the College Level Examination Program conducted by the College Entrance Examination Board. Students may arrange to take these examinations on campus or at designated centers throughout the country. Passing grades are determined by Montana State University. These students receive credit and a P grade on the transcript for scores above the passing level; scores below the passing level are not entered on the transcript. CLEP examinations may not be used to replace a grade of a course previously taken. University Core requirements cannot be satisfied by the CLEP procedures. In general, a department will not give a challenge examination if a CLEP examination is available for the same course.

2. Advanced Standing by Challenge. Challenge provides the opportunity to earn college credits and grade points without formal course enrollment. A student who has completed the work of a college course on his or her own initiatives and time, may, with the approval of the student’s academic advisor, the instructor, the department heads, and the college deans, take a comprehensive examination in the subject matter of the course. Performance in the examination will become the basis for a grade in the course, and the results will be recorded on the student’s permanent academic record at the end of the term which the challenge exam is taken. Official permission forms should be secured in advance from the Registrar’s Office. Students must be registered at MSU when they take the challenge examination, and they must have passed ten credits of regular course work at Montana State University before the challenge grade will be recorded on their permanent records.

   The challenge examination for credit in a course which is a prerequisite to a second course must be taken before enrollment in the second course. Students who have enrolled in a regular or an extension course and received a grade (other than that of W) or have taken a regular or an extension course for zero credit may not challenge that course. Challenges are
Graduation Registration Requirements for Baccalaureate Degrees

Graduation Registration Requirements

A student must be registered at Montana State University the semester of his or her graduation. If the student is not required to take any courses at Montana State University during the final semester, he or she must process an “in absentia” registration and pay a registration fee of $30 before the end of the third week of the semester he or she expects to earn a degree. Arrangements for this registration must be made by the student with the Graduate Dean. Graduate students must have the written permission of the Graduate Dean to register in absentia.

Enrollment must coincide with the university’s offering of a specific credential. A student must enroll and complete at least one course for credit during the time a credential is offered in order to receive that credential. Retroactive awarding for a newly approved and offered credential when all credits earned preceded that offering is not permitted.

Except for certain pre-professional curricula (e.g., pre-medicine), twenty-three of the last thirty credits earned to meet the graduation requirement must be MSU Bozeman credits. Specific majors may have program-specific requirements for courses that must be taken from MSU Bozeman to meet graduation requirements. Such requirements are clearly identified in the curriculum description for that department.

Graduation Procedures

Notification of Degree Eligibility

Students are expected to submit an Application for Baccalaureate Degree form by October 1st for spring semester graduation and March 1st for summer or fall semester graduation. A $30 degree application fee is assessed at the time the Application for Degree form is filed. Returning former students must file the application during the first week of university instruction of the semester of completion. Application for Degree forms can be moved from one semester to the next within one academic year. If it is necessary to delay graduation the student must file a new Application for Degree resulting in an additional $30 fee.

Satisfaction of Financial Obligation

All candidates for degrees must fully satisfy their financial obligations to the University (or make arrangements with Montana State University for doing so) as a condition for completing their degree programs. Candidates failing to comply with this requirement shall not be eligible for graduation, diplomas, degrees, or any transcripts of their records.

Graduation Grade Point Average

In order to graduate, students must earn a cumulative grade point average of 2.00. Further restrictions and graduation requirements may be imposed by the various curricula. To receive a graduate degree from MSU-Bozeman, students must earn a 3.00 grade point average.

Graduation with Honors

Graduation with honors or highest honors applies only to undergraduate degrees.

To receive honors, a student must earn a cumulative grade-point average between 3.25 and 3.69. To receive highest honors, a student must earn a minimum cumulative grade point average of 3.70. Cumulative grade point averages are computed at the end of the semester of graduation.

All MSU credits attempted and grades received will be used in computing graduation with honors or highest honors.
Transfer students receiving their first baccalaureate degree must meet the cumulative grade-point average requirements stated above and complete a minimum of sixty semester credits at MSU. The credits earned at MSU must compute to minimum grade point averages of 3.25 or 3.70 for graduating with honors or highest honors respectively.

For second degree or subsequent baccalaureate candidates, the grade point average of the first or subsequent degrees will be included in the determination of honors or highest honors.

**Diplomas**

Diplomas are dated the last day of the semester in which the requirements for the degree are completed. Diplomas are mailed to graduates the semester following degree completion after final degree verification is complete.

**Appeals of Graduation Requirements**

The Admission and Graduation Requirements Committee (GARC) is composed of the Assistant Vice Provost for Undergraduate Education (chairperson), the assistant dean of the college concerned, and the Registrar. This board considers appeals and/or petitions from undergraduate and non-degree students seeking waivers of established requirements in special situations.

Instructions for submitting appeals and petitions are available through the Registrar’s Office.

These submissions should be forwarded by letter to the Registrar and should originate with the student in conjunction with the student’s adviser.

**Student Records**

Access to student records is restricted according to the Family Educational Rights & Privacy Act (FERPA). For more information see www2.montana.edu/policy/family_ed_privacy_act/. Questions regarding privacy of student records should be directed to the Registrar.

**Name Change**

Notice of legal change of name, resulting from marriage, divorce, or other reason, must be promptly filed with the Registrar. Name change forms are available from the Registrar’s Office and must be submitted with copies of a legal court document, driver’s license and Social Security card with new name before academic records can reflect any name change.

** Transcript of Record**

Transcripts are sent only at the signed request of the student. Transcripts may be requested online at www.montana.edu/registrar or may be requested in person at the Registrar’s Office, 101 Montana Hall, and for each transcript issued, a fee is charged. Transcript requests are generally processed within four to six business days, though at the end of the semester, additional time is needed.

If the student requesting a transcript has an outstanding debt with the University, the request will not be processed until the bill has been paid.
Code of Conduct, Policies, Regulations, & Reports

Academic and Conduct Guidelines
Montana State University expects students to maintain acceptable standards of behavior on campus and in the community and to manifest a serious purpose by maintaining satisfactory scholastic standing in their coursework. Students who show persistent unwillingness or inability to comply with these requirements will not be permitted to continue his or her affiliation with the University.

A complete statement of the guidelines and procedures concerning academic integrity and student conduct is contained in the Student Code of Conduct (http://www2.montana.edu/policy/student_conduct).

The following identifies the responsibilities of all MSU students as defined by the Student Code of Conduct. The entire code of conduct can be found at www.montana.edu/knowyourcode/

Student Responsibilities

Academic Expectations
Students must:

1. be prompt and regular in attending classes;
2. be well-prepared for classes;
3. submit required assignments in a timely manner;
4. take exams when scheduled, unless rescheduled under 310.01;
5. act in a respectful manner toward other students and the instructor and in a way that does not detract from the learning experience; and
6. make and keep appointments when necessary to meet with the instructor. In addition to the above items, students are expected to meet any additional course and behavioral standards as defined by the instructor and listed in the syllabus.

A student officially representing MSU in athletic events, government, performance, or in similar official capacities, is entitled to the rescheduling of exams or important assignments due to required absences, only if a student has met the academic expectations outlined in section 310.00 of the Student Conduct Code. Students who do not meet the academic expectations, however, may not be entitled to special accommodations. Students are expected to provide course instructors with official notification of scheduled activity(ies) as early as possible, preferably at least ten (10) days in advance of the event.

Students participating in official MSU activities should not expect any special accommodation for attendance at regularly scheduled practice sessions or meetings (i.e., the routine activities required for performance, athletic pursuits, etc.).

Assistance
Students should seek assistance from the instructor and from the appropriate University support services (e.g., tutors, study skills counseling, career development, etc.), if the need for such services arises.

Evaluation
Students should follow fair and appropriate procedures when evaluating their courses and instructors. Factors such as race, ethnicity, color, religion, sex/gender, sexual orientation or preference, age, national origin, disability, marital status, political beliefs, veteran status or personal relationships may not be considered.

Academic Honesty
The integrity of the academic process requires that credit be given where credit is due. Accordingly, it is academic misconduct to present the ideas or works of another as one’s own work, or to permit another to present one’s work without customary and proper acknowledgment of authorship. Students may collaborate with other students only as expressly permitted by the instructor. Students are responsible for the honest completion and representation of their work, the appropriate citation of sources and the respect and recognition of others’ academic endeavors.

The Dean of Students’ Office reviews the MSU Conduct Code and Grievance Procedures for Students annually. As changes occur in the organizational, operational, educational, and legal environments, the guide is revised.

Alcohol, Drug, Tobacco Policy
Montana State University is a tobacco-free campus, to include e-cigarettes (vaping) and an environment where inappropriate use of alcohol and unlawful possession, consumption, use or distribution of illicit drugs or alcohol is prohibited. The university requirements are found in the Tobacco Free Campus Policy (http://www2.montana.edu/policy/smoking_facilities) and the Campus Alcohol and Drug Policy (http://www2.montana.edu/policy/security_report/alcohol_drug_policies.html).

For more information on resources http://www.montana.edu/oha (http://www.montana.edu/oha)

Valuable personal property should be adequately protected. Montana State University is not responsible for the loss or destruction of any of the personal property of students.

Vehicles
All persons operating vehicles on the University campus should be familiar with MSU vehicle regulations, copies of which are available at the University Police Department, Roy Huffman Building, 7th and Kagy. Students, faculty, staff, and visitors must register any motor vehicles they park on the university campus for any reason.

The regulations are considered to be part of the terms and conditions of enrollment for students and of employment for staff members. Students must register their vehicles within one week after classes begin; faculty and staff must register within one week after beginning employment. A vehicle registration fee is payable at the time each vehicle is registered.

Registration is not considered complete until the registration decal is mounted on the left side of the rear bumper so that it is plainly visible from the rear. The registration decal designates areas in which the vehicle may be legally parked on campus.

All visitors are required to have a parking permit to park at Montana State University Monday through Friday, 6:00 a.m. to 6:00 p.m. Parking permits may be purchased at the Visitor Information Booth located at 7th and Grant or the University Police Department at 7th and Kagy.

Montana State University assumes no responsibility for the care or protection of any vehicle or its contents while operated or parked on the campus. The University reserves the right to revoke student use or possession of vehicles for conduct or scholastic reasons. The Board of Regents has authorized Montana State University to levy fines against students, faculty, and employees for violations of parking, traffic, or vehicle registration regulations. These fines and penalties are listed in the vehicle regulations.
Bicycles must be registered if they are used on campus. They should be operated in a prudent manner and parked only in racks provided, except in the campus family housing area. Violators are subject to fine. Bicycles must be walked, not ridden, though designated areas in the central campus.

All matters concerning parking and traffic should be referred to the University Police Department. The University Police are sworn peace officers of the State of Montana and have authority as vested in these officers by law.

**Campus Crime Report**

Crime is a reality at Montana State University. Preventing crime is everyone’s responsibility. Unreported crime is a criminal’s greatest ally. Suspicion that a criminal act has taken place is the only justification needed to call the University Police Department. Whether you are a victim, witness, or have information about a criminal offense or suspicious activity, contact the University Police:

On campus call 911
Off campus call 994-2121
24 hour emergency dispatch

Report a crime anonymously by email to: switness@montana.edu


**Common Hour Exam Policy**

**Introduction and Purpose**

Common hour exams are given during the semester for multi-section courses. Dates and times are posted online at www.montana.edu/registrar/Schedules. These exams take the place of one class meeting and are included in the student’s commitment to the course upon enrolling in it.

**Policy**

1. The nominal examination time may be from one to two hours.

2. For each Common Hour Examination, students will be excused from an equivalent period of instruction.

3. Requests regarding the date, duration, and room assignments for Common Hour Examinations must be submitted to the Registrar’s Office by the 20th class day of the prior semester.

4. Departments must provide for make-up/conflict examinations or other equivalent means of evaluating the student who are absent from the scheduled examination for legitimate reasons.

4.1 Make-up examinations for conflicts are to be given only to those students who, at the same hour:

a. Have another Common Hour Examination

b. Have a regularly scheduled class

c. Are engaged in an activity or event sanctioned in paragraph 310.01 of the Student Conduct Code (Official student representatives with a regularly scheduled practice or meeting that conflict with a Common Hour Exam see point 5 below.)

d. Sustained a personal emergency that prevented participation in the scheduled examination.

4.2. During the third week of classes, the Registrar’s Office will disseminate a list of the students who have conflicts among scheduled common hour examinations (cf 4.1.a.). This list will be updated regularly after that date and made available to all instructors. A priority list for resolving conflicts between common hour examinations (cf 4.4.) will also be published during the third week of classes.

4.3. Students are responsible for identifying all conflicts. Apart from unforeseeable, personal emergencies (4.1.d.), students are required to confirm the need for make-up examinations with the instructor as early as possible, but no later than ten (10) days before the scheduled examination.

4.4. In the event of a conflict between scheduled common hour examinations (cf 4.1.a.), the priority of scheduled versus make-up examination will be determined by the priority list published by the Registrar’s office. The order of priority will vary from semester to semester.

4.5. Dates for make-up examinations will be arranged by the instructor. The examinations are to be equivalent to the original examinations as a means of evaluating the student. These examinations and their scheduling are to be non-punitive.

5. Students who are official representatives of MSU who have regularly scheduled meetings or practices that conflict with a Common Hour exam may request of their instructor that they be allowed to arrive up to thirty (30) minutes late for a Common Hour Exam. The approval of such a request, however, is entirely at the discretion of the instructor. The instructor must be notified at least ten (10) days in advance. Students and instructors are encouraged to work with the Testing Center to assist with any accommodations if alternate testing possibilities cannot be arranged readily within the program or department.

6. All faculty should consider the Common Hour Examination schedule when planning ad-hoc evening examinations and other activities. Common Hour Examinations take precedence over all activities that occur outside of scheduled class hours except as provided for in this policy.

**Family Educational Rights and Privacy Act (FERPA)**

The Family Educational Rights and Privacy Act of 1974 (FERPA) affords students certain rights with respect to their education records.

**Student Rights**

**Right of Access**

Students at Montana State University may access to their educational records. This includes nearly all information maintained by the university which is directly related to the student. In most cases, an educational record that “is directly related to a student,” consists of grades and semester enrollment. Students have the right to review their educational record within 45 days of the day the university receives a request for access. Students should submit to the registrar, dean, head of the academic department, or other appropriate official, written requests that identify the record(s) they wish to inspect. The university official will make
arrangements for access and notify the student of the time and place where the records may be inspected. If the records are not maintained by the university official to whom the request was submitted, that official shall advise the student of the correct official to whom the request should be addressed.

Note: Students must provide photo identification in order to access their education records.

**Right to Amend**
The right to request the amendment of the student’s education records that the student believes are inaccurate or misleading. Students who believe their record is inaccurate or misleading should write to the university official responsible for the record. Clearly identify the part of the record they want changed, and explain why it is inaccurate or misleading. If the university decides not to amend the record as requested by the student, the university will notify the student of the decision and advise the student of his or her right to a hearing about the request for amendment. Additional information about the hearing procedures will be provided to the student when notified of the right to a hearing.

Note: FERPA does not address grade disputes or grievances, which are pursued through other university and/or college procedures. Students should consult section 530.00 of the Student Code of Conduct (http://www.montana.edu/policy/student_conduct/#academicgrievances).

**The Right to Consent**
At institutions of higher education, students may authorize the release of their educational records—but the student has the exclusive right to decide whether or not to authorize the release. This means that, in most cases, even a student’s parent may not demand the release of the student’s educational record. Moreover, students’ access to their own educational records—as well as the right to limit disclosure of those records—continues even after they graduate or otherwise leave the institution.

A student may give consent in writing to release their enrollment information to a third party, this includes a letter of verification or an official transcript. Students may also complete a FERPA Release to have certain information made available to their parent or guardian.

**Exceptions**
Disclosure of Directory Information (http://www.montana.edu/registrar/ferpa/directory_information.html) can be made without a student’s consent.

Disclosure without consent is also permitted to school officials with legitimate educational interests. School officials include administrators, faculty, professional staff, academic advisors, clerical or support employees, including MSU law enforcement unit personnel and MSU health staff; volunteers; a person or company with whom the university has contracted as its agent, acting with a legitimate educational interest, to provide a service instead of using university employees or officials (such as an attorney, auditor, collection agent, service provider); a person serving on the Board of Regents; staff in the Alumni Association and MSU Foundation offices; or a student serving on an official committee, such as a disciplinary or grievance committee, or assisting another school official in performing his or her tasks. A school official has a legitimate educational interest if the interest in an education record is justified under one or more of the following conditions:

- the task or determination is an employment responsibility or a properly assigned subject for the inquirer’s determination and/or
- the task or determination is consistent with the purpose for which the records, information, or data are maintained.

**Letters of Recommendation**
Occasionally, a school official may be asked, or volunteer, to write a letter of recommendation on behalf of a student.

This usually would not require the student’s written release or authorization. But if the letter includes information that falls within FERPA’s definition of educational records—such as grade point average or class ranking—the student’s written consent to include such information would be necessary.

**Directory Information**
The University has designated certain information as “directory information” which it may disclose without the student’s written consent. Montana State University has designated the following as directory information:

1. name, campus address, home address, telephone listing and campus email address.
2. state of residence
3. age, date, and place of birth
4. sex and marital status
5. name of advisor
6. name and address of parent(s)
7. major field of study, including the college, division, department, or program in which the student is enrolled
8. classification as a freshman, sophomore, junior, senior, or graduate student, or by number referring to such cases
9. participation in officially recognized activities and sports
10. weight and height of members of athletic teams
11. dates of attendance and graduation, and degrees received
12. the most recent educational institutional attended
13. honors and awards received, including selection to a Dean’s list or honorary organization, and the grade point average of students selected
14. photographic, video or electronic images of students taken and maintained by the University

Any student may refuse to permit the university from designating any or all of the personally identifiable information designated as directory information with regard to his or her records. Any student wishing to exercise this right must inform the University Registrar in writing no later than the 10th class day of the semester, of the categories of personally identifiable information which are not to be designated as directory information with respect to that student.

FERPA permits the disclosure of certain information from the students’ education records without the consent of the student if the disclosure meets certain conditions as outlined in the federal regulations (34 C.F.R. §99.31. The University will comply with the requirements of FERPA as outlined in 20 U.S.C. 1232G and 34 C.F.R., Part 99.

**Complaints**
If you believe Montana State University is not complying with state or federal regulations regarding FERPA or other privacy protections, please bring the Registrar’s Office or Legal Council your concerns to see if we can agree upon a resolution. Every effort will be made to address your concern; if you are not satisfied; you have the right to file a complaint with the U.S. Department of Education concerning alleged failures by Montana State University.
Discrimination, Harassment, Sexual Misconduct, Dating & Domestic Violence, Stalking and Retaliation

University to comply with the requirements of FERPA. A complaint may be filed in writing with the Department of Education at the following address: Family Policy Compliance Office U.S. Department of Education 400 Maryland Avenue, SW Washington, DC, 20202.

Definitions

**Education Record** —Any record(s) directly related to a student and maintained by MSU or by a party acting for the university. Education records include any information or data recorded in any medium, including but not limited to handwriting, print, computer media, video or audio tape, film, microfilm, and microfiche.

**Personally Identifiable Information** —Includes not only the name of the student and other personal identifiers, but also a list or description of personal characteristics or any other information that, alone or in combination, is linked or linkable to a specific student that would allow a reasonable person in the school community, who does not have personal knowledge of the student and/or relevant circumstances, to identify the student with reasonable certainty. Further, personally identifiable information includes all information about a student that is not defined as directory information, as well as any information that the student has indicated may not be released, including directory information.

**Student** —Any individual formally admitted who is or has been in attendance at MSU. The term does not apply to applicants for admission, nor does it apply to persons who have been admitted but who have not registered.

**Discrimination, Harassment, Sexual Misconduct, Dating & Domestic Violence, Stalking and Retaliation**

**Discrimination, Harassment, Sexual Misconduct, Dating Violence, Domestic Violence, Stalking and Retaliation Policy and Grievance Procedures**

Montana State University is committed to providing an environment that emphasizes the dignity and worth of every member of its community and that is free from discrimination and harassment based upon race, color, religion, national origin, creed, service in the uniformed services (as defined in state and federal law), veteran’s status, sex, age, political ideas, marital or family status, pregnancy, physical or mental disability, genetic information, gender identity, gender expression, or sexual orientation. Such an environment is necessary to a healthy learning, working, and living atmosphere because discrimination and harassment undermine human dignity and the positive connection among all people at our University.

Acts of discrimination, harassment, sexual misconduct, dating violence, domestic violence, stalking, and retaliation will be addressed by the University through the Discrimination, Harassment, Sexual Misconduct, Dating Violence, Domestic Violence, Stalking and Retaliation Policy (http://www.montana.edu/policy/discrimination) and the related Discrimination Grievance Procedures (http://www.montana.edu/policy/discrimination/procedures). The Office of Institutional Equity (OIE) is responsible for implementing informal and formal resolution via the Policy, and ensuring compliance with local, state, and federal civil rights laws. OIE also facilitates informal and formal resolution processes via the Discrimination and Harassment Policy and Discrimination and Harassment Procedure.

**Reporting, Filing a Complaint or Questions**

Anyone who believes they have been discriminated against or harassed based on a protected class, and anyone who has experienced sexual violence, dating or domestic violence, stalking, or retaliation, has the right to file a report with the University. The OIE Director and staff is available to discuss options, explain University policies and procedures, and provide education on relevant issues. Reports may also be reported securely online through the Reporting Form (https://publicdocs.maxient.com/reportingform.php?MontanaStateUniv&layout_id=9).

To file an anonymous report:

Phone: 855-753-0486

All employees, with the exception of the VOICE Center, Counseling and Psychological Services, and Student Health Services are required to report known or suspected discrimination or harassment to OIE.

Anyone can make a report by calling OIE, going to the OIE office, e-mailing, or making a report on-line.

Office of Institutional Equity (http://www.montana.edu/equity)
PO Box 172430
Bozeman MT 59717-2430
Tel: (406) 994-5326
Email: oie@montana.edu
Location: Hamilton Hall Room 114, 116, 118

Montana State University’s Title IX and 504 Coordinator is the Director of the Office of Institutional Equity. They may be reached by phone at 406-994-5326 or email at oie@montana.edu.

![www.montana.edu/equity](www.montana.edu/equity)

**Residency Requirements for Fee Purposes**

In-state admission and fee status is granted to those persons who have demonstrated over a period of time that their permanent residence is Montana, a state which they have supported through the payment of appropriate taxes. In general, a person must meet all seven requirements listed below to qualify for in-state status:

1. A person must be physically present in Montana for twelve or more consecutive months without an absence in excess of a total of thirty days. One must demonstrate by appropriate actions during the twelve month period the intent to make Montana one’s permanent home. The required twelve month period does not begin until specific actions are taken to change legal ties to Montana.

2. The twelve month period does not begin until one or more acts, that clearly indicate the intent to become a resident, are taken. Mere presence in Montana alone will not serve to start this period. The legal action date must occur in the preceding year, on or before the fifteenth day of class of the term for which reclassification is requested. Sufficient actions to begin the period are:
   a. Montana vehicle registration
   b. Montana driver’s license
   c. Montana voter registration
   d. Purchase of a principal residence where a Montana title is obtained
   e. Filing of a resident Montana income tax return
   f. If none of the above is applicable, an affidavit of intent may be filed with the Registrar’s Office.
3. An individual must be at least fifty-one percent financially self-sufficient during the entire twelve month period, and that person must not be claimed as an exemption under federal income tax regulations by someone filing an out-of-state federal tax return, commencing with the tax year in which the twelve month period begins.

4. A person must file a Montana income tax return

5. If a person drives a motor vehicle in Montana or has a driver’s license from another state, he or she must obtain a Montana operator’s license within the required legal time limit.

6. If a person owns a motor vehicle in Montana, he or she must license the vehicle in Montana within the required legal time limit.

7. An individual must register to vote in Montana if she or he expects to exercise the right to vote.

An individual who is enrolled for more than half-time status during any semester that falls within the twelve month period is presumed to be present in the state primarily for educational purposes, and such periods may not generally be applied toward the physical presence requirement of the policy. At Montana State University, six credits is considered half-time enrollment.

There are additional regulations concerning married persons and others with special circumstances. Persons interested in gaining residency should request the pamphlet “Montana University System Student Guide to Montana’s Residency Policy.” For more information, new students should contact the Office of Admissions. Currently enrolled students and former students can obtain petition forms and more information from the Registrar’s Office.

Right of Appeal and Grievances

Student grievances are handled by approved university procedures. Grievances may be of at least four types: 1) academic, 2) student conduct, 3) discrimination harassment, or 4) other non-academic grievances.

1. Academic Grievances: Academic grievances are grievances involving coursework, grades, etc. All such grievances are to be handled in accordance with approved university guidelines and procedures. Copies of the approved procedures are available from offices of department heads, college deans, the Provost’s Office, and the Dean of Students’ Office.

2. Student Conduct Grievances: Student conduct grievances are those which do not involve academics or alleged discrimination or sexual harassment. Copies of university conduct guidelines and appeals procedures for conduct grievances are available at the Dean of Students’ Office.

3. Discrimination or Harassment: Montana State University guarantees the right to file a grievance related to all students, employees, visitors, and applicants for admission or employment. The Office of Institutional Equity (OIE) is responsible for MSU's Discrimination, Harassment, Sexual Misconduct, Dating Violence, Domestic Violence, Stalking, and Retaliation Policy (http://www.montana.edu/policy/discrimination/procedures) which covers these rights and the related processes (http://www.montana.edu/policy/discrimination/procedures). If you believe you may have experienced unlawful discrimination on basis of race, color, religion, national origin, creed, service in the uniformed services (as defined in state and federal law), veteran’s status, sex, age, political ideas, marital or family status, pregnancy, physical or mental disability, genetic information, gender identity, gender expression, or sexual orientation, you can report to OIE to discuss your rights and resources under University Policy. Anyone with questions about their rights and resources related to discrimination, harassment, sexual misconduct, dating violence, domestic violence, stalking, or retaliation can contact OIE. The Director of OIE is the University’s Title IX and 504 Coordinator.

4. Other Non-Academic Grievances:

   a. Traffic Violation Appeals: The Traffic Appeals and Regulations Committee handles appeals of traffic violation citations. This committee is composed of four students, three faculty, three classified staff, and three professional non-faculty members. The University Police Director is an ex-officio non-voting member. The decision of the committee is final on all appeals. Contact the University Police Department for appeal forms and additional information.

   b. Student Financial Aid Appeals: Appeals of actions of the Financial Aid Services Office, which relate to financial aid awards, may be addressed to the Financial Aid Appellate Board. The student should first contact the Director of Financial Aid and, if the grievance cannot be resolved at that level, the director will refer the student to the chair of the Financial Aid Appellate Board. Appeals must be in writing.

   c. Appeals of Residency Status Classification for Fee Purposes: Residency status for fee purposes is initially determined for undergraduates by the Office of Admissions and for graduates by The Graduate School. Requests for reclassification are handled by the Registrar. Appeals of registry decisions made by these offices may be made to the Residency Appeals Board. Information about reclassification and appeals can be obtained from the Office of the Registrar.

   d. Student Athletic Grievances: Student athletes who have grievances should contact the Director of Athletics. Regulations and requirements are published by the Athletics Department as well as by the directors for each sport.

   e. Residence Life Grievances: Grievances related to living in the residence halls should contact the Director of Residence Life. Family housing residents should contact the Family Housing Office if they have grievances.

Appeal

The student should be aware that, in cases of disagreement with the decision of a staff member, an appeal for review of the decision may be made to the next higher official or body unless otherwise stated in the grievance policy. If the student is in doubt concerning the person to whom the appeal should be made, he or she should consult the Dean of Students’ Office.
Core 2.0 General Curricular Requirements

- Core 2.0 Foundation Courses (p. 62)
- Core 2.0 Ways of Knowing Courses (p. 64)
- Core 2.0 Credit Policies (p. 65)
- Core 2.0 Grading Standards (p. 66)
- Approved Core 2.0 Courses (http://www.montana.edu/newcore/approved_courses.html)
- Permitted Substitutions (p. 65)
- Appeals (p. 66)
- Accommodations for Students with Math Learning Disabilities (p. 66)

Purpose of Core 2.0

As a land-grant university, MSU-Bozeman is charged, through the Morrill Act of 1862, with providing "liberal and practical education...in the several pursuits and professions of life." In addition, as a member of the Montana University System, MSU is charged with providing programs that "stimulate critical analysis, clear and effective communication, and the creative process." Students should also "broaden their cultural horizons by contact with the creative arts, sciences and the humanities, and achieve an understanding of the political, social, economic and ethical problems of the contemporary world and the relation of their studies to these problems."

To this end, the faculty of MSU have developed a common core curriculum, called Core 2.0, for all undergraduate students in an effort to enable students to reach their intellectual potential, to become contributing members of society, and to compete more successfully in our rapidly changing and increasingly complex world.

The purpose of the Core 2.0 curriculum is to ensure a wide-ranging general education of consistent and high quality to all Montana State University students regardless of their major or area of study. Core courses allow students to reaffirm their common experiences, redefine their common goals, and confront their common problems. Core courses emphasize communication and techniques of creative inquiry in a variety of disciplines.

One of the goals of Core is to provide students with the opportunity to develop their creative and intellectual potential. Therefore, Core courses will require students to do the following:

1. Think, speak, and write effectively, and evaluate the oral and written expression of others.
2. Develop learning objectives and the means to reach them, thus developing lifelong patterns of behavior which increase the potential to adapt to and create change.
3. Exercise and expand intellectual curiosity.
4. Think across areas of specialization and integrate ideas from a variety of academic disciplines and applied fields.
5. Use complex knowledge in making decisions and judgments.
6. Make discriminating moral and ethical choices with an awareness of the immediate and long-term effects on our world.
7. Develop a critical appreciation of the ways in which we gain and apply knowledge and understanding of the universe, of society, and of ourselves.
8. Understand the experimental methods of the sciences as well as the creative approaches of the arts.
9. Develop an appreciation of other cultures as well as an understanding of global issues.

Core 2.0 Overview

The Core 2.0 curriculum at Montana State University is designed to enhance students' intellectual experience in all realms of academia, with the express goal of providing students with a broad exposure to and knowledge of multiple and varied methods of scholarship. The Core curriculum consists of required classes that focus on clear verbal and written expression(s) of critical analysis and evaluation of academic fields of study at the heart of human intellectual and artistic inquiry and achievement. Completion of the Core curriculum requirements will introduce students to the theories, methods, and foundations of these academic fields, enable them to critically evaluate information in these subjects, and teach them to present their knowledge clearly in both verbal and written form.

Core 2.0 has two broad categories: Foundation Courses and Ways of Knowing (Inquiry and Research & Creative Experience) Courses. Courses that apply to specific areas in either of these categories are indicated with a "letter attribute" after the course number which corresponds to the specific Core area. For example, courses that fulfill the Core 2.0 writing requirement are indicated with a "W" (WRIT 101 W). A current list of Core 2.0 course offerings can be found in the schedule of Core 2.0 classes (https://atlas.montana.edu:9000/pls/bzagent/bzsxcore.pw_selterm).

Students must complete the equivalent of one course in each of the Foundation Course areas: University Seminar (US), College Writing (W), Quantitative Reasoning (Q), Diversity (D), and Contemporary Issues in Science (CS).

Students must complete at least one 3 credit course in each of the Ways of Knowing Course areas: Arts (IA or RA), Humanities (IH or RH), Natural Sciences (IN or RN), and Social Sciences (IS or RS). All students must take at least one 3 credit course in an approved Research & Creative Experience course. Students may take an approved Research & Creative Experience course in one of the four areas mentioned above (indicated with an R) or they may take a separate Research & Creative Experience course in any discipline, including Undergraduate Scholars Program (USP 490R).

Notes:

- Total number of credits: 27 if the Research and Creative Experience requirement is completed as part of the requirements in Arts, Humanities, Natural Sciences or Social Sciences; otherwise 30.
- A grade of C- or better is required in all Core 2.0 courses.
- Completion of at least two approved Natural Science courses with a grade of C- or better satisfies both the Contemporary Issues in Science and the Natural Science Inquiry requirements. Individual substitutions for one requirement of the other are not permissible.

Core 2.0 Foundation Courses

University Seminar (US)

Rationale

Courses with the University Seminar (US) core designation are primarily intended for first-year students throughout all curricula to provide a platform for collegiate level discourse. Activities that hone written and oral communication skills are universally incorporated, but the themes represented in individual US core courses vary considerably to reflect the department or program from which the course originates. All US core courses are small in size and rely heavily on seminar-style teaching where course content is delivered by discussion and interaction rather than by lecture. This learning environment promotes vibrant interactions between first-year students, a faculty member, and in many courses, a more experienced student fellow. US core courses provide a venue where students
can enjoy rigorous academic discussions that promote critical thinking, learning, and understanding in a supportive and truly collegiate manner.

**Student Learning Outcomes**

Through completion of the US Core students will:

- Demonstrate critical thinking abilities
- Prepare and deliver an effective oral presentation
- Demonstrate analytical, critical, and creative thinking in written communication.

**College Writing (W)**

**Rationale**

WRIT 101W is a multi-section, three-credit course with an enrollment cap of 25. Classes consist largely of first and second-year students. The course fulfills the written communication requirement of the current core and is taught by adjunct instructors, teaching assistants, and tenure-track faculty. The departmental course design focuses on expository (vs. creative or personal) writing, requires at least four graded paper assignments per term, and calls for sections to be organized around topics/themes of the instructor’s choosing. With some variation, typical sections of 101W incorporate a wide range of learning components in support of major paper assignments: reading of essays, study of writing instruction texts, short compositions in response to reading, in-class writing, small group workshops, peer review of writing, draft conferences, and class discussion.

**Student Learning Outcomes**

It is intended that students who complete WRIT 101W will have been significantly aided in their ability to:

- Demonstrate themselves to be reflective writers
- Show willingness to take risks in new writing situations
- Collaborate with other writers
- Demonstrate ability to read rhetorical situations
- Demonstrate control of situation-appropriate conventions of writing
- Integrate source material in their writing

Students whose scores meet or exceed any one of the following are exempt from the College Writing requirement:

- ACT English score of 28
- SAT Critical Reading score of 650
- ACT/SAT essay/ writing sub-score of 11

*The credits will have to be made up in other coursework in order to meet the minimum graduation requirements.

**Quantitative Reasoning (Q)**

**Rationale**

The ability to reason quantitatively is essential for citizenship in the 21st Century world. An understanding of data and quantity, and how they are presented and interpreted by the press and on the Internet, is invaluable. Mathematics and logic are used throughout the world as essential tools in many fields, including natural science, engineering, medicine, and the social sciences. In the words of John Allen Paulos,

“…There are three reasons or, more accurately, three broad classes of reasons to study mathematics. Only the first and most basic class is practical. It pertains to job skills and the needs of science and technology. The second concerns the understandings that are essential to an informed and effective citizenry. The last class or reasons involves considerations of curiosity, beauty, playfulness, and perhaps even transcendence and wisdom.”

In a Q course, the student will be exposed to the methods employed in the mathematical sciences. This will include the application of mathematical or statistical models to complex problems which can then lead to potential solutions of these problems. There are two types of Q courses: foundation and terminal. The type of course taken is dependent on a student’s program of study.

**Criteria**

- A foundation Q course (e.g. calculus or introductory statistics) provides the mathematical foundation prerequisite for successful completion of courses contained in a student’s program of study. Thus, a core goal of the foundation course is to provide the quantitative and logical tools required in subsequent courses that demand a high level of mathematical sophistication and preparedness.

- A terminal Q course stresses mathematical and related foundational methods and concepts over a broad array of topics, and, in particular, mathematical and statistical foundational methods. Mathematical-foundation methods include the understanding of numerical or foundational concepts and the proper expression, proof, and refutation of arguments in the language of mathematics. Statistical-foundation methods include the understanding of quantitative and statistical concepts, the analysis of data, and the critical interpretation of statistical information.

- Mathematical and statistical foundational concepts include properties of numbers (integers, fractions, real numbers, complex numbers,...), problems in higher dimensions, shapes (classical geometric, topological equivalence,...), measures (distance, angles, area, volume, data-based statistics), random variables (distributions, expectations,...), functions of these concepts and their interplay, as well as methods of formal proof in the language of mathematics.

- Q courses enable students to develop those skills that lead to an understanding of quantitatively-based problems related to contemporary society. They provide practical applications that relate to their current daily and future professional lives as consumers of quantitative information. Ultimately, after having developed certain Q skills, they can apply them to make informed decisions in their personal and professional lives.

**Student Learning Outcomes**

Students completing a Core 2.0 Quantitative Reasoning (Q) course should demonstrate an ability to:

- Interpret and draw inferences from mathematical models such as formulas, graphs, diagrams or tables.
- Represent mathematical information numerically, symbolically and visually.
- Employ quantitative methods in symbolic systems such as, arithmetic, algebra, or geometry to solve problems.

**Diversity (D)**

**Rationale**

Graduates of Montana State University face an ever-changing and increasingly complex world. A carefully informed understanding of multiple identities and cultures, both within the United States and beyond, helps create a campus community that is committed to intellectual inquiry and prepares students to be members of a diverse global community. Diversity courses focus on identity (race, ethnicity, class, gender, sexuality, nationality, ability, etc.); the study of languages other than English; and/or traditionally marginalized or less frequently studied societies, nations, and/or cultures.

**Criteria**

The course must focus in in-depth analytical and critical attention to difference and to historical, cultural, and/or social contexts, with an emphasis on class discussion and active student engagement.
In addition to this primary criterion, the course will meet one of the following criteria listed below:

- The course examines identity in relation to race, ethnicity, gender, sexuality, class, nationality, ability, and/or other axes of difference.
- The course teaches a language other than English and includes the examination of the culture(s) that speak(s) the language.
- The course examines the historical, political, cultural, and/or social forces that foster systemic disparities based on difference, and critically examines concepts of difference within these systems.

**Student Learning Outcomes**

Students who successfully complete a Diversity-designated course will demonstrate one or more of the following:

- An analytical and critical understanding of diversity within societies, nations, and cultures.
- Knowledge of a language other than English and the culture(s) that speak(s) that language.
- An analytical and critical understanding of particular, traditionally marginalized, or less frequently studied societies, nations, and/or cultures and an understanding of cultural difference in relation to those societies, nations, and/or cultures.

**Contemporary Issues in Science (CS) Rationale**

Contemporary Issues in Science (CS) is a course focused on natural science or technology that examines the ways in which science contributes to the study of significant problems in the contemporary world, and can help individuals and society make informed decisions about these issues. CS courses explore how knowledge is created in the natural sciences. They have a central goal of providing an understanding of the methods used to discover and create factual and theoretical scientific knowledge. These courses will examine particular scientific or technological issues and at the same time explore the methodological and theoretical foundations of scientific inquiry.

CS courses, for example, might devote some time to examining the history of particular contemporary scientific issues and the ways in which truths or assumptions about these issues have changed over time. They might examine the social and political consequences of scientific and technological discoveries, or ethical issues arising from their use, or how science and scientific methods can aid public, personal, and professional decision-making.

CS, like Inquiry courses, will build on the critical thinking and communication skills developed in other core courses, particularly those of the University Seminar and College Writing courses. By enhancing students’ understanding of the process of scientific inquiry, they will enrich students’ experience of the core Research and Creative Experience and may incorporate non-traditional teaching methods, including small group learning activities and guided research projects.

**Criteria**

To receive a CS designation, a course should:

- Have a clearly defined science and/or technology focus, and explore a contemporary science or technology issue.
- Examine ways in which science and/or technology can contribute to the study of a significant problem in the contemporary world, and can help individuals and society make informed decisions about such issues.
- Explore how knowledge is created in science and/or technology (at least one-third of the course should be devoted to this goal).
- Include at least one major, discovery-based learning activity.
- Emphasize critical thinking, writing and oral communication skills.
- Ask students to independently analyze information from multiple sources.
- Develop students’ abilities to work effectively in small groups.

**Student Learning Outcomes**

After completing a Contemporary Issues in Science course, students will:

- Explain how science contributes to analyzing complex problems in the contemporary world.
- Describe the scientific method, the kinds of questions asked by scientists and the methods used to explore those questions.
- Demonstrate critical thinking, writing and oral communication skills.
- Work effectively in small groups.

Students may substitute courses for this requirement. See the Permitted Substitutions near the end of this section.

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**Core 2.0 Ways of Knowing Courses**

All Ways of Knowing Courses emphasize the methods used to discover and create the factual and theoretical knowledge of the discipline. Inquiry courses (indicated with an I) do this primarily through classroom instruction and require at least one major learning activity based on methods of inquiry appropriate to the discipline. Research courses (indicated with an R) require students to have autonomous experience in the research and creative process and to generate a scholarly product. Lower-division R courses are intended to introduce students to the discipline and thus also satisfy a Ways of Knowing area (RA, RI, RN, or RS). Upper-division R course are often intended for majors and do not have a Ways of Knowing designation. These courses are listed separately with an R following the number.

All students must take at least one (1) Inquiry or one (1) Research & Creative Experience course in each of the following areas:

**Inquiry (I) Rationale**

The central goal of every Inquiry course is to provide students with an understanding of the methods used to discover and create the factual and theoretical knowledge of the discipline. Each course will examine particular issues in the discipline while exploring its methodological and theoretical foundations.

Inquiry courses, for example, might devote some time to examining the history of the discipline and the ways in which its truths or assumptions have changed over time. They might focus on major paradigm shifts or on contested ethical and interpretive issues within the discipline.

Inquiry courses will build on the critical thinking and communication skills developed in other core courses, particularly those of the University Seminar and College Writing courses. By enhancing students’ understanding of the process of academic inquiry, they will enrich students’ experience of the core Research and Creative Experience.

Inquiry courses are encouraged to incorporate non-traditional teaching methods, including small group learning activities and guided research projects.

**Criteria**

- A substantial proportion of the course will be devoted to exploring ways in which the discipline (http://www.montana.edu/newcore/areadescriptions.html) creates knowledge.
- The course must include at least one major learning activity based on methods of inquiry appropriate to the discipline.
Student Learning Outcomes

Inquiry courses are intended to improve students’

- Understanding of disciplinary methods, including the kinds of questions asked in the discipline and the methods that practitioners use to explore those questions
- Demonstrate critical thinking skills within the field.
- Demonstrate communication skills.

All students must take at least three credits in each of the following areas:

- Arts (IA or RA)
- Humanities (IH or RH)
- Natural Sciences (IN or RN)
- Social Sciences (IS or RS)

All students must take at least one (1) approved Research & Creative Experience course. Students may take an approved Research & Creative Experience course in any discipline, including the Undergraduate Scholars Program (USP 490R).

Notes:

- Total number of courses: 9, if the Research and Creative Experience requirement is completed as part of the requirements in Arts, Humanities, Natural Sciences or Social Sciences; otherwise 10.
- A grade of C- or better is required in all Core courses.
- Completion of at least two approved natural sciences courses with a grade of C- or better satisfies both the Contemporary Issues in Science and the Natural Science Inquiry requirements. Individual substitutions for one requirement or the other are not permissible.
- Completion of UH 202 with a grade of C- or better satisfies the Humanities Inquiry requirement.

Research & Creative Experience (R)

Rationale

The Research & Creative Experience builds on the competencies students have developed in the foundation courses. These experiences will not be limited to a student’s major field of study and will incorporate a range of authentic experiences from traditional one-on-one mentoring to group Research and Creative Experience courses. Because research and creative projects vary from one discipline to the next, some general guidelines have been developed to determine what constitutes a Research and Creative Experience.

Criteria

- Students experience the process of research and creative experience as a unique intellectual activity and generate a scholarly product.
- Student autonomy directs the research and creative experience, while faculty and staff provide the framing concepts and contexts.
- Research and Creative Experience courses provide frequent and early benchmarks for student progress to encourage early engagement in the research and creative process.
- The research and creative experience component done individually or in small groups constitutes at least 1/3 of the course. The remaining part of the course should provide sufficient information about the subject to enable the student to formulate a project as well as provide the student with the tools to do a research and creative project.
- Courses geared toward sophomore level students are particularly encouraged, but Research & Creative Experience courses can be at any level. Research & Creative Experience courses may have prerequisites.
- Course must address the responsible conduct of research.

Student Learning Outcomes

Through the Research and Creative Experience students will:

- Locate relevant information from broad and diverse sources
- Apply critical and creative thinking to synthesize information
- Produce a scholarly product based on both existing information and student effort (e.g., analysis, synthesis, design, etc.)
- Demonstrate the ability to successfully collaborate as a member of a team (when applicable).
- Demonstrate an understanding of the responsible conduct of research.

Permitted Substitutions

Completion of at least two of the following courses with a grade of C- or better satisfies the Contemporary Issues in Science (CS) and the Inquiry Natural Science (IN) requirements. Individual substitutions for one requirement or the other are not permissible.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 105CS</td>
<td>Introduction to Biotechnology</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 110CS</td>
<td>Introduction to Plant Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 160</td>
<td>Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>BIOB 260</td>
<td>Cellular and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOH 201</td>
<td>Human Anatomy and Physiology I</td>
<td>5</td>
</tr>
<tr>
<td>BIOH 211</td>
<td>Human Anatomy and Physiology II</td>
<td>4</td>
</tr>
<tr>
<td>BIOM 250</td>
<td>Microbiology for Health Sciences: Infectious Diseases</td>
<td>3</td>
</tr>
<tr>
<td>BIOO 220</td>
<td>General Botany</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 121IN</td>
<td>Introduction to General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 123</td>
<td>Introduction to Organic Chemistry and Biochemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 151</td>
<td>Honors College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 153</td>
<td>Honors College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 211</td>
<td>Elements of Organic Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>ENSC 245IN</td>
<td>Soils</td>
<td>3</td>
</tr>
<tr>
<td>GEO 103CS</td>
<td>Intro to Envrmntl Geology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 211</td>
<td>Earth History and Evolution</td>
<td>3</td>
</tr>
<tr>
<td>NRSM 240</td>
<td>Natural Resource Ecology</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 205</td>
<td>College Physics I</td>
<td>4</td>
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<tr>
<td>PHSX 207</td>
<td>College Physics II</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 220</td>
<td>Physics I (w/ calculus)</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 222</td>
<td>Physics II (w/ calculus)</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 224</td>
<td>Physics III</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 240</td>
<td>Honors Gen &amp; Mod Phys I</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 242</td>
<td>Honors Gen &amp; Mod Phys II</td>
<td>4</td>
</tr>
</tbody>
</table>

Core 2.0 Credit Policies

1. University Core requirements cannot be satisfied by the CLEP procedure.
2. Advanced Placement credits (AP), if equivalent to MSU Core courses, can be used to fulfill Core requirements.
3. Credit earned in repeatable Core courses may be applied only once to University Core requirements.
4. Some study abroad programs, upon approval, may satisfy the Diversity requirement.
5. Students in good standing in the University Honors Program may fulfill part of their University Core curriculum requirements with designated honors courses. Specific information is available in the Honors Program Office, Quad D.

**Core 2.0 Grading Standards**

1. College-level competence in all areas of the Core curriculum is necessary for adequate performance in the Core and beyond. A grade of C- or better is required in all University core courses.
2. No University Core course may be taken on a pass/fail basis.

**Appeals**

Unusual circumstances that warrant an appeal of the established policies and procedures must be initiated by the student and sent through his/her adviser to the Core Equivalency Review Committee (CERC) via the Registrar’s Office.

**Accommodation for Students with Math Learning Disabilities**

Accommodation to the Quantitative Reasoning (Q) Core Curriculum Requirement may be made for students with Math learning problems caused by disabilities. Accommodations, when permitted, apply only to the Core Curriculum Requirement; they do not change requirements in majors, minors, or certificates.

MSU recognizes that some students with specific learning disabilities may experience difficulty completing the Core Quantitative Reasoning requirement. Students with learning disabilities who believe that they need an accommodation to meet the Quantitative Reasoning requirement should contact the office of Disabled Student Services (DSS) to begin the process to certify the disability. Learning Disability documentation must meet established MSU requirements as developed by DSS. This documentation is available from:

Disabled Student Service
P.O. Box 173960
Strand Union, Room 155
Montana State University
Bozeman, MT 59717-3960
Undergraduate Programs

- College of Agriculture (p. 67)
- College of Arts and Architecture (p. 67)
- Jake Jabs College of Business & Entrepreneurship (p. 67)
- College of Education, Health and Human Development (p. 67)
- College of Engineering (p. 68)
- College of Letters and Science (p. 68)
- College of Nursing (p. 69)
- Gallatin College (p. 69)
- Honors College (p. 69)
- University Programs (p. 69)

Montana State University offers a wide range of programs through its nine academic colleges. Specific degrees, majors, and options are listed under each college. By their junior year, earlier if possible, students will need to select a major; the choice should be based on interests and on plans for the future. Careful consideration should also be given to the courses offered in the major and the requirements for completing the program of study.

College of Agriculture (p. 70)

- Bachelor of Science in Agricultural Business (p. 71)
  - Agribusiness Management Concentration
  - Farm and Ranch Management Concentration
- Bachelor of Science in Agricultural Education (p. 75)
  - Agricultural Education Broadfield Teaching Option
  - Agricultural Communication, Leadership, and Extension Option
- Bachelor of Science in Animal Science (p. 78)
  - Equine Science Option
  - Livestock Management and Industry Option
  - Science Option
- Bachelor of Science in Environmental Horticulture (p. 86)
  - Environmental Horticulture Science Option
  - Landscape Design Option
- Bachelor of Science in Environmental Sciences (p. 89)
  - Environmental Biology Option
  - Environmental Science Option
  - Geospatial and Environmental Analysis Option
  - Land Rehabilitation Option
  - Soil and Water Sciences Option
- Bachelor of Science in Financial Engineering (p. 73)
- Bachelor of Science in Microbiology (p. 235)
  - Microbiology Pre-Veterinary Track
- Bachelor of Science in Natural Resources and Rangeland Ecology (p. 96)
  - Rangeland Ecology and Management Option
  - Wildlife Habitat Ecology and Management Option
- Bachelor of Science in Plant Science (p. 98)
  - Crop Science Option
  - Plant Biology Option
- Bachelor of Science in Sustainable Food & Bioenergy Systems (p. 101)
  - Agroecology Option
  - Sustainable Crop Production Option
  - Sustainable Livestock Production Option
- Non-degree program
  - Pre-veterinary Medicine Program (p. 100)

College of Arts and Architecture (p. 105)

- Bachelor of Arts in Art (p. 105)
  - Art Education K-12 Broadfield Option
  - Art History Option
  - Liberal Arts Studio Option
- Bachelor of Fine Arts in Art (p. 105)
  - Graphic Design Option
  - Studio Arts Option
- Bachelor of Arts in Environmental Design (p. 115)
- Bachelor of Arts in Film and Photography (p. 118)
  - Film Option
  - Photography Option
- Bachelor of Arts in Music (p. 120)
- Bachelor of Music Education (p. 123)
- Bachelor of Arts in Music Technology (p. 122)

Jake Jabs College of Business & Entrepreneurship (p. 277)

- Bachelor of Science in Business (p. 277)
  - Accounting Option
  - Finance Option
  - Management Option
  - Marketing Option

College of Education, Health and Human Development (p. 125)

- Bachelor of Science in Community Health (p. 143)
- Bachelor of Science in Early Childhood Education and Child Services (p. 144)
  - Child Development Option
  - Preschool-Age Three (P-3) Option
- Bachelor of Science in Elementary Education K-8 (p. 129)
  - Early Childhood Education Option
  - Mathematics Option
  - Science Education Option
  - Special Education Option
- Bachelor of Science in Food and Nutrition (p. 146)
  - Dietetics Option
  - Nutrition Science Option
- Bachelor of Science in Secondary Education (p. 131)
  - General Science Broadfield Option
  - Social Studies Broadfield Option
• (Departmental Teaching Options)
• Bachelor of Science in Health Enhancement K-12 (p. 147) (Health and Physical Education)
• Bachelor of Science in Health and Human Performance (p. 153)
  • Exercise Science Option
  • Kinesiology Option
• Bachelor of Science in Hospitality Management (p. 149)
  • Food Enterprise
  • Lodging and Facilities
  • Restaurant Management: Farm to Table
• Bachelor of Science in Human Development and Family Science (p. 151)
  • Family and Consumer Sciences Education Option
  • Human Development and Family Science Option
• Bachelor of Science in Sustainable Food & Bioenergy Systems (p. 156)
  • Sustainable Food Systems Option
• Bachelor of Science in Technology Education (p. 133)
  • Industrial Technology Option
  • Technology Education Broadfield Teaching Option
• Certificate of Gerontology (p. 147)

College of Engineering (p. 160)
• Bachelor of Science in Biological Engineering (p. 162)
• Bachelor of Science in Chemical Engineering (p. 162)
• Bachelor of Science in Civil Engineering (p. 165)
  • Bio-Resources Option
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• Bachelor of Science in Computer Science (p. 171)
  • Interdisciplinary Option
  • Professional Option
  • Bachelor of Arts in Computer Science
• Bachelor of Science in Construction Engineering Technology (p. 165)
• Bachelor of Science in Electrical Engineering (p. 173)
• Bachelor of Science in Financial Engineering (p. 179)
• Bachelor of Science in Industrial and Management Systems Engineering (p. 179)
• Bachelor of Science in Mechanical Engineering (p. 179)
• Bachelor of Science in Mechanical Engineering Technology (p. 179)
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  • Military Aerospace Studies (p. 187) - Air Force ROTC
  • Military Science (p. 188) - Army ROTC

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• Bachelor of Arts in American Studies (p. 189)
• Bachelor of Arts in Asian Studies (p. 191)
• Bachelor of Science in Anthropology (p. 193)
• Bachelor of Science in Biological Sciences (p. 207) (Department of Ecology)
  • Biology Teaching Option
  • Conservation Biology and Ecology Option
  • Fish and Wildlife Ecology and Management Option
  • Organismal Biology Option
• Bachelor of Science in Cell Biology and Neuroscience (p. 194)
  • Biomedical Sciences Option (includes Pre-medicine, Pre-dentistry, Pre-optometry)
  • Neuroscience
• Bachelor of Science in Chemistry and Biochemistry (p. 195)
  • Biochemistry Option
  • Biochemistry Option: Pre-Med Track
  • Chemistry (Professional) Option
  • Teaching Option
• Bachelor of Science in Earth Sciences (p. 201)
  • Geography Option
  • Geology Option
  • GIS/Planning Option
  • Paleontology Option
  • Snow Science Option
• Bachelor of Science in Economics (p. 213)
• Bachelor of Arts in English (p. 215)
  • Writing Option
  • Teaching Option
  • Literature Option
• Bachelor of Arts in History (p. 218)
  • History Option
  • History Teaching Option
  • Science, Environment, Technology and Society Option (SETS)
• Bachelor of Arts in Liberal Studies (p. 224)
  • Environmental Studies Option
  • Global and Multicultural Option
  • Quaternary Option
  • Global Studies Minor
  • Global Studies Health Minor
• Bachelor of Science in Mathematics (p. 230)
  • Applied Mathematics Option
  • Mathematics Option
  • Mathematics Teaching Option
  • Statistics Option
• Bachelor of Science in Microbiology (p. 235)
  • Microbiology Option: Microbiology Track
  • Microbiology Option: Pre-Medical Track
  • Microbiology Option: Pre-Veterinary Track
  • Microbiology Option: Environmental Microbiology Track
  • Microbiology Option: Environmental Health Option
  • Medical Laboratory Science Option
• Bachelor of Arts in Modern Languages and Literatures (p. 242)
  • French K-12 Teaching Option
  • French and Francophone Studies Option
  • German K-12 Teaching Option
  • German Studies Option
  • Hispanic Studies Option
• Latin American and Latino/Latina Studies
• Spanish K-12 Teaching Option
• Bachelor of Arts in Philosophy (p. 249)
• Bachelor of Science in Physics (p. 251)
  • Physics Professional Option
  • Physics Teaching Option
  • Physics Interdisciplinary Option
• Bachelor of Arts in Political Science (p. 254)
• Bachelor of Science in Psychology (p. 257)
  • Applied Psychology Option
  • Psychological Science Option
• Bachelor of Science in Sociology (p. 258)
  • General Sociology Option
  • Criminology Option
• Non-degree program
  • Pre-Medical/Pre-Health Professions (p. 256)

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• Bachelor of Science in Nursing (p. 260)

Gallatin College (p. 266)
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• Associate of Applied Science in Interior Design (p. 271)
• Associate of Applied Science in Photonics and Laser Technology (p. 273)
• Associate of Arts (p. 266)
• Associate of Science (p. 267)
• Certificate of Applied Science in Bookkeeping (p. 268)
• Certificate of Applied Science in CNC Machine Technology (p. 269)
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• Certificate of Applied Science in Welding Technology (p. 274)
• Professional Certificate in Business Management (p. 269)

Honors College (p. 274)
• Honors College provides academically motivated students with unique opportunities to undertake interdisciplinary coursework and undergraduate research leading to an Honors baccalaureate degree.
• Directed Interdisciplinary Studies (p. 275)

University Programs (p. 275)
• University Programs offers several important academic programs to students including the Undergraduate Scholars Program and Leadership Fellows. University Programs also includes the MSU Advising Center and the National Student Exchange.

Undergraduate Minors

Teaching Minors

Teaching Minors
A number of teaching minors are available for students majoring in Secondary Education or Elementary Education.

• Art (K-12) (p. 136)
• Biology (5-12) (p. 137)
• Chemistry (5-12) (p. 137)
• Earth Science (5-12) (p. 137)
• Economics (5-12) (p. 137)
• Family and Consumer Sciences (5-12) (p. 137)
• French (K-12) (p. 138)
• German (K-12) (p. 138)
• Government (5-12) (p. 138)
• History (5-12) (p. 138)
• Mathematics (5-12) (p. 138)
• Physics (5-12) (p. 138)
• Reading (K-12) (p. 139)
• Spanish (K-12) (p. 139)
• Technology Education (5-12) (p. 139)

Non-teaching Minors
In addition to a major field of study, many students are now declaring a non-teaching minor. This is a secondary area of academic specialization. Some students use minors to expand their career opportunities, while others pursue minors in education. Students must submit an Application for a Minor to the Registrar’s Office two semesters prior to graduation. Below is a list of non-teaching minors currently available.

• Accounting (p. 284)
• Aerospace (p. 179)
• Agricultural Business (p. 74)
• Animal Science (p. 78)
• Anthropology (p. 193)
• Art History (p. 108)
• Asian Studies (p. 192)
• Astrobiology (p. 208)
• Biochemistry (p. 200)
• Building Energy Systems (p. 180)
• Business Administration (p. 284)
• China Studies (p. 243)
• Chemistry (p. 201)
• Coaching (p. 142)
• Computer Engineering (p. 176)
• Computer Science (p. 172)
• Economics (p. 214)
• Electrical Engineering (p. 178)
• English Literature (p. 217)
• English Writing (p. 218)
• Entrepreneurship and Small Business Management (p. 286)
• Entomology (p. 86)
College of Agriculture

Charles Boyer, VP of Agriculture, Dean and Director

Undergraduate Programs Available:

The College of Agriculture offers the following academic programs. The pre-veterinary program is available for students wishing to prepare for professional training in veterinary medicine. The College also participates in multidisciplinary programs: an economics major and additional microbiology options are available through the Colleges of Letters and Science, and a financial engineering major is available through the College of Engineering. Biological sciences span multiple departments, click here to learn more.

- B.S. in Agricultural Business
- B.S. in Agricultural Education
- B.S. in Animal Science
- B.S. in Economics
- B.S. in Environmental Horticulture
- B.S. in Environmental Sciences
- B.S. in Financial Engineering
- B.S. in Microbiology
- B.S. in Natural Resources and Rangeland Ecology
- B.S. in Plant Science
- B.S. in Sustainable Food & Bioenergy Systems
- Pre-veterinary Medicine Curriculum
- Preveterinary Medicine Certificate

Available Academic Minors:

Agricultural Business Minor
The Agricultural Business minor is specifically designed for management training with emphasis on finance, accounting, and managerial economics in agriculture-related businesses and industries.

Animal Science Minor
The minor in animal science is designed to give students outside of agriculture a broad overview of the livestock industry.

Entomology Minor
The Entomology minor provides focused training in entomology for students majoring in agricultural and natural resource disciplines.

Environmental Horticulture Minor
The Environmental Horticulture Minor provides an overview of the science and art of growing and maintaining plants for food and for the enjoyment and improvement of the human environment.

Genetics Minor
Housed in five academic departments on campus (Animal and Range Science, Cell Biology and Neuroscience, Ecology, Microbiology and Immunology, and Plant Sciences and Plant Pathology) the Genetics Minor is available to students majoring in these departments.

Natural Resources and Rangeland Ecology Minor
A Natural Resources and Rangeland Ecology minor provides students with the basics of managing rangeland ecosystems for wildlife habitat, livestock production, and soil and water conservation.

Soil Science Minor
The Soil Science minor is designed to provide non-majors with fundamental soils courses in preparation for natural resource careers.

Water Resources Minor
The Water Resources Minor is designed to encourage a student from any discipline to explore water resources beyond course work in their major.
Agricultural Business

Department of Agricultural Economics & Economics

Agribusiness is a dynamic industry with a high degree of global and technological sophistication. The agribusiness sector includes companies that are on the cutting edge in the use of biotechnology, strategy, information systems, risk management, logistics and international trade. The study of agricultural business involves the application of business and economic principles to farming and ranching and related sectors of the general economy. Training in agricultural business includes courses in agricultural firm management, marketing farm products, farm credit and finance, agricultural prices and outlook, agricultural policy, management science, agricultural law, technical agriculture and the business aspects of industries serving agriculture. Surveys indicate that employers seek out graduates with expertise in communication, critical thinking, business management and quantitative analyses. Our program specifically develops each of these skills.

Many employment possibilities are open to students with training in agricultural business. Positions are available with businesses which process and market agricultural products, and with the large number of businesses that sell products and services to farmers and ranchers, such as fertilizer companies, farm machinery companies, banks, and farm credit institutions. Also, opportunities exist to operate and manage farms and ranches. In addition, federal and state governments employ persons with training in agricultural business. Many of our graduates work for regional, national, and even international agribusiness firms that market, process, and transport agricultural products. Other graduates work for companies that service agriculture by supplying inputs to producers. Agricultural credit institutions employ many of our graduates. Some of our graduates continue their education by pursuing graduate degrees or attending law school.

Agribusiness Management Concentration

The agribusiness sector of the economy, which produces and sells goods and services to farmers and ranchers on one hand, and processes and markets agricultural commodities on the other, is growing rapidly. In the United States, for every job in agricultural production, there are approximately three jobs in agriculture-related businesses. The MSU agribusiness management curriculum has established an excellent reputation with employers and is specifically designed for management training with emphasis on finance, accounting, and managerial economics in agriculture-related businesses and industries.

Farm and Ranch Management Concentration

For a student who expects to work in agricultural production and eventually own and operate a farm or ranch, the farm and ranch management option provides a vital set of management skills for success in undertaking the investment and complicated business aspects of farming and ranching. The future farm or ranch manager needs to be familiar with marketing, finance, business management, and the global agribusiness system in which production agriculture operates. Farm and ranch management is a strong academic program designed to provide marketing, management, and finance skills. This curriculum is supplemented with courses that emphasize technical agricultural issues.

Undergraduate Programs

- Agribusiness Management Concentration (p. 71)
- Farm and Ranch Management Concentration (p. 72)
- Financial Engineering (p. 73)
- Minor in Agricultural Business (p. 74)
- Minor in Financial Engineering (p. 74)
**ECNS 251IS (Honors Economics, 4 credits) may be substituted for the 3 course sequence ECNS 101IS, ECNS 202, and ECNS 204IS.**

Neither AGBE 445 nor AGBE 421 can be used to simultaneously satisfy the Major and Supporting Area Course requirements.

### Electives Must Include

<table>
<thead>
<tr>
<th>Social Sciences (excluding AGBE/ECNS)</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>One additional course from Fine Arts, Humanities, or Social Sciences (excluding AGBE/ECNS)</td>
<td>3</td>
</tr>
</tbody>
</table>

These nine elective credits must be over and above University Core Requirements.

### Graduation Requirements

Agricultural Business students must receive a grade of C or better in ECNS 101IS, ECNS 202, ECNS 204IS, ECNS 301, ECNS 303, and M 161Q or M 171Q (or their equivalents) to meet departmental graduation requirements. All other AGBE/ECNS and selective courses counting toward departmental graduation requirements must be graded C- or better.

Agricultural Business students seeking a second major in Economics must complete an additional 15 credits at the 300 level or above in AGBE/ECNS electives over and above all requirements for graduation with a major in Agricultural Business.

A minimum of 120 credits is required for graduation; 42 of these credits must be numbered 300 or above.

### Farm and Ranch Management Concentration

#### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 101IS - Economic Way of Thinking*</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 202 - Principles of Macroeconomics*</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose three of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 110CS - Introduction to Plant Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 160 - Principles of Living Systems</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 170IN - Principles of Biological Diversity</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 121IN - Introduction to General Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 123 - Introduction to Organic Chemistry and Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 143 - College Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 245IN - Soils</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 161Q - Survey of Calculus</td>
<td>3</td>
</tr>
<tr>
<td>M 171Q - Calculus I</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGED 140US - Leadership Dev For Agriculture</td>
<td>3</td>
</tr>
<tr>
<td>COMX 111US - Introduction to Public Speaking (Formerly COM 110US)</td>
<td>4</td>
</tr>
</tbody>
</table>

University Core and Electives

| Year Total: | 30-32 |

Total Program Credits: 120

* ECNS 251IS Honors Economics (4 credits) may be substituted for the 3 course sequence ECNS 101IS, ECNS 202, and ECNS 204IS.

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 204IS - Microeconomics*</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 201 - Principles of Financial Acct</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGBE 321 - Economics of Ag Marketing</td>
<td>3</td>
</tr>
<tr>
<td>AGBE 345 - Ag Finance and Credit Analysis</td>
<td>3</td>
</tr>
<tr>
<td>AGBE 451RS - Economics of Ag Policy</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 301 - Intermediate Micro with Calc</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 303 - Intermediate Macro with Calc</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGED 421 - Advanced Ag Marketing</td>
<td>3</td>
</tr>
<tr>
<td>AGBE 445 - Agribusiness Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Complete 9 credits or more from:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGSC 341 - Field Crop Prod</td>
<td>9</td>
</tr>
<tr>
<td>AGSC 342 - Forages</td>
<td>9</td>
</tr>
<tr>
<td>ANSC 100 - Introduction to Animal Science</td>
<td>9</td>
</tr>
<tr>
<td>ANSC 265 - Anatomy and Physiology of Domestic Animals - Lecture</td>
<td>9</td>
</tr>
<tr>
<td>ANSC 320 - Animal Nutrition</td>
<td>9</td>
</tr>
<tr>
<td>BIOO 230 - Identification of Seed Plants</td>
<td>9</td>
</tr>
<tr>
<td>NRSM 101 - Natural Resource Conservation</td>
<td>9</td>
</tr>
<tr>
<td>NRSM 102 - Montana Range Plants</td>
<td>9</td>
</tr>
<tr>
<td>NRSM 240 - Natural Resource Ecology</td>
<td>9</td>
</tr>
</tbody>
</table>

University Core and Electives

| Year Total: | 24 |

Total Program Credits: 60

### Electives Must Include

<table>
<thead>
<tr>
<th>Social Sciences (excluding AGBE/ECNS)</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>One additional course from Fine Arts, Humanities, or Social Sciences (excluding AGBE/ECNS)</td>
<td>3</td>
</tr>
</tbody>
</table>

These nine elective credits must be over and above University Core Requirements.

### Graduation Requirements

Agricultural Business students must receive a grade of C or better in ECNS 101IS, ECNS 202, ECNS 204IS, ECNS 301, ECNS 303, and M 161Q or M 171Q (or their equivalents) to meet departmental graduation requirements. All other selective courses counting toward departmental graduation requirements must be graded C- or better.
Agricultural Business students seeking a second major in Economics must complete an additional 15 credits at the 300 level or above in AGBE/ECNS electives over and above all requirements for graduation with a major in Agricultural Business.

A minimum of 120 credits is required for graduation; 42 of these credits must be numbered 300 and above.

---

### Financial Engineering

The Bachelor of Science in Financial Engineering (FE) is a multidisciplinary major that emphasizes the creation of new financial economic instruments as well as the combining of existing instruments to manage risk, create strategic business opportunities, lower costs, and access new markets. Risk management is essential in today’s highly leveraged domestic markets as well as the global business environment. Successful market, credit, and production risk management requires complex financial economic modeling and analysis.

The objective of the program is to provide students with the necessary tools to help manage a business’s financial risks. In keeping with this objective, financial engineering majors undertake rigorous training in financial economics, engineering mathematics, and actuarial methods:

- Mathematics similar to engineering but expanded to include more statistics and probability theory
- Financial economics with a solid background in classical economic theory and markets (capital, commodity, and derivative)
- Software engineering and modeling

Financial engineers are commonly employed in banking, corporate finance, securities, insurance, manufacturing, agricultural businesses, and other industries that require sophisticated financial analysis skills. To remain competitive, regional industries as well as national and international firms will employ financial engineers because of the increased complexity and sophistication of business risk management. Due to their rigorous training, the demand for financial engineering graduates is high with a forecasted growth rate of 18 to 20% annually over the next seven years, according to the Occupational Outlook Handbook.

### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 127 - Joy and Beauty of Data</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLS 101US - Knowledge and Community</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMX 111US - Introduction to Public Speaking (formerly COM 110US)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 171Q - Calculus I</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Core Electives</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECNS 251IS - Honors Economics*</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EFIN 101 - Introduction to Financial Engineering</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 172Q - Calculus II</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 220 - Physics I (w/ calculus)</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WRIT 101W - College Writing I”</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>17</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 132 - Basic Data Structures and Algorithms</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 313 - Money and Banking</td>
<td>3</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
</tr>
<tr>
<td>EFIN 345 - Econ Org, Finance &amp; Credit</td>
<td></td>
</tr>
<tr>
<td>EGEN 325 - Engineering Economic Analysis</td>
<td></td>
</tr>
<tr>
<td>M 221 - Introduction to Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>M 273Q - Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 232 - Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>ECNS 301 - Intermediate Micro with Calc</td>
<td>3</td>
</tr>
<tr>
<td>M 274 - Introduction to Differential Equation</td>
<td>4</td>
</tr>
</tbody>
</table>

### Year Total:

| Total Program Credits: | 125 |

* May substitute ECNS 202 Principles of Macroeconomics and ECNS 204IS Microeconomics

** Students exempt from MSU writing requirement should substitute another writing course such as WRIT 201, WRIT 221, HONR 201US, HONR 202IH

### Professional Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BFIN 420R - Investments I</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 435 - Corporate Finance</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 452 - International Finance</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 456 - Financial Management for the Entrepreneur</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 458 - Commercial Bank Management</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 460 - Derivative Securities and Risk Management</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 466 - Investments II</td>
<td>3</td>
</tr>
</tbody>
</table>
Financial Engineering Minor

Financial Engineering is a multidisciplinary field that emphasizes complex modeling and analysis of new financial economic instruments to manage risk, create strategic business opportunities, and access new markets. Especially in today’s highly leveraged domestic markets and fluctuating global business environment, successful management of market, credit, and production risk is essential yet increasingly difficult. This minor equips students with the basic analytical tools to help a business assess and manage financial risks, and can be used to complement a range of majors.

The financial engineering major is a joint program of the Department of Financial Engineering and the Department of Agricultural Economics and Economics.

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 251IS</td>
<td>Honors Economics *</td>
<td>4</td>
</tr>
<tr>
<td>M 171Q</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>M 172Q</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>M 221</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
</tr>
</tbody>
</table>

* May substitute ECNS 202 Principles of Macroeconomics and ECNS 204IS Microeconomics

Total Credits: 12

Technical Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 440</td>
<td>Database Systems</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 446</td>
<td>Artificial Intelligence</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 447</td>
<td>Machine Learning: Soft Computing</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 501</td>
<td>Microeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 502</td>
<td>Macroeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 562</td>
<td>Econometrics II</td>
<td>3</td>
</tr>
<tr>
<td>EIND 422</td>
<td>Introduction to Simulation</td>
<td>3</td>
</tr>
<tr>
<td>EIND 455</td>
<td>DOE for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>EIND 458</td>
<td>Production &amp; Engineering Mgmt</td>
<td>3</td>
</tr>
<tr>
<td>EIND 477</td>
<td>Quality Management Systems</td>
<td>3</td>
</tr>
<tr>
<td>ESOF 322</td>
<td>Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ESOF 422</td>
<td>Advanced Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ESOF 522</td>
<td>Empirical Software Engr</td>
<td>3</td>
</tr>
<tr>
<td>M 441</td>
<td>Numerical Linear Algebra &amp; Optimization</td>
<td>3</td>
</tr>
<tr>
<td>STAT 408</td>
<td>Statistical Computing and Graphical Analysis</td>
<td>1-3</td>
</tr>
<tr>
<td>STAT 421</td>
<td>Probability Theory</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: May substitute EIND 373 and ECNS 345 for BFIN 322 prerequisite, and substitute ECNS 313 for BFIN 357 prerequisite.

Minor Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 301</td>
<td>Intermediate Micro with Calc</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 313</td>
<td>Money and Banking</td>
<td>3</td>
</tr>
<tr>
<td>EFIN 101</td>
<td>Introduction to Financial Engineering</td>
<td>1</td>
</tr>
<tr>
<td>EFIN 301</td>
<td>Engineering &amp; Economic Financial Management I</td>
<td>3</td>
</tr>
<tr>
<td>EFIN 401</td>
<td>Engineering &amp; Economic Financial Management II</td>
<td>3</td>
</tr>
<tr>
<td>EIND 354</td>
<td>Engineering Probability and Statistics I</td>
<td>3</td>
</tr>
<tr>
<td>EIND 364</td>
<td>Principles of Operations Research I</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose one of the following:

- ECNS 345 Econ Org, Fin, & Credit
- EGEN 325 Engineering Economic Analysis

Choose one of the following:

- ECNS 309 Managerial Economics
- ECNS 406 Industrial Organization
- ECNS 461 Financial Econometrics

Choose one of the following:

- EIND 457 Regres & Multivar Analysis
- EIND 464 Prin of Operations Research II
- EIND 468 Managerial Forecasting & Decision Analysis

Minor in Agricultural Business (Non-Teaching)

A student must receive a grade of C- or better in all courses required for the minor.

Departmental Course Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 202</td>
<td>Principles of Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 204IS</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 301</td>
<td>Intermediate Micro with Calc</td>
<td>3</td>
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<tr>
<td>AGBE 321</td>
<td>Economics of Ag Marketing</td>
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<tr>
<td>AGBE 341</td>
<td>Farm and Ranch Management</td>
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<tr>
<td>AGBE 345</td>
<td>Ag Finance and Credit Analysis</td>
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Plus six upper division AGBE/ECNS elective credits (no seminars, 490’s or 492’s)

Supporting Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>ACTG 201</td>
<td>Principles of Financial Acct</td>
<td>3</td>
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<tr>
<td>M 161Q</td>
<td>Survey of Calculus</td>
<td>4</td>
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<tr>
<td>or M 171Q</td>
<td>Calculus I</td>
<td>4</td>
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<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
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<td>3 credits of 200+ (ACTG, BFIN, BGEN, BMGT, BMIS, BMKT) courses</td>
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Total Credits: 40

* The 6 upper division elective credits cannot be met by any course being used to satisfy a student’s major degree requirements. In addition, students cannot use either AGBE 337 or BGEN 361 to meet the requirements of the minor.

** AGBE 353 is not a permitted substitution for field courses.

ECNS 251IS Honors Economics (4 credits) may be substituted for the three-course sequence: ECNS 101IS, ECNS 202, and ECNS 204IS.
“P” grades may be accepted at the discretion of the department only for courses transferred from outside the Montana University System.

Agricultural Education

Agricultural Education majors may choose from two options: 1) Teaching Option or 2) Communications, Leadership, and Extension Option. Agricultural Education graduates are employed by high schools, area vocational schools, community colleges, the public agriculture sector, Extension Service, Natural Resource Conservation Service, and other federal, state, and government agencies.

The Agricultural Education curricula are designed to provide professional preparation for extension agents, middle school and secondary agricultural education teachers and service providers in agricultural areas where content knowledge, pedagogical and andragogical skills, and experience in public communication are desirable attributes. Our graduates are prepared for a variety of careers with an agricultural background.

Students enrolled in Agricultural Education options gain leadership experience through active participation in Collegiate 4-H, Collegiate FFA, MSU Agricultural Education Club and other College of Agriculture student clubs and organizations.

Teaching Option

The Teaching Option permits a student to choose a balanced program of courses that meet the needs of agricultural areas. Students preparing to teach spend 14 weeks in an approved high school agriculture department as teaching candidates. Graduates are eligible to receive a Montana Class Two (standard) teaching license which permits them to teach in middle and high schools. This license is recognized in most other states throughout the U.S.

Students may pursue a teaching minor in a variety of disciplines that provides them with additional employment opportunities.

Agricultural Education Communications, Leadership, and Extension Option

The Agricultural Education Communications Option emphasizes academic coursework to provide students with a broad base of scientific knowledge combined with excellent people skills.

The Agricultural Education Leadership Option emphasizes academic coursework to develop knowledge and skills necessary to work with people in leadership and management positions. Students will develop leadership, motivation, and management in the broad area of agriculture.

Students will also enhance their degree by pursuing a Leadership Fellows certificate integrated into their program of study. An array of careers in private and public sectors may include sales, management, organizational training, community development, non-formal education, and consulting in agricultural and natural resource industries. An approved internship with an agricultural agency is required.

Undergraduate Programs

• Agricultural Education Teaching Option (p. 77)
• Agricultural Education Communications, Extension and Leadership (p. 79)

Graduate Programs

• M.S. in Agricultural Education (p. 395)

Agricultural Education Communications, Leadership, and Extension Options

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
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<td>Freshman Year</td>
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<td>WRIT 101W - College Writing I</td>
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<td>ECNS 101IS - Economic Way of Thinking</td>
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<td>CHMY 121IN - Introduction to General Chemistry</td>
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<tr>
<td>AGED 101 - Introduction to Agricultural and Environmental Resources</td>
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<tr>
<td>NRSM 101 - Natural Resource Conservation</td>
<td>3</td>
<td></td>
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<tr>
<td>NRSM 102 - Montana Range Plants</td>
<td>1</td>
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<td>M 121Q - College Algebra</td>
<td>3</td>
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<tr>
<td>BIOB 160 - Principles of Living Systems</td>
<td>4</td>
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<tr>
<td>AGED 140US - Leadership Dev For Agriculture</td>
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<tr>
<td>ANSC 100 - Introduction to Animal Science</td>
<td>3</td>
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<td>AGED 105 - Microcomputers in Agricultural</td>
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<td>Total Program Credits:</td>
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Communications Track

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<tr>
<td>LING 210IH - Intro to Language/Linguistics</td>
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<tr>
<td>UC 121US - Leadership Foundations</td>
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<tr>
<td>ENSC 245IN - Soils</td>
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<tr>
<td>SFBS 146 - Introduction to Sustainable Food and Bioenergy Systems</td>
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<tr>
<td>ECNS 204IS - Microeconomics</td>
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<tr>
<td>CRWR 240RA - Introduction to Creative Writing</td>
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</table>

Graduate Programs

• M.S. in Agricultural Education (p. 395)
BIOB 110CS - Introduction to Plant Biology 3
WRIT 221 - Intermediate Tech Writing 3
ANSC 222 - Livestock in Sustain Systems 3
or NRSM 240 - Natural Resource Ecology 3
AGBE 210IS - Economics of Ag Business 3

Year Total: 15 15

Junior Year

Fall  Spring  Summer  Credits
BIOB 318 - Biometry 3
AGED 312R - Communicating Agriculture 3
BMKT 325 - Principles of Marketing 3
UC 302 - Leadership Capstone 1
WRIT 371 - Digital Rhetorics and Multimodal Writing 3
AGED 333 - Construction Technology or AGED 315 - Electrical and Power Systems Operation 3
WRIT 373 - News and Pub Relations Writing 3
AGED 309 - Philosophy and Programs in Extension 3
BMKT 337 - Consumer Behavior 3
ANSC 265 - Anatomy and Physiology of Domestic Animals - Lecture 3
ANSC 266 - Anatomy and Physiology of Domestic Animals - Lab 1
AGED 498 - Internship 4-8

Year Total: 16 13 4-8

Senior Year

Fall  Spring  Summer  Credits
WRIT 372 - Science Writing for Popular Non-Fiction 3
AGED 482 - Non-Formal Teaching Methods in Agriculture 3
BMKT 343 - Integrated Marketing Communication 3
AGED 485 - Laboratory Management and Teaching in Agricultural Education 3
AGBE 337 - Agricultural Law 3
WRIT 376 - Public Rhetorics and Writing *Includes a non-teaching writing minor 3
AGED 401 - Agricultural Issues and Research 3
Core D 3

Year Total: 12 12

Total Program Credits: 121

Leadership Track

Sophomore Year

Fall  Spring  Summer  Credits
BIOO 262IN - Introduction to Entomology 3

Civil Engineering

ENSC 245IN - Soils 3
ECNS 204IS - Microeconomics 3
UC 121US - Leadership Foundations 3
SOCI 101IS - Introduction to Sociology or PSYX 100IS - Intro to Psychology 3
BIOB 110CS - Introduction to Plant Biology 3
SFBS 146 - Introduction to Sustainable Food and Bioenergy Systems 3
ANSC 222 - Livestock in Sustain Systems or NRSM 240 - Natural Resource Ecology 3
AGBE 210IS - Economics of Ag Business 3

Year Total: 15 15

Junior Year

Fall  Spring  Summer  Credits
BIOB 318 - Biometry 3
AGED 312R - Communicating Agriculture 3
BMGT 335 - Management and Organization 3
AGED 333 - Construction Technology 3
UC 302 - Leadership Capstone 1
AGED 337 - Agricultural Law 3
AGED 309 - Philosophy and Programs in Extension 3
AGED 363 - Agricultural Youth Event Planning & Management 3
AGED 498 - Internship 2-8

Year Total: 13 16 2-8

Senior Year

Fall  Spring  Summer  Credits
AGED 482 - Non-Formal Teaching Methods in Agriculture 3
BMGT 420 - Leadership and Motivation 3
AGED 485 - Laboratory Management and Teaching in Agricultural Education 3
BMKT 337 - Consumer Behavior 3
BMGT 406 - Negotiation/Dispute Resolution 3
Core D 3

AGED 401 - Agricultural Issues and Research 3
BMKT 436 - Sales and Sales Management 3
### Extension Track

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>WRIT 221 - Intermediate Tech Writing</td>
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<td>SFBS 146 - Introduction to Sustainable Food and Bioenergy Systems</td>
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<td>or ANSC 202 - Livestock Feeding</td>
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<td>ENSC 245IN - Soils</td>
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<tr>
<td>BIOO 262IN - Introduction to Entomology</td>
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<td>BMGT 335 - Management and Organization</td>
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<tr>
<td>BIOB 110CS - Introduction to Plant Biology</td>
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<td>UC 121US - Leadership Foundations</td>
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<td>HDFS 101IS - Indiv and Fam Dev: Lifespan</td>
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<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
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<td>ANSC 222 - Livestock in Sustain Systems or NRSM 240 - Natural Resource Ecology</td>
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**Junior Year**

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<td>ECNS 204IS - Microeconomics</td>
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<td>AGED 333 - Construction Technology or AGED 315 - Electrical and Power Systems Operation</td>
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<td>BMGT 335 - Management and Organization</td>
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<td>AGED 363 - Agricultural Youth Event Planning &amp; Management</td>
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<td>AGED 309 - Philosophy and Programs in Extension</td>
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<td>AGED 315 - Electrical and Power Systems Operation</td>
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<td>ANSC 265 - Anatomy and Physiology of Domestic Animals - Lecture</td>
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<td>ANSC 266 - Anatomy and Physiology of Domestic Animals - Lab</td>
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<td>AGBE 210IS - Economics of Ag Business</td>
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<td>AGED 498 - Internship</td>
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<td>AGED 498 - Internship</td>
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**Total Program Credits:** 121

### Agricultural Education Teaching Option

**Freshman Year**

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<td>M 121Q - College Algebra</td>
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<td>WRIT 101W - College Writing I</td>
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<td>AGED 105 - Microcomputers in Agricultural</td>
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<tr>
<td>BIOB 110CS - Introduction to Plant Biology</td>
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<tr>
<td>ECNS 101IS - Economic Way of Thinking</td>
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<td>HDFS 101IS - Indiv and Fam Dev: Lifespan</td>
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**Sophomore Year**

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<tr>
<td>WLDG 110 - Welding Theory I</td>
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<td>WLDG 111 - Welding Theory I Practical</td>
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<td>BIOB 318 - Biometry</td>
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<tr>
<td>AGED 482 - Non-Formal Teaching Methods in Agriculture</td>
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<td></td>
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<tr>
<td>AGED 485 - Laboratory Management and Teaching in Agricultural Education</td>
<td>3</td>
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<tr>
<td>AGSC 342 - Forages</td>
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<tr>
<td>EDU 211D - Multicultural Education</td>
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<td>Core H</td>
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<tr>
<td>AGED 401 - Agricultural Issues and Research</td>
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<td>AGBE 337 - Agricultural Law</td>
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**Senior Year**

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<tr>
<th>Course</th>
<th>Fall</th>
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<tr>
<td>BMKT 325 - Principles of Marketing</td>
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<td>AGED 482 - Non-Formal Teaching Methods in Agriculture</td>
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<td>AGED 485 - Laboratory Management and Teaching in Agricultural Education</td>
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<td>AGSC 342 - Forages</td>
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<td>EDU 211D - Multicultural Education</td>
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<td>AGBE 337 - Agricultural Law</td>
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**Total Program Credits:** 121
EDSP 306 - Exceptional Learners  
AGED 253 - Ag Ed in Pub Schools  
AGED 363 - Agricultural Youth Event Planning & Management  
ANSC 316 - Meat Science  
University Core (3)  
AGED 315 - Electrical and Power Systems  

<table>
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<tr>
<td>AGED 397 - Educational Methods in Ag</td>
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<td>AGED 312R - Communicating Agriculture</td>
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<td>EDU 382 - Assessmnt, Curric, Instructn</td>
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<td>Fall</td>
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<td>Spring</td>
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</table>

Total Program Credits: 121

A minimum of 121 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

**Animal Science**

**Note:** MSU’s programs in the biological sciences are distributed across multiple departments; MSU does not have a single Department of Biology. For additional options see Biological Sciences at MSU, Department of Animal and Range Sciences.

The animal science curricula are administered by the Department of Animal and Range Sciences. The curricula in animal science provide students with a firm foundation in the biological and natural sciences, animal breeding, reproductive physiology, nutrition and livestock production and management. Applications to production environments of the western United States are emphasized, including the close relationships among livestock, rangeland and natural resources. Three options are offered leading to a B.S. in Animal Science. Proper use of restricted electives allows students to tailor curricula to meet their individual needs.

**Equine Science Option**

The Equine Science Option emphasizes science and technology combined with practical aspects of management, horsemanship and training. Graduates of this program will have a firm foundation to meet the growing needs of the equine industry. This program is designed to prepare students for employment in breeding, nutrition, and management of facilities and land, as well as in the allied industries such as sales, feed, tack, and equipment. Students can tailor their program for more emphasis in biotechnology, business, or range management.

**Livestock Management & Industry Option**

The Livestock Management & Industry Option stresses the application of science to livestock production, incorporating courses in agricultural economics and business. Emphasis is placed on the application of the principles of economics, range science, genetics, physiology and nutrition in sustainable livestock production systems and business and management skills as they relate to livestock enterprises and service industries closely allied to livestock production. It is designed to allow flexible course work choices to prepare graduates to manage livestock enterprises or for employment with companies producing and marketing livestock, animal feeds and health products, as well as employment with a variety of communication and service organizations such as breed associations, commodity groups, livestock publications and government agencies.

**Science Option**

The Science Option emphasizes greater depth in the basic sciences and is designed for highly motivated students who have a strong interest in graduate training or professional school. Individual curricula can be tailored to provide excellent preparation for veterinary school, medical school, or graduate studies in animal biotechnology, physiology, nutrition or genetics.

**Undergraduate Programs**

- Equine Science Option (p. 79)
- Livestock Management & Industry Option (p. 80)
- Science Option (p. 81)

**Undergraduate Minors**

- Animal Science Minor (Non-Teaching) (p. 78)
- Genetics Minor (Non-Teaching) (p. 95)

**Graduate Programs**

- M.S. in Animal and Range Sciences (p. 293)
- M.S. in Land Rehabilitation (interdisciplinary) (p. 300)
- Ph.D. in Animal and Range Sciences (p. 294)

**Animal Science Minor (Non-Teaching)**

<table>
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<th>Course Title</th>
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<td>Introduction to Animal Science</td>
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<td>NRSM 101</td>
<td>Natural Resource Conservation</td>
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<td>NRSM 102</td>
<td>Montana Range Plants</td>
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<td>ANSC 222</td>
<td>Livestock in Sustain Systems</td>
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<td>CHMY 123</td>
<td>Introduction to Organic Chemistry and Biochemistry</td>
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<td>ANSC 265</td>
<td>Anatomy and Physiology of Domestic Animals - Lecture</td>
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<td>ANSC 266</td>
<td>Anatomy and Physiology of Domestic Animals - Lab</td>
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<tr>
<td>ANSC 320</td>
<td>Animal Nutrition</td>
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<tr>
<td>ANSC 321</td>
<td>Physiology of Animal Reproduction</td>
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<tr>
<td>ANSC 322</td>
<td>Principles of Animal Breeding and Genetics</td>
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Choose one of the following: 1-2

- ANSC 205 Intro to Meat Evaluation
- ANSC 215 Calving Management
- ANSC 232 Livestock Management - Sheep I
- EQUS 233 Horse Science and Mgt Lab
- ANSC 234 Livestock Management - Beef I
- NRSM 236 Small Pasture Management
- ANSC 308 Livestock Evaluation

Choose one of the following: 3-4

- ANSC 316 Meat Science
- EQUS 430 Horse Management
- ANSC 452R Sheep Management

**Graduate Programs**

- M.S. in Animal and Range Sciences (p. 293)
- M.S. in Land Rehabilitation (interdisciplinary) (p. 300)
- Ph.D. in Animal and Range Sciences (p. 294)
ANSC 434R  Beef Cattle Management

Total Credits  32-34

All students are responsible for meeting prerequisites for upper division courses.

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**Equine Science Option**

**Freshman Year**

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<tr>
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<td>NRSM 102 - Montana Range Plants</td>
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<td>CHMY 121IN - Introduction to General Chemistry</td>
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<tr>
<td>AGED 140US - Leadership Dev For Agriculture or COMX 111US - Introduction to Public Speaking</td>
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**Sophomore Year**

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<td>EQUH 206 - Equine Ethology: Understanding Horse Behavior</td>
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**Junior Year**

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<td>AGBE 210IS - Economics of Ag Business</td>
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<td>ANSC 322 - Principles of Animal Breeding and Genetics</td>
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<td>ANSC 337 - Disease of Domestic Livestock</td>
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**Senior Year**

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**Total Program Credits:**

| Year Total: | 120 |

**Applied Courses**

Select 6 credits

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<td>EQUH 114 - Beginning English Equitation</td>
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<td>EQUH 133 - Horses: Ground Level</td>
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<td>EQUH 207 - Intermed English Equitation</td>
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<td>EQUH 210 - Intermed Western Equitation</td>
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<td>EQUH 253 - Starting Colts</td>
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<td>EQUH 256 - Developing The Young Horse</td>
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<td>EQUH 314 - Equestrian Instruction Methods</td>
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**Equine Science Electives**

Take 2 courses

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<td>EQUH 346 - Equine Reproductive Management</td>
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<td>EQUH 424 - Equine Exercise Physiology</td>
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**Econ & Business Electives**

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<td>ACTG 202 - Principles of Managerial Accounting</td>
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<td>ACTG 220 - Survey of Accounting</td>
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<td>AGBE 321 - Economics of Ag Marketing</td>
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<td>AGBE 337 - Agricultural Law</td>
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<td>AGBE 341 - Farm and Ranch Management</td>
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<td>AGBE 345 - Ag Finance and Credit Analysis</td>
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<td>AGBE 353 - Co-operative Business Principles and Practice</td>
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<td>BGEN 204 - Business &amp; Entrepreneurship Fundamentals</td>
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<td>BGEN 242D - Intro to Int’l Business</td>
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Management & Industry Electives
Select 9 credits

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<td>ANSC 418</td>
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<td>Habitat Inventory and Analysis</td>
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<td>Riparian Ecology &amp; Management</td>
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A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. University core requirements must be completed.

Livestock Management & Industry Option

Freshman Year

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<tr>
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Sophomore Year

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Year Total: 17 15

Junior Year

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Senior Year

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Livestock and Range Practicum Electives
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<td>Livestock Evaluation</td>
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<td>Horse Science and Mgt Lab</td>
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<td>Range and Pasture Monitoring</td>
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Livestock Management Electives
Select 6 credits

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Econ & Business Electives
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<td>Principles of Managerial Accounting</td>
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<td>AGBE 321</td>
<td>Economics of Ag Marketing</td>
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<td>AGBE 337</td>
<td>Agricultural Law</td>
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<td>AGBE 341</td>
<td>Farm and Ranch Management</td>
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<td>AGBE 345</td>
<td>Ag Finance and Credit Analysis</td>
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AGBE 353  Co-operative Business Principles and Practice  3
AGBE 421  Advanced Ag Marketing  3
BFIN 205  Personal Finance  3
BGEN 204  Business & Entrepreneurship Fundamentals  3
BGEN 242D  Intro to Int'l Business  3
BGEN 361  Principles of Business Law  3
BMGT 335  Management and Organization  3
BMKT 325  Principles of Marketing  3
BMKT 337  Consumer Behavior  3
BMKT 436  Sales and Sales Management  3

Management & Industry Electives
Select 12 credits
AGSC 341  Field Crop Prod  3
AGSC 342  Forages  3
ANSC 215  Calving Management  2
ANSC 410  Veterinary Entomology and Parasitology  3
ANSC 418  Topics in Beef Nutrition  2
ANSC 421  Assisted Reproduction Technologies w/ Lab  4
ANSC 436  Professional Development in Beef Production Systems  2
ANSC 437  Professional Development in Beef Feedlot Systems  2
BIOM 405  Host-Associated Microbiomes  3
EQUH 133  Horses: Ground Level  2
EQUS 327  Equine Lameness  3
EQUS 423  Equine Nutrition  2
ENSC 245IN  Soils  3
NRSM 353  Grazing Ecology and Management  3
NRSM 453  Habitat Inventory and Analysis  3
NRSM 455  Riparian Ecology & Management  3
WILD 420  Range & Wildlife Policy and Planning  3

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. University core requirements must be completed.

Science Option
Freshman Year

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<td>BIOB 160</td>
<td>Principles of Living Systems</td>
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Sophomore Year

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<td>NRSM 240</td>
<td>Natural Resource Ecology</td>
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<td>Economic Way of Thinking</td>
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<td>M 161Q</td>
<td>Survey of Calculus</td>
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<tr>
<td>BIOB 318</td>
<td>Biometry</td>
<td>3</td>
</tr>
<tr>
<td>or STAT 216Q</td>
<td>Introduction to Statistics</td>
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<tr>
<td>ANSC 222</td>
<td>Livestock in Sustain Systems</td>
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<tr>
<td>ANSC 265</td>
<td>Anatomy and Physiology of Domestic Animals - Lecture</td>
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<td>ANSC 266</td>
<td>Anatomy and Physiology of Domestic Animals - Lab</td>
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<tr>
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<td>Elements of Organic Chemistry</td>
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<td>BMGT 205</td>
<td>Prof Business Communication</td>
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<tr>
<td>or WRIT 221</td>
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<tr>
<td>BIBOB 105CS</td>
<td>Introduction to Biotechnology</td>
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Junior Year

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<tr>
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<tr>
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<td>ANSC 321</td>
<td>Physiology of Animal Reproduction</td>
<td>4</td>
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<tr>
<td>BCH 380</td>
<td>Biochemistry</td>
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<tr>
<td>ANSC 322</td>
<td>Principles of Animal Breeding and Genetics</td>
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Senior Year

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<td>Livestock Management Electives</td>
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<td>ANSC 498</td>
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<td>or ANSC 490R</td>
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Total Program Credits: 120

Livestock Management Electives
Take two

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<tbody>
<tr>
<td>ANSC 316</td>
<td>Meat Science</td>
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<tr>
<td>ANSC 432R</td>
<td>Sheep Management</td>
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<td>ANSC 434R</td>
<td>Beef Cattle Management</td>
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<td>EQUS 430</td>
<td>Horse Management</td>
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Restricted Electives
Select 12 credits

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<tr>
<td>ANSC 337</td>
<td>Disease of Domestic Livestock</td>
<td>3</td>
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<tr>
<td>ANSC 410</td>
<td>Veterinary Entomology and Parasitology</td>
<td>3</td>
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<td>ANSC 421</td>
<td>Assisted Reproduction Technologies w/ Lab</td>
<td>4</td>
</tr>
<tr>
<td>BIOB 375</td>
<td>General Genetics</td>
<td>3</td>
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<td>BIOH 323</td>
<td>Human Developmental Biology</td>
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<tr>
<td>BIOH 454</td>
<td>Microanatomy (Histology)</td>
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<tr>
<td>BIOM 360</td>
<td>General Microbiology</td>
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</tr>
<tr>
<td>BIOM 405</td>
<td>Host-Associated Microbiomes</td>
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</tbody>
</table>
A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. University core requirements must be completed.

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**Biological Sciences**

**Animal Science** (p. 78) - Animal and Range Sciences Department; College of Agriculture

Equine Science: emphasizes science and technology combined with practical aspects of management, horsemanship and training. Livestock Management and Industry: stresses the application of science to livestock production, incorporating courses in agriculture economics and business. This program focuses on sustainable livestock systems, business, and management skills as they relate to livestock enterprises and production service industries.

Science Option: emphasizes greater depth in the basic sciences and is designed for highly motivated students who have a strong interest in graduate training or professional school.

**Biological Sciences** - Ecology Department; College of Letters and Science

Conservation Biology and Ecology: gives students a clear understanding of the ways that natural and human-related processes affect species, communities and ecosystems, and relate this knowledge to its broad societal context.

Fish and Wildlife Ecology and Management: provides a professional degree program for those students who have an interest in employment in these fields. Study leading toward a bachelor’s degree emphasizes basic principles of animal ecology, with considerable work in related fields.

Organismal Biology: provides a rigorous program of study in plant or animal biology at the whole-organism, species, population, and community levels, while allowing students flexibility in selecting those biology courses that best meet their interests and objectives.

Biology Teaching: certifies graduates to be qualified to teach secondary school biology and provides a solid education in biology and basic sciences with professional preparation courses required for state teacher certification.

**Biotechnology** - Microbiology Dept; Plant Sciences and Plant Pathology Department

Modern research in cellular and molecular biology, in areas focused on Animal Systems, Plant Systems, and Microbial Systems, and its resultant technology offers unparalleled opportunities to provide solutions to our society’s most urgent problems in human and animal health, agriculture, and environmental quality.

**Cell Biology and Neuroscience** - Cell Biology and Neuroscience Department; College of Letters and Science

Biomedical Sciences: The biomedical science options curriculum provides a strong background for students who are (1) interested in biomedical sciences career in research or teaching, or (2) plan on a career in medicine or other health professions.

Cell Biology and Neuroscience: The curriculum in the cell biology and neuroscience option provides a strong background for students who are interested in a career in research or teaching in cell biology, molecular biology, developmental biology, or neuroscience.

**Chemistry, Biochemistry option** - Chemistry and Biochemistry Department; College of Letters and Science

This course of study includes a core of Chemistry, Biochemistry, and biology courses for the student interested in the molecular nature of biological materials and life processes.

**Environmental Horticulture** - Plant Sciences and Plant Pathology Department; College of Agriculture

Environmental Horticulture Science: the science and art of growing and maintaining plants for food and the enjoyment and improvement of the human environment. Its application through research has led to improved varieties of plants to benefit our daily lives.

Landscape design: prepares students to solve aesthetic and functional landscape problems.

**Environmental Sciences** - Land Resources and Environmental Sciences Department; College of Agriculture

Environmental Sciences Major: This major is for students who wish to obtain a more general Environmental Sciences degree and design more of their course of study than possible in one of the below options. The required courses in this major are also required in each of the options, allowing for a relatively seamless transfer to one of them if accomplished by the end of the student’s second year.

Environmental Biology Option: intended to train students who are interested in understanding the ecology of organisms in natural environments, and/or in understanding how organisms may be used to clean up environments that have been disturbed by human activities.

Geospatial and Environmental Analysis Option: This program is for students interested in land resources and their management at landscape scales.

Land Rehabilitation Option: This course of study provides training in site re-vegetation, soil remediation, riparian zone restoration, stream channel restoration, investigation of impacted geologic resources, restoration ecology, and remediation of sites contaminated by industrial activities.

Soil and Water Sciences Option: provides students with fundamental training in biological, chemical, and physical sciences and advanced training in soil and water sciences.

**Microbiology** - Microbiology Department; College of Letters and Science

Environmental Health: provides a program for attaining a broad understanding of the physical, chemical, and biological factors in our environment, and their interactions that relate to health.

Medical Laboratory Science: designed to prepare students for careers in Clinical Laboratory Science.

Microbiology: In this option, students obtain a thorough education in the fields of medical, ecological, physiological and environmental microbiology, immunology, virology, and molecular biology.

**Natural Resources and Rangeland Ecology** - Animal and Range Sciences Department; College of Agriculture

Rangeland Ecology and Management: provides training in soils, vegetation, water, riparian areas, and livestock production on rangelands.

Wildlife Habitat Ecology and Management: the science and art of managing wildland habitats for wildlife.
**Plant Sciences** - Plant Sciences and Plant Pathology Department; College of Agriculture

*Crop Science.* The challenge for crop scientists is to implement crop and soil management schemes that maintain or increase production, but at the same time conserve our soil and water resources and preserve the delicate balance in the agroecosystem.

*Plant Biology.* Plant biology provides a broad education in the plant sciences.

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**Biotechnology**

*Note: MSU’s programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology.* For additional options see Biological Sciences at MSU.

**Biotechnology**

Modern research in cellular and molecular biology and its resultant technology offers unparalleled opportunities to provide solutions to our society’s most urgent problems in human and animal health, agriculture, and environmental quality. The emerging biotechnology industries are involved in developing products to maintain biodiversity, restore soil and water quality, develop new pharmaceuticals to combat disease, decrease our dependence on nonrenewable resources, and improve food and fiber production. Students interested in microbiology, animal or plant science, biochemistry, and animal or human medicine will find challenging careers in the diverse areas of biotechnology in either an academic or industrial setting. Students successfully completing a biotechnology curriculum will also be prepared to enter graduate or medical professional schools for further study.

The Bachelor of Science in Biotechnology is an interdisciplinary degree that spans two academic departments: Microbiology and Immunology and Plant Sciences/Plant Pathology. Students will choose an area of emphasis in plant or animal/microbial systems for upper-division coursework. Students will be assigned faculty advisors depending on the chosen option.

**Undergraduate Programs**

- Animal Systems Option (p. 83)
- Microbial Systems Option (p. 84)
- Plant Systems Option (p. 85)

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**All Biotechnology Options**

**Freshman Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
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<tr>
<td>BIOB 105CS</td>
<td>Introduction to Biotechnology</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>BIOB 160</td>
<td>Principles of Living Systems</td>
<td>4</td>
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<tr>
<td>or BIOB 260</td>
<td>Cellular and Molecular Biology</td>
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<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
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</table>

Select one of the following:

- BIOB 318 - Biometry
- STAT 216Q - Introduction to Statistics
- M 165Q - Calculus for Technology I

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>BIOB 375</td>
<td>General Genetics</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 321</td>
<td>Organic Chemistry I</td>
<td>4</td>
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<tr>
<td>or CHMY 211</td>
<td>Elements of Organic Chemistry</td>
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<tr>
<td>CHMY 323</td>
<td>Organic Chemistry II</td>
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<td>BIOM 360</td>
<td>General Microbiology</td>
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<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
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<tr>
<td>University Core and Electives</td>
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</table>

**Total Program Credits:** 66-71

* If a student takes BIOB 318 Biometry or STAT 216Q Introduction to Statistics, then the student must take M 161Q Survey of Calculus. If a student takes M 165Q Calculus for Technology I, then the student must take M 166Q Calculus for Technology II.

**Animal Systems Option**

All Biotechnology Options have the same Freshman and Sophomore year requirements.

**Freshman Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 105CS</td>
<td>Introduction to Biotechnology</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
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<td>CHMY 141</td>
<td>College Chemistry I</td>
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Select one of the following:

- BIOB 318 - Biometry
- STAT 216Q - Introduction to Statistics
- M 165Q - Calculus for Technology I

**Sophomore Year**

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<th>Course Title</th>
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<td>CHMY 321</td>
<td>Organic Chemistry I</td>
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<tr>
<td>or CHMY 211</td>
<td>Elements of Organic Chemistry</td>
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<td>BIOM 360</td>
<td>General Microbiology</td>
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<td>CHMY 323</td>
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**Total Program Credits:** 66-71

* If a student takes BIOB 318 Biometry or STAT 216Q Introduction to Statistics, then the student must take M 161Q Survey of Calculus. If a student takes M 165Q Calculus for Technology I, then the student must take M 166Q Calculus for Technology II.
** If a student takes CHMY 321 Organic Chemistry I, the student must take CHMY 323 Organic Chemistry II.

### Junior Year

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<th>Course</th>
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<tr>
<td>BCH 380 - Biochemistry</td>
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<td>BIOB 412 - Hybridomas</td>
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<td>BIOB 415 - Adv Immunology Methods</td>
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<td>BIOB 413 - Flow Cytometry</td>
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<td>BIOB 414 - Advanced Microscopy</td>
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<td>BIOM 400 - Medical Microbiology</td>
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<td>BIOB 477 - Genome Science and Gene Expression</td>
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Choose one of the following:

- ANSC 265 - Anatomy and Physiology of Domestic Animals - Lecture (AND)
- ANSC 266 - Anatomy and Physiology of Domestic Animals - Lab
- BIOH 201 - Hum Anatomy & Physiology I
- BIOH 211 - Hum Anatomy & Physiology II

University Core and Electives: 3

** Year Total:** 15 15

### Senior Year

<table>
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<tr>
<th>Course</th>
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<td>IMID 498R - Biotech Internship</td>
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<td>PHSX 207 - College Physics II</td>
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<td>BIOB 424 - Ethical Practice of Science</td>
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<td>IMID 499 - Biotechnology Capstone</td>
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** Year Total:** 15 15

** Total Program Credits:** 60

* BIOH 201 Hum Anatomy & Physiology I may also be taken in the spring.

### Recommended Electives

- ANSC 320 Animal Nutrition: 4
- ANSC 321 Physiology of Animal Reproduction: 4
- ANSC 322 Principles of Animal Breeding and Genetics: 3
- ANSC 337 Disease of Domestic Livestock: 3
- ANSC 421 Assisted Reproduction Technologies w/ Lab: 4
- BCH 441 Biochemistry of Macromolecules: 3
- BCH 442 Metabolic Regulation: 3
- BCH 444R Biochemistry & Molecular Biology Methods: 3
- BIOB 425 Adv Cell & Molecular Biology: 3
- BIOB 410 Immunology: 3
- BIOH 201 Hum Anatomy & Physiology I **: 5
- BIOH 211 Hum Anatomy & Physiology II **: 4
- BIOH 405 Hematology: 3
- BIOM 431 Medical Bacteriology: 3
- BIOM 435 Virology: 3
- BIOM 450 Microbial Physiology: 3
- BIOO 310 Comparative Vertebrate Anatomy: 4
- BIOO 412 Animal Physiology: 3

### Microbial Systems Option

All Biotechnology Options have the same Freshman and Sophomore year requirements.

#### Freshman Year

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<tr>
<th>Course</th>
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<td>WRIT 101W - College Writing I</td>
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<tr>
<td>BIOB 105CS - Introduction to Biotechnology</td>
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<tr>
<td>BIOB 170IN - Principles of Biological Diversity</td>
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<tr>
<td>CHMY 141 - College Chemistry I</td>
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<td>Select one of the following:</td>
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<tr>
<td>BIOB 318 - Biometry **</td>
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<tr>
<td>STAT 216Q - Introduction to Statistics *</td>
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<td>M 165Q - Calculus for Technology I</td>
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<tr>
<td>BIOB 160 - Principles of Living Systems or BIOB 260 - Cellular and Molecular Biology</td>
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<td>CHMY 143 - College Chemistry II</td>
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<td>Select one of the following:</td>
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<td>M 161Q - Survey of Calculus *</td>
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<td>M 166Q - Calculus for Technology II</td>
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University Core and Electives: 11

** Year Total:** 39-40

#### Sophomore Year

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<td>CHMY 321 - Organic Chemistry I</td>
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<tr>
<td>or CHMY 211 - Elements of Organic Chemistry</td>
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<td>BIOM 360 - General Microbiology</td>
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<tr>
<td>CHMY 323 - Organic Chemistry II **</td>
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University Core and Electives: 8-12

** Year Total:** 27-31

** Total Program Credits:** 66-71

* If a student takes BIOB 318 Biometry or STAT 216Q Introduction to Statistics, then the student must take M 161Q Survey of Calculus. If a student takes M 165Q Calculus for Technology I, then the student must take M 166Q Calculus for Technology II.

** If a student takes CHMY 321 Organic Chemistry I, the student must take CHMY 323 Organic Chemistry II.
Microbial Systems Option

Junior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>BCH 380</td>
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<td>PHSX 205</td>
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<td>Immunology</td>
<td>3</td>
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Senior Year

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
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<tr>
<td>BIOM 450</td>
<td>Microbial Physiology</td>
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<td>BIOM 494</td>
<td>Seminar/Workshop</td>
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<td>BIOM 490R</td>
<td>Undergraduate Research</td>
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<td>University Core and Electives</td>
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<tr>
<td>BIOM 430</td>
<td>Applied and Environmental Microbiology</td>
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<tr>
<td>BIOM 452</td>
<td>Soil &amp; Environmental Microbiology</td>
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<td>or BIOM 415</td>
<td>Microbial Diversity, Ecology, and Evolution</td>
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<td>BIOM 410</td>
<td>Microbial Genetics</td>
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</table>

Total Program Credits: 60

Select at least three of the following:

- BCH 441 Biochemistry of Macromolecules
- BCH 442 Metabolic Regulation
- BCH 444R Biochemistry & Molecular Biology Methods
- BIOB 477 Genome Science and Gene Expression
- BIOH 405 Hematology & Hematology Laboratory
- BIOM 405 Host-Associated Microbiomes
- BIOM 425 Toxicology: Science of Poisons
- BIOM 431 Medical Bacteriology & BIOM 432 and Med Bacteriology Lab
- BIOM 435 Virology
- BIOM 455R Research Mthds in Microbiology
- EBIO 438 Bioprocess Engin
- EENV 447 Hazardous Waste Management
- ENSC 251 Materials Structures and Prop
- ENSC 272CS Water Resources
- ENSC 353 Environmental Biogeochemistry

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

Plant Biotechnology Option

Freshman Year

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<tr>
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<th>Credits</th>
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<tr>
<td>WRIT 101W</td>
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<tr>
<td>BIOB 105CS</td>
<td>Introduction to Biotechnology</td>
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<tr>
<td>BIOM 450</td>
<td>Microbial Physiology</td>
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<tr>
<td>BIOM 494</td>
<td>Seminar/Workshop</td>
<td>1</td>
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<tr>
<td>BIOM 490R</td>
<td>Undergraduate Research</td>
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Junior Year

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<tr>
<td>BCH 380</td>
<td>Biochemistry</td>
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<td>BIOM 430</td>
<td>Plant Biotechnology</td>
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<td>BIOO 433</td>
<td>Plant Physiology</td>
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<td>HORT 447</td>
<td>Advanced Plant Propagation</td>
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<tr>
<td>PHSX 205</td>
<td>College Physics I</td>
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<tr>
<td>PHSX 207</td>
<td>College Physics II</td>
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<tr>
<td>or STAT 217Q</td>
<td>Intermediate Statistical Concepts</td>
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<td>University Core and Electives</td>
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Senior Year

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<tr>
<td>BIOM 490R</td>
<td>Undergraduate Research</td>
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<td>BIOM 498</td>
<td>Internship/Cooperative Edu</td>
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<td>BIOB 499</td>
<td>Senior Thesis/Capstone</td>
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<td>BIOM 421</td>
<td>Concepts of Plant Pathology</td>
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<td>BIOO 460</td>
<td>Plant Metabolism</td>
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<td>Select one of the following:</td>
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<tr>
<td>BIOM 444R</td>
<td>Biochemistry &amp; Molecular Biology Methods</td>
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<td>BIOM 455R</td>
<td>Research Mthds in Microbiology</td>
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Total Program Credits: 60
Entomology Minor (Non-Teaching)

The College of Agriculture offers an undergraduate Entomology minor (non-teaching) in addition to the graduate program in Entomology. The entomology minor provides students majoring in various areas of the agricultural and biological sciences with a discrete set of courses emphasizing the important discipline of entomology. The minor was designed to serve the needs of students in both the College of Agriculture and the College of Letters and Science (Biology and Microbiology). In addition to the minor students may also undertake undergraduate research projects, internships, special topics and undergraduate creative activity projects with individual faculty housed in the Department of Animal and Range Sciences, Land Resources and Environmental Sciences, and Plant Science and Plant Pathology.

Required Courses

- BIOO 262IN Introduction to Entomology 3
- AGSC 401 Integrated Pest Management 3
- BIOO 465 Insect Identification 4

Choose one of the following: 1-3

- BIIIO 490R Undergraduate Research
- ANSC 490R Undergraduate Research
- ENSC 490R Undergraduate Research

Directed Elective Courses

Choose three of the following: 12-13

- AGSC 341 Field Crop Prod 3
- ANSC 410 Veterinary Entomology and Parasitology 3
- BCH 380 Biochemistry 5
- BIIIO 318 Biometry (OR) 5
- STAT 216Q Introduction to Statistics 3
- BIIIO 375 General Genetics 3
- BIIIO 420 Evolution 3
- BIIIOE 370 General Ecology (equiv to 270) (OR) 3
- NRSM 240 Natural Resource Ecology 3
- BIIIOE 422 Insect Ecology 3
- BIIIOE 428 Freshwater Ecology 3

Restricted Electives

Select five of the following:

- AGSC 341 Field Crop Prod 3
- AGSC 441 Plant Breeding & Genetics 3
- BCH 441 Biochemistry of Macromolecules 3
- BCH 442 Metabolic Regulation 3
- BIIIOB 425 Adv Cell & Molecular Biology 3
- BIIIOB 428 Molecular Evolution 3
- or BIIIOB 420 Evolution
- BIIIOB 477 Genome Science and Gene Expression 5
- BIIIOB 480 Conservation Genetics 3
- or BIIIOB 484 Population Genetics
- BIIIOE 424 Ecology of Fungi 3
- BIIIOB 410 Microbial Genetics 3
- BIIIOB 423 Mycology 3
- BIIIOB 430 Applied and Environmental Microbiology 4
- BIIIOB 450 Microbial Physiology 3
- BIIIOO 437 Plant Development 3

BIOM 250 Microbiology for Health Sciences: Infectious Diseases 3
BIOM 421 Concepts of Plant Pathology 3
BIIOO 412 Animal Physiology 3
ENSC 407 Environmental Risk Assessment 3
ENSC 466 Chemical Ecology 3
WILD 301 Princ of Fish & Wildlife Mgmt 3

Total Credits 21-24

Environmental Horticulture

Note: MSU’s programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology. For additional options see Biological Sciences (p. 82) at MSU.

Department of Plant Sciences and Plant Pathology

http://plantsciences.montana.edu/

The department participates in MSU’s Genetics Minor and recommends this minor to students particularly interested in genetics.

The curriculum in Environmental Horticulture is administered by the Department of Plant Sciences and Plant Pathology. Options are available in Environmental Horticulture Science, and Landscape Design.

Faculty members who advise students and teach courses are also active researchers in their disciplines. Students learn current knowledge and technology through formal coursework and gain valuable first-hand experience in departmental laboratories, greenhouses, and at field research farms. Students are encouraged to seek additional learning experiences outside the classroom by working in summer jobs and internship with private industry and government agencies.

Each student works closely with a faculty advisor to formulate a program of study which is appropriate with the student’s career goals and also fits into one of the following options.

Environmental Horticulture Science Option

Horticulture is the science and art of growing and maintaining plants for food and for the enjoyment and improvement of the human environment. Its application through research has led to improved varieties of plants to benefit our daily lives. Students studying horticulture take fundamental courses in biology and chemistry prior to taking specialized courses such as plant materials, plant physiology, commercial plant production, plant propagation, turfgrass management and horticulture capstone and landscape management.

Graduates of this program are prepared for careers in such area as nursery crop production; landscape nurseries; greenhouse businesses; botanic gardens; golf courses; grounds maintenance; cooperative extension service; and research with private companies, public agencies or institutions of higher learning.

Landscape Design Option

The Landscape Design option will prepare students to solve aesthetic and functional landscape problems. Students learn written, oral and graphic communication skills which are necessary to convey creative solutions for landscape planning. This blend of art and science which utilizes both technical and creative studies leads to problem-solving skills for beautiful, functional and efficient landscape design solutions. Emphasis is placed on utilization of plant materials to solve specific site problems.
Graduates are employed by landscape nurseries, landscape contractors, and planning agencies; others become self-employed as landscape designers and contractors. Many students have chosen to continue advanced studies in programs of landscape architecture.

**Undergraduate Programs**
- Environmental Horticulture Science Option (p. 87)
- Landscape Design Option (p. 88)

**Undergraduate Minors**
- Environmental Horticulture Minor (Non-Teaching) (p. 87)

### Environmental Horticulture Minor (Non-Teaching)

**Required Courses**
- HORT 105 - Miracle Growing 3
- BIOB 170IN - Principles of Biological Diversity 4
- CHMY 121IN - Introduction to General Chemistry 4
- HORT 231 - Woody Ornamentals 3
- HORT 232 - Herbaceous Ornamentals 3
- HORT 245 - Plant Propagation 3

**Elective courses**
Select four of the following: 12
- HORT 310 - Turfgrass Management
- HORT 337 - Vegetable Production
- HORT 343 - Comm Plant Production
- HORT 345 - Market Gardening
- BIOM 421 - Concepts of Plant Pathology
- BIOO 433 - Plant Physiology
- HORT 447 - Advanced Plant Propagation

Total Credits 32

### Environmental Horticulture Science Option

**Freshman Year**
- AGSC 101 - Introduction to Agricultural and Environmental Resources 1
- BIOB 170IN - Principles of Biological Diversity 4
- BIOB 160 - Principles of Living Systems 4
- BIOB 110CS - Introduction to Plant Biology 3
- HORT 105 - Miracle Growing 3
- CHMY 121IN - Introduction to General Chemistry 4
- M 121Q - College Algebra 3
- WRIT 101W - College Writing I 3

University Core and Electives 5

Year Total: 30

**Sophomore Year**
- CHMY 123 - Introduction to Organic Chemistry and Biochemistry 4
- BIOO 262IN - Introduction to Entomology 3
- ENSC 245IN - Soils 3
- HORT 231 - Woody Ornamentals 3
- HORT 232 - Herbaceous Ornamentals 3
- HORT 245 - Plant Propagation 3
- BIOB 377 - Practical Genetics 3
- HORT 343 - Comm Plant Production 3
- HORT 345 - Market Gardening 3
- Select one of the following: 3
  - BIOB 318 - Biometry
  - STAT 216Q - Introduction to Statistics
- University Core and Electives 9-12

Year Total: 30

Select three of the following: 9-12
- AGED 315 - Electrical and Power Systems Operation
- AGSC 341 - Field Crop Prod
- AGSC 441 - Plant Breeding & Genetics
- AGSC 450 - Plant Disease Control
- BIOB 430 - Plant Biotechnology
- BIOE 416 - Alpine Ecology
- BIOE 424 - Ecology of Fungi
- BIOM 360 - General Microbiology
- BIOM 423 - Mycology
- BGEN 204 - Business & Entrepreneurship Fundamentals
- BGEN 210 - Accounting & Finance Basics
- BGEN 242D - Intro to Int'l Business
- BGEN 242I - Intro to Int'l Business
- BMGT 335 - Management and Organization
- BMIS 211 - Intro to Bus Decision Support
- BMIS 212 - Intro to Bus Decision Support
- BMGT 335 - Management and Organization
- SPSN 101 - Elementary Spanish I
- WRIT 201 - College Writing II
- WRIT 221 - Intermediate Tech Writing

Year Total: 30

Total Program Credits: 120
A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

**Landscape Design Option**

**Freshman Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>ARCH 151RA</td>
<td>Design Fundamentals I</td>
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<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 121IN</td>
<td>Introduction to General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>M 121Q</td>
<td>College Algebra</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 110CS</td>
<td>Introduction to Plant Biology</td>
<td>3</td>
</tr>
<tr>
<td>HORT 105</td>
<td>Miracle Growing</td>
<td>3</td>
</tr>
<tr>
<td>HORT 120</td>
<td>Introduction to Landscape Design Studio</td>
<td>3</td>
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<tr>
<td>HORT 131</td>
<td>Landscape Design/ Hist/Theory</td>
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<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
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**Sophomore Year**

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<td>ENSC 245IN</td>
<td>Soils</td>
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<td>HORT 201</td>
<td>HORT 201 Sustainable Landscape Studio</td>
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<td>HORT 231</td>
<td>Woody Ornamentals</td>
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<td>HORT 232</td>
<td>Herbaceous Ornamentals</td>
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<td>HORT 225</td>
<td>Landscape Graphics I</td>
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<tr>
<td>HORT 226</td>
<td>Landscape Graphics II</td>
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<td>DDSN 131</td>
<td>Introduction to Drafting and Design</td>
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<td>AGED 312R</td>
<td>Communicating Agriculture</td>
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<td>AGED 482</td>
<td>Non-Formal Teaching Methods in Agriculture</td>
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<td>BMGT 205</td>
<td>Prof Business Communication</td>
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<td>MART 145RA</td>
<td>Web Design</td>
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<td>SPNS 101</td>
<td>Elementary Spanish I</td>
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<td>WRIT 201</td>
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<td>University Core &amp; Electives</td>
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**Junior Year**

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<tr>
<td>HORT 331</td>
<td>Planting Design</td>
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<tr>
<td>HORT 310</td>
<td>Turfgrass Management</td>
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<tr>
<td>HORT 335</td>
<td>Site Development</td>
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<td>HORT 336</td>
<td>Landscape Construction</td>
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<td>Select two of the following:</td>
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<tr>
<td>ACTG 202</td>
<td>Principles of Managerial Accounting</td>
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<td>BGEN 204</td>
<td>Business &amp; Entrepreneurship Fundamentals</td>
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<td>BGEN 210</td>
<td>Accounting &amp; Finance Basics</td>
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<td>BMGT 335</td>
<td>Management and Organization</td>
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<td>BMKT 491-001</td>
<td>Farm to Market: An Interdisciplinary Design Lab</td>
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<td>ECV 308</td>
<td>Construction Practice</td>
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<td>Small Business and Entrepreneurship in Food and Health</td>
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**Senior Year**

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<td>Advanced Landscape Design</td>
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<td>HORT 440</td>
<td>Urban Planning and Design</td>
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<td>or HORT 435</td>
<td>Landscape Planning</td>
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<tr>
<td>HORT 245</td>
<td>Plant Propagation</td>
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<td>HORT 343</td>
<td>Comm Plant Production</td>
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<td>HORT 345</td>
<td>Market Gardening</td>
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<td>Select three (at least 12 total credits) of the following from across any specialization tracks:</td>
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<td>Visual Language - Drawing</td>
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<tr>
<td>ARTZ 109RA</td>
<td>Visual Language: Comprehensive Foundation</td>
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<tr>
<td>ARTZ 110RA</td>
<td>Visual Language: Ideation and Creativity</td>
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<td>ARCH 152</td>
<td>Design Fundamentals II</td>
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<td>ARCH 450</td>
<td>Community Design Center</td>
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<td>History- Art/Design/Architecture</td>
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<td>ARTH 200IA</td>
<td>Art of World Civilization I</td>
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<td>ARTH 201IA</td>
<td>Art of World Civilization II</td>
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<td>ARTH 360</td>
<td>History of Asian Art and Architecture</td>
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<td>ARCH 322IA</td>
<td>World Architecture I</td>
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<td>ARCH 323IA</td>
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<td>History of Identity of Contemporary Places</td>
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<td>Non-Western Architectural History</td>
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<td>Plant, Water, &amp; Land Ecology</td>
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<td>BIOE 370</td>
<td>General Ecology (equiv to 270)</td>
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<td>BIOE 408</td>
<td>Rocky Mountain Vegetation (Planning)</td>
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<td>BIOE 416</td>
<td>Alpine Ecology (Planning)</td>
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<td>BIOE 421</td>
<td>Yellowstone Wildlife Ecology (Planning)</td>
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<td>BIOE 428</td>
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<td>ENSC 272CS</td>
<td>Water Resources (Planning)</td>
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<td>ENSC 444</td>
<td>Watershed Hydrology (Planning)</td>
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<td>ENSC 448</td>
<td>Stream Restoration Ecology</td>
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<td>NRSM 101</td>
<td>Natural Resource Conservation</td>
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<td>NRSM 240</td>
<td>Natural Resource Ecology (Planning)</td>
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<td>NRSM 330</td>
<td>Fire Ecology and Mgmt (Planning)</td>
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<td>NRSM 350</td>
<td>Vegetation of Western Wildlands</td>
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<td>NRSM 421</td>
<td>Holistic Thought/Mgmt</td>
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<td>NRSM 453</td>
<td>Habitat Inventory and Analysis (Planning)</td>
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<td>WILD 438</td>
<td>Wildlife Habitat Ecology (Planning)</td>
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<td>Planning</td>
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<tr>
<td>GPHY 121D</td>
<td>Human Geography (GIS/GPS)</td>
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<td>GPHY 321</td>
<td>Urban Geography</td>
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<td>GPHY 325</td>
<td>Cultural Geography (GIS/GPS)</td>
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<tr>
<td>GPHY 365</td>
<td>Geographical Planning</td>
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<tr>
<td>GPHY 411</td>
<td>Biogeography</td>
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<tr>
<td>GPHY 445</td>
<td>Adv. Regional Geography (GIS/GPS)</td>
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<tr>
<td>GIS/GPS</td>
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<tr>
<td>GPHY 284</td>
<td>Intro to GIS Science &amp; Cartog</td>
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<tr>
<td>GPHY 357</td>
<td>GPS Fund/App in Mapping</td>
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<tr>
<td>GPHY 384</td>
<td>Adv GIS and Spatial Analysis</td>
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<tr>
<td>Construction</td>
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AGED 333 - Construction Technology (Plant, Water, & Land Ecology)
ARCH 241 - Building Construction I (Plant, Water, & Land Ecology)
SRVY 230 - Intro to Surveying for Engineers
Internship
HORT 498 - Internship
University Core & Elective 4
Total Program Credits 120

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

Environmental Sciences

Note: MSU’s programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology. For additional options see Biological Sciences at MSU.

Department of Land Resources & Environmental Sciences
http://landresources.montana.edu/

Effective management of land and water resources requires a solid fundamental understanding of the processes and relationships in land and natural resources systems, combined with applications of environmental science and applied ecology. The Environmental Sciences curriculum is designed to provide this classroom, laboratory, and field training. Graduates of this degree program will:

1. possess a broad knowledge of biological, physical, and chemical processes important across landscapes;
2. receive training in applied ecology, soil and water science, and land resources analysis;
3. be capable of critical analysis of land resource problems; and
4. be experienced with teamwork required to develop and implement effective land management strategies. They will be the scientists most capable of making significant advances and contributions in the 21st century!

Environmental Sciences

This program is for students who wish to obtain a more general Environmental Sciences degree and design more of their course of study than possible in one of the below options. The required courses in this major are also required in each of the options, allowing for a relatively seamless transfer to one of them if accomplished by the end of the student’s second year.

Career opportunities: Environmental consulting firms, industry, government agencies, and the military careers where the focus is on using scientific knowledge to protect the environment and human health. An environmental scientist might pursue a career in consulting, research, or teaching. Consulting firms offer opportunities to help businesses and agencies comply with environmental laws and policy. This degree can also prepare a student for a wide range of graduate studies.

Environmental Biology Option

This option is intended to train students who are interested in understanding the ecology of organisms in natural environments, and/or in understanding how organisms may be used to clean up environments that have been disturbed by human activities. The curriculum launches from a base in environmental science which includes a broad knowledge of organisms (including plants, animals, and microorganisms) and the physical and chemical characteristics of natural environments. A special feature of this option is that it emphasizes cross-training between the traditional disciplines of Biology and Microbiology. Students trained in Biology or Microbiology normally focus on either large or small organisms or on human biology and disease. But, even biologists trained as ecologists have a poor understanding of microorganisms, despite the fact that they appreciate the great importance of microorganisms in most natural environments. Similarly, most microbiologists do not understand the diversity of large organisms and are never exposed to natural principles of ecology and evolution. In the LRES Environmental Biology option, students will develop a knowledge of the diversity of organisms and their interrelated functions in complex environments. In later stages of the curriculum, students may select from a wide array of upper division courses in environmental microbiology, natural ecosystems, applied ecology, and policy and planning that enable them to specialize in areas best-suited to their own career vision.

Career opportunities: Environmental industries and consulting firms that address problems associated with disturbed environments. Biotechnology companies that attempt to exploit biological diversity for the benefit of humans. Government jobs in environmental management and policy making. Graduate training that leads to independent research in basic and applied ecology, environmental biology, and environmental microbiology.

Geospatial & Environmental Analysis Option

Effective management of agricultural and other managed land resources requires individuals to have sound fundamental understanding of the processes and relationships in land systems, combined with excellent skills in modern land inventory and analysis techniques including geographic information systems (GIS), global positioning systems (GPS), remote sensing, and an appreciation for the intricacies of land resources and land use practices. The Land Resource Sciences curricula are designed to provide classroom, laboratory, and field training. Graduates of this program will: (i) possess a broad knowledge of land processes, (ii) be able to critically analyze and solve land resource problems, and (iii) work in teams to develop and implement effective land management strategies. They will be the premier land resource users and managers in the 21st century.

This degree is for students interested in land resources and their management at landscape scales. All human activities depend on the world’s land and water resource base. The air we breathe, the water we drink, and the food we eat all depend upon activities occurring and interacting across broad extents of the Earth’s land surface. This curriculum is based on the philosophy that our well-being requires knowledge-based decision making involving land and natural resources across these large areas. Students build on knowledge of the basic natural sciences with course work in geology, biology, geography, soils, and ecology. Then, courses in remote sensing, geographic information systems, global positioning and statistics provide tools for gathering, processing, analyzing, and displaying information about land resources across large areas. Finally, students learn how to integrate land resource information with social and financial realities to support balanced management decisions. Throughout the program, students are encouraged to gain hands-on experience with land, people and information through field trips, internships, and the capstone field course. The knowledge and skills of land resource analysis and management are needed wherever there are land resources. Graduates in the LRES Geospatial & Environmental Analysis option can be the environmental
scientists and managers most capable of providing information for sound management of the land resource base.

**Career Opportunities:** Careers in natural resource management, environmental consulting, precision agriculture, watershed management, and land mapping, requiring professionals who can work outdoors on the land and indoors with data and computer applications dealing with geographic information systems and remote sensing. Employment with federal government land management agencies, such as the Forest Service, Bureau of Land Management, Natural Resources Conservation Service, and Bureau of Reclamation; state agencies, such as departments of natural resources; local and regional planning organizations; private organizations which own and manage land (timber companies, ranches, farms, recreation areas); consulting firms; conservation organizations such as land trusts; and Congressional staffs. Graduate training leading to independent research in remote sensing, ecological processes, and soil and water science.

**Land Rehabilitation Option**
The Land Rehabilitation curriculum provides understanding in site remediation and restoration ecology, including soil remediation, re-vegetation, fluvial and riparian restoration, investigation of impacted geologic resources, amelioration of contaminated soils and water, integrated management of invasive species, and remediation of sites impacted by industrial, recreational, and land management activities. Emphasis is placed on developing a broad understanding of hydrologic, soil, and plant processes from both a basic and an applied science approach. Coursework in the chemical, biological, and environmental sciences provides a foundation of knowledge. During the junior and senior years, students take courses in soil, water, and plant sciences that range from molecular to landscape in scale. Students will acquire skills in plant identification and landscape inventory including geographic information systems. Land rehabilitation is critically important to Montana, to the surrounding region, and to the United States. Graduates possess a broad knowledge of land rehabilitation processes, are able to critically analyze and solve problems, and can work in teams to develop and implement effective land management strategies. Studies in Land Rehabilitation will infuse students with critical knowledge and skills needed to analyze and manage lands requiring rehabilitation. Students will also receive foundation skills in writing, communication, arts, humanities and social sciences.

**Career Opportunities:** Worker and manager for local, state, and federal agencies responsible for land rehabilitation and remediation, ecological restoration, invasive species management, and land resources management. Land reclamation managers for environmental consulting, mining, and highway construction companies. Stepping stone to Graduate School for independent research and advanced coursework in restoration ecology, soil sciences, geology, hydrology, ecology, and the plant sciences. Environmental consulting and non-profit organization related to restoration and conservation.

**Soil and Water Science Option**
The Soil and Water Science Option provides students with fundamental training in basic biological, chemical, and physical sciences and advanced training in soil and water sciences. Students are encouraged through choice electives to emphasize specific course sequences to help them understand the underlying processes central to managed and natural landscapes, as well as to develop practical skills and abilities relevant to applying this knowledge to land resource management and the environmental sciences.

Water is perhaps the most unique substance on earth, having a multitude of seemingly anomalous properties, and literally forms the basis for life as we know it. Soils form the precious ‘skin’ of the Earth, the critical interface between atmospheric and geologic/groundwater systems. The multitude of physical, chemical, and biological processes that occur in the three-phase soil system (solids, water, and air) are critical to sustainability of natural and managed ecosystems. Soils and water will be among the most critical limiting resources in coming decades. The LRES Soil and Water Science Option provides students with advanced training in the chemical, physical, and biological sciences, and integration of these fundamentals in applications related to soil science, hydrology, watershed management, pollution treatment and prevention, land rehabilitation, agricultural and natural resources management, and bioremediation. Students develop relevant skills in written and oral communication, and gain experience in modern measurement, monitoring and analysis techniques used in land and water sciences and management.

**Career opportunities:** Environmental industries and consulting firms that work on problems associated with soils, water, contaminant transport, fate of chemicals in the environment, and water resource management. Local, state, or federal government positions in natural resources and environmental sciences management and policy. Advanced graduate training to prepare for research and management positions in soil sciences, hydrology, water resources, land reclamation, and related areas.

**Undergraduate Programs**
- Environmental Sciences Option (p. 90)
- Environmental Biology Option (p. 91)
- Geospatial & Environmental Analysis Option (p. 92)
- Land Rehabilitation Option (p. 93)
- Soil & Water Science Option (p. 94)

**Undergraduate Minors**
- Soil Science Minor (Non-Teaching) (p. 95)
- Entomology Minor (Non-Teaching) (p. 86)
- Water Resources Minor (Non-Teaching) (p. 207)

---

**Environmental Sciences - Environmental Sciences Option**

**Freshman Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ENSC 110</td>
<td>Land Resources and Environmental Sciences</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>BIOB 160</td>
<td>Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
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<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>M 161Q</td>
<td>Survey of Calculus (or higher)</td>
<td>4</td>
</tr>
<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
<td>3</td>
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<tr>
<td>University Seminar (US Core)</td>
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**Year Total:** 29

**Sophomore Year**

<table>
<thead>
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<td>ENSC 210</td>
<td>Role of Plants in the Environment</td>
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</tr>
<tr>
<td>ENSC 245IN</td>
<td>Soils</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 260</td>
<td>Evolution for Env Scientists</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 284</td>
<td>Intro to GIS Science &amp; Cartog</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 205</td>
<td>College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>WRIT 201</td>
<td>College Writing II</td>
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<tr>
<td></td>
<td>Choose one of the following:</td>
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<tr>
<td></td>
<td>STAT 216Q - Introduction to Statistics (or higher)</td>
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<td></td>
<td>BIOB 318 - Biometry</td>
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</table>

**University Core & Electives** 12

**Year Total:** 34
### Montana State University

**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>ENSC 353 - Environmental Biogeochemistry</td>
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<tr>
<td>Take one of the following:</td>
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<tr>
<td>NRSN 240 - Natural Resource Ecology</td>
<td>3</td>
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<tr>
<td>BIOE 370 - General Ecology (equiv to 270)</td>
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<td>University Core &amp; Electives</td>
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**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ENSC 444 - Watershed Hydrology</td>
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<td>Choose one of the following:</td>
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<tr>
<td>ENSC 464 - Computational Techniques</td>
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<tr>
<td>Environmental Science</td>
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<tr>
<td>ENSC 465 - Environmental Biophysics</td>
<td></td>
</tr>
<tr>
<td>Take one of the following:</td>
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<tr>
<td>NRSN 430 - Natural Resource Law</td>
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<td>PSCI 362 - Natural Resource Policy</td>
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<td>ENSC 499R - LRES Capstone</td>
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<td>University Core &amp; Electives</td>
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</table>

**Total Program Credits:** 120

---

**Free Electives**

Take at least 21 credits of free electives, 15 of which must be 300/400 level.

Because some of our courses are offered during alternate years, the proposed scheduling of courses in junior and senior years may need to be modified. Work with an advisor to determine an individual schedule.

A minimum of 120 credits is required for graduation; at least 42 of these credits must be in courses numbered 300 and above.

---

**Each student shall work closely with their faculty advisor to plan an integrated set of elective courses appropriate to their academic and professional goals.**

---

**Environmental Biology Option**

### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ENSC 110 - Land Resources and Environmental Sciences</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 170IN - Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>BIOB 160 - Principles of Living Systems</td>
<td>4</td>
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<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 143 - College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>M 161IQ - Survey of Calculus (or higher)</td>
<td>4</td>
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<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
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<td>University Seminar (US Core)</td>
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<tr>
<td>Year Total:</td>
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### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ENSC 210 - Role of Plants in the Environment</td>
<td>3</td>
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<tr>
<td>ENSC 245IN - Soils</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 260 - Evolution for Env Scientists</td>
<td>3</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 262 - Spatial Sci Tech &amp; Application</td>
<td></td>
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<tr>
<td>GPHY 284 - Intro to GIS Science &amp; Cartog</td>
<td></td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 318 - Biometry</td>
<td></td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td></td>
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<tr>
<td>PHSX 205 - College Physics I</td>
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<td>WRIT 201 - College Writing II</td>
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<td>University Core and Electives</td>
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<td>Year Total:</td>
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### Junior Year

<table>
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<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>CHMY 211 - Elements of Organic Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>BIOM 360 - General Microbiology</td>
<td>5</td>
</tr>
<tr>
<td>ENSC 353 - Environmental Biogeochemistry</td>
<td>3</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>BIOE 370 - General Ecology (equiv to 270)</td>
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</tr>
<tr>
<td>NRSN 240 - Natural Resource Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOM 452 - Soil &amp; Environmnt Microbiology</td>
<td></td>
</tr>
<tr>
<td>ENSC 468 - Ecosystem Biogeochem and Global Change</td>
<td>3</td>
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<tr>
<td>University Core and Electives</td>
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<tr>
<td>Year Total:</td>
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</table>

### Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Choose one of the following:</td>
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<tr>
<td>BIOE 422 - Insect Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOM 415 - Microbial Diversity, Ecology, and Evolution</td>
<td></td>
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</tbody>
</table>
Geospatial and Environmental Analysis Option

BIOE 455 - Plant Ecology
ENSC 444 - Watershed Hydrology 3
BCH 380 - Biochemistry 5
Choose one of the following: 1-3
ENSC 464 - Computational Techniques Environmental Science
ENSC 465 - Environmental Biophysics
Choose one of the following: 3
NRSM 430 - Natural Resource Law
PSCI 362 - Natural Resource Policy
ENSC 499R - LRES Capstone 3
University Core and Electives 10-12
Year Total: 28-32
Total Program Credits: 120

Restricted Electives
Choose 15-17 credits from the following
AGSC 401 Integrated Pest Management 3
BIOB 375 General Genetics 3
BIOB 420 Evolution 3
BIOE 375 Ecological Responses to Climate Change 3
BIOE 405 Behavioral and Evolutionary Ecology 3
BIOE 408 Rocky Mountain Vegetation 3
BIOE 428 Freshwater Ecology 3
BIOM 410 Microbial Genetics 3
BIOM 423 Mycology (even years) 3
BIOM 430 Applied and Environmental Microbiology 4
BIOM 450 Microbial Physiology 3
BIOM 455R Research Mths in Microbiology 4
BIOO 412 Animal Physiology 3
BIOO 415 Ichthyology 3
BIOO 433 Plant Physiology 3
BIOO 470 Ornithology 3
BIOO 475 Mammalogy 3
ECNS 332 Econ of Natural Resources 3
ENSC 407 Environmental Risk Assessment (odd years) 3
ENSC 410R Biodiversity Survey and Monitoring Methods 3
ENSC 443 Weed Ecology and Management 3
ENSC 445 Watershed Analysis 3
ENSC 448 Stream Restoration Ecology 3
ENSC 461 Restoration Ecology 3
ENSC 466 Chemical Ecology 3
GPHY 426 Remote Sensing 3
NRSM 421 Holistic Thought/Mgmt 4
NRSM 453 Habitat Inventory and Analysis 3
WILD 301 Princ of Fish & Wildlife Mgmt 3
WILD 438 Wildlife Habitat Ecology 3

Because some of our courses are offered during alternate years, the proposed scheduling of courses in junior and senior years may need to be modified. Work with an advisor to determine an individual schedule.

A minimum of 120 credits is required for graduation; at least 42 of these credits must be in courses numbered 300 and above.

Each student shall work closely with their faculty advisor to plan an integrated set of elective courses appropriate to their academic and professional goals.

Geospatial and Environmental Analysis Option

Freshman Year
ENSC 110 - Land Resources and Environmental Sciences 3
BIOB 170IN - Principles of Biological Diversity 4
CHMY 141 - College Chemistry I 4
BIOB 160 - Principles of Living Systems 4
CHMY 143 - College Chemistry II 4
M 161Q - Survey of Calculus (or higher) 4
WRIT 101W - College Writing I 3
University Seminar (US) Core 3
Year Total: 29

Sophomore Year
ERTH 101IN - Earth System Sciences 4
ENSC 245IN - Soils 3
ENSC 260 - Evolution for Env Scientists 3
GPHY 284 - Intro to GIS Science & Cartog 3
PHSX 205 - College Physics I 4
STAT 216Q - Introduction to Statistics 3
STAT 217Q - Intermediate Statistical Concepts 3
WRIT 201 - College Writing II 3
University Core and Electives 5
Year Total: 31

Junior Year
ENSC 353 - Environmental Biogeochemistry 3
ENSC 210 - Role of Plants in the Environment 3
Choose one of the following: 3
NRSM 240 - Natural Resource Ecology
BIOE 370 - General Ecology (equiv to 270)
GPHY 357 - GPS Fund/App in Mapping 3
GPHY 384 - Adv GIS and Spatial Analysis 3
University Core and Electives 15
Year Total: 30

Senior Year
ENSC 444 - Watershed Hydrology 3
ENSC 454 - Landscape Pedology 3
Choose one of the following: 1-3
ENSC 464 - Computational Techniques Environmental Science
ENSC 465 - Environmental Biophysics
GPHY 429R - Applied Remote Sensing 3
GPHY 484R - Applied GIS & Spatial Analysis 3
Choose one of the following: 3
NRSM 430 - Natural Resource Law
PSCI 362 - Natural Resource Policy
ENSC 499R - LRES Capstone 3
University Core and Electives 9-11
Year Total: 28-32
Total Program Credits: 120
Directed Electives

Each student shall work closely with their faculty advisor to plan an integrated set of directed electives appropriate to their academic, professional and personal goals.

Choose 17-19 Credits from the following:

(Determined by taking 1 credit ENSC 464 or ENSC 465 in the Required Courses).

AGSC 401 Integrated Pest Management 3
AGSC 428 Cropping Systems and Sustainable Ag 3
BIOE 375 Ecological Responses to Climate Change 3
BIOE 408 Rocky Mountain Vegetation 3
BIOE 416 Alpine Ecology 3
BIOE 428 Freshwater Ecology 3
BIOE 455 Plant Ecology 3
BIOE 466 Chemical Ecology 3
BIOE 468 Ecosystem Biogeochem and Global Change 3
ERTH 307 Principles of Geomorphology 4
ERTH 432R Surface Water Resources 3
GPHY 121D Human Geography 3
GPHY 457 Adv GPS Mapping for GIS 3
NRSM 421 Holistic Thought/Mgmt 4
NRSM 453 Habitat Inventory and Analysis 3
NRSM 455 Riparian Ecology & Management 3
SOCI 470 Environmental Sociology 3
SRVY 230 Intro to Surveying for Engineers 3
SRVY 375 Analytic Photogrammetry and Remote Sensing 3
STAT 401 Applied Methods in Statistics 3
STAT 408 Statistical Computing and Graphical Analysis 1-3
STAT 411 Methods for Data Analysis I 3
STAT 412 Methods for Data Analysis II 3

Because some of our courses are offered during alternate years, the proposed scheduling of courses in junior and senior years may need to be modified. Work with your advisor for your individual schedule.

A minimum of 120 credits is required for graduation; at least 42 of these credits must be in courses numbered 300 and above.

Each student shall work closely with their faculty advisor to plan an integrated set of elective courses appropriate to their academic and professional goals.

Land Rehabilitation Option

Freshman Year

ENSC 110 - Land Resources and Environmental Sciences 3
BIOB 170IN - Principles of Biological Diversity 4
CHMY 141 - College Chemistry I 4
BIOB 160 - Principles of Living Systems 4
CHMY 143 - College Chemistry II 4
WRIT 101W - College Writing I 3
M 161Q - Survey of Calculus (or higher) 4
University Seminar (US) Core 3
Year Total: 29

Sophomore Year

ENSC 245IN - Soils 3
PHSX 205 - College Physics I 4
GPHY 284 - Intro to GIS Science & Cartog 3
BIOO 230 - Identification of Seed Plants 4
ENSC 210 - Role of Plants in the Environment 3
ENSC 260 - Evolution for Env Scientists 3
Choose one of the following: 3

ENSC 410R - Biodiversity Survey and Monitoring Methods 3
ENSC 443 - Weed Ecology and Management 3
ENSC 445 - Watershed Analysis 3
ENSC 448 - Stream Restoration Ecology 3
ENSC 460 - Soil Remediation 3
ENSC 461 - Restoration Ecology 3
ENSC 466 - Chemical Ecology 3
ENSC 468 - Ecosystem Biogeochem and Global Change 3
ERTH 307 - Principles of Geomorphology 4
ERTH 432R - Surface Water Resources 3
GPHY 121D - Human Geography 3
GPHY 457 - Adv GPS Mapping for GIS 3
NRSM 421 - Holistic Thought/Mgmt 4
NRSM 453 - Habitat Inventory and Analysis 3
NRSM 455 - Riparian Ecology & Management 3
SOCI 470 - Environmental Sociology 3
SRVY 230 - Intro to Surveying for Engineers 3
SRVY 375 - Analytic Photogrammetry and Remote Sensing 3
STAT 401 - Applied Methods in Statistics 3
STAT 408 - Statistical Computing and Graphical Analysis 1-3
STAT 411 - Methods for Data Analysis I 3
STAT 412 - Methods for Data Analysis II 3

Year Total: 30

Junior Year

ENSC 353 - Environmental Biogeochemistry 3
ENSC 443 - Weed Ecology and Management 3
ENSC 454 - Landscape Pedology 3
BIOM 452 - Soil & Environmental Microbiology 3
Take one of the following: 3

BIOE 370 - General Ecology (equiv to 270)
NRSM 240 - Natural Resource Ecology 15
University Core and Electives 6-8
Year Total: 30

Senior Year

ENSC 410R - Biodiversity Survey and Monitoring Methods 3
ENSC 444 - Watershed Hydrology 3
ENSC 448 - Stream Restoration Ecology 3
ENSC 461 - Restoration Ecology 3
ENSC 499R - LRES Capstone 3
ENSC 460 - Soil Remediation 3
Take one of the following: 1-3

ENSC 464 - Computational Techniques Environmental Science
ENSC 465 - Environmental Biophysics
Take one of the following: 3

NRSM 430 - Natural Resource Law
PSCI 362 - Natural Resource Policy
University Core and Electives 6-8
Year Total: 28-32

Total Program Credits: 120
Each student shall work closely with their faculty advisor to plan an integrated set of directed electives appropriate to their academic, professional and personal goals.

**Choose 14-16 Credits from the following**

Determined by if you take one credit of ENSC 464 or 3 credits of ENSC 465 in the Required Courses.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGSC 454</td>
<td>Agrostology</td>
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<tr>
<td>BIOE 375</td>
<td>Ecological Responses to Climate Change</td>
<td>3</td>
</tr>
<tr>
<td>BIOE 428</td>
<td>Freshwater Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOE 455</td>
<td>Plant Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOO 433</td>
<td>Plant Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOO 435</td>
<td>Plant Systematics</td>
<td>3</td>
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<td>ENSC 407</td>
<td>Environmental Risk Assessment</td>
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<td>ENSC 445</td>
<td>Watershed Analysis</td>
<td>3</td>
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<tr>
<td>ENSC 466</td>
<td>Chemical Ecology</td>
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<td>ENSC 468</td>
<td>Ecosystem Biogeochemistry and Global Change</td>
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<tr>
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<td>Principles of Geomorphology</td>
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<td>GPS Fund/App in Mapping</td>
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<td>GPHY 384</td>
<td>Adv GIS &amp; Spatial Analysis</td>
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<tr>
<td>GPHY 484R</td>
<td>Applied GIS &amp; Spatial Analysis</td>
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<td>NRSM 350</td>
<td>Vegetation of Western Wildlands</td>
<td>3</td>
</tr>
<tr>
<td>NRSM 351</td>
<td>Biomes of Western Wildlands</td>
<td>2</td>
</tr>
<tr>
<td>NRSM 453</td>
<td>Habitat Inventory and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>WILD 301</td>
<td>Princ of Fish &amp; Wildlife Mgmt</td>
<td>3</td>
</tr>
</tbody>
</table>

Because some courses are offered during alternate years, the proposed scheduling of courses in junior and senior years may need to be modified. Students should work with an advisor for their individual schedules.

A minimum of 120 credits is required for graduation; at least 42 of these credits must be in courses numbered 300 and above.

---

Each student shall work closely with their faculty advisor to plan an integrated set of elective courses appropriate to their academic and professional goals.

**Soil and Water Sciences Option**

### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENSC 110 - Land Resources and Environmental Sciences</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BIOC 170IN - Principles of Biological Diversity</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>BIOC 160 - Principles of Living Systems</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CHMY 143 - College Chemistry II</td>
<td>4</td>
<td></td>
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<tr>
<td>ERTH 101IN - Earth System Sciences</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
<td></td>
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<tr>
<td>University Seminar (US) Core</td>
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<td><strong>Total Year:</strong></td>
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### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>M 161Q - Survey of Calculus (or higher)</td>
<td>4</td>
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<tr>
<td>ENSC 245IN - Soils</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ENSC 260 - Evolution for Env Scientists</td>
<td>3</td>
<td></td>
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<tr>
<td>Choose one of the following:</td>
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<tr>
<td>BIOC 318 - Biometry</td>
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<tr>
<td>STAT 216Q - Introduction to Statistics (or higher)</td>
<td>3</td>
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<tr>
<td>GEO 208IN - Earth Materials</td>
<td>3</td>
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<tr>
<td>GPHY 284 - Intro to GIS Science &amp; Cartog</td>
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<td>WRIT 201 - College Writing II</td>
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<td>University Core &amp; Electives</td>
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### Junior Year

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<tbody>
<tr>
<td>ENSC 210 - Role of Plants in the Environment</td>
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<tr>
<td>CHMY 211 - Elements of Organic Chemistry</td>
<td>5</td>
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<tr>
<td>Choose one of the following:</td>
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<tr>
<td>BIOE 370 - General Ecology (equiv to 270)</td>
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<tr>
<td>NRSM 240 - Natural Resource Ecology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PHSX 205 - College Physics I</td>
<td>4</td>
<td></td>
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<tr>
<td>ERTH 307 - Principles of Geomorphology</td>
<td>4</td>
<td></td>
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<tr>
<td>Take one of the following:</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>BIOE 428 - Freshwater Ecology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BIOE 455 - Plant Ecology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ENSC 448 - Stream Restoration Ecology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ENSC 461 - Restoration Ecology</td>
<td>3</td>
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<tr>
<td>Take one of the following:</td>
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<tr>
<td>NRSM 430 - Natural Resource Law</td>
<td>3</td>
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<tr>
<td>PSCI 362 - Natural Resource Policy</td>
<td>3</td>
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<tr>
<td>Take one of the following:</td>
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<tr>
<td>ENSC 464 - Computational Techniques Environmental Science</td>
<td>3</td>
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<tr>
<td>AND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENSC 445 - Watershed Analysis</td>
<td>3</td>
<td></td>
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<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENSC 465 - Environmental Biophysics</td>
<td>3</td>
<td></td>
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<tr>
<td>ENSC 468 - Ecosystem Biogeochem and Global Change</td>
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<tr>
<td>University Core and Electives</td>
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<td><strong>Year Total:</strong></td>
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</table>

**Total Program Credits:** 120

### Directed Electives

Each student shall work closely with their faculty advisor to plan an integrated set of directed elective courses appropriate to their academic, professional and personal goals.

**Choose 11-12 Credits from the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AGSC 454 - Agrostology</td>
<td>3</td>
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<tr>
<td>BIOE 375 - Ecological Responses to Climate Change</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BIOE 428 - Freshwater Ecology (if not taken above)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BIOE 455 - Plant Ecology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BIOM 415 - Microbial Diversity, Ecology, and Evolution</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BIOM 452 - Soil &amp; Environmntl Microbiology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CHMY 311 - Fundamental Analytical Chem</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>EENV 441 - Natural Treatment Systems</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ENSC 407 - Environmental Risk Assessment</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Because some of the courses are offered during alternate years, the proposed scheduling of courses in junior and senior years may need to be modified. Work with an advisor for an individual schedule.

A minimum of 120 credits is required for graduation; at least 42 of these credits must be in courses numbered 300 and above.

Each student shall work closely with their faculty advisor to plan an integrated set of elective courses appropriate to their academic and professional goals.

Soil Science Minor (Non-Teaching)

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>ENSC 245IN</td>
<td>Soils</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 353</td>
<td>Environmental Biogeochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 452</td>
<td>Soil &amp; Environmental Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 454</td>
<td>Landscape Pedology</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 465</td>
<td>Environmental Biophysics</td>
<td>3</td>
</tr>
<tr>
<td>Choose two from the following:</td>
<td></td>
<td></td>
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<tr>
<td>ENSC 444</td>
<td>Watershed Hydrology</td>
<td></td>
</tr>
<tr>
<td>ENSC 460</td>
<td>Soil Remediation</td>
<td></td>
</tr>
<tr>
<td>ENSC 461</td>
<td>Restoration Ecology</td>
<td></td>
</tr>
<tr>
<td>ENSC 468</td>
<td>Ecosystem Biogeochemist and Global Change</td>
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</tr>
<tr>
<td>Total Credits</td>
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</tbody>
</table>

Genetics Minor

Genetics is a fundamental topic in biology and an important component of many biological disciplines. Montana State University offers a wide variety of genetics courses taught by faculty in five departments (Animal and Range Science, Cell Biology and Neuroscience, Ecology, Microbiology and Immunology, and Plant Sciences and Plant Pathology). A Genetics Minor is available to students majoring in these departments.

In order to earn a Genetics Minor, a student must take 13 units of required courses and 15 units of elective courses (see below) and must earn a grade of at least C- in every course. Students interested in this minor should consult the genetics advisor within each department to decide whether the Genetics Minor is appropriate for them and to help select specific courses. Course requirements for the Genetics Minor are consistent across all departments.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 160</td>
<td>Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>or BIOB 260</td>
<td>Cellular and Molecular Biology</td>
<td></td>
</tr>
<tr>
<td>BIOB 375</td>
<td>General Genetics</td>
<td>3</td>
</tr>
<tr>
<td>or BIOH 320</td>
<td>Biomedical Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOB 480</td>
<td>Conservation Genetics</td>
<td>3</td>
</tr>
<tr>
<td>or BIOB 484</td>
<td>Population Genetics</td>
<td></td>
</tr>
<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>or BIOB 318</td>
<td>Biometry</td>
<td></td>
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<tr>
<td>Elective Courses Choose 15 credits from the following:</td>
<td>15</td>
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<tr>
<td>AGSC 441</td>
<td>Plant Breeding &amp; Genetics</td>
<td></td>
</tr>
<tr>
<td>ANSC 322</td>
<td>Principles of Animal Breeding and Genetics</td>
<td></td>
</tr>
<tr>
<td>BCH 444R</td>
<td>Biochemistry &amp; Molecular Biology Methods</td>
<td></td>
</tr>
<tr>
<td>BIOB 420</td>
<td>Evolution</td>
<td></td>
</tr>
<tr>
<td>BIOB 428</td>
<td>Molecular Evolution</td>
<td></td>
</tr>
<tr>
<td>BIOB 430</td>
<td>Plant Biotechnology</td>
<td></td>
</tr>
<tr>
<td>BIOB 476R</td>
<td>Gene Construction</td>
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</tr>
<tr>
<td>BIOB 477</td>
<td>Genome Science and Gene Expression</td>
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<tr>
<td>BIOB 480</td>
<td>Conservation Genetics (3 if not taken as a requirement)</td>
<td></td>
</tr>
<tr>
<td>BIOB 484</td>
<td>Population Genetics (3 if not taken as a requirement)</td>
<td></td>
</tr>
<tr>
<td>BIOH 420</td>
<td>Molecular Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOH 422</td>
<td>Genes and Cancer</td>
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<tr>
<td>BIOH 455</td>
<td>Molecular Medicine</td>
<td></td>
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<tr>
<td>BIOH 465R</td>
<td>Gene Expression Lab: From Genes to Proteins to Cells</td>
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<tr>
<td>BIOM 410</td>
<td>Microbial Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOM 415</td>
<td>Microbial Diversity, Ecology, and Evolution</td>
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</tr>
<tr>
<td>BIOM 435</td>
<td>Virology</td>
<td></td>
</tr>
<tr>
<td>BIOM 450</td>
<td>Microbial Physiology</td>
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<tr>
<td>BIOM 455R</td>
<td>Research MPhds in Microbiology</td>
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</tr>
<tr>
<td>BIOO 435</td>
<td>Plant Systematics</td>
<td></td>
</tr>
<tr>
<td>Total Credits</td>
<td>28</td>
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</tbody>
</table>

Requirements for Admission to Upper Division Courses in Biology

For admission to upper division (numbered 300 or higher) Biology (BIOB, BIOE, BIOM), and Fish and Wildlife Management (WILD) courses, students must have completed at least 45 total university credits with a cumulative GPA of at least 2.5 for all courses and have also earned a “C-” or better for any prerequisite courses. Limited exceptions may be made by consent of instructor. Any student who obtains enrollment in an upper division biology course without satisfying these requirements will be required to withdraw from the course. Specific courses may have additional prerequisites.
Natural Resources and Rangeland Ecology

Note: MSU’s programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology. For additional options see Biological Sciences (p. 82) at MSU.

Department of Animal and Range Sciences
http://animalrange.montana.edu/

Students who complete the requirements for a B.S. degree in Natural Resources and Rangeland Ecology in the Department of Animal and Range Sciences will be eligible for a variety of natural resource jobs with state and federal agencies or private industries or will be eligible to pursue a Master of Science degree. The two options available within this degree offer students an opportunity to study the interaction of livestock and wildlife and their rangeland habitats. Emphasis is placed on soil, water and vegetation attributes which influence habitat ecology and management for livestock and wildlife. The curriculum in both these options has been designed to allow students to score at the highest level for employment with federal agencies. We are professionally accredited by the Society for Range Management.

Rangeland Ecology and Management Option
This option is designed to emphasize management of rangeland environments. Courses in resource inventory, watershed, rangeland restoration and vegetation ecology are required to give the student a background in ecological principles used to manage rangelands in the western United States. Students in this option can select courses which focus on production agriculture or other natural resource areas. This option is designed to train students for employment with state or federal land management agencies, as well as private industry or graduate school.

Wildlife Habitat Ecology and Management Option
This option provides students with a broad based background in wildlife habitat, rangeland ecology, and wildlife-livestock interactions common in the western United States. The focus will be on wildlife habitat, major vegetation types, rangeland livestock production, soils, and water within the framework of total resource management. Habitat management under a variety of uses and goals will be discussed. Courses specifically designed for this option include classes in wildlife habitat ecology, habitat restoration, wildlife-livestock habitat issues and wildlife-livestock nutrition. Students who graduate with a degree in this option will be eligible for employment in private industry, state and federal land agencies, or to pursue a Master of Science degree.

Undergraduate Programs
- Rangeland Ecology and Management Option (p. 96)
- Wildlife Habitat Ecology and Management Option (p. 97)
- Natural Resources and Rangeland Ecology Minor (Non-Teaching) (p. 96)

### Natural Resources and Rangeland Ecology Minor (Non-Teaching)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>NRSM 101</td>
<td>Natural Resource Conservation</td>
<td>3</td>
</tr>
<tr>
<td>NRSM 102</td>
<td>Montana Range Plants</td>
<td>1</td>
</tr>
<tr>
<td>BIOO 230</td>
<td>Identification of Seed Plants</td>
<td>4</td>
</tr>
<tr>
<td>NRSM 350</td>
<td>Vegetation of Western Wildlands</td>
<td>3</td>
</tr>
<tr>
<td>NRSM 351</td>
<td>Biomes of Western Wildlands</td>
<td>2</td>
</tr>
<tr>
<td>AGSC 454</td>
<td>Agrostology</td>
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Rangeland Ecology and Management Option

<table>
<thead>
<tr>
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<th>Course Title</th>
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<tr>
<td>NRSM 240</td>
<td>Natural Resource Ecology</td>
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<tr>
<td>NRSM 353</td>
<td>Grazing Ecology and Management</td>
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</tr>
<tr>
<td>NRSM 453</td>
<td>Habitat Inventory and Analysis</td>
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<tr>
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</table>

Take two of the following:  
- WILD 325 Wildlife-Livestock Nutrition  
- NRSM 455 Riparian Ecology & Management  
- NRSM 330 Fire Ecology and Mgmt  
- WILD 438 Wildlife Habitat Ecology  
- WILD 355 Wildlife and Livestock Habitat Restoration  
- WILD 426 Wildlife Habitat Management  

Total Credits 31

A Natural Resources and Rangeland Ecology Minor does not meet qualifications for professional employment with federal agencies.

All students are responsible for meeting prerequisites for upper division courses.

### Rangeland Ecology and Management Option

#### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>NRSM 101</td>
<td>Natural Resource Conservation</td>
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</tr>
<tr>
<td>NRSM 102</td>
<td>Montana Range Plants</td>
<td>1</td>
</tr>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
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<td>CHMY 121IN</td>
<td>Introduction to General Chemistry</td>
<td>4</td>
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<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>ANSC 100</td>
<td>Introduction to Animal Science</td>
<td>3</td>
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<tr>
<td>BIOB 160</td>
<td>Principles of Living Systems</td>
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<td>AGED 140US</td>
<td>Leadership Dev For Agriculture</td>
<td>3</td>
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<tr>
<td>or COMX 111US</td>
<td>Introduction to Public Speaking</td>
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#### Sophomore Year

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<th>Course Title</th>
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<tbody>
<tr>
<td>NRSM 235</td>
<td>Range and Pasture Monitoring</td>
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<tr>
<td>NRSM 240</td>
<td>Natural Resource Ecology</td>
<td>3</td>
</tr>
<tr>
<td>AGSC 342</td>
<td>Forages</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 245IN</td>
<td>Soils</td>
<td>3</td>
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<tr>
<td>Choose one of the following:</td>
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<tr>
<td>BMGT 205</td>
<td>Prof Business Communication</td>
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<tr>
<td>WRIT 201</td>
<td>College Writing II</td>
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<td>WRIT 221</td>
<td>Intermediate Tech Writing</td>
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#### Credits

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<tbody>
<tr>
<td>Freshman</td>
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<td>13</td>
</tr>
<tr>
<td>Sophomore</td>
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<td>15</td>
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<tr>
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<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGSC 454</td>
<td>Agrostology</td>
<td>3</td>
</tr>
<tr>
<td>or BIOO 435</td>
<td>Plant Systematics</td>
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</tr>
<tr>
<td>NRSM 240</td>
<td>Natural Resource Ecology</td>
<td>3</td>
</tr>
<tr>
<td>NRSM 353</td>
<td>Grazing Ecology and Management</td>
<td>3</td>
</tr>
<tr>
<td>NRSM 453</td>
<td>Habitat Inventory and Analysis</td>
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<tr>
<td>WILD 325</td>
<td>Wildlife-Livestock Nutrition</td>
<td>6</td>
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<tr>
<td>WILD 438</td>
<td>Wildlife Habitat Ecology</td>
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<tr>
<td>WILD 355</td>
<td>Wildlife and Livestock Habitat Restoration</td>
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<tr>
<td>WILD 426</td>
<td>Wildlife Habitat Management</td>
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</tr>
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#### Credits

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
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Natural Resources and Rangeland Ecology Minor (Non-Teaching)

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<td>BIOO 230</td>
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<td>NRSM 351</td>
<td>Biomes of Western Wildlands</td>
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<td>AGSC 454</td>
<td>Agrostology</td>
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## Junior Year

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<td>GPHY 284</td>
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<td>Grazing Ecology and Management</td>
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## Senior Year

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<td>Riparian Ecology &amp; Management</td>
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<td>Range &amp; Wildlife Policy and Planning</td>
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Total Program Credits: 120

### Restricted Electives (Select six credits)

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<td>Animal Nutrition</td>
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<td>ANSC 337</td>
<td>Disease of Domestic Livestock</td>
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<td>ERTH 101IN</td>
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<td>Holistic Thought/Mgmt</td>
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### Wildlife Habitat Ecology and Management Option

#### Freshman Year

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<td>Natural Resource Conservation</td>
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<td>Montana Range Plants</td>
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<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
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<td>CHMY 121IN</td>
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<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
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#### Sophomore Year

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<td>College Writing II</td>
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<td>Intermediate Tech Writing</td>
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<td>Wildlife and Livestock Habitat Restoration</td>
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<td>GPHY 284</td>
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<td>Range &amp; Wildlife Policy and Planning</td>
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#### Senior Year

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<tr>
<td>NRSM 453</td>
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resources and preserve the delicate balance in the agroecosystem. To increase production, but at the same time conserve our soil and water resources, we must implement crop and soil management schemes that maintain and enhance our soil, water, and other finite resources. The challenge for crop scientists and agricultural researchers is to develop sustainable practices that can meet the food and fiber needs of the future of humankind. Yet increased production places increased pressure on our soil, water, and other natural resources. Continued increases in food and fiber crop production are essential for the health and well-being of the global population.

Each student works closely with a faculty advisor to formulate a program of study that is appropriate with the student’s career goals and also fits into the College of Agriculture and Forestry. Faculty members who advise students and teach courses are also active researchers in their respective disciplines. Students learn current knowledge and technology through formal course work and gain valuable first-hand experience in departmental laboratories, greenhouses, and field research farms. Students are encouraged to gain additional learning experiences outside the classroom by working as research assistants in faculty programs, summer jobs, and internships with private industry and government agencies.

Crop Science

Continued increases in food and fiber crop production are essential for the future of humankind. Yet increased production places increased pressure on our soil, water, and other finite resources. The challenge for crop scientists is to develop sustainable practices that maintain and increase production, but at the same time conserve our soil and water resources and preserve the delicate balance in the agroecosystem.

Course requirements in the Crop Science option are designed to acquaint students with the principles underlying crop and soil management. Thus soil fertility, plant physiology, crop production, crop breeding, and pest management, along with courses in the biological and physical sciences are included in this area of study.

Graduates from this option find careers in farming and ranching; as crop production specialists; in pest management; in seed, fertilizer, and chemical industries; with banks and other lending institutions; Cooperative Extension Service and with a government agency such as the Natural Resource Conservation Service.

Plant Biology Option

Plant biology provides a broad education in the plant sciences. The expertise of the Plant Sciences faculty provides an opportunity to focus at the cellular and molecular level, but opportunities also exist for emphasis in plant ecology and systematics. Course requirements include beginning and advanced courses in biology, microbiology, biochemistry, physiology, genetics, plant development, ecology, and systematics.

Graduates are prepared for post-graduate school, and academic and professional careers.

Undergraduate Programs

- Crop Science Option (p. 98)
- Plant Biology Option (p. 99)
- Plant Biotechnology Option (p. 85)

Undergraduate Minor

- Genetics Minor (Non-Teaching) (p. 95)

Graduate Programs

- Plant Sciences and Plant Pathology (p. 301)

Crop Science Option

Freshman Year

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<tr>
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<td>Principles of Biological Diversity</td>
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<td>BIOB 160</td>
<td>Principles of Living Systems</td>
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<td>CHMY 121IN</td>
<td>Introduction to General Chemistry</td>
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<td>CHMY 123</td>
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Year Total: 30

Sophomore Year

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<td>BIOO 262IN</td>
<td>Introduction to Entomology</td>
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<td>Soils</td>
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<td>BIOB 110CS</td>
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Total Program Credits: 120

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. University core requirements must be completed.

### Plant Science

Note: MSU’s programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology. For additional options see Biological Sciences (p. 82) at MSU.

#### Department of Plant Sciences and Plant Pathology

http://plantsciences.montana.edu/

Plant Science involves a thorough background in the liberal arts and a comprehensive understanding of the scientific principles underlying plant sciences. Plant systems are the fundamental basis for life on earth and are also a major contributor to the economy. Modern plant science encompasses many areas, impacting such diverse interests as agriculture, biotechnology, and recreational land management.

Faculty members who advise students and teach courses are also active researchers in their respective disciplines. Students learn current knowledge and technology through formal course work and gain valuable first-hand experience in departmental laboratories, greenhouses, and field research farms. Students are encouraged to gain additional learning experiences outside the classroom by working as research assistants in faculty programs, summer jobs, and internships with private industry and government agencies.

Each student works closely with a faculty advisor to formulate a program of study that is appropriate with the student’s career goals and also fits into either the Crop Science or Plant Biology options.

### Crop Science Option

Continued increases in food and fiber crop production are essential for the future of humankind. Yet increased production places increased pressure on our soil, water, and other finite resources. The challenge for crop scientists is to develop sustainable practices that maintain and increase production, but at the same time conserve our soil and water resources and preserve the delicate balance in the agroecosystem.
## STAT 216Q - Introduction to Statistics

University Core and Electives 6

**Year Total:** 24

### Junior Year

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<td>AGSC 356</td>
<td>Plant Nutrition and Soil Fertility Management</td>
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<td>ENSC 443</td>
<td>Weed Ecology and Management</td>
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<td>BIOM 421</td>
<td>Concepts of Plant Pathology</td>
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<td>BGEN 242D</td>
<td>Intro to Inf l Business</td>
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<td>Plant Breeding &amp; Genetics</td>
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<td>Livestock Feeding</td>
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<td>ANSC 215</td>
<td>Calving Management</td>
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<td>Livestock in Sustain Systems</td>
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<td>Spatial Sci Tech &amp; Application</td>
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<td>Turfgrass Management</td>
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A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

## Plant Biology Option

### Freshman Year

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<td>WRIT 101W</td>
<td>College Writing I</td>
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<td>M 161Q</td>
<td>Survey of Calculus</td>
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### Sophomore Year

<table>
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<tbody>
<tr>
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<td>General Botany</td>
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<td>CHMY 211</td>
<td>Elements of Organic Chemistry</td>
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<td>PHSX 205</td>
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### Junior Year

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<tr>
<td>BIOB 377</td>
<td>Practical Genetics</td>
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<td>BGEN 242D</td>
<td>Intro to Inf l Business</td>
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<tr>
<td>CHMY 380</td>
<td>Biochemistry</td>
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### Senior Year

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<tr>
<td>BIOB 420</td>
<td>Evolution</td>
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<tr>
<td>BIOO 433</td>
<td>Plant Physiology</td>
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<tr>
<td>BIOB 490R</td>
<td>Undergraduate Research</td>
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<tr>
<td>University Core and Electives</td>
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</tbody>
</table>

### Additional Requirements:

A minimum of 20 credits of advisor-approved plant biology electives must be taken, at least 16 of which must be upper division. Up to 7 total credits may be included from BIOB/HORT 492, and BIOB/HORT 498 courses. Electives could come from any plant biology courses in the Plant Sciences and Plant Pathology Department (e.g., AGSC 454–Agrostology, BIOO 435–Plant Systematics, BIOO 437–Plant Development, BIOO 458–Plant Cell Physiology), other plant courses in the Plant
Pre-Veterinary Curriculum

MSU offers pre-veterinary coursework and advising for students interested in pursuing admission into any school or college of veterinary medicine. MSU’s pre-veterinary curriculum is not a degree-granting option on the MSU campus. Rather, it is an advising program and a series of required undergraduate classes that prepare students for admission into schools of veterinary medicine. The Pre-Veterinary Intake major is supported through the College of Agriculture, and we offer several resources to students who are interested in attending a veterinary medical program after their MSU baccalaureate careers. MSU’s College of Agriculture and College of Letters and Science have pre-vet advisors available who work with students as they prepare to apply for admission to schools of veterinary medicine.

The State of Montana does not have a college of veterinary medicine. However, Montana State University participates in the WIMU Regional Program in Veterinary Medicine, a cooperative program offered through Washington State University’s College of Veterinary Medicine. The program’s first year of study is on the WSU campus, with the next three years of study housed in Pullman, on the Washington State University campus. Montana currently supports ten students through this program. Montana residents may also compete for admission to veterinary school through a contract agreement with WICHE (Western Interstate Commission for Higher Education). Information on the current status of this program in Montana may be obtained by contacting the Commissioner for Higher Education Office in Helena, MT.

MSU Pre-Veterinary Course Requirements

This outline is designed to qualify students to apply to the WIMU program; carefully read all information on required courses, and if you have any questions about qualifying for admission to a veterinary medicine program, please contact your academic advisor(s).

1. Chemistry *
   - CHMY 141 College Chemistry I
   - CHMY 143 College Chemistry II
   - CHMY 211 Elements of Organic Chemistry
     or CHMY 321 Organic Chemistry I
     & CHMY 322 Organic Chemistry II
   - BCH 380 Biochemistry

   For students without a strong background in chemistry, consider taking CHMY 121IN as a preparatory course before taking CHMY 141. This is not usually done, but it is an option. CHMY 121IN is not required for the pre-veterinary curriculum and does not count as an elective. Some undergraduate degree curricula may require CHMY 321 and CHMY 323 or equivalent; these will substitute for CHMY 211 for all vet schools.

   *Includes appropriate labs.

2. Biology
   - BIOB 160 Principles of Living Systems
     or BIOB 260 Cellular and Molecular Biology
   - BIOB 170IN Principles of Biological Diversity
   - BIOB 375 General Genetics
     or ANSC 322 Principles of Animal Breeding and Genetics

3. Mathematics
   - M 161Q Survey of Calculus

   The math requirement changes frequently, but all science degrees require M 161Q.

4. Statistics
   - STAT 216Q Introduction to Statistics

5. Physics
   - PHSX 205 College Physics I

6. English
   - WRIT 101W College Writing I
   - COMX 111US Introduction to Public Speaking

7. Electives
   - WSU requires 27 General Education requirements and electives. The general education requirements concern only those students who have not obtained a B.S. degree before entering the professional program.

8. Recommended Electives
   - Remaining electives are recommended to be in Biotechnology/Animal System, Animal Science, Biology, Microbiology, Chemistry, Business courses, or possibly other areas. Electives should be used to obtain credits in the curriculum chosen for a degree. Once a degree curriculum is decided on, proper selection of electives may make it easier to complete the pre-veterinary requirements and degree requirements simultaneously.

Veterinary School Course Reverse Transfer

Pre-veterinary students are strongly encouraged to complete a Bachelor’s degree before enrolling in a College of Veterinary Medicine. Bachelor’s degrees are necessary for graduation from some veterinary schools. Baccalaureate degrees are usually required for entrance to graduate schools, so if the student intends to pursue a graduate degree after completing veterinary school, the lack of a bachelor’s degree is prohibitive. Additionally, certain scholarships or fellowships require the applicant to have an undergraduate degree. However, a completed baccalaureate degree is not required for admission to many of the 33 accredited Veterinary Schools in the United States. Montana State University developed a reverse-transfer process for those students who chose to begin their Veterinary Medicine studies before completing their Bachelor’s degree.

This procedure provides a standardized process whereby veterinary students who have not completed their MSU undergraduate degrees are able to use up to 15 veterinary school course credits for reverse-transfer back to MSU to complete the baccalaureate degrees. Each reverse-transferred course may be used towards fulfillment of a single requirement (i.e., double-counting is not allowed).

Reverse-transfer courses are graduate (veterinary school) courses transferred back to MSU to complete a degree at MSU. This process may be used by veterinary school students from any department that files the appropriate paperwork to be posted to the Registrar’s Office website. Note that it is the student’s responsibility to complete the required procedures and all paperwork according to the specified deadlines.

Qualifications
MSU students desiring to follow this plan must meet the following qualifications:

1. The student must have a minimum of 105 undergraduate credits posted to their MSU transcript prior to reverse transfer of Veterinary School credits. Of those 105 credits:
   - All general education requirements (e.g., Core 2.0) must be complete.
   - No more than 15 other upper-division credits may be substituted by reverse-transfered courses.
   - Grades in courses counting toward degree requirements must meet established grade requirements, typically C- or better, or P for Veterinary School courses if they are only offered as Pass/Marginal/Fail or Pass/Fail.
   - All department-specified required courses (as applicable) for each degree must be completed.
   - Reverse-transfer courses can substitute for up to 15 department-specified courses to fulfill degree requirements. All courses selected to be eligible for fulfillment by reverse-transfer courses must be preapproved by the department and will be maintained on file at the Registrar’s Office and in the departmental office.

Procedure

2. Prior to their last date of course enrollment at MSU, students must submit a Petition to Reserve Veterinary School Courses for Reverse-Transfer indicating the student’s intent to use Veterinary School courses to complete their MSU baccalaureate degree requirements. The petition will identify the department-preapproved courses for which reverse-transfer courses will be substituted. The petition must be approved by the academic advisor, Department Certifying Officer, College Dean’s Office, and Registrar. Petitions should be submitted at the time of acceptance to an accredited veterinary medical program/school.

3. The student can apply for completion of their undergraduate degree requirements (using reverse-transfer courses) only after the first year of veterinary school has been completed. This would most commonly occur during the next fall semester but may occur later as well. The following steps are required:
   - File an “Intent to Register” Form, making sure to declare the degree specified above in the reverse-transfer petition (see item 2), with the Registrar’s Office by the established deadline in the semester prior to the intended term of graduation (October 1st for graduation in spring, March 1st for graduation in summer or fall).
   - Complete an Application for Baccalaureate Degree and submit this application with the graduation fee required of all graduating students. The deadlines for graduation application are the same as those for the “Intent to Register” (October 1st for graduation in spring, March 1st for graduation in summer or fall).
   - Register for credit in absentia (prior to the 10th day of class of the intended graduation term).
   - Have an official copy of their veterinary school transcript submitted to Montana State University - Office of the Registrar once the required courses have been completed.

Policy Considerations

This reverse-transfer policy has been approved by the faculty senate and adherence to the procedures herein circumvent the need for a Graduation and Admissions Review Committee (GARC) petition in relation to the following graduation standards:

- The residency requirement that 23 of a student’s last 30 credits be completed through MSU.
- The 9-credit limit on reservation-of-credit when using graduate-level courses for an undergraduate degree.
- The 12-credit limit as to applicability of Pass/Fail courses used toward undergraduate degree requirements.
- The use of Pass/Fail courses for degree requirements.

The need for these exceptions varies depending upon the given veterinary school and their embedded grading policies.

Sustainable Food & Bioenergy Systems

The Sustainable Food and Bioenergy Systems (SFBS) program offers an interdisciplinary, hands-on curriculum focused on the ecological, cultural, economic, and health aspects of food and bioenergy systems from production through consumption. The degree plan is intended to prepare and motivate students as agents of change to address society’s most pressing food and bioenergy issues towards sustained environmental and human well-being. Students of the program are provided with broad interdisciplinary training founded on a core SFBS curriculum while gaining disciplinary training by selecting one of four program options housed in either the College of Agriculture, or the College of Education, Health and Human Development: (1) Sustainable Food Systems, (2) Agroecology, (3) Sustainable Crop Production and, (4) Sustainable Livestock Production. The SFBS program seeks to enhance students’ practical and critical thinking skills to approach food systems through service-based learning internships, hands-on production, training on research methods, independent and group projects, story-telling, and community engagement. Students must receive a grade of “C” or higher in all required courses as outlined in the major.

Agroecology Option (p. 157)—Department of Land Resources and Environmental Sciences

Agroecology explores how crops and pest organisms interact with their environment, and the application of technology to efficiently and sustainability produce crops. Agroecology focuses on application of population principles and community ecology, environmental science, and cropland ecosystems. The curriculum is based on the philosophy that to be able to successfully predict management outcomes and thus make informed recommendations, one must understand fundamental principles of evolution, ecology, soil science, agronomy, and pest management.

The curriculum originates from a base in biological science which includes a broad knowledge of organisms (including plants, animals and microorganisms), and the physical and chemical characteristics of environments. In the Agroecology curriculum, students will develop a knowledge of the diversity of organisms and how they interact in natural and managed ecosystems. Furthermore, the curriculum will build on this knowledge in courses that demonstrate the application of ecology and environmental science principles. Students will also learn how new technologies like remote sensing and geographic information systems are modernizing agriculture. In later stages of the curriculum, students may select from an array of upper division courses in natural ecosystems, cropping systems, pest management, applied ecology, soil and water science, biochemistry, and policy and planning courses that enable them to specialize in food or bioenergy-related areas best suited to their own career vision.

Career Opportunities

Graduates from this option find careers in environmental industries and consulting firms that solve problems associated with agroecosystems or agricultural practices; government jobs in environmental management and policy making; agricultural industry positions associated with precision agriculture, pest management, general agronomy, and information services. Students will be prepared for graduate training that leads to independent research in basic and applied ecology, environmental biology, cropping
systems, precision agriculture, ecologically-based pest management, weed science, or agricultural entomology (pest management science).

**Sustainable Crop Production Option (p. 158)—Department of Plant Sciences and Pathology**
Where does our food come from? Are there ways to sustainably maintain production levels and yet protect our natural resources? Is it possible to improve the quality and nutrition of our food supply? Are local food systems viable alternatives to corporate agricultural production? Can crops grown for bioenergy production reduce our use of fossil fuels and lessen carbon dioxide emissions? The answers to these questions and many more are discovered by students in the Sustainable Crop Production option. The curriculum is designed to train students in a broad range of principles and practices in sustainable crop production, including agronomy, soil fertility, plant genetics, plant physiology, greenhouse production, plant propagation, integrated pest management, and small business management. Both large- and small-scale food and bioenergy production systems are examined.

**Career Opportunities**
Graduates from this option find careers in conventional and organic farming; as crop production specialists and consultants; in pest management; in seed, fertilizer, and chemical industries; with banks and other lending institutions; and as managers of CSAs and local food organizations. Other career opportunities exist in the Extension Service, state and federal agencies, and private or nonprofit organizations.

**Sustainable Food Systems Option (p. 159)—Department of Health and Human Development**
The Sustainable Food Systems option trains students in the natural and social sciences to evaluate and mitigate outcomes of complex interactions in the food system for human health and nutrition. This option focuses on the interconnections between production, policy, food security, and health. Courses in this option provide disciplinary foundation in food and nutrition while providing an interdisciplinary framework that draws from ecology, environmental sciences, plant biology and chemistry, anthropology, sociology, economics, family and consumer sciences, and political science. Students develop practical and critical thinking skills through hands-on experience in service-based learning internships, organic farming, culinary fundamentals and management, training on research methods, and carrying out research projects in surrounding communities. Previous service-based learning experiences in this option have involved assessment of food access and food quality in health disparate communities. Previous service-based learning experiences in this option have involved assessment of food access and food quality in health disparate communities. Previous service-based learning experiences in this option have involved assessment of food access and food quality in health disparate communities. Previous service-based learning experiences in this option have involved assessment of food access and food quality in health disparate communities. Previous service-based learning experiences in this option have involved assessment of food access and food quality in health disparate communities. Previous service-based learning experiences in this option have involved assessment of food access and food quality in health disparate communities. Previous service-based learning experiences in this option have involved assessment of food access and food quality in health disparate communities.

**Career Opportunities**
Graduates from this option are prepared for careers in both the production and allied industries associated with animal agriculture. Graduates will also be prepared for opportunities in extension and graduate work.

**Undergraduate Programs**
- Agroecology Option (p. 102)
- Sustainable Food Systems Option (p. 159)
- Sustainable Crop Production Option (p. 103)
- Sustainable Livestock Production Option (p. 104)

**Agroecology Option**

### Land Resources and Environmental Sciences

**Freshman Year**

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<th>Course Title</th>
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<tr>
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<td>Land Resources and Environmental Sciences</td>
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<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
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<td>M 121Q</td>
<td>College Algebra</td>
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<td>WRIT 101W</td>
<td>College Writing I</td>
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<tr>
<td>SFBS 146</td>
<td>Introduction to Sustainable Food and Bioenergy Systems</td>
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<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
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<tr>
<td>BIOB 110CS</td>
<td>Introduction to Plant Biology</td>
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<tr>
<td>CHMY 141</td>
<td>- College Chemistry I</td>
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<td>University Seminar (US Core)</td>
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**Year Total:**

30-31

**Sophomore Year**

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<td>CHMY 143</td>
<td>- College Chemistry II</td>
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<td>ENSC 245IN</td>
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<td>CHMY 123</td>
<td>- Introduction to Organic Chemistry and Biochemistry</td>
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<td>ENSC 210</td>
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<td>GPHY 284</td>
<td>Intro to GIS Science &amp; Cartog</td>
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<td>NUTR 221CS</td>
<td>Basic Human Nutrition</td>
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<td>NUTR 226</td>
<td>Food Fundamentals</td>
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<td>SFBS 298</td>
<td>Internship</td>
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<td>SFBS 296</td>
<td>Practicum: Towne’s Harvest</td>
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**Year Total:**

30-31

**Junior Year**

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<tr>
<td>BIOB 318</td>
<td>Biometry</td>
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<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
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</table>
Choose one of the following: 3
   NRSM 240 - Natural Resource Ecology
   BIOE 370 - General Ecology (equiv to 270)
   ENSC 353 - Environmental Biogeochemistry
   NUTR 351 - Nutrition and Society
   SFBS 327 - Measure Innovation in Food Sys
   AGSC 341 - Field Crop Prod
Choose one of the following: 3-4
   BIOO 433 - Plant Physiology
   SFBS 429 - Small Business and Entrepreneurship in Food and Health
   SFBS 466 - Food System Resilience, Vulnerability and Transformation

University Core and Electives 9

Year Total: 30-31

Senior Year Credits
Choose two of the following: 6
   AGSC 401 - Integrated Pest Management
   AGSC 428 - Cropping Systems and Sustainable Ag
   BIOM 421 - Concepts of Plant Pathology
   ENSC 443 - Weed Ecology and Management
Choose one of the following: 3
   BIOE 455 - Plant Ecology
   BIOE 452 - Soil & Environmntl Microbiology
   ENSC 468 - Ecosystem Biogeochem and Global Change
   SFBS 498 - Internship
   SFBS 499 - Senior Thesis/Capstone
University Core and Electives 15

Year Total: 30

Total Program Credits: 120

**Directed Electives**

Each student shall work closely with their faculty advisor to plan an integrated set of directed elective courses appropriate to their academic, professional and personal goals.

Take 12 credits of the following:
   AGSC 342 - Forages 3
   ANSC 222 - Livestock in Sustain Systems 3
   BIOB 375 - General Genetics 3
   BIOE 370 - General Ecology (equiv to 270) 3
   BIOE 375 - Ecological Responses to Climate Change 3
   BIOM 360 - General Microbiology 5
   ECNS 132 - Econ & the Environment 3
   ENSC 410R - Biodiversity Survey and Monitoring Methods 3
   GPHY 384 - Adv GIS and Spatial Analysis 3
   GPHY 484R - Applied GIS & Spatial Analysis 3
   HORT 337 - Vegetable Production 3
   HORT 345 - Market Gardening 3
   NASA 415 - Native Food Systems 3
   NUTR 301 - Food and Culture 3
   NUTR 491-001 - Farm-to-Market 3
   PSCI 436 - Politics of Food & Hunger 3
   SFBS 346 - Sustainable Food and Bioenergy Systems Summer Field Course 2
   SFBS 429 - Small Business and Entrepreneurship in Food and Health (if not taken above) 3
   SFBS 445R - Culinary Marketing: Farm/Table 3
   SFBS 451R - Sustainable Food Systems 3
   SFBS 466 - Food System Resilience, Vulnerability and Transformation (if not taken above) 3

A minimum of 120 credits is required for graduation, 42 of which must be numbered 300 and above.

Each student shall work closely with their faculty advisor to plan an integrated set of elective courses appropriate to their academic and professional goals.

Because some of our courses are offered during alternate years, the proposed scheduling of courses in junior and senior years may need to be modified. Work with your advisor to determine an individual schedule.

A minimum of 120 credits is required for graduation; at least 42 of these credits must be in courses numbered 300 and above.

**Sustainable Crop Production Option**

**Plant Sciences and Plant Pathology**

**Freshman Year**

 SFBS 146 - Introduction to Sustainable Food and Bioenergy Systems 3
   BIOB 170IN - Principles of Biological Diversity 4
   ECNS 101IS - Economic Way of Thinking 3
   BIOB 110CS - Introduction to Plant Pathology 3
   ENSC 110 - Land Resources and Environmental Sciences 3
   ENSC 245IN - Soils 3
   Select one of the following: 4
      CHMY 121IN - Introduction to General Chemistry
      CHMY 141 - College Chemistry I
   Select one of the following: 3
      M 105Q - Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts)
      M 121Q - College Algebra
University Core and Electives 4

Year Total: 30

**Sophomore Year**

 Select one of the following: 3
   SFBS 296 - Practicum: Towne’s Harvest
   SFBS 298 - Internship
Select one of the following: 3
   NASX 232D - MT Indians: Cultures, Histories, Current Issues
   PSCI 230D - Introduction to International Relations
Select one of the following: 3
   STAT 216Q - Introduction to Statistics
Select one of the following: 3
   AGBE 210IS - Economics of Ag Business
### Sustainable Livestock Production Option

#### Animal and Range Sciences

**Freshman Year**

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<th>Course Title</th>
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<tr>
<td>ANSC 100</td>
<td>Introduction to Animal Science</td>
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<tr>
<td>NRSM 101</td>
<td>Natural Resource Conservation</td>
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<tr>
<td>NRSM 102</td>
<td>Montana Range Plants</td>
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<td>SFBS 146</td>
<td>Introduction to Sustainable Food and Bioenergy Systems</td>
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<td>BIOL 100</td>
<td>Principles of Living Systems</td>
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<td>CHMY 121</td>
<td>Introduction to General Chemistry</td>
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<td>ENSC 110</td>
<td>Lnd Res Environ Sciences</td>
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<td>BIOL 110</td>
<td>Introduction to Plant Biology</td>
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<td>WRIT 101</td>
<td>College Writing I</td>
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<td>COMX 111</td>
<td>Introduction to Public Speaking (formerly COM 110US)</td>
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<td>AGED 140</td>
<td>Leadership Dev For Agriculture</td>
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**Sophomore Year**

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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ANSC 222</td>
<td>Livestock in Sustain Systems</td>
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<td>CHMY 123</td>
<td>Introduction of Organic Chemistry and Biochemistry</td>
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<td>NUTR 221</td>
<td>Basic Human Nutrition</td>
<td>3</td>
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<tr>
<td>ENSC 245</td>
<td>Soils</td>
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<tr>
<td>ANSC 265</td>
<td>Anatomy and Physiology of Domestic Animals - Lecture</td>
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<tr>
<td>ANSC 266</td>
<td>Anatomy and Physiology of Domestic Animals - Lab</td>
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**Junior Year**

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<th>Course Title</th>
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<tr>
<td>ANSC 210</td>
<td>Economics of Ag Business</td>
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<td>ANSC 316</td>
<td>Meat Science</td>
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<td>ECHM 205</td>
<td>Energy and Sustainability</td>
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<td>Year Total</td>
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**Senior Year**

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<tr>
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<td>ECNS 101</td>
<td>Economic Way of Thinking</td>
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<tr>
<td>STAT 216</td>
<td>Introduction to Statistics</td>
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</table>

**University Core and Electives**

**Year Total:** 122-132
College of Arts and Architecture

Dr. Royce Smith, Ph.D., Dean

Undergraduate Programs Available:

- B.A. and B.F.A. in Art (p. 105)
- B.A. in Environmental Design (p. 115)
- B.A. and B.F.A. in Film and Photography (p. 118)
- B.A. in Music (p. 120)
- B.A. in Music Technology (p. 122)
- Bachelor of Music Education (p. 123)

The College of Arts & Architecture includes the School of Architecture, the School of Art, the School of Film & Photography, and the School of Music. Shakespeare in the Parks, a theatre outreach performance company, is also affiliated with the College. The College houses the offices and production studios of Montana Public Broadcasting System and MSU’s public television station, KUSM. The curriculum provides for baccalaureate degree programs with majors in Architecture (Environmental Design), Studio Art (Ceramics, Jewelry and Metalsmithing, Painting and Drawing, Printmaking, and Sculpture), Graphic Design, Art History, Art Education K-12 Broadfield Option, Film, Photography, Integrated Lens-Based Media, Music, Music Technology and Music Education.

A Master of Architecture, Master of Arts in Art History, Master of Fine Arts in Art and Master of Fine Arts in Science and Natural History Filmmaking degrees are offered at the graduate level.

All College of Arts & Architecture students take a spectrum of humanities and science courses to provide depth and substance to their artistic explorations, as well as foundational coursework in their first year of study.

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Art

The School of Art is committed to making available the best possible faculty, curriculum, facilities, and experiences for a professional education in the studio arts, graphic design, art education and art history. On both the undergraduate and graduate levels, the School seeks to prepare students for careers in the visual arts and to enrich the cultural lives of all University students. Additionally, the School recognizes its responsibility to serve as a cultural resource for the community, state, and nation.

The School of Art, fully accredited by the National Association of Schools of Arts and Design, was established in 1893 and its first graduate degree was conferred in 1932. As an academic department of the University, the School of Art is a subdivision of the College of Arts and Architecture and is allied with the School of Architecture, School of Film & Photography and the School of Music.

The School’s faculty is composed of practicing artists, designers, and scholars, each teaching in the particular discipline of his or her professional involvement. The regular faculty is augmented by graduate teaching assistants, adjuncts and by visiting artists/scholars who are part of an active program of lectures, workshops, and critiques supported by the National Endowment for the Arts, the Montana Arts Council, the Associated Students of Montana State University, and the MONT’S Speakers Program. The Helen E. Copeland Gallery located in Haynes Hall, and the Waller-Yobsons Gallery located in the Melvin Graduate Art Studios, display continuous exhibitions covering all aspects of the visual arts.

The curriculum is divided into eight areas of study: art history, ceramics, graphic design, jewelry and metalsmithing, painting, drawing, printmaking, and sculpture. Curricula within these areas lead to the Bachelor of Fine Arts (BFA) in Graphic Design and Studio Arts, and the Bachelor of Arts (BA) in Art History, Art Education K-12 Broadfield, and Liberal Arts Studio. Minors are also available in Art History (non-teaching) and Art Education K-12 (available for teaching majors only). The graduate degrees offered are the Master of Fine Arts in Studio Art (MFA) and the Master of Arts in Art History (MA). For information on the Master of Fine Arts and Master of Arts degrees, consult the graduate section of this bulletin.

Admission to Art Programs

During the first year in the School of Art, students receive formative assessment of their work through the Foundations Advisory Portfolio meetings, helping prepare them for the remaining three year curriculum leading to the Bachelor of Arts in Liberal Studio Arts, the Bachelor of Arts...
in Art Education, the Bachelor of Fine Arts in Studio Arts and the Bachelor of Fine Arts in Graphic Design. Total enrollment in the program shall be limited by the teaching resources and space capacities of the School of Art. Spaces available each year will be awarded to those applicants with the greatest creative promise and highest scholastic achievement. While the School of Art does not accept Advanced Placement Studio Art credits to fulfill the foundations level courses the School does allow substitution of those credits for some 200 level studio courses.

Students transferring from other academic departments within the University may be required to take ARTZ 105RA, ARTZ 109RA & ARTZ 110RA regardless of prior coursework. Portfolio critique for transfer students will take place as needed depending on transfer credits and the program of study. Contact the School of Art for details.

BFA Admission to Studio Arts and Graphic Design

In the Studio Arts Option-BFA and Graphic Design Option-BFA a formative assessment is required for all students before admittance to 300/400 level courses. Prospective students who are transferring from similar programs at other institutions must also submit portfolios. Contact the School of Art for details and deadlines.

The curriculum for art majors is composed of both required and elective courses within the School, and supporting courses from the other schools and departments of the College of Arts and Architecture and the University. Students may be limited to two studio courses per semester based on space availability and teaching resources. Required courses outside of the School of Art have either specific application to the student’s particular concentration or general application to a liberal arts education. The purpose of the curriculum is to develop perceptual and technical skills and to establish a foundation of ideas which gives meaning and direction to this training. The many and varied departments within the University offer the art student a rich source of technical, philosophical, and scientific information.

Semester In Italy Program

Each spring the School of Art offers a semester of study in Italy. This program provides upper-level students with an enriching opportunity to participate in an intensive studio and art history experience by immersing participants in the art and culture of Italy. Course offerings vary from year to year. Please contact the School of Art for more information.

Internship Program

It is possible for students to earn academic credit while working outside of the University, employed by businesses, galleries, individual artists, craftspersons, designers, or other agencies through the School of Art’s Art and Design Internship Program. To be eligible, students must be art majors and be of junior standing. Further, all internships may need to be vetted by the School of Art and students must have the recommendation of their academic advisor and approval by the Director of the School of Art. Accepted students enroll for internship credits under ARTZ 498 and GDSN 498.

Computer Notebook Requirement

Laptop Computers with specific software are required for all upper level graphic design courses. Contact the School of Art for specifications.

GPA Requirement

Art majors must maintain a cumulative GPA of 2.5 or higher to remain in the curriculum.

Program Fee

Because of the unique nature of equipment and materials used in the School of Art, all majors are assessed an additional fee. Students in some courses will also be required to purchase additional materials on their own. Please inquire at the School of Art office for specific fees.

Undergraduate Programs

- Graphic Design Option - B.F.A (p. 110)
- Studio Arts Option - B.F.A (p. 113)
- Art Education K-12 Broadfield Option - B.A (p. 106)
- Art History Option - B.A. (p. 108)
- Liberal Arts Studio Option - B.A (p. 111)

Undergraduate Minors

- Art History Minor (Non-teaching) (p. 108)
- Art Education K-12 Minor (p. 107)

Graduate Programs

- M.F.A. in Art (p. 307)
- M.A. in Art History (p. 306)

Art Education K-12 Broadfield Option - B.A.

The Art Education K-12 Broadfield Major is designed for students who wish to become licensed to teach art in grades K-12. Upon completion of the degree, students are eligible for licensure in the state of Montana. Secondary education students are encourage to pursue a teaching minor in an additional content areas and should contact an advisor for details. Obtaining a teaching minor along with the major will require more than eight semesters. For more information on admission to the teacher Education Program, Student Teaching, Licensure, Professional Expectations and more, please visit: http://catalogmontana.edu/undergraduate/education-health-human-development/department-education/teacher-education-program/

Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ARTZ 105RA - Visual Language: Comprehensive Foundation</td>
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<td></td>
</tr>
<tr>
<td>ARTH 200IA - Art of World Civilization I</td>
<td>4</td>
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<tr>
<td>University Core and Electives</td>
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<tr>
<td>ARTZ 109RA - Visual Language - Drawing</td>
<td>3</td>
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<tr>
<td>ARTZ 110RA - Visual Language: Ideation and Creativity</td>
<td>4</td>
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<tr>
<td>ARTH 201IA - Art of World Civilization II</td>
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<tr>
<td>EDU 202 - Early Field Experience</td>
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<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
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Sophomore Year

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<tr>
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<tr>
<td>ARTZ 231RA - Ceramics I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTZ 251 - Sculpture I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTZ 261 - Metals I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTZ 271 - Printmaking I</td>
<td></td>
<td></td>
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<tr>
<td>EDU 211D - Multicultural Education</td>
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<td>University Core and Electives</td>
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<tr>
<td>ARTZ 211RA - Drawing I</td>
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</tr>
<tr>
<td>Art Studio-Beginning</td>
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<td></td>
</tr>
</tbody>
</table>
Choose one of the following:  
ARTZ 221 - Painting I  
ARTZ 231RA - Ceramics I  
ARTZ 251 - Sculpture I  
ARTZ 261 - Metals I  
ARTZ 271 - Printmaking I  
EDU 370 - Integrating Tech into Educ  

University Core and Electives  
Year Total: 14 15  

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>Credits</th>
<th>Fall</th>
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<td>Art Studio-Beginning</td>
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Choose one of the following:  
ARTZ 221 - Painting I  
ARTZ 231RA - Ceramics I  
ARTZ 251 - Sculpture I  
ARTZ 261 - Metals I  
ARTZ 271 - Printmaking I  
EDU 382 - Assessmt, Curric, lnstructn 3  
EDSP 306 - Exceptional Learners 3  
University Core and Electives 3  
Art Studio-Beginning  
Choose one of the following:  
ARTZ 221 - Painting I  
ARTZ 231RA - Ceramics I  
ARTZ 251 - Sculpture I  
ARTZ 261 - Metals I  
ARTZ 271 - Printmaking I  
Art History-Elective  
Choose one of the following:  
ARTH 302 - Survey of Ancient Art  
ARTH 312 - History of Decorative Arts  
ARTH 360 - History of Asian Art and Architecture  
ARTH 400 - Art and Architecture of Egypt  
ARTH 402 - Greek Art and Architecture  
ARTH 406 - Roman Art and Architecture  
ARTH 410 - Medieval Art  
ARTH 421 - Late Gothic Painting  
ARTH 422 - Early Renaissance to 15th Century Art  
ARTH 424 - High Renaissance and Mannerism  
ARTH 426 - Baroque Art in Italy and Southern Europe, 1600-1700  
ARTH 427 - Baroque Art in Northern Europe  
ARTH 430 - 19th Century Art  
ARTH 432 - Art in the Age of Revolution  
ARTH 438 - Beginnings of Modern Art  
ARTH 440 - 20th Century Art  
ARTH 451 - Contemporary Art  
EDU 397 - Methods 3  
EDU 408 - Professional Issues: K-12 2  
EDU 495R - Student Teaching 12  
Year Total: 16 14  
Total Program Credits: 122  

A minimum of 122 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.  

<table>
<thead>
<tr>
<th>Art Education K-12 Minor</th>
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<tbody>
<tr>
<td>ARTZ 105RA Visual Language - Drawing</td>
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<tr>
<td>ARTZ 109RA Visual Language: Comprehensive Foundation</td>
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</tr>
<tr>
<td>ARTZ 110RA Visual Language: Ideation and Creativity</td>
<td>4</td>
</tr>
<tr>
<td>ARTH 200IA Art of World Civilization I</td>
<td>4</td>
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</table>
**Art History Minor (Non-Teaching)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ARTH 200IA</td>
<td>Art of World Civilization I</td>
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<tr>
<td>ARTH 201IA</td>
<td>Art of World Civilization II</td>
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Choose one of the following:

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tr>
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<td>ARTZ 231RA</td>
<td>Ceramics I</td>
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<td>ARTZ 251</td>
<td>Sculpture I</td>
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<td>ARTZ 261</td>
<td>Metals I</td>
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<td>ARTZ 271</td>
<td>Printmaking I</td>
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Choose one of the following (must have taken 200 level prerequisite course):

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<th>Course</th>
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<td>ARTZ 322</td>
<td>Intermediate Painting</td>
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<td>ARTZ 332</td>
<td>Intermediate Ceramics</td>
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<td>ARTZ 352</td>
<td>Intermediate Sculpture</td>
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<td>ARTZ 361</td>
<td>Metals II</td>
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<tr>
<td>ARTZ 373</td>
<td>Intermediate Printmaking - Lithography</td>
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<td>ARTZ 374</td>
<td>Intermediate Printmaking - Serigraphy</td>
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<td>ARTZ 375</td>
<td>Intermediate Printmaking - Intaglio</td>
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<td>ARTZ 376</td>
<td>Intermediate Printmaking - Relief</td>
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<td>ARTZ 379</td>
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<td>Methods</td>
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<td>EDU 497</td>
<td>Methods</td>
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**Total Credits** 34

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**Art History Option - B.A.**

**Freshman Year**

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<tr>
<td>ARTZ 109RA</td>
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<td>ARTH 200IA</td>
<td>Art of World Civilization I</td>
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<tr>
<td>University Core and Electives</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ARTH 201IA</td>
<td>Art of World Civilization II</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTZ 110RA</td>
<td>Visual Language: Ideation and Creativity</td>
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<tr>
<td>Humanities Elective Requirement</td>
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<tr>
<td>Take one course from the English, History, Religious Studies or Philosophy Department.</td>
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<tr>
<td>University Core and Electives</td>
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**Year Total:** 15 15

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
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<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
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<tbody>
<tr>
<td>ARTZ 109RA</td>
<td>Visual Language: Comprehensive Foundation</td>
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</tr>
<tr>
<td>ARTH 200IA</td>
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<td>ARTH 201IA</td>
<td>Art of World Civilization II</td>
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<tr>
<td>ARTZ 110RA</td>
<td>Visual Language: Ideation and Creativity</td>
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<tr>
<td>Take one course from the English, History, Religious Studies or Philosophy Department.</td>
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<tr>
<td>University Core and Electives</td>
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**Year Total:** 15 15

**Art History (Group I)**

Choose one of the following:

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<th>Title</th>
<th>Credits</th>
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<tr>
<td>ARTH 302</td>
<td>Survey of Ancient Art</td>
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<tr>
<td>ARTH 375</td>
<td>Roman, Etruscan, Greek</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 400</td>
<td>Art and Architecture of Egypt</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 402</td>
<td>Greek Art and Architecture</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 406</td>
<td>Roman Art and Architecture</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 410</td>
<td>Medieval Art</td>
<td>3</td>
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**Art History (Group II)**

Choose one of the following:

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ARTH 421</td>
<td>Late Gothic Painting</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 422</td>
<td>Early Renaissance to 15th Century Art</td>
<td>3</td>
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<td>ARTH 424</td>
<td>High Renaissance and Mannerism</td>
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<tr>
<td>ARTH 426</td>
<td>Baroque Art in Italy and Southern Europe, 1600-1700</td>
<td>3</td>
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<tr>
<td>ARTH 427</td>
<td>Baroque Art in Northern Europe</td>
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<tr>
<td>ARTH 432</td>
<td>Art in the Age of Revolution</td>
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**Art History (Group III)**

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<td>ARTH 435</td>
<td>Art in the United States</td>
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<td>ARTH 438</td>
<td>Beginnings of Modern Art</td>
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<td>ARTH 440</td>
<td>20th Century Art</td>
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<tr>
<td>ARTH 451</td>
<td>Contemporary Art</td>
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<td>ARTH 452</td>
<td>Art in the United States</td>
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**Art History Minor (Non-Teaching)**

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<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ARTH 200IA</td>
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<td>ARTH 200IA</td>
<td>Art of World Civilization II</td>
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<td>ARTH 492</td>
<td>Independent Study</td>
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(One credit must be on a topic from group I)

Choose six of the following, at least one from each group:

**Group I - Ancient Medieval**

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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ARTH 302</td>
<td>Survey of Ancient Art</td>
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<td>Art and Architecture of Egypt</td>
<td>4</td>
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<tr>
<td>ARTH 402</td>
<td>Greek Art and Architecture</td>
<td>4</td>
</tr>
<tr>
<td>ARTH 406</td>
<td>Roman Art and Architecture</td>
<td>4</td>
</tr>
<tr>
<td>ARTH 410</td>
<td>Medieval Art</td>
<td>4</td>
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</tbody>
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**Group II - Renaissance & Baroque**

<table>
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<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTH 421</td>
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<tr>
<td>ARTH 424</td>
<td>High Renaissance and Mannerism</td>
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</tr>
<tr>
<td>ARTH 427</td>
<td>Baroque Art in Northern Europe</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 432</td>
<td>Art in the Age of Revolution</td>
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</table>

**Group III - Modern & Contemporary**

<table>
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<tr>
<th>Course</th>
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<tr>
<td>ARTH 430</td>
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<td>ARTH 435</td>
<td>Art in the United States</td>
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<tr>
<td>ARTH 438</td>
<td>Beginnings of Modern Art</td>
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<tr>
<td>ARTH 440</td>
<td>20th Century Art</td>
<td>3</td>
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<td>ARTH 451</td>
<td>Contemporary Art</td>
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<td>ARTH 452</td>
<td>Art in the United States</td>
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**Group IV - Non-Western, Diversity, Theory**

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<tr>
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<tr>
<td>ARTH 310</td>
<td>Ancient Art Mesoamerica</td>
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<td>ARTH 312</td>
<td>History of Decorative Arts</td>
<td>4</td>
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<tr>
<td>ARTH 360</td>
<td>History of Asian Art and Architecture</td>
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<td>ARTH 323</td>
<td>History of Printmaking</td>
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**Total Credits** 27
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<thead>
<tr>
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<tr>
<td>ARTH 427</td>
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### Junior Year

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<td>ARTH 312</td>
<td>- History of Decorative Arts</td>
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<td>ARTH 310</td>
<td>- Ancient Art Mesoamerica</td>
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<td>ARTH 360</td>
<td>- History of Asian Art and Architecture</td>
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<td>- Contemporary Art &amp; Ecology</td>
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<td>Art History Electives (art rubric)</td>
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<tr>
<td>ARTH 302</td>
<td>- Survey of Ancient Art</td>
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<td>ARTH 310</td>
<td>- Ancient Art Mesoamerica</td>
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<tr>
<td>ARTH 312</td>
<td>- History of Decorative Arts</td>
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<tr>
<td>ARTH 323</td>
<td>- History of Printmaking</td>
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<tr>
<td>ARTH 360</td>
<td>- History of Asian Art and Architecture</td>
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<td>ARTH 460</td>
<td>- Contemporary Art &amp; Ecology</td>
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<td>Choose two of the following:</td>
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<td>ARTH 302</td>
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<td>ARTH 310</td>
<td>- Ancient Art Mesoamerica</td>
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<td>- History of Asian Art and Architecture</td>
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<td>ARTH 375</td>
<td>- Roman, Etruscan, Greek</td>
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<td>- Art and Architecture of Egypt</td>
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<tr>
<td>ARTH 421</td>
<td>- Late Gothic Painting</td>
</tr>
<tr>
<td>ARTH 422</td>
<td>- Early Renaissance to 15th Century Art</td>
</tr>
<tr>
<td>ARTH 424</td>
<td>- High Renaissance and Mannerism</td>
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<tr>
<td>ARTH 426</td>
<td>- Baroque Art in Italy and Southern Europe, 1600-1700</td>
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### Senior Year

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<td>- History of Asian Art and Architecture</td>
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<td>ARTH 460</td>
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### Art History Electives

Choose two of the following: 6

ARTH 302 - Survey of Ancient Art
ARTH 310 - Ancient Art Mesoamerica
ARTH 312 - History of Decorative Arts
ARTH 323 - History of Printmaking
ARTH 360 - History of Asian Art and Architecture
ARTH 375 - Roman, Etruscan, Greek
ARTH 400 - Art and Architecture of Egypt
ARTH 402 - Greek Art and Architecture
ARTH 406 - Roman Art and Architecture
ARTH 410 - Medieval Art
ARTH 421 - Late Gothic Painting
ARTH 422 - Early Renaissance to 15th Century Art
ARTH 424 - High Renaissance and Mannerism
ARTH 426 - Baroque Art in Italy and Southern Europe, 1600-1700
### Graphic Design Option - B.F.A.

#### Freshman Year

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<tr>
<td>ARTZ 105RA</td>
<td>Visual Language - Drawing</td>
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<td>ARTZ 109RA</td>
<td>Visual Language: Comprehensive Foundation</td>
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<td>ARTH 200IA</td>
<td>Art of World Civilization I</td>
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<td>ARTH 201IA</td>
<td>Art of World Civilization II</td>
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#### Sophomore Year

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<td>Design Principles</td>
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<td>ARTZ 211RA</td>
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<td>Painting I</td>
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<td>ARTZ 231RA</td>
<td>Ceramics I</td>
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<td>ARTZ 251</td>
<td>Sculpture I</td>
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<td>ARTZ 261</td>
<td>Metals I</td>
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<td>ARTZ 271</td>
<td>Printmaking I</td>
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<td>ARTH 310</td>
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<td>ARTH 312</td>
<td>History of Decorative Arts</td>
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<td>ARTH 323</td>
<td>History of Printmaking</td>
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<td>Late Gothic Painting</td>
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<td>ARTH 422</td>
<td>Early Renaissance to 15th Century Art</td>
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<td>High Renaissance and Mannerism</td>
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<td>ARTH 426</td>
<td>Baroque Art in Italy and Southern Europe, 1600-1700</td>
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<td>Baroque Art in Northern Europe</td>
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<td>ARTH 451</td>
<td>Contemporary Art</td>
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<td>Contemporary Art &amp; Ecology</td>
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<td>ARTH 461</td>
<td>Art and Social Activism</td>
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<td>ARTH 491</td>
<td>Special Topics</td>
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<td>Take one course from the English, History Religious Studies or Philosophy Department.</td>
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<td>Total Program Credits</td>
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</table>

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.
Montana State University

ARTH 460 - Contemporary Art & Ecology
ARTH 461 - Art and Social Activism
ARTH 491 - Special Topics
University Core and Electives 4

Art History Elective
Choose one from the list above. 3
GDSN 224 - Form and Content 4

Art Studio Beginning (must include one 2D & one 3D)
Choose one of the following: 4
- ARTZ 211RA - Drawing I
- ARTZ 221 - Painting I
- ARTZ 231RA - Ceramics I
- ARTZ 251 - Sculpture I
- ARTZ 261 - Metals I
- ARTZ 271 - Printmaking I

University Core and Electives 4
Portfolio Review is required for all students before admittance to 300 level design courses.

Year Total: 15 15

Junior Year

GDSN 366 - History of Graphic Design 3
Advanced Graphic Design studio electives
Choose one of the following: 5
- GDSN 367 - Identity Systems
- GDSN 368 - Art Direction
- GDSN 369 - Publication Design
- GDSN 372 - Interaction Design
- GDSN 373 - Illustration
- GDSN 374 - Digital Visualization
- GDSN 375 - Letterpress

Advanced Studio Elective
Choose one of the following: 5
- ARTZ 312 - Intermediate Drawing
- ARTZ 322 - Intermediate Painting
- ARTZ 332 - Intermediate Ceramics
- ARTZ 352 - Intermediate Sculpture
- ARTZ 361 - Metals II
- ARTZ 373 - Intermediate Printmaking - Lithography
- ARTZ 374 - Intermediate Printmaking - Serigraphy
- ARTZ 375 - Intermediate Printmaking - Intaglio
- ARTZ 376 - Intermediate Printmaking - Relief
- ARTZ 379 - Alternative Print Media
- ARTZ 491 - Special Topics
- GDSN 378 - Guerrilla Advertising
- GDSN 492 - Independent Study
- GDSN 498 - Internship
University Core and Electives 5
Advanced Studio
Choose one from the list above. 5
GDSN 499 - Senior Portfolio 5
University Core and Electives 5
Year Total: 15 15

Senior Year

GDSN 465 - Professional Studio 5
Advanced Studio
Take one of the following: 5
- ARTZ 312 - Intermediate Drawing
- ARTZ 322 - Intermediate Painting
- ARTZ 332 - Intermediate Ceramics
- ARTZ 352 - Intermediate Sculpture
- ARTZ 361 - Metals II
- ARTZ 373 - Intermediate Printmaking - Lithography
- ARTZ 374 - Intermediate Printmaking - Serigraphy
- ARTZ 375 - Intermediate Printmaking - Intaglio
- ARTZ 376 - Intermediate Printmaking - Relief
- ARTZ 379 - Alternative Print Media
- ARTZ 491 - Special Topics
- GDSN 378 - Guerrilla Advertising
- GDSN 492 - Independent Study
- GDSN 498 - Internship
University Core and Electives 5
Advanced Studio
Choose one from the list above. 5
GDSN 499 - Senior Portfolio 5
University Core and Electives 5
Year Total: 15 15
Total Program Credits: 120

All Graphic Design courses must be taken in sequence. A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

Liberal Arts Studio Option - B.A.

Freshman Year

ARTH 105RA - Visual Language - Drawing 3
ARTH 109RA - Visual Language: Comprehensive Foundation 4
ARTH 200IA - Art of World Civilization I 4
University Core and Electives 5
ARTZ 110RA - Visual Language: Ideation and Creativity 4
ARTH 201IA - Art of World Civilization II 4
ARTZ 211RA - Drawing I 4
University Core and Electives 3
### Sophomore Year

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<td>ARTZ 261 - Metals I</td>
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<td>ARTZ 271 - Printmaking I</td>
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<td>ARTZ 282 - Photographic Image and its Construction</td>
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<td>Take one of the following:</td>
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<tr>
<td>ARTH 302 - Survey of Ancient Art</td>
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<td>ARTH 427 - Baroque Art in Northern Europe</td>
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<td>ARTH 432 - Art in the Age of Revolution</td>
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<td>ARTH 438 - Beginnings of Modern Art</td>
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<td>ARTH 451 - Contemporary Art</td>
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<td>ARTH 460 - Contemporary Art &amp; Ecology</td>
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<td>ARTH 491 - Special Topics</td>
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University Core and Electives 1

Choose two of the following: 8

### Junior Year

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<td>ARTZ 231RA - Ceramics I</td>
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<td>ARTZ 251 - Sculpture I</td>
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<tr>
<td>ARTZ 261 - Metals I</td>
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<td>ARTZ 271 - Printmaking I</td>
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<td>ARTZ 282 - Photographic Image and its Construction</td>
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<td>GDSN 223 - Design Principles</td>
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<td>Take one of the following:</td>
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<tr>
<td>ARTH 312 - Intermediate Drawing</td>
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<td>ARTH 322 - Intermediate Painting</td>
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<td>ARTH 332 - Intermediate Ceramics</td>
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<td>ARTH 352 - Intermediate Sculpture</td>
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University Core and Electives 6

Choose one of the following: 4

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<td>ARTH 360 - History of Asian Art and Architecture</td>
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University Core and Electives 4

Year Total: 15 15
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<td>ARTH 451</td>
<td>Contemporary Art</td>
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<td>Contemporary Art &amp; Ecology</td>
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<td>Art and Social Activism</td>
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<td>ARTH 491</td>
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**Year Total:** 15

**Senior Year**

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**Year Total:** 15

**Sophomore Year**

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<td>ARTZ 211RA</td>
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<td>Painting I</td>
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<td>ARTZ 231RA</td>
<td>Ceramics I</td>
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<td>Sculpture I</td>
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<td>Printmaking I</td>
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<td>ARTZ 282</td>
<td>Photographic Image and its Construction</td>
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<td>ARTH 302</td>
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<td>ARTH 310</td>
<td>Ancient Art Mesoamerica</td>
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<td>History of Decorative Arts</td>
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<td>ARTH 323</td>
<td>History of Printmaking</td>
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<td>History of Asian Art and Architecture</td>
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<td>ARTZ 421</td>
<td>Guided Research- Painting</td>
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<tr>
<td>ARTH 432</td>
<td>Art in the Age of Revolution</td>
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A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

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**Studio Arts Option - B.F.A.**

**Freshman Year**

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<td>ARTZ 109RA</td>
<td>Visual Language: Comprehensive Foundation</td>
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A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.
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<td>ARTH 440</td>
<td>20th Century Art</td>
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<tr>
<td>ARTH 451</td>
<td>Contemporary Art</td>
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<tr>
<td>ARTH 460</td>
<td>Contemporary Art &amp; Ecology</td>
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<tr>
<td>ARTH 461</td>
<td>Art and Social Activism</td>
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<td>PHOT 113RA</td>
<td>Understanding Photography</td>
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Choose two of the following: 8

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<td>ARTZ 282</td>
<td>Photographic Image and its Construction</td>
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University Core and Electives 5

Portfolio Review is required before admittance to the BFA major medium. Students who fail portfolio review may continue in the BA option or may reapply to the BFA program the following year.

Year Total: 15

<table>
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Junior Year

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<td>Ancient Art Mesoamerica</td>
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University Core and Electives 2

Semester in Italy Option (15)

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Advanced Studio Elective

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<td>Intermediate Printmaking - Relief</td>
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Art History Elective

Must have at least one contemporary/modern course

Choose one of the following: 3

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<td>ARTH 460</td>
<td>Contemporary Art &amp; Ecology</td>
</tr>
<tr>
<td>ARTH 461</td>
<td>Art and Social Activism</td>
</tr>
<tr>
<td>ARTZ 312</td>
<td>Intermediate Drawing</td>
</tr>
<tr>
<td>ARTZ 322</td>
<td>Intermediate Painting</td>
</tr>
<tr>
<td>ARTZ 332</td>
<td>Intermediate Ceramics</td>
</tr>
<tr>
<td>ARTZ 352</td>
<td>Intermediate Sculpture</td>
</tr>
<tr>
<td>ARTZ 361</td>
<td>Metals II</td>
</tr>
<tr>
<td>ARTZ 373</td>
<td>Intermediate Printmaking - Lithography</td>
</tr>
</tbody>
</table>

Advanced Studio Elective

Choose one of the following: 5

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTZ 312</td>
<td>Intermediate Drawing</td>
</tr>
<tr>
<td>ARTZ 322</td>
<td>Intermediate Painting</td>
</tr>
<tr>
<td>ARTZ 332</td>
<td>Intermediate Ceramics</td>
</tr>
<tr>
<td>ARTZ 352</td>
<td>Intermediate Sculpture</td>
</tr>
<tr>
<td>ARTZ 361</td>
<td>Metals II</td>
</tr>
<tr>
<td>ARTZ 373</td>
<td>Intermediate Printmaking - Lithography</td>
</tr>
</tbody>
</table>
**ARTZ 374 - Intermediate Printmaking - Serigraphy**

**ARTZ 375 - Intermediate Printmaking - Intaglio**

**ARTZ 376 - Intermediate Printmaking - Relief**

**ARTZ 379 - Alternative Print Media**

**ARTZ 494 - Undergraduate Seminar**

**University Core and Electives**

**Senior Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>15</td>
<td>16</td>
</tr>
</tbody>
</table>

**Major Medium**

Choose one of the following:

| ARTZ 312 - Intermediate Drawing |
| ARTZ 322 - Intermediate Painting |
| ARTZ 332 - Intermediate Ceramics |
| ARTZ 352 - Intermediate Sculpture |
| ARTZ 361 - Metals II |
| ARTZ 373 - Intermediate Printmaking - Lithography |
| ARTZ 374 - Intermediate Printmaking - Serigraphy |
| ARTZ 375 - Intermediate Printmaking - Intaglio |
| ARTZ 376 - Intermediate Printmaking - Relief |
| ARTZ 379 - Alternative Print Media |

**ARTZ 399 - Studio Arts Pre-Thesis**

**ARTZ 494 - Undergraduate Seminar**

**Art History Elective**

Must have at least one contemporary/modern course

Choose one of the following:

| ARTH 302 - Survey of Ancient Art |
| ARTH 310 - Ancient Art Mesoamerica |
| ARTH 312 - History of Decorative Arts |
| ARTH 323 - History of Printmaking |
| ARTH 360 - History of Asian Art and Architecture |
| ARTH 375 - Roman, Etruscan, Greek |
| ARTH 400 - Art and Architecture of Egypt |
| ARTH 402 - Greek Art and Architecture |
| ARTH 406 - Roman Art and Architecture |
| ARTH 410 - Medieval Art |
| ARTH 421 - Late Gothic Painting |
| ARTH 422 - Early Renaissance to 15th Century Art |
| ARTH 424 - High Renaissance and Mannerism |
| ARTH 426 - Baroque Art in Italy and Southern Europe, 1600-1700 |
| ARTH 427 - Baroque Art in Northern Europe |
| ARTH 430 - 19th Century Art |
| ARTH 432 - Art in the Age of Revolution |
| ARTH 435 - Art in the United States |
| ARTH 438 - Beginnings of Modern Art |
| ARTH 440 - 20th Century Art |
| ARTH 451 - Contemporary Art |
| ARTH 460 - Contemporary Art & Ecology |
| ARTH 461 - Art and Social Activism |

**University Core and Electives**

**ARTZ 499R - Senior Thesis: Studio**

**Choose one of the following:**

| ARTZ 312 - Intermediate Drawing |
| ARTZ 322 - Intermediate Painting |
| ARTZ 332 - Intermediate Ceramics |
| ARTZ 352 - Intermediate Sculpture |
| ARTZ 361 - Metals II |
| ARTZ 373 - Intermediate Printmaking - Lithography |
| ARTZ 374 - Intermediate Printmaking - Serigraphy |
| ARTZ 375 - Intermediate Printmaking - Intaglio |
| ARTZ 376 - Intermediate Printmaking - Relief |
| ARTZ 379 - Alternative Print Media |

**University Core and Electives**

**Choose one of the following:**

| ARTZ 312 - Intermediate Drawing |
| ARTZ 322 - Intermediate Painting |
| ARTZ 332 - Intermediate Ceramics |
| ARTZ 352 - Intermediate Sculpture |
| ARTZ 361 - Metals II |
| ARTZ 373 - Intermediate Printmaking - Lithography |
| ARTZ 374 - Intermediate Printmaking - Serigraphy |
| ARTZ 375 - Intermediate Printmaking - Intaglio |
| ARTZ 376 - Intermediate Printmaking - Relief |
| ARTZ 379 - Alternative Print Media |

**Year Total:**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>16</td>
</tr>
</tbody>
</table>

**Total Program Credits:**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>14</td>
</tr>
</tbody>
</table>

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

---

**Environmental Design**

**School of Architecture**

The School of Architecture offers a four year Bachelor of Arts in Environmental Design undergraduate program which, when combined with our three-semester graduate program, leads to a fully accredited Master of Architecture degree. The Master of Architecture degree is a first-professional degree.

In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit US professional degree programs in architecture, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted a six-year, three-year, or two-year term of accreditation, depending on the extent of its conformance with established educational standards.

Doctor of Architecture and Master of Architecture degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree, that, when earned sequentially, constitute an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

Montana State University, College of Arts and Architecture, School of Architecture offers the following NAAB-accredited degree program:

**Master of Architecture**

*(Pre-professional degree + 42 graduate credits)*

The Montana State University School of Architecture received a full 8 year accreditation standard in Summer 2014.

*The next accreditation visit for this program will take place in 2022.*

The School of Architecture seeks to prepare students for a lifelong critical engagement in the arts and science of architecture. Located in “the last best place” of the Northern Rockies, we are in an extraordinary position to engage questions regarding the relationship between the natural and built...
environments. As architects, we strive to play an essential and innovative role in enhancing the human condition. To that end, we teach and practice a moral, ethical and aesthetic responsibility to society and the natural world in the design of the built environment. The School of Architecture empowers students to critically engage the complexities of society and the natural environment by instilling the fundamental principles of design and inspiring a spirit of exploration and creative experimentation in shaping the built environment.

It is in our design studios that this philosophy is most clearly demonstrated. Each studio is conceived to build upon the previous studio in a manner that develops a student’s mastery of the science of architecture while at the same time exposing the student to the rich diversity of our faculty’s philosophical beliefs. Within a structured sequence of increasingly complex problems, emphasis is placed on teaching both an iterative design process and the visualization skills necessary to demonstrate the resultant design proposals. The science of architecture is continuously evolving and will do so over the life of every architect. We are committed to preparing our students to enter the profession with both contemporary scientific knowledge and emerging technical expertise to further this evolution while at the same time ensuring that our graduates are grounded in the fundamental drawing design thinking, investigative and communication skills that have been central to architecture throughout its history. In addition to the science of architecture, we are equally committed to ensuring that our graduates acquire a critical philosophy with which they can engage the design of the built environment.

Knowing how to build is a matter of science and technology but knowing what to build is a question of morality, ethics, and aesthetic responsibility. In this regard the faculty shares a commitment to the stewardship of our environment. This is particularly important in the Northern Rockies where our historic fabric of cities, rural communities and the natural landscape coexist in a tenuous balance. Focusing on the broad principles of creating a sustainable social, cultural, economic and physical environment we utilize the region, from its major cities to its national parks, as the canvas for our teaching, research and creative activities.

Architecture

Briefly defined, architecture is the art and science of designing buildings that provide appropriate accommodation for human activities. Professional practice requires a person with the unique combination of creative ability, technical knowledge, human understanding, and administrative skill. The undergraduate Environmental Design curriculum, which leads to the Bachelor of Arts in Environmental Design degree, prepares students to enter the graduate program in Architecture at MSU or serve as a basis for application to other graduate programs or for employment as a non-architect in environmental design fields. However, the Bachelor of Arts in Environmental Design degree by itself does not qualify students to become registered architects. Students wishing to become registered architects must complete the graduate program of study and receive the accredited Master of Architecture degree.

Once admitted to the Environmental Design program, and after completing their fourth year design studios, students with an acceptable academic record may apply to the Master of Architecture professional program. Specific dates for graduate applications can be obtained from the main office of the School of Architecture. The program offers a professional education as well as exposure to other academic disciplines, and provides the foundation for an internship with a practicing architect.

In most states, a graduate with a professional degree in architecture needs to complete the requirements of the Intern Development Program (IDP) developed by the National Council of Architectural Registration Boards (NCARB) in which students gain varied experience in an architectural office. Graduates of the Master of Architecture program are qualified to take the Architectural Registration Exam in order to obtain a professional license. A person is not authorized to practice architecture until the architectural licensing examination is passed and a license is issued. Other areas of employment open to the architecture graduate include construction, government service, industry, and education.

In addition to the college preparatory curriculum, high school students planning on enrolling in architecture are especially encouraged to take art courses such as basic design and drawing.

Students begin the undergraduate program in the fall semester because the first course of the design studio sequence is offered fall semester only. Students that have completed their university core requirements or have completed a previous degree may enroll in an accelerated first year design sequence offered in the summer semester.

Admission of transfer students is selective; only those students whose past academic performance and portfolio submission indicate a probability of success are admitted.

Admission to the Environmental Design Program

Admission to the first year of the Environmental Design Program is open. At the end of the spring semester of the first year of the Environmental Design Program, students will undergo a substantive portfolio review to assess their preparedness for the subsequent three years of the Bachelor of Arts in Environmental Design degree program. All portfolio reviews will be undertaken by the Second Year Admissions Committee. Total enrollment in the program shall be limited by the teaching resources and space capacities of the School of Architecture.

To continue into the second year of the environmental design program first year Environmental Design students must:

1. Be in good scholastic standing with a cumulative GPA of 2.7 or higher.
2. Have received at least a 3.0 Architecture Studio GPA (ARCH 151 & ARCH 152)
3. Have satisfactorily completed all required course work of the first year of the Environmental Design Program.
4. Have a design portfolio that indicates creative potential. The design portfolio will be evaluated by faculty in the School of Architecture to assess a student’s preparedness for the subsequent three years of the program. Transfer students from other architecture or environmental design programs must have, prior to acceptance and advanced design year placement, an overall grade-point average of 3.0 or above and a high quality, creative portfolio. Transfer students planning to attend the fall semester must submit their application and portfolio to the Environmental Design Program by May 1. Applications received after that date will be considered on a space-available basis only.

Portfolio review procedures for the Environmental Design Program:

1. First year Environmental Design students will obtain an application for portfolio review including portfolio requirements, from the School of Architecture after March 1st. The completed application form, plus portfolio of design and graphic work, are to be submitted to the School of Architecture by May 1.
2. First year students are required to submit a portfolio including examples of their design and graphic work.
3. An applicant who has previously undergone the portfolio review was found to not be prepared for the subsequent years of the Environmental Design Program or who fails to enroll in the second year environmental design program after being accepted or who fails to complete ARCH 253 must re-apply for the portfolio review in the regular manner.
First year Environmental Design students who are found to not be prepared for the subsequent years of the program have the right to meet with the Second Year Admissions Committee, Undergraduate Coordinator or Director for a review of their materials.

Students who are found to not be prepared for the subsequent years of the Environmental Design program may not take ARCH 253, ARCH 254, ARCH 261, or ARCH 262 and upper division courses in the curriculum without permission of the director. Former students who have withdrawn after being admitted to the program must be in good scholastic standing for re-admission and will be readmitted on a space available basis only. Former students must contact the School in writing, stating their intent to return, at least two months prior to their return so that a decision can be made regarding space availability.

**Architecture Residency Design Program**

This is an optional enrichment program for students who, for a short period in their education, would benefit at least as much from professional experience as academic experience. The goals of the program are those of the required architecture courses plus those which can be sought only in the office context, such as familiarization with the relationship of all aspects of professional practice.

Students must obtain their own employment in an architecture firm for a continuous period of not less than 6 months.

Students must apply in writing to the coordinator of the program by the end of Spring semester of their 3rd year. The Architecture Residency Design studio will take place during the Summer and Fall of the student’s fourth year in Environmental Design curriculum. The Residency Design Studio Coordinator and Director reviews all applications and makes the decision concerning acceptance into the program. A student meeting the criteria listed below may still be denied acceptance if the faculty determines that the student would benefit more from a formal design studio. The criteria for admission are:

1. A minimum 2.75 overall cumulative grade point average and a minimum 3.0 in all architecture courses.
2. Completion of all required courses as tabulated through the third year.

**Foreign Study Program**

This is an optional enrichment program which allows qualified students to participate in an intensive semester of foreign study. Students pay the additional costs of travel, lodging, and administration related to this program in addition to normal tuition and fees. The program is typically offered Summer semester, subject to funding constraints and student demand, and is organized and directed by a faculty member(s) from the School of Architecture.

The criteria for participation in the Foreign Study Program are as follows:

1. A high degree of self-motivation and self-discipline as demonstrated by performance in required course work.
2. A minimum 3.0 overall cumulative grade point average and a minimum 3.0 in all architecture courses.
3. Completion of ARCH 121IA, ARCH 322IA and ARCH 323IA.
4. Completion of all required courses as tabulated through the third year.

Admission to the program requires submission of a request in writing by December 1st of the third year of the Environmental Design program. A cash deposit will be required at this time.

**Standard of Work in Architecture Courses**

Any student receiving two consecutive grades of C- or lower in any design sequence course will be required to repeat the last course in which a C- or lower was received.

**Financial**

Costs for an architectural education are similar to, though somewhat higher than, other programs in the university. An academic exposure to both rural and urban settings through class field trips, the integration of computer technology, networking, digital fabrication, printing as well as other program enhancements are an important part of an architect’s education. In order to meet this need and help defer costs of the field trips, computer integration, lecture series and program enhancements, a Program Fee is assessed to each student in the environmental design and architectural programs that reflects the student’s degree status in the program. For current Program Fee costs, students may contact the School of Architecture. Students are required to purchase their own personal notebook computer, which meets the specifications of the School of Architecture, during the second year of the Environmental Design undergraduate program. The computer will be an essential tool for use throughout the Professional Program.

Beyond normal tuition, fees, room, board, and supplies, an architectural student requires drawing equipment and materials for drawing and models during the school year. This can be expected to add at least another $600 per year to the cost. Inquiries for financial aid or assistance should be sent directly to the Office of Financial Aid Services at Montana State University.

**Curriculum in Environmental Design**

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
</tr>
<tr>
<td>ARCH 121IA - Introduction to Design</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 151RA - Design Fundamentals I</td>
<td>4</td>
</tr>
<tr>
<td>M 151Q - Precalculus or M 171Q - Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>University Core</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 152 - Design Fundamentals II</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 205 - College Physics I or PHSX 220 - Physics I (w/ calculus)</td>
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<tr>
<td>University Core</td>
<td>6-9</td>
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<td>Year Total:</td>
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<table>
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<tr>
<th>Sophomore Year</th>
<th>Credits</th>
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<tbody>
<tr>
<td></td>
<td>Fall</td>
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<tr>
<td>ARCH 241 - Building Construction I</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 253 - Architectural Design I</td>
<td>5</td>
</tr>
<tr>
<td>ARCH 261 - Architectural Graphics I</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 322IA - World Architecture I</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 262 - Arch Graphics II</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 254 - Architectural Design II</td>
<td>5</td>
</tr>
<tr>
<td>ARCH 323IA - World Architecture II</td>
<td>3</td>
</tr>
<tr>
<td>University Core</td>
<td>3-6</td>
</tr>
<tr>
<td>Year Total:</td>
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</table>

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
</tr>
<tr>
<td>ARCH 331 - Environmental Controls I</td>
<td>4</td>
</tr>
<tr>
<td>ARCH 363 - Architectural Graphics III</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 343 - Architectural Structures I</td>
<td>4</td>
</tr>
<tr>
<td>ARCH 355 - Architectural Design III</td>
<td>5</td>
</tr>
<tr>
<td>ARCH 332 - Environmental Controls II</td>
<td>4</td>
</tr>
</tbody>
</table>
The School of Film and Photography (SFP) prepares students to meet the challenges of a rapidly expanding media environment as professionally trained creative artists and informed critical thinkers. Our students develop their own voices as tomorrow’s leaders through intensive hands-on exploration of motion picture, photography, theatre and new-media production.

The School of Film and Photography offers a Bachelor of Arts degree with concentrations (options) in Film or Photography, plus a Bachelor of Fine Arts degree in Integrated Lens-Based Media as well as a minor in Photography.

Both degree options provide flexibility for students to broaden their education with course work outside of the School of Film and Photography. All of our students are encouraged to consider the benefits of study abroad and/or minoring in another area of interest. While we aim to provide professional film and photography training, we place equal importance on providing our students with a broad education to prepare them for a wide range of future opportunities not confined to these industries.

After the completion of a successful freshman year of introductory courses in media production, analysis, and history, students will continue to develop advanced skills and knowledge of photography and/or filmmaking over the next three years.

### Transfer Students

Students who intend to transfer to The School of Film and Photography should seek prior approval of credit taken elsewhere in order to be certain that these credits will fulfill requirements in the Film or Photography options. In no case may a class completed with a grade below "C-" elsewhere be applied toward the program requirements for the degree. Any class that is not an equivalent class within the Montana university system must be approved by the SFP Director and Advisor on the basis of a review of the syllabus of the course taken elsewhere. A challenge exam or portfolio review may be required for any transfer credit at the discretion of the SFP Director or Advisor.

### Course and Program Fees

Course fees are assessed to all students enrolled in foundation courses FILM 112 and PHOT 113RA. Students in either the Film or Photography option are charged a program fee per semester.

### Undergraduate Programs

- BA Film Option (p. 118)
- BA Photography Option (p. 120)
- BFA in Integrated Lens-Based Media (p. 307)

### Undergraduate Minor

- Photography Minor (Non-Teaching) (p. 119)

### Film Option

Students in the Film Option gain hands-on experience in all aspects of motion picture production, supported by theatrical production work. Students have opportunities to engage in film production throughout the program, starting in the first year and culminating in a senior thesis film project. At the same time, students study film history, film aesthetics, and

<table>
<thead>
<tr>
<th>Instructor Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ARCH 340 - Building Construction II</td>
<td>4</td>
</tr>
<tr>
<td>ARCH 344 - Architectural Structures II</td>
<td>4</td>
</tr>
<tr>
<td>ARCH 356 - Arch Design IV</td>
<td>5</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td><strong>Senior Year</strong></td>
<td><strong>17 credits</strong></td>
</tr>
<tr>
<td>Non-Architecture Electives</td>
<td>3</td>
</tr>
<tr>
<td>University Core</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 431 - Sustainability in Architecture (Online Course)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Choose one of the Following Option Studios</strong></td>
<td><strong>5-12 credits</strong></td>
</tr>
<tr>
<td>ARCH 414 - Architectural Study Abroad &amp; ARCH 428 - Foreign Study History</td>
<td></td>
</tr>
<tr>
<td>ARCH 450 - Community Design Center (5 credits)</td>
<td></td>
</tr>
<tr>
<td>ARCH 458 - Arch Design VI (5 credits)</td>
<td></td>
</tr>
<tr>
<td>ARCH 498 - Internship (6 credits)</td>
<td></td>
</tr>
<tr>
<td>ARCH 413 - Professional Practice</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 457 - Architectural Design V</td>
<td>5</td>
</tr>
<tr>
<td>ARCH 452 - Research Methods in Arch</td>
<td>3</td>
</tr>
<tr>
<td>Non-Architecture Electives</td>
<td>6</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td><strong>14-21 credits</strong></td>
</tr>
<tr>
<td><strong>Total Program Credits:</strong></td>
<td><strong>126 credits</strong></td>
</tr>
</tbody>
</table>

ARCH 414, ARCH 428, ARCH 498 and ARCH 450 are offered both in Summer and Fall semesters in the Senior year to provide diverse options.

A minimum of 126 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

The School of Architecture reserves the right to retain student work for exhibition and instructional purposes.

### Additional Professional Program Requirement

For students interested in obtaining a Bachelor of Arts in Environmental Design degree leading to a Master of Architecture degree, 45 non-architecture credits, taken at either the undergraduate or graduate level, must be completed prior to the completion of the Master of Architecture degree program. For additional advising information please contact the School of Architecture at 160 Cheever Hall, 994-4255.

### Additional Professional Program Requirements (PMSEM)

Students interested in obtaining a Bachelor of Arts in Environmental Design degree and considering entry into the Professional Master of Science and Engineering Management Degree (http://catalog.montana.edu/graduate/interdisciplinary-other-programs/prof-ms-engineering-mgmt-pmsem) will be required to take additional Math, English, Natural Science, Business and Engineering courses from those listed above. Students interested in this Engineering Management Focus should contact the Department of Civil Engineering, 3900 Cobleigh Hall, 994-2111 to obtain specific course requirements.

### Graduate Programs

- Master of Architecture (p. 303)

### Film and Photography

#### The School of Film and Photography

The School of Film and Photography (SFP) prepares students to meet the challenges of a rapidly expanding media environment as professionally...
the film industry, to broaden their understanding of the film medium and inform their personal filmmaking goals.

**Film Option Foundations**

Upon completion of all of the four required foundation courses and two university Core requirements, WRIT 101W and University Seminar (US), interested students may apply for acceptance into the Film option. The Film Option will accept no more than 48 students each and a wait list will be generated for applicants beyond that number. Students wait listed will be contacted if space becomes available. Selection will be based on the average of grades (GPA) earned in the required foundation courses and the successful completion of WRIT 101W and US.

In order to apply for acceptance into the Film Option for the following year, students must submit an application form by April 30. Students must also submit a portfolio consisting of one individual film project completed in FILM 112 and a written statement. Portfolios are due by the last day of spring semester finals week.

All applicants will be notified of the review outcome by email. If unsuccessful, students may reapply the following year. Students who wish to reapply may retake any courses during the intervening year to improve their chances of success.

**Film Option Curriculum**

Please note that some Film program-related courses are listed under different headings, including:

- FILM 112, WRIT 101W and University Seminar are offered both fall and spring semesters and may be taken in either semester.

**Foundation Courses (typically taken in freshman year)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILM 100H</td>
<td>Intro to Film &amp; Photography</td>
<td>3</td>
</tr>
<tr>
<td>FILM 112</td>
<td>Aesthetics of Film Prodctn I</td>
<td>3</td>
</tr>
<tr>
<td>FILM 101H</td>
<td>Understanding Film and Media</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 113RA</td>
<td>Understanding Photography</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>University Seminar (topic of choice)</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

* FILM 112, WRIT 101W and University Seminar are offered both fall and spring semesters and may be taken in either semester.

**Film Option Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILM 201D</td>
<td>Film History I: Origins to the 1960’s</td>
<td>3</td>
</tr>
<tr>
<td>FILM 202D</td>
<td>Film History II: 1960s to the Present</td>
<td>3</td>
</tr>
<tr>
<td>FILM 212</td>
<td>Aesthetics Film Production II</td>
<td>4</td>
</tr>
<tr>
<td>FILM 251</td>
<td>Scriptwriting</td>
<td>3</td>
</tr>
<tr>
<td>FILM 254</td>
<td>Acting for Film</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose two of the following:

- FILM 381 Studies in Film
- FILM 449 Film and Documentary Theory
- FILM 481 Advanced Studies in Film
- FILM 494 Seminar/Workshop

Choose two of the following:

- FILM 371 Non-Fiction Film Production
- FILM 372 Fiction Film Production
- THTR 304 Theatre Production
- FILM 499 Senior Production

A minimum of 120 credits is required for graduation, 42 of these credits must be in courses numbered 300 or above.

**Photography Minor (Non-Teaching)**

The School of Film and Photography offers a Photography minor on a space-available basis. The minor consists of 28 credits. Typically, the minor will require a minimum of 2 1/2 years to complete. Photography minors must meet the same eligibility requirements as majors described above, excluding FILM 112. Accepted Photo minors are required to purchase a Mac laptop computer.

**Photography Minor Curriculum**

**Foundation Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILM 100H</td>
<td>Intro to Film &amp; Photography</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 113RA</td>
<td>Understanding Photography</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 213</td>
<td>Intermediate Photography</td>
<td>3</td>
</tr>
</tbody>
</table>

**Photography Minor Requirements**

Choose two of the following Photography production courses:

- PHOT 331 Prof Practices in Photography
- PHOT 350 Advanced Color Photography
- PHOT 352 Advanced Lighting Practices
- PHOT 359 Alternative Photographic Techniques
- PHOT 371 Portraiture
- PHOT 373 Non-Fiction Photography
- PHOT 374 Experimental Photography

OR other photography-related production course(s) approved by advisor

**Total Credits**

- SFP Electives (at least 4 other SFP courses*) 12
- Non-SFP Electives (at least 3 courses**) 9
- Total Credits 56

* SFP Electives are any courses offered in the School of Film & Photography including THTR 304, MUST 380 and MUST 382 that are not serving to fulfill any requirements listed above. Any of the studies or production courses listed above in excess of the number required in each category can be taken as SFP Electives. This requirement is intended to permit Film and Photography students to explore their individual interests in greater depth in one area or more broadly in both areas.

** Non-SFP Electives are any courses offered outside the School of Film & Photography, not including THTR 304, MUST 380 and MUST 382, that are not serving to fulfill university CORE requirements. This requirement is intended to encourage Film and Photography students to develop an area of knowledge to inform their pursuits as creative artists. Completion of a minor outside of the School of Film and Photography will fulfill this requirement.
Photography Option

The Photography option offers both artistic and applied approaches to the medium, providing a solid foundation for those entering a professional field and those choosing to pursue postgraduate education. Accredited by the National Association of Schools of Art and Design, the Photography option sets high standards for production and is one of the few comprehensive four-year photography degree programs in a sizable geographical area of the north central and northwest United States. Coursework covers everything from traditional silver-based darkroom techniques to alternative processes as well as emphasis in digital technologies across the curriculum.

Photography Option Foundations

Upon completion of all of the four required Photography foundation courses and two university Core requirements, WRIT 101W and University Seminar (US), interested students may apply for acceptance into the Photography option. The Photography option will accept up to 36 students each year and establish a wait list for the rest, Selection will be based on the grade point average (GPA) earned in the required foundation courses, the successful completion of WRIT 101W and US core, and a portfolio review based on work completed in PHOT 213 Intermediate Photography.

In order to apply for acceptance into the Photography Option for the following year, students must submit an application form by April 30. Portfolio submissions will be accepted immediately after the scheduled final critique of assignments in PHOT 213.

All applicants will be notified of the review outcome on or before May 30th. Within the first two weeks of the fall semester immediately following the review, should room become available in the major for wait listed students, they will be admitted in descending order of preference. It is the student’s responsibility to provide accurate contact information for this to occur. Once the two-week period is over, the wait list will be retired, and students not placed may reapply the following year. Students who wish to reapply may retake any courses during the intervening year to improve their chances of success.

Those accepted into the program after the freshman year will be required to purchase a Macintosh laptop computer that meets the specifications of the department by the fall semester of their sophomore year. Students will be notified of these specifications upon a successful portfolio review outcome in May.

Photography Option Curriculum

Foundation Courses (typically taken in freshman year)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILM 100H</td>
<td>Intro to Film &amp; Photography</td>
<td>3</td>
</tr>
<tr>
<td>FILM 112</td>
<td>Aesthetics of Film Production I</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 113RA</td>
<td>Understanding Photography</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 213</td>
<td>Intermediate Photography</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>University Seminar (topic of choice)</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

* FILM 112, WRIT 101W and University Seminar are offered both fall and spring semesters and may be taken in either semester.

Photography Option Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHOT 255</td>
<td>Intro to Color Photography</td>
<td>4</td>
</tr>
<tr>
<td>PHOT 258</td>
<td>View Camera</td>
<td>4</td>
</tr>
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</table>

Choose four of the following Film & Photo Studies courses (must include 303 or 304):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILM 101H</td>
<td>Understanding Film and Media</td>
<td>3</td>
</tr>
<tr>
<td>FILM 201D</td>
<td>Film History I: Origins to the 1960's</td>
<td>3</td>
</tr>
<tr>
<td>FILM 202D</td>
<td>Film History II: 1960s to the Present</td>
<td>3</td>
</tr>
</tbody>
</table>

Take two of the following Photography Production courses: 8

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHOT 331</td>
<td>Prof Practices in Photography</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 350</td>
<td>Advanced Color Photography</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 352</td>
<td>Advanced Lighting Practices</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 359</td>
<td>Alternative Photographic Techniques</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 371</td>
<td>Portraiture</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 373</td>
<td>Image &amp; Text</td>
<td>3</td>
</tr>
<tr>
<td>PHOT 374</td>
<td>Experimental Photography</td>
<td>3</td>
</tr>
</tbody>
</table>

Other photography-related production course(s) approved by advisor

PHOT 499 - Senior Thesis/Capstone (fall or spring; may be taken twice)

SFP Electives (at least 4 courses*: photo majors are strongly encouraged to fulfill 2 SFP electives with Photography Production courses) 12-16

Non-SFP Electives Not Including Core Requirement (at least 3 courses**) 9

Total Credits 67

* SFP Electives are any courses offered in the School of Film & Photography that are not serving to fulfill any requirements listed above. Any of the studies or production courses listed above in excess of the number required in each category will count as SFP Electives. This requirement is intended to permit Film and Photography students to explore their individual interests in greater depth in one area or more broadly in both areas.

** Non-SFP Electives are any courses offered outside the School of Film & Photography that are not serving to fulfill any requirements listed above. Any of the studies or production courses listed above in excess of the number required in each category will count as SFP Electives. This requirement is intended to permit Film and Photography students to explore other areas of knowledge outside of film and photography. Completion of a minor outside of the School of Film and Photography automatically fulfills this requirement.

Photography Students are strongly recommended to take at least one of ARTZ 109RA Visual Language: Comprehensive Foundation, ARTZ 110RA Visual Language: Ideation and Creativity, or ARTZ 105RA Visual Language - Drawing, and ARTH 200IA Art of World Civilization I or ARTH 201IA Art of World Civilization II. The ARTH courses will count as Photography Studies electives.

A minimum of 120 credits is required for graduation, 42 of these credits must be in courses numbered 300 and above. The Photography major requirements fulfill a minimum of 16 upper division credits.

Music

School of Music

The School of Music at Montana State University offers dynamic programs in music, music technology, and music education, preparing students for various professions in music and music education, along with life-long musical enhancement.
Inspired by the belief that music is central to human ways of life, the School of Music affirms the University’s mission to serve the people and communities of Montana by providing a musically enriched environment.

The School of Music is committed to contributing to the musical world through performance, scholarship, composition, leadership, and by nurturing the musical expression, understanding, discovery, and creativity of its faculty and students.

The School of Music offers classes to all students regardless of major and some music courses satisfy University core requirements.

Membership in School of Music ensembles is open to all students regardless of major. Interested students may study band and orchestral instruments, voice, piano, and guitar. Some ensembles require an audition.

All incoming music majors must demonstrate their level of musicianship through auditions before being accepted into an applied studio. Additionally, all incoming music majors must demonstrate their level of musicianship through theory, aural perception, and keyboard skills pre-tests, prior to enrollment.

### Undergraduate Curricula in Music
- Bachelor of Arts in Music (p. 121)
- Bachelor of Music Education (p. 123)
- Bachelor of Arts in Music Technology (p. 122)
- Music Minor (Non-Teaching) (p. 125)

### Graduate Curricula
A selection of courses in music education, music theory, and music history are offered at the graduate level. A Master of Education in Curriculum and Instruction is available with a Professional Educator Option, especially designed for K-12 music teachers. The degree is offered through the Department of Education.

Master’s Program Information (p. 317)

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### Bachelor of Arts in Music

The Bachelor of Arts in Music degree emphasizes the study of music within a broad program of general study. A non-teaching minor is also offered by the School of Music.

Students are required to audition with the appropriate applied instrumental or vocal faculty prior to, or at the latest, during the first semester of study for all music programs. Placement in MUSI 195 (Applied Music) will be at the sole determination of the applied studio professor. Students with limited experience on their principal instrument are responsible for obtaining preparatory instruction and basic music-reading skills and may be required to complete MUSI 102 in order to develop the required skills necessary to be accepted for applied study and enroll in MUSI 195. If accepted for applied lessons, music majors must enroll in Applied Music each semester of residency. Advancement to the next level will be by performance jury and with the approval of the applied music instructor. An appearance on a recital as a soloist must be completed before advancement to MUSI 395. Successful completion of at least one semester of MUSI 395 is required to graduate. All BA students and all applied music students are expected to participate in the School’s band, choral, and orchestral ensembles. Acceptable ensembles are listed in the Music Major Handbook.

Students in the BA music major or those seeking a music minor must achieve the grade of “C” or better in all required music courses. Further, a grade of “C” or better is required in all courses that will be counted toward the 42 upper-division credits required in all degrees. Courses with a passing grade of D-, D, or D+ may only be counted toward the overall 120 credit requirement.

As with many degree programs at MSU, the Music curriculum in sequential nature, with upper-level courses building upon knowledge acquired in previous course work. Completion of a course with a “C” or better is required to satisfy all music (MUST/MUSI/MUED) prerequisites. Any exceptions will be at the sole discretion of the Director.

Students are required to adhere to the current concert/lecture attendance policy as stated in the School of Music Music Major Handbook.

The following Foundation Courses may be taken a maximum of two times in order to meet the “C” or better requirement of the B.A. in Music.

- MUSI 140 Aural Perception I and MUSI 141 Aural Perception II
- MUSI 105 Music Theory I and MUSI 106 Music Theory II
- MUSI 135 Keyboard Skills I and MUSI 136 Keyboard Skills II

For music elective credits below, a maximum of 2 credits of ensembles can be applied for all 8 music elective credits, NO Applied Lessons.

#### Freshman Year

| MUSI 100 | 0 |
| MUSI 140 - Aural Perception I | 1 |
| MUSI 141 - Aural Perception II | 1 |
| MUSI 105 - Music Theory I | 3 |
| MUSI 106 - Music Theory II | 3 |
| MUSI 135 - Keyboard Skills I | 1 |
| MUSI 136 - Keyboard Skills II | 1 |
| MUSI 195 - Applied Music I | 1 |
| MUSI 195 - Applied Music I | 1 |
| Ensemble | 2 |
| University Core and Electives | 16 |
| Year Total: | 30 |

#### Sophomore Year

| MUSI 200 | 0 |
| MUSI 240 - Aural Perception III | 1 |
| MUSI 241 - Aural Perception IV | 1 |
| MUSI 205 - Music Theory III | 3 |
| MUSI 206 - Music Theory IV | 3 |
| Choose two of the following: | 2 |
| MUSI 230 - Intern Keyboard: Repertoire | |
| MUSI 231 - Intern Keyboard: Accompanying | |
| MUSI 232 - Intern Keyboard: Opn Scre Rdng | |
| MUSI 233 - Intern Keyboard Skill: Jazz | |
| MUSI 295 - Applied Music II | 1 |
| MUSI 295 - Applied Music II | 1 |
| MUSI 307IA - World Music | 3 |
| Ensemble | 2 |
| University Core and Electives | 13 |
| Year Total: | 30 |

#### Junior Year

| MUSI 100 | 0 |
| Choose two of the following: | 6 |
| MUSI 301 - Music History I | |
| MUSI 302 - Music History II | |
| MUSI 303 - Music History of 20th Century | |
Music Technology students wishing to study piano as their primary instrument may be accepted for applied study (MUSI 195) by the following methods:

1. By earning an A- or A in MUSI 135 and MUSI 136
2. By earning a grade of “C” or better in a minimum of two semesters of Advanced Keyboard Skills (MUSI 230, MUSI 231, MUSI 232, or MUSI 233)
3. By audition and subsequent permission of the instructor

Music Technology students wishing to study piano as a secondary instrument may be admitted to MUSI 195 only by fulfilling requirements #2 and #3 of the above.

All Music Technology majors must enroll in Applied Music for a minimum of three semesters. Advancement to the next level will be by performance jury and with the approval of the applied music instructor. Successful completion of one semester at the MUSI 295 level or higher is required for graduation. All students must successfully complete a minimum of three semesters of large ensemble performance, as listed in the music major handbook. Music Technology students are required to complete two semesters of MUSI 485 Acoustic Composition or one semester each of MUSI 485 Acoustic Composition and MUST 482 Electronic Composition.

Students are required to adhere to the current concert/lecture attendance policy as stated in the School of Music “Music Major Handbook.”

Music Technology majors must receive the grade of “C” or better in all music content courses (MUST/MUSI/MUSE), EELE 217, CEE 490R, CCA 290R, and FILM 259. Further, a grade of “C-” or better is required in all courses that will be counted toward the 42 upper-division credits required in all degrees. Courses with a passing grade of D-, D, or D+ may only be counted toward the overall 120 credit requirement.

As with many degree programs at MSU, the Music Technology curriculum is sequential in nature, with upper-level courses building upon knowledge acquired in previous course work. Completion of a course with a “C” or better is required to satisfy all music (MUST/MUSI/MUSE) prerequisites. Any exceptions will be at the sole discretion of the School of Music Director and the Coordinator of Music Technology.

The following Foundation Courses are limited to a maximum of two enrollments (assigned grade or withdrawal) in order to meet the “C” or better requirement of the B.A. in Music Technology. Any exceptions will be at the sole discretion of the School of Music Director and the Coordinator of Music Technology.

- MUST 140 Aural Perception I and MUSI 141 Aural Perception II
- MUSI 105 Music Theory I and MUSI 106 Music Theory II
- MUSI 135 Keyboard Skills I and MUSI 136 Keyboard Skills II
- MUST 115 Introduction to Digital Music
- MUST 125 MIDI and Electro-Acoustic Comp

Undergraduate Music Technology majors are required to be enrolled for a minimum of six credits each semester, and to make consistent progress toward the degree requirements each semester until graduation. Any exceptions will be at the sole discretion of the School of Music Director and the Coordinator of Music Technology. (For example, post-baccalaureate students pursuing a second bachelor’s degree in Music Technology may be exempt from the six hour requirement.)

Music Technology is a broad field encompassing a wide variety of topics, and Music Technology programs at different institutions vary significantly in emphasis and curriculum order. Therefore, transfer credits for Music Technology courses (MUST 115, MUST 220, MUST 125, MUST 341, MUST 380, MUST 382, MUST 384, and Music Technology electives) will not generally be awarded. The Coordinator of Music Technology and
the School of Music Director reserve the right to award transfer credits in exceptional circumstances, at their sole discretion. Annual program fees are assessed to all Music Technology majors. Program fees support emergent equipment needs and maintenance of the computer lab and individual studios. These fees enable Music Technology students to accomplish their equipment needs and maintenance of the computer lab and individual studios.

**Freshman Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUSI 140 - Aural Perception I</td>
<td>1</td>
</tr>
<tr>
<td>MUSI 141 - Aural Perception II</td>
<td>1</td>
</tr>
<tr>
<td>MUSI 105 - Music Theory I</td>
<td>3</td>
</tr>
<tr>
<td>MUSI 106 - Music Theory II</td>
<td>3</td>
</tr>
<tr>
<td>MUSI 135 - Keyboard Skills I</td>
<td>1</td>
</tr>
<tr>
<td>MUSI 136 - Keyboard Skills II</td>
<td>1</td>
</tr>
<tr>
<td>MUSI 195 - Applied Music I</td>
<td>1</td>
</tr>
<tr>
<td>or MUSI 160 - Beginning Guitar</td>
<td></td>
</tr>
<tr>
<td>MUSI 195 - Applied Music I</td>
<td>1</td>
</tr>
<tr>
<td>or MUSI 161 - Intermediate Guitar II</td>
<td></td>
</tr>
<tr>
<td>MUST 115 - Introduction to Digital Music</td>
<td>3</td>
</tr>
<tr>
<td>MUST 125 - MIDI and Electro-Acoustic Comp</td>
<td>3</td>
</tr>
<tr>
<td>University Core: Quantitative Reasoning (Q)</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>9</td>
</tr>
<tr>
<td>Ensemble</td>
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<tr>
<td>Year Total:</td>
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</table>

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUSI 295 - Applied Music II</td>
<td>1</td>
</tr>
<tr>
<td>or MUSI 260 - Intermediate Guitar</td>
<td></td>
</tr>
<tr>
<td>MUSI 195 - Applied Music I (If Not Previously Completed)</td>
<td>(1)</td>
</tr>
<tr>
<td>ELEL 217 - The Science of Sound</td>
<td>2</td>
</tr>
<tr>
<td>FILM 259 - Multimedia Audio Prod</td>
<td>3</td>
</tr>
<tr>
<td>MUST 220 - Recording I</td>
<td>3</td>
</tr>
<tr>
<td>MUST 341 - Sound Design and Synthesis</td>
<td>3</td>
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<tr>
<td>Ensemble</td>
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<td>University Core and Electives</td>
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<td>Year Total:</td>
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</table>

**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUSI 195 - Applied Music I (If Not Previously Completed)</td>
<td>(1)</td>
</tr>
<tr>
<td>MUSI 295 - Applied Music II (If Not Previously Completed)</td>
<td>(1)</td>
</tr>
<tr>
<td>MUSI 301 - Music History I</td>
<td>3</td>
</tr>
<tr>
<td>or MUSI 302 - Music History II</td>
<td></td>
</tr>
<tr>
<td>MUSI 307A - World Music</td>
<td>3</td>
</tr>
<tr>
<td>MUSI 485 - Acoustic Composition</td>
<td>1</td>
</tr>
<tr>
<td>or MUST 482 - Electronic Composition</td>
<td></td>
</tr>
<tr>
<td>MUST 305 - Orchestration for New Media</td>
<td>3</td>
</tr>
<tr>
<td>MUST 350 - Real-Time Computer Music</td>
<td>3</td>
</tr>
<tr>
<td>MUST 382 - Interdisciplinary Projects II</td>
<td>3</td>
</tr>
<tr>
<td>or CAA 490R/290R - Collaborative Rsch/creative</td>
<td></td>
</tr>
<tr>
<td>MUST 384 - Film Scoring</td>
<td>3</td>
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<tr>
<td>Ensemble</td>
<td>1</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>9</td>
</tr>
<tr>
<td>Year Total:</td>
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</tbody>
</table>

**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUSI 303 - Music History of 20th Century</td>
<td>3</td>
</tr>
<tr>
<td>MUST 380 - Interdisciplinary Proj I: Visual Music</td>
<td>3</td>
</tr>
</tbody>
</table>

**Bachelor of Music Education**

The Bachelor of Music Education (K-12 Broadfield) degree is designed for students who wish to become licensed to teach music in grades K-12. Upon completion of the degree, students are eligible for licensure in the state of Montana. Obtaining a teaching minor will require more than eight semesters. For more information on admission to the Teacher Education Program, Student Teaching, Licensure, Professional Expectations and more, please visit: http://catalog.montana.edu/graduate/education-health-human-development/department-education/teacher-education-program/

A selection of courses in music education, music theory, and music history are offered at the graduate level. A Master of Education degree with an emphasis in music is available through the Department of Education. Please see http://catalog.montana.edu/graduate/education-health-human-development/education/med-curriculum-leadership/for more information.

Bachelor of Music Education (BME) degree students are required to audition with the appropriate applied instrumental or vocal faculty prior to, or at the latest, during the first semester of study for all music programs. Placement in MUSI 195 (Applied Music) will be at the sole determination of the applied studio professor. Students with limited experience on their principal instrument are responsible for obtaining preparatory instruction and basic music-reading skills and may be required to complete MUSI 102 in order to develop the required skills necessary to be accepted for applied study and enroll in MUSI 195. If accepted for applied lessons, music majors must enroll in Applied Music each semester of residency. Advancement to the next level will be by performance jury and with the approval of the applied music instructor. A recital, or an appearance in
in order to meet the "C" or better requirement of the BME in Music.

The following Foundation Courses may be taken a maximum of two times
exceptions will be at the sole discretion of the Director.

required to satisfy all music (MUST/MUSI/MUSE) prerequisites. Any
in previous course work. Completion of a course with a "C" or better is
in nature, with upper-level courses building upon knowledge acquired
as a portion of the required course work, wind and percussion majors must enroll in MUSI 155 (Marching Band) for two semesters and a choral ensemble for one semester.

BME students must receive the grade of "C" or better in ALL music content
and education classes to be approved for student teaching. BME students
must also demonstrate guitar proficiency by either passing the guitar
proficiency examination or completing MUSI 160 with a grade of "C" or
better. Further, a grade of "C-" or better is required in all courses that will
be counted toward the 42 upper-division credits required in all degrees.

Courses with a passing grade of D-, D, or D+ may only be counted toward
the overall 120 credit requirement.

As with many degree programs at MSU, the music curriculum is sequential
in nature, with upper-level courses building upon knowledge acquired
in previous course work. Completion of a course with a "C" or better is required to satisfy all music (MUST/MUSI/MUSE) prerequisites. Any
exceptions will be at the sole discretion of the Director.

The following Foundation Courses may be taken a maximum of two times
in order to meet the "C" or better requirement of the BME in Music.

• MUSI 140 Aural Perception I and MUSI 141 Aural Perception II
• MUSI 105 Music Theory I and MUSI 106 Music Theory II
• MUSI 135 Keyboard Skills I and MUSI 136 Keyboard Skills II

Bachelor of Music Education

Freshman Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>MUSI 100 -</td>
</tr>
<tr>
<td>3</td>
<td>MUSI 105 - Music Theory I</td>
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<td>1</td>
<td>MUSI 140 - Aural Perception I</td>
</tr>
<tr>
<td>1</td>
<td>MUSI 135 - Keyboard Skills I</td>
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<tr>
<td>3</td>
<td>MUSI 106 - Music Theory II</td>
</tr>
<tr>
<td>1</td>
<td>MUSI 141 - Aural Perception II</td>
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<tr>
<td>1</td>
<td>MUSI 136 - Keyboard Skills II</td>
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<tr>
<td>1</td>
<td>MUSE 134 - Techniques: Percussion</td>
</tr>
<tr>
<td>1</td>
<td>MUSE 123 - Techniques: Voice</td>
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<tr>
<td>1</td>
<td>MUSI 195 - Applied Music I</td>
</tr>
<tr>
<td>1</td>
<td>MUSI 195 - Applied Music I</td>
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<tr>
<td>2</td>
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<tr>
<td>12</td>
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Sophomore Year

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<tr>
<th>Credits</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>MUSI 100 -</td>
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<tr>
<td>3</td>
<td>MUSI 205 - Music Theory III</td>
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<tr>
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| 1       | MUSI 231 - Intern Keyboard:
|         | Accompanying                      |

Junior Year

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<tr>
<td>2</td>
<td>MUSI 335 - Instrumental Conducting</td>
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<td>MUSI 336 - Choral Conducting</td>
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<td>MUSE 131 - Techniques: Sax, Oboe, Bassoon</td>
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<td>MUSE 135 - Techniques: Strings</td>
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<td>MUSE 397 - Methods: General Music</td>
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<td>MUSE 437 - Instrumental Field Experience</td>
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<td>MUSE 497MI - Methods: Inst Mthds &amp; Lit 5-12</td>
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<td>MUSI 442 - Vocal Studio Pedagogy and Lit</td>
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<td>MUSI 440 - Orchestration</td>
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<td>EDSP 306 - Exceptional Learners</td>
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Senior Year

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<td>MUSE 439 - Choral Field Experience</td>
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<td>MUSE 497MC - Methods: Chel Mthds &amp; Lit 5-12</td>
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<td>MUSI 499R - Senior Capstone Project</td>
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A minimum of 120 credits is required for graduation; 42 of these credits
must be in courses numbered 300 or above.
Music Minor (non-Teaching)

A Music Minor (Non-Teaching) is offered for those non-majors across the university whose involvement with the School of Music forms a substantial portion of their undergraduate study.

Students are required to audition with the appropriate applied instrumental or vocal faculty prior to the first semester of study for all music programs. Placement in MUSI 195 (Applied Music) will be at the sole determination of the applied studio professor. Students with limited experience on their principal instrument are responsible for obtaining preparatory instruction and basic music-reading skills and may be required to complete MUSI 102 in order to develop the required skills necessary to be accepted for applied study and enroll in MUSI 195. Advancement to the next level will be by performance jury and with the approval of the applied music instructor. All applied music students are expected to participate in the School’s band, choral, and orchestral ensembles. Acceptable ensembles are listed in the Music Major Handbook. A minimum of 4 credits of Applied Music must be taken over a period of four semesters.

Students seeking a music minor must achieve the grade of "C" or better in all required music courses.

Completion of a course with a "C" or better is required to satisfy all music prerequisites. Any exceptions will be at the sole discretion of the SOM Director.

The following Foundation Courses may be taken a maximum of two times in order to meet the "C" or better requirement of the music minor.

- MUSI 140 Aural Perception I and MUSI 141 Aural Perception II
- MUSI 105 Music Theory I and MUSI 106 Music Theory II
- MUSI 135 Keyboard Skills I and MUSI 136 Keyboard Skills II

Nine upper-division credits in music must be completed for the music minor.

MUSI 105 Music Theory I 3
MUSI 106 Music Theory II 3
MUSI 140 Aural Perception I 1
MUSI 141 Aural Perception II 1
MUSI 195 Applied Music I 1
MUSI 195 Applied Music I 1
Choose one of the following: 3

- MUSI 101IA Enjoyment of Music
- MUSI 211IA Masterworks in Music

- MUSI 295 Applied Music II 1
- MUSI 295 Applied Music II 1

- MUSI 307IA World Music 3

Music Ensembles (see music major handbook for acceptable ensembles) 4
Music Electives (no ensembles or applied music) 6

Total Credits 28

Undergraduate Programs Available

Department of Education (p. 126)
- B.S. in Elementary Education K-8 (p. 129)
- B.S. in Secondary Education (p. 131)
- B.S. in Technology Education (p. 133)
- Teacher Education Program (p. 127)
- Teaching Minors (p. 136)

Department of Health and Human Development (p. 140)
- B.S. in Community Health (p. 143)
- B.S. in Early Childhood Education and Child Services (p. 144)
- B.S. in Food and Nutrition (p. 146)
- B.S. in Health Enhancement (Health and Physical Education) K-12 (p. 147)
- B.S. in Health and Human Performance (p. 153)
- B.S. in Hospitality Management (p. 149)
- B.S. in Human Development and Family Science (p. 151)
- B.S. in Sustainable Food & Bioenergy Systems (p. 156)
- Coaching Minor (Non-Teaching) (p. 142)
- Human Development Minor (Non-Teaching) (p. 156)
- Personal and Consumer Finance Minor (p. 156) (Non-Teaching) (p. 156)
- Gerontology Certificate (p. 147)

The College of Education, Health and Human Development provides studies for those persons interested in careers in the helping professions associated with education, school counseling, human development, physical education, hospitality management, exercise science, health, counseling, and nutrition. These functions are carried out within the college's two departments: the Department of Education, and the Department of Health and Human Development.

The Department of Education is composed of three units: Curriculum and Instruction, for the preparation of undergraduate and graduate teacher education majors who seek teaching careers in either elementary or secondary schools; Educational Leadership, offering graduate programs in K-12 administration; and Adult and Higher Education offering graduate programs for those seeking advanced study in adult education and higher education administration.

The Department of Health and Human Development administers a variety of curricula that prepares students for various careers including child development, community health, dietetics, early childhood education and child services, exercise science, hospitality management, human development and family science, kinesiology, nutrition science, and sustainable food and bioenergy systems. Teaching careers are offered in early childhood education P-3 (preschool to grade 3), family and consumer sciences 5-12, and health enhancement K-12 (health and physical education). A post-baccalaureate dietetics internship is also offered—the only internship program in the state of Montana.

The college cooperates with other agencies in Montana in the improvement of educational programs and services through its After School Partnership, Child Development Center, Early Childhood Project, Field Placement and Licensure, Indian Education for All, Human Development Clinic, Montana Team Nutrition, and other public service centers and activities.
Graduate Programs Available
In addition to its baccalaureate degree programs, the college offers graduate-level programs leading to the Master of Science in Community Health, Counseling (marriage and family; mental health), Exercise and Nutrition Sciences (exercise physiology and nutrition; sport and coaching sciences), Family and Consumer Sciences (early childhood education/child development; human development and family science), Family Financial Planning, and Sustainable Food Systems, as well as a Master of Education in School Counseling through the Department of Health and Human Development. The Department of Education offers the Library Media Certificate, the College Teaching Certificate, the School Superintendent Certificate, the Master of Education, the Education Specialist degree, and the EdD with emphasis in Adult and Higher Education, Curriculum and Instruction, and Educational Leadership, or a PhD in Education with emphasis in Adult and Higher Education, Curriculum & Instruction and Educational Leadership.

Montana State University is a member of the American Association of Colleges for Teacher Education and is accredited by the Northwest Association of Secondary and Higher Schools. Professional programs for the preparation of elementary and secondary teachers at the baccalaureate level are accredited by the Council for the Accreditation of Educator Preparation, as are the master’s level programs for the preparation of elementary school principals, high school principals, and the doctoral program in education administration. All education programs are approved by the Montana Board of Public Education. Marriage and family, mental health, and school counseling programs are accredited by the Council for Accreditation of Counseling and Related Educational Programs of the American Counseling Association. The Dietetics program is accredited by Accreditation Council for Education in Nutrition and Dietetics for the Academy of Nutrition and Dietetics. The Child Development Center in Herrick Hall is licensed by the state of Montana and accredited by the National Association for the Education of Young Children.

Mission Statement
The mission of the Department of Education is to prepare highly qualified professional educators and administrators through exemplary campus and distance based programs and field placements in quality public and private schools. In addition, the department contributes to the State of Montana and the nation through the faculty’s active research and outreach efforts.

Montana State University is one of the units in the Montana University System charged with the responsibility of recommending teacher candidates for teacher licensure. In discharging this responsibility, the College of Education, Health and Human Development attempts to encourage, prepare, and recommend for licensure only those students who show promise of teaching excellence. Consequently, certain criteria have been established for admission to the Teacher Education Program, and screening procedures have been provided at several points in the program.

The Teacher Education Program endeavors to select applicants who have the ability to become highly competent teachers. As an accredited teacher education program, the curriculum in teacher education adheres to the standards of the Montana Professional Educator Preparation Program Standards outlined by the Montana Board of Public Education (BPE) and the Council for the Accreditation of Educator Preparation (CAEP). Within these guidelines, the Teacher Education faculty have the freedom and ultimate responsibility for the selection and evaluation of its students; the design, implementation, and evaluation of its curriculum; and the determination of who should be recommended for a degree and state licensure. Admission and retention decisions are based not only on prior satisfactory academic achievement but also on a range of factors which serve to ensure that the teacher candidate can demonstrate the Professional Expectations required in the Teacher Education Program.

The program does not discriminate on the basis of race, color, creed, religion, national origin, gender, sexual orientation, age, marital status, or disability. When requested, the University will provide reasonable accommodations to otherwise qualified students with disabilities.

Undergraduate Teacher Education Program—Conceptual Framework
The Teacher Education Program at MSU believes that learning to teach in educational settings is a complex task requiring a thoughtful blending of content mastery with carefully guided field experiences. In order to meet the multiple demands of an ever-changing profession, we ensure that students demonstrate their competencies in guided field experiences through every phase of our program. Thus, students who graduate from the Teacher Education Program at MSU are engaged in and committed to:

1. Content Mastery
   The Teacher Education Program at MSU has been designed to provide our students with a rich and well-balanced education grounded in the liberal arts & sciences and current educational theory, research, and practice. Students participate in learning communities within our program in which they develop in-depth content knowledge for their work as classroom teachers and school leaders. Our graduates understand the central concepts, tools of inquiry, and structures of the disciplines and can create standards-based learning experiences that are meaningful for students.

2. Understanding Development and Diversity of Learners
   Graduates of the Teacher Education Program understand how K-12 students learn and develop and can provide learning opportunities which are adapted to diverse learners and support their intellectual, social, and personal development. Our graduates are committed to building a caring, respectful, and supportive learning environment and are prepared to provide access to the necessary tools to help every student learn. They are also cognizant of and committed to Montana’s
American Indian cultures and the values embodied by the Indian Education for All Act.

3. **Pedagogical and Technological Proficiency**
   We believe that professional educators must have sound pedagogical content knowledge and be skilled in the use of research-based instructional practices. Our graduates understand and use a variety of instructional strategies to foster students’ motivation for learning and encourage their conceptual understandings through the development of critical thinking, problem solving, and performance/work force skills. Our graduates understand the principles of differentiated instruction and can integrate these concepts and practices into their teaching. The graduates of our Teacher Education Program also demonstrate knowledge of effective verbal and nonverbal communication techniques and effectively use educational technology to foster active inquiry, collaboration, and supportive interaction in the classroom.

4. **Excellence in Instructional Design and Assessment**
   It is essential for teachers to understand and practice alignment in curriculum, standards, and assessments. Our program is committed to current models of instructional design in which our candidates focus on defining learning outcomes and determining evidence that all learners have met curricular goals. Our graduates plan instruction based upon knowledge of subject matter, students, the community, and curriculum goals. They also understand how to analyze pre-, formative, and summative assessment of student learning for individuals, small groups, or whole class settings to ensure the intellectual, social, and personal development of every learner.

5. **Professionalism in Practice and Reflection**
   Continuous improvement of the education profession depends upon the systematic practice of professional reflection, inquiry, and collaboration to discover new and more effective educational approaches. Our graduates demonstrate the ability to reflect on classroom decision-making with regard to content, diversity, pedagogy and assessment in order to improve teaching and learning. They are reflective practitioners who examine their own biases and endeavor to provide equitable educational opportunities for students. They also demonstrate an understanding that education happens in a context and develop effective relationships with family and community members. As candidates move from campus to the K-12 classroom, they are expected to adhere to and model our program’s Professional Expectations and Montana’s Code of Ethics for teachers.

**Professional Competencies & Dispositions For Prospective Teachers**

The following professional competencies are required by Montana State University for all professional educators and are evidenced by the behaviors indicated. MSU professional educators will able to demonstrate the following:

**Communication competencies appropriate to one’s professional level and teaching context:**
- Using appropriate grammar (syntax, inflection, and word choice) in oral communication.
- Speaking distinctly and with confidence.
- Interacting sensitively to situation and circumstances with professors, students, peers, and colleagues.
- Using correct spelling, standard English mechanics, and meaningful word choice in written expression.

**Intellectual competencies appropriate one’s professional level and teaching context:**
- Mastering relevant content in subjects commonly taught in K-12 settings.
- Mastering pedagogical principles and their application in field settings at a level deemed appropriate by the MSU faculty.
- Comprehending, memorizing, analyzing, and synthesizing material.
- Developing reasoning and decision-making skills appropriate to the practice of teaching.

The following professional dispositions are required by Montana State University for all professional educators and are evidenced by the behaviors indicated. MSU professional educators will able to demonstrate the following:

**Dispositions toward professional engagement:**
- Committing fully in all class activities and field settings.
- Presenting a consistent professional appearance, including dress, body art, and hygiene.
- Prioritizing obligations to maintain poise and complete all responsibilities punctually and efficiently.

**Dispositions toward valuing diversity:**
- Showing habitual respect for and promotion of others’ cultures, languages, abilities, views, etc.
- Implementing equitable practices when planning instruction or when organizing assessments/testing.
- Working collaboratively for positive learning environments sensitive to school & community values.

**Dispositions toward embracing feedback for professional growth:**
- Accepting, responding to, and seeking out experienced critiques of one’s professional development.
- Taking responsibility for one’s own growth, regularly reflecting on personal teaching strengths and flaws.
- Maintaining a calm professional distance during conflict, showing a willingness to “let things go.”
- Exhibiting resilience by persevering in the face of injustice or challenge.

**Dispositions toward a collaborative team spirit:**
- Practicing thoughtful, active listening and mindful observation of people and situations.
- Including colleagues, learners, and others in setting goals and in making decisions.
- Using various methods of clear and professional communication to forge connections with diverse colleagues.

**Dispositions toward ethical behavior:**
- Understanding and applying professional educator ethics, standards, law, and policy.
- Exercising judgment and discretion as an advocate for students.
- Showing commitment to the ethical collection, interpretation, and application of data.

**Dispositions toward responsibility and trustworthiness:**
- Showing appropriate accountability to those served through positivity, professional courtesy, self-control, and unbiased concern for others—both in and outside of the school community (including online).
- Evidencing continuous learning by drawing on policy and research to reflect and improve practice.

**Dispositions to responsive, encouraging student-centeredness:**
• Responding to students’ strengths as a basis for growth and to their misconceptions as opportunities.
• Using varied forms of timely, kind, and meaningful feedback according to each learner’s unique needs.
• Encouraging flexible learning environments that support learner expression and discovery. # Working to develop each learner’s capacity to self-assess and to provide respectful, positive peer assessment

Admission to the Teacher Education Program
Students must apply to the Teacher Education Program during the semester prior to taking their upper-division methods and practicum coursework. Admission to the Teacher Education Program requires completion of the “Application for Admission.” These forms are available at www.montana.edu/ehhd/educ/advising/index.shtml and must be turned into the Education Advising Center, Reid Hall 132.

The requirements for admission to the Teacher Education Program are:
1. a cumulative grade-point average of at least 2.75
2. a 2.75 grade-point average in the teaching major, minor and option, with no grade below a “C” in any of these areas
3. a current background check completed as outlined by Sec. 20-4-110 of the MCA

Application and Approval for Student Teaching
Certain requirements must be met by all students desiring to student teach:
1. maintenance of the same standards required for admission into the program including satisfactory clearance on a federal criminal background check
2. completion of all required courses (meeting academic requirements as listed above) prior to student teaching
3. certification in first aid with CPR

Student teaching is limited to seniors. A completed application must be submitted to the Office of Field Placement and Licensure before any placement is made.

If special services or accommodations (for a disability) are needed or required while student teaching, requests must be submitted to the Office of Field Placement and Licensure before any placement is made.

Recommendation and Approval for Licensure
The requirements for recommendation by Montana State University for licensure include:
• completion of all courses in the Teacher Education Program as outlined in DegreeWorks meeting the GPA standards according to catalog year
• maintenance of the same standards as are required for student teaching including Montana Assessment of Content Knowledge
• meet the Office of Public Instruction (OPI) assessment requirements to include the Praxis Subject exam
• completion of the OPI licensure application (http://www.montana.edu/fieldplacement/licensure/sk_msu.html)

Residency Requirements for Professional Education Courses
In order to recommend prospective teachers in elementary and/or secondary education for Montana teacher licensure, students must enroll in most methods, teaching practicum(s), and student teaching through the MSU-Bozeman campus.

Based on MSU graduation requirements, twenty-three of the last thirty credits earned to meet the graduation requirement (p. 54) must be MSU credits. Specific majors may have program-specific requirements for courses that must be taken from MSU to meet graduation requirements. Such requirements are clearly identified in the curriculum description for that department.

Second Degree and Non-degree Licensure
Students already holding valid Bachelor’s degrees may fulfill licensure requirements by completing a second undergraduate degree, or in some cases, a non-degree program. Students completing a second degree are required to complete 30 credits, nine of which must be 300-400 level. Students should contact the Office of Field Placement and Licensure for further information. Non-degree and second-degree students must meet the same standards for program entrance and student teaching as first-degree students

Elementary Education K-8 (p. 129)
The following options may be added to the Elementary Education K-8 major, but students are not required to add an option.
• Early Childhood Education Option (p. 130) (Does not lead to additional licensure)
• Mathematics Education Option (p. 131) (Does not lead to additional licensure)
• Science Education Option (p. 131) (Does not lead to additional licensure)
• Special Education Option (p. 131) (Does not lead to additional licensure—students interested in Special Education licensure should speak to an Education Department advisor)

Secondary Education (Grades 5-12 and K-12) (p. 131)
The Department of Education administers secondary education degrees in General Science Broadfield (5-12) and Social Studies Broadfield (5-12). Additional teaching degrees at the 5-12 and K-12 levels are offered in cooperation with other departments across campus.
• General Science Broadfield (5-12) (p. 132)
• Social Studies Broadfield (5-12) (p. 133)

Technology Education (p. 133)
• Technology Education Broadfield (5-12) (p. 133)
• Industrial Technology Option (p. 134) (Does not lead to teaching licensure)

Teaching Minors
A number of teaching minors are available for students majoring in Secondary Education or Elementary Education.
• Art (K-12) (p. 136)
• Biology (5-12) (p. 137)
• Chemistry (5-12) (p. 137)
• Earth Science (5-12) (p. 137)
• Economics (5-12) (p. 137)
• Family and Consumer Sciences (5-12) (p. 137)
• French (K-12) (p. 138)
• German (K-12) (p. 138)
• Government (5-12) (p. 138)
• History (5-12) (p. 138)
• Mathematics (5-12) (p. 138)
• Physics (5-12) (p. 138)
• Reading (K-12) (p. 139)
• Spanish (K-12) (p. 139)
• Technology Education (5-12) (p. 139)

Programs and Degrees Offered
Post Baccalaureate Teacher Licensure (http://catalog.montana.edu/graduate/education-health-human-development/education/teacherlicensure)
Licensed Teacher Added Recommendation (http://catalog.montana.edu/graduate/education-health-human-development/education/addedrecommendation)

Certificates
• College Teaching Certificate (p. 312)
• Library Media Certificate (p. 313)
• School Superintendent Certificate (p. 314)

MEd
• Adult and Higher Education (p. 314)
• Curriculum and Instruction (p. 317)
• Educational Leadership (p. 323)

EdD
• Adult and Higher Education (p. 324)
• Curriculum and Instruction (p. 327)
• Educational Leadership (p. 329)

EdS
• Educational Leadership (p. 337)

PhD
• Adult and Higher Education (p. 330)
• Curriculum and Instruction (p. 333)
• Educational Leadership (p. 335)

Elementary Education K-8

The Department of Education offers a teacher education program for students seeking teaching careers in grades kindergarten through eight (K-8). The Elementary Education major is designed to provide a broad educational foundation with a focus on how science, technology, engineering, and math interconnect within the language arts, social studies, arts, and health enhancement curricula. This program content is essential in the preparation of successful K-8 pre-service teachers.

Prospective elementary school teachers follow a program of study the first two years which is essentially the same for all students. There is sufficient flexibility, however, for specialization in the various teaching options available.

One of the major attributes of the Elementary Education program at Montana State University is its extensive field experience component. This includes service learning experiences in the freshman year, micro-teaching experiences in the After School Partnership in the sophomore year, and two practicum teaching semesters prior to student teaching. During these semesters, students spend the equivalent of four half-days for a minimum of eight weeks in supervised settings working directly with children while concurrently completing methods courses on campus. The final clinical experience is student teaching where students spend fourteen weeks in a supervised classroom setting.

Students in the Elementary Education K-8 program can choose to add the following options: Early Childhood, Mathematics, Science, and/or Special Education. These options permit students to focus in these specific areas in addition to completing the K-8 degree requirements. The options, while not providing additional endorsements in the specialties addressed, do allow for added study in each area. Students can also pursue teaching minors (p. 136) which would provide additional endorsements in the State of Montana.

Alternately, students interested in working exclusively with younger students may choose to pursue a major in Early Childhood Education & Child Services: P-3 Option (p. 144), which is administered by the Department of Health and Human Development (p. 140).

Students in 5-12 and K-12 teaching majors are required to take courses in certain areas of professional education. A grade of “C” or better is required in all professional education courses; a “C-” is not acceptable.

See the Teacher Education Program (p. 127) website for entrance requirements.

Graduate degree programs are offered for students who wish to pursue advanced programs in curriculum and instruction (See The Department of Education’s Graduate Program’s website (http://catalog.montana.edu/graduate/education-health-human-development/education)).

Elementary Education K-8

Note: Students must be admitted into the Teacher Education Program prior to taking their upper-division methods and practicum coursework.

Recommended Program Sequence For Required Elementary Education K-8

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<td>M 132 - Numbers &amp; Operations for K-8 Teachers</td>
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<tr>
<td>BIOB 100IN - Organism Function or BIOM 103IN - Unseen Universe: Microbes</td>
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<td>EDU 204IA - Arts &amp; Lifelong Learning</td>
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<td>NASX 105D - Introduction to Native American Studies or NASX 205D - Native Americans in Contemporary Society or NASX 232D - MT Indians: Cultures, Histories, Current Issues</td>
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<td>GPHY 121D - Human Geography or GPHY 141D - Geography of World Regions or ANTY 101D - Anthropology and the Human Experience or SOCI 101IS - Introduction to Sociology or AMST 101D - Introduction to American Studies</td>
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<td>M 133Q - Geometry &amp; Measure K-8 Teachers</td>
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<td>or HSTR 101IH</td>
<td>Western Civilization I</td>
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<td>or HSTR 102IH</td>
<td>Western Civilization II</td>
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<td>Emergent Literacy</td>
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<td>Higher Math for K-8 Teachers</td>
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<td>PHSX 103IN</td>
<td>The Physics of How Things Work</td>
<td>3</td>
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<tr>
<td>or PHSX 201IN</td>
<td>Physics by Inquiry</td>
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<tr>
<td>or CHMY 102CS</td>
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<td></td>
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<tr>
<td>EDU 211D</td>
<td>Multicultural Education</td>
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<td>Introduction to American Government</td>
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<td>ERTH 101IN</td>
<td>Earth System Sciences</td>
<td>3-4</td>
<td></td>
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<tr>
<td>or ERTH 212RN</td>
<td>Yellowstone: Scientific Lab</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or GEO 103CS</td>
<td>Intro to Envrmntl Geology</td>
<td></td>
<td></td>
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<tr>
<td>or GEO 105IN</td>
<td>Oceanography</td>
<td></td>
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<tr>
<td>or GEO 111IN</td>
<td>Dinosaurs</td>
<td></td>
<td></td>
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<tr>
<td>or GEO 140IN</td>
<td>Planetary Geoscience</td>
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<td>Year Total:</td>
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### Junior Year

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<tbody>
<tr>
<td>EDU 382</td>
<td>Assessmt, Curric, Instructn</td>
<td>3</td>
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<td>EDSP 306</td>
<td>Exceptional Learners</td>
<td>3</td>
<td></td>
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<td>EDU 331</td>
<td>Lit and Literacy for Children</td>
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<tr>
<td>EDU 397</td>
<td>Methods (K-8 Health Enhancement)</td>
<td>3</td>
<td></td>
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<tr>
<td>Option Course(s) or Elective</td>
<td></td>
<td>1-3</td>
<td></td>
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<tr>
<td>Elective</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDU 397</td>
<td>Methods (K-8 Language Arts)</td>
<td>3</td>
<td></td>
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<tr>
<td>EDU 397</td>
<td>Methods (K-8 Science)</td>
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<td></td>
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<tr>
<td>EDU 342</td>
<td>Managing the Learning Envir</td>
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<tr>
<td>EDU 395</td>
<td>Practicum (I)</td>
<td>1-3</td>
<td></td>
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<tr>
<td>Elective</td>
<td></td>
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### Senior Year

<table>
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<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 397</td>
<td>Methods (K-8 Creative Arts)</td>
<td>3</td>
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<tr>
<td>EDU 397</td>
<td>Methods (K-8 Math)</td>
<td>3</td>
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<tr>
<td>EDU 397R</td>
<td>Methods:K-8 Social Studies</td>
<td>3</td>
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<tr>
<td>EDU 438</td>
<td>Ltrcy Asmnt, Diagnos and Instr</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDU 395</td>
<td>Practicum (II)</td>
<td>1-3</td>
<td></td>
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<tr>
<td>EDU 495R</td>
<td>Student Teaching</td>
<td>5</td>
<td>16</td>
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<td>13-15</td>
<td>5-16</td>
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Total Program Credits: 104-123

### Approved Stem Electives

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ASTR 110IN</td>
<td>Introduction to Astronomy: Mysteries of the Sky</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 160</td>
<td>Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>BIOE 103CS</td>
<td>Environmental Science and Society</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 103IN</td>
<td>Unseen Universe: Microbes</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 102CS</td>
<td>Applying Chemistry to Society</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 121IN</td>
<td>Introduction to General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>ECHM 205CS</td>
<td>Energy and Sustainability</td>
<td>3</td>
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<tr>
<td>EELE 101</td>
<td>Intro Electrical Fundamentals</td>
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<tr>
<td>EGEN 105</td>
<td>Intro to General Engineering</td>
<td>2</td>
</tr>
<tr>
<td>EGEN 125CS</td>
<td>Tech, Innovation, and Society</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 101IN</td>
<td>Earth System Sciences</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 212RN</td>
<td>Yellowstone: Scientific Lab</td>
<td>4</td>
</tr>
<tr>
<td>GEO 103CS</td>
<td>Intro to Envrmntl Geology</td>
<td>4</td>
</tr>
<tr>
<td>M 105Q</td>
<td>Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts)</td>
<td>3</td>
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<tr>
<td>M 121Q</td>
<td>College Algebra</td>
<td>3</td>
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<tr>
<td>M 147Q</td>
<td>Language of Mathematics</td>
<td>3</td>
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<tr>
<td>M 149Q</td>
<td>Secrets of the Infinite</td>
<td>3</td>
</tr>
<tr>
<td>M 151Q</td>
<td>Precalculus</td>
<td>4</td>
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<tr>
<td>M 161Q</td>
<td>Survey of Calculus</td>
<td>4</td>
</tr>
<tr>
<td>M 171Q</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>M 420</td>
<td>Geometry, Measurement, and Data in the Middle Grades</td>
<td>3</td>
</tr>
<tr>
<td>M 424</td>
<td>Algebraic Thinking and Number Sense in the Middle Grades</td>
<td>3</td>
</tr>
<tr>
<td>NRS 101</td>
<td>Natural Resource Conservation</td>
<td>3</td>
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<tr>
<td>PHSX 103IN</td>
<td>The Physics of How Things Work</td>
<td>3</td>
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<tr>
<td>PHSX 201IN</td>
<td>Physics by Inquiry</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 205</td>
<td>College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 207</td>
<td>College Physics II</td>
<td>4</td>
</tr>
<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>STAT 217Q</td>
<td>Intermediate Statistical Concepts</td>
<td>3</td>
</tr>
<tr>
<td>TE 207</td>
<td>Materials and Processes</td>
<td>4</td>
</tr>
</tbody>
</table>

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

### Options

The following options may be added to the Elementary Education K-8 major, but students are not required to add an option.

- Early Childhood Education Option (p. 130) (Does not lead to additional licensure)
- Mathematics Education Option (p. 131) (Does not lead to additional licensure)
- Science Education Option (p. 131) (Does not lead to additional licensure)
- Special Education Option (p. 131) (Does not lead to additional licensure—students interested in Special Education licensure should speak to an Education Department advisor)

### Early Childhood Education Option

All early childhood education option students must meet the requirements of the Elementary Education K-8 curriculum, with these additions:

- EDEC 160 Early Childhood Development 3
- EDEC 271 Paraprofessional Experience in Early Childhood 2
- EDEC 350 Play and Learning in Early Childhood 3
Mathematics Education Option

All mathematics education option students must meet the requirements of the Elementary Education K-8 curriculum, with these additions:

- EDU 497R Methods 5-8 Mathematics 3
- STAT 216Q Introduction to Statistics 3
- M 420 Geometry, Measurement, and Data in the Middle Grades 3
  or M 424 Algebraic Thinking and Number Sense in the Middle Grades

**Recommended Mathematics Elective (cannot double count in any credits):**

Choose two of the following: 6
- M 147Q Language of Mathematics
- M 149Q Secrets of the Infinite
- M 151Q Precalculus
- M 161Q Survey of Calculus
- M 171Q Calculus I
- M 420 Geometry, Measurement, and Data in the Middle Grades
- M 424 Algebraic Thinking and Number Sense in the Middle Grades
- STAT 217Q Intermediate Statistical Concepts
  or another approved Mathematics course

**Total Credits** 15

All courses in this option must be completed with a grade of C or better and with a minimum option GPA of 2.75. Students choosing this option voluntarily select a program that requires additional coursework beyond the 120 credits required for a standard four-year degree. This option does not lead to additional licensure.

Science Education Option

Choose one lab course and one additional course from the following: 7-8
- BIOC 160 Principles of Living Systems
- BIOC 170IN Principles of Biological Diversity
- BIOE 103CS Environmental Science and Society
- BIOM 103IN Unseen Universe: Microbes

Choose one lab course and one additional course from the following: 7-8
- ASTR 110IN Introduction to Astronomy: Mysteries of the Sky
- ERTH 101IN Earth System Sciences
- ERTH 212RN Yellowstone: Scientific Lab
- GEO 103CS Intro to Envrnmtl Geology

**Total Credits** 15

All courses in this option must be completed with a grade of C or better and with a minimum option GPA of 2.75. Students choosing this option voluntarily select a program that requires additional coursework beyond the 120 credits required for a standard four-year degree. This option does not lead to additional licensure.

Special Education Option

- EDSP 307 Exceptional Learners Lab 1
- EDU 330 Emergent Literacy 3
- EDU 438 Ltrcy Asmnt, Diagnos and Instr 3
- EDSP 458 Assessment and Intervention 4
- Three Special Education Courses from MSU-Billings 9

**Total Credits** 20

Secondary Education (Grades 5-12 and K-12)

The Department of Education offers teacher education programs for students seeking teaching careers in specific subject areas for grades five through twelve. General Science Broadfield, Social Studies Broadfield, and Technology Education Broadfield are three degrees which are totally administered and housed within the Department of Education. Several other programs are administered inter-departmentally such as English, history, and health enhancement. Students in these programs will enroll in the departments offering the teaching options in their chosen areas (see below).

In addition to its secondary programs, the Department of Education provides foundation coursework which is valuable to teachers at all levels in such areas as history and philosophy of education, multicultural education, educational psychology, assessment, curriculum, instructional technology, and exceptionality.

Teaching minors, that is, preparation for a second teaching field in addition to the major field, are offered by many departments. All teaching minors must be linked to a teaching major. Graduate degree programs are available for secondary teachers who are already licensed (see The Graduate School (p. 288)).

All students in secondary education programs must apply for admission to the Teacher Education Program at the beginning of the semester prior to taking their methods course(s) in their major(s) and minor(s). Application to the Secondary Education program should be turned into the Education Advising Center, Reid Hall 132.

Major in Secondary Education

Students enroll/major in the Department of Education.
• General Science Broadfield (5-12) (p. 132)
• Social Studies Broadfield (5-12) (p. 133)

**Major in Technology Education**

- Technology Education Broadfield (5-12) (p. 133)
- Industrial Technology (p. 134) (*Does not lead to teaching licensure*)

**Subject Area Majors with Teaching Options**

Students enroll/major in the appropriate departments outside of the Department of Education. See the Teacher Education Program (p. 127) page for entrance requirements.

- Agricultural Education Broadfield (5-12) (p. 77)
- Art Education Broadfield (p. 106) (K-12) (p. 106)
- Biology (5-12) (p. 209)
- Chemistry (5-12) (p. 200)
- English (5-12) (p. 216)
- Family and Consumer Sciences (5-12) (p. 151)
- Health Enhancement Broadfield (K-12) (p. 147)
- History (5-12) (p. 221)
- Mathematics (5-12) (p. 233)
- Modern Languages K-12 (French, German, Spanish) (p. 242)
- Music Education (K-12) (p. 123)
- Physics (5-12) (p. 253)

**Teaching Minors**

A number of teaching minors are available for students majoring in Secondary Education or Elementary Education.

- Art (K-12) (p. 136)
- Biology (5-12) (p. 137)
- Chemistry (5-12) (p. 137)
- Earth Science (5-12) (p. 137)
- Economics (5-12) (p. 137)
- Family and Consumer Sciences (5-12) (p. 151)
- French (K-12) (p. 138)
- German (K-12) (p. 138)
- Government (5-12) (p. 138)
- History (5-12) (p. 138)
- Mathematics (5-12) (p. 138)
- Physics (5-12) (p. 138)
- Reading (K-12) (p. 139)
- Spanish (K-12) (p. 139)
- Technology Education (5-12) (p. 139)

**General Science Broadfield**

The General Science Broadfield program prepares students to be licensed to teach all middle and senior high school science areas in the state of Montana. See the Teacher Education Program (p. 127) page for entrance requirements.

Secondary level endorsement will cover grades five through twelve for all applicants graduating from approved programs. Practicum and student teaching experiences are coordinated through the Office of Field Placement & Licensure (http://www.montana.edu/fieldplacement).

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**Program Sequence**

**Freshman Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
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<tbody>
<tr>
<td>WRIT 101W - College Writing I</td>
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<tr>
<td>M 161Q - Survey of Calculus</td>
<td>4</td>
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<tr>
<td>HDFS 101IS - Indiv and Fam Dev: Lifespan</td>
<td>3</td>
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<tr>
<td>BIBOB 170IN - Principles of Biological Diversity</td>
<td>4</td>
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<td>Elective</td>
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</table>

<table>
<thead>
<tr>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 101US - Teaching and Learning</td>
<td>3</td>
</tr>
<tr>
<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
<td>3</td>
</tr>
<tr>
<td>EDU 202 - Early Field Experience</td>
<td>1</td>
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<tr>
<td>PHSX 205 - College Physics I</td>
<td>4</td>
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<td>CHMY 141 - College Chemistry I</td>
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**Sophomore Year**

<table>
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<tbody>
<tr>
<td>EDU 370 - Integrating Tech into Educ</td>
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<tr>
<td>BIBOB 160 - Principles of Living Systems</td>
<td>4</td>
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<td>CHMY 143 - College Chemistry II</td>
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<tr>
<td>PHSX 207 - College Physics II</td>
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**Junior Year**

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<td>EDU 382 - Assessmt, Curric, Instructn</td>
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<tr>
<td>BIBOB 375 - General Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIBOB 412 - Animal Physiology or BIBOB 433 - Plant Physiology</td>
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<table>
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<tr>
<td>Earth Science Elective</td>
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<tr>
<td>EDU 306 - Exceptional Learners</td>
<td>3</td>
</tr>
<tr>
<td>BIBOB 420 - Evolution</td>
<td>3</td>
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<td>ERTH 303 - Weather and Climate or GEO 211 - Earth History and Evolution</td>
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<tr>
<td>BIOM 103IN - Unseen Universe: Microbes or BIOM 360 - General Microbiology</td>
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| Year Total: | 16-18 |

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**Senior Year**

<table>
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<tr>
<td>ASTR 371 - Solar System Astronomy</td>
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<tr>
<td>History of Science (Restricted Elective)</td>
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<tr>
<td>EDU 497 - Methods (5-12 Science)</td>
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<td>EDU 395 - Practicum (5-12)</td>
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<tr>
<td>EDU 494 - Seminar: Lab Safety</td>
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<table>
<thead>
<tr>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EDU 495 - Student Teaching</td>
<td>5-16</td>
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<tr>
<td>EDU 408 - Professional Issues: K-12</td>
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</table>
A minimum of 128 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

All courses with a 1 indicated by the name is a Required course for Elementary Education.

**Note:** While we recommend this sequence, there will be some variance, especially between courses taken by the end of the junior year and first-semester senior year.

**Social Studies Broadfield**

**Social Studies Broadfield Option**
The Social Studies Broadfield program prepares students to be licensed to teach all middle and high school social science areas in the state of Montana. See the Teacher Education Program (p. 127) page for entrance requirements.

Secondary level endorsement will cover grades five through twelve for all applicants graduating from approved programs. Practicum and student teaching experiences are coordinated through the Office of Field Placement & Licensure (http://www.montana.edu/fieldplacement).

### Sequencing Your Required Education Courses

#### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>HDFS 101IS - Indiv and Fam Dev: Lifespan</td>
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<tr>
<td>HSTR 102IH - Western Civilization II</td>
<td>4</td>
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<tr>
<td>EDU 101US - Teaching and Learning</td>
<td>3</td>
<td></td>
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<tr>
<td>W Core</td>
<td>3</td>
<td></td>
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<tr>
<td>Q Core</td>
<td>3</td>
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</tr>
<tr>
<td>PSCI 210IS - Introduction to American Government</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EDU 202 - Early Field Experience</td>
<td>1</td>
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<tr>
<td>GPHY 141D - Geography of World Regions</td>
<td>3-4</td>
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<tr>
<td>or GPHY 121D - Human Geography</td>
<td></td>
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<tr>
<td>or ANTY 101D - Anthropology and the Human Experience</td>
<td></td>
<td></td>
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<tr>
<td>or SOCI 101IS - Introduction to Sociology</td>
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<tr>
<td>or PSYX 100IS - Intro to Psychology</td>
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<td></td>
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<tr>
<td>CS Core</td>
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<td></td>
</tr>
<tr>
<td>HSTR 101IH - Western Civilization I</td>
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**Year Total:** 16-17

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>HSTA 101IH - American History I</td>
<td>4</td>
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<tr>
<td>EDU 370 - Integrating Tech into Educ</td>
<td>2</td>
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<tr>
<td>PSCI 201 - Scope and Methods of Political Science</td>
<td>3</td>
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</tr>
<tr>
<td>PSCI 230D - Introduction to International Relations</td>
<td>3</td>
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</tr>
<tr>
<td>HSTR 130D - Latin American History</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>or HSTR 135D - The Modern Middle East</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or HSTR 140D - Modern Asia</td>
<td></td>
<td></td>
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<tr>
<td>HSTA 102IH - American History II</td>
<td>4</td>
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<tr>
<td>EDU 211D - Multicultural Education</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NASX 232D - MT Indians: Cultures, Histories, Current Issues</td>
<td>3</td>
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<tr>
<td>IA/RA Core</td>
<td>3</td>
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</tr>
<tr>
<td>Social Science Upper Division Elect 300+</td>
<td>3</td>
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<tr>
<td>PSCI Upper Division Elect 300+</td>
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<tr>
<td>NASX Upper Division Elect 300+</td>
<td>3</td>
<td></td>
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<tr>
<td>HSRT/HSTA Upper Division Elect 300+</td>
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<tr>
<td>EDSP 306 - Exceptional Learners</td>
<td>3</td>
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<tr>
<td>HSTR/HSTA Upper Division Elect 300+</td>
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</tr>
<tr>
<td>PSCI Upper Division Elect 300+</td>
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<tr>
<td>PSCI Upper Division Elect 300+</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>1-3</td>
<td></td>
</tr>
</tbody>
</table>

**Year Total:** 18-19

#### Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Spring</th>
</tr>
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<tbody>
<tr>
<td>EDU 382 - Assessmt, Curric, Instructn</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>IN/RN Core</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>HSTR/HSTA Upper Division Elect 300+</td>
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<td></td>
</tr>
<tr>
<td>PSCI Upper Division Elect 300+</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NASX Upper Division Elect 300+</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EDU 305 - Multicultural Education</td>
<td>1</td>
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<tr>
<td>PSCI Upper Division Elect 300+</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>1-3</td>
<td></td>
</tr>
</tbody>
</table>

**Year Total:** 18-19

**Total Program Credits:** 119-135

A minimum of 128 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

**Note:** While we recommend this sequence, there will be some variance, especially between courses taken by the end of the junior year and first-semester senior year.

**Technology Education**

Technology Education is an integrated discipline designed to develop students' technological literacy. Through the study of past, present, and future technological systems, and their resources, processes, and impacts on society, students will better understand the role of technology in society.

The Technology Education Program at MSU is for individuals wishing to teach technology at the middle or high school level or to work within an industry where a broad understanding of technological concepts is important.

Two Technology Education options are available to allow for diversity in personal interests and career aspirations. The Broadfield Teaching Option is designed for in-depth study of Technology Education. The Industrial Technology Option does not lead to teaching licensure and is tailored for those individuals who are pursuing a career in an industry which requires a broad background in technology.

The Technology Education Program is sequenced into three phases to develop a progression of interrelated information. The foundation phase
constitutes the introduction to technology. This introduction forms the base for future study and an understanding of basic technological concepts. The synthesis phase begins the in-depth study of the primary technology education components of communication, construction, manufacturing, and power/energy. During this phase students in the teaching option are involved in professional education coursework, while students in the industrial technology option begin selecting coursework which is tailored to meet specific career goals. The capstone phase of the program is structured to integrate the information and experiences of the preceding phases through applied learning activities. Students in the teaching option student teach at the middle/high school level. Students in the non-teaching option intern in business and industry areas related to their career interests.

Students in 5-12 and K-12 teaching majors are required to take courses in certain areas of professional education. A grade of "C" or better is required in all professional education courses; a "C-" is not acceptable. See the Teacher Education Program (p. 127) website for entrance requirements.

### Technology Education Broadfield Teaching Option

#### Program Sequence

**Freshman Year**
- CHMY 121IN - Introduction to General Chemistry
- COMX 111US - Introduction to Public Speaking (formerly COM 110US)
- or EDU 101US - Teaching and Learning
- EDU 202 - Early Field Experience
- WRIT 101W - College Writing I
- FCS 101IS - Indiv and Fam Dev: Lifespan or EDEC 160 - Early Childhood Development
- TE 101 - Intro to Technology Ed
- EERE 101 - Intro Electrical Fundamentals
- DDSN 114 - Introduction to CAD
- University Core and Electives

**Year Total:** 30

**Sophomore Year**
- TE 207 - Materials and Processes
- EDU 223IS - Educ Psych and Adolescent Dev or EDU 222IS - Educ Psych & Child Development
- M 151Q - Precalculus
- TE 250CS - Technology and Society
- EDU 211D - Multicultural Education
- PHSX 205 - College Physics I
- University Core and Electives

**Year Total:** 30

**Junior Year**
- AGED 333 - Construction Technology or ARCH 241 - Building Construction I
- TE 330 - Alternative Power/Energy Tech
- EDU 382 - Assessmnt, Curric, Instructn
- TE 331 - Electronic Communication Technology
- ESDP 306 - Exceptional Learners
- TE 410 - Computer Aided and Industrial Machining and Manufacturing
- University Core and Electives

**Year Total:** 30

**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE 353 - Teaching Practices</td>
<td>1</td>
</tr>
<tr>
<td>TE 406 - Curriculum &amp; Facilities Plan</td>
<td>3</td>
</tr>
<tr>
<td>TE 417 - Manufacturing Technology</td>
<td>3</td>
</tr>
<tr>
<td>EDU 395 - Practicum (5-12)</td>
<td>3</td>
</tr>
<tr>
<td>EDU 497 - Methods (5-12 Ag &amp; Tech Ed)</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>3</td>
</tr>
<tr>
<td>~ Student Teaching Semester ~</td>
<td></td>
</tr>
<tr>
<td>EDU 495 - Student Teaching</td>
<td>12</td>
</tr>
<tr>
<td>EDU 408 - Professional Issues: K-12</td>
<td>2</td>
</tr>
</tbody>
</table>

**Year Total:** 30

**Total Program Credits:** 120

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

### Industrial Technology

Technology Education is an integrated discipline designed to develop students' technological literacy. Through the study of past, present, and future technological systems, and their resources, processes, and impacts on society, students will better understand the role of technology in society.

The Technology Education Program at MSU is for individuals wishing to teach technology at the middle or high school level or to work within an industry where a broad understanding of technological concepts is important.

Two Technology Education options are available to allow for diversity in personal interests and career aspirations. The Broadfield Teaching Option is designed for in-depth study of Technology Education. The Industrial Technology Option does not lead to teaching licensure and is tailored for those individuals who are pursuing a career in an industry which requires a broad background in technology.

The Technology Education Program is sequenced into three phases to develop a progression of interrelated information. The foundation phase constitutes the introduction to technology. This introduction forms the base for future study and an understanding of basic technological concepts. The synthesis phase begins the in-depth study of the primary technology education components of communication, construction, manufacturing, and power/energy. During this phase students in the teaching option are involved in professional education coursework, while students in the industrial technology option begin selecting coursework which is tailored to meet specific career goals. The capstone phase of the program is structured to integrate the information and experiences of the preceding phases through applied learning activities. Students in the teaching option student teach at the middle/high school level. Students in the non-teaching option intern in business and industry areas related to their career interests.

According to university policy, a grade of C- or better is required to satisfy requirements for pre-requisite and required courses in majors, minors, and certificate programs, and for all core requirements.

### Industrial Technology Option

**Freshman Year**
- M 151Q - Precalculus
- COM 110US
- WRIT 101W - College Writing I
- TE 101 - Intro to Technology Ed

**Year Total:** 30
satisfactory academic achievement, but also on a range of factors which
licensure. Admission and retention decisions are based not only on prior
determination of who should be recommended for a degree and state
the design, implementation, and evaluation of its curriculum; and the
and ultimate responsibility for the selection and evaluation of its students;
Within these guidelines, the Teacher Education faculty have the freedom
and the Council for the Accreditation of Educator Preparation (CAEP).
Standards outlined by the Montana Office of Public Instruction (OPI)
standards of the Montana Professional Educator Preparation Program
education program, the curriculum in teacher education adheres to the
ability to become highly competent teachers. As an accredited teacher
Professor recommends only those students who show
Education, Health and Human Development attempts to encourage,
for teacher licensure. In discharging this responsibility, the College of
Montana State University is one of the units in the Montana University
must be in courses numbered 300 and above.

Teacher Education Program

Montana State University is one of the units in the Montana University
System charged with the responsibility of recommending teacher candidates
for teacher licensure. In discharging this responsibility, the College of
Education, Health and Human Development attempts to encourage, prepare, and recommend for licensure only those students who show promise of teaching excellence. Consequently, certain criteria have been established for admission to the Teacher Education Program, and screening procedures have been provided at several points in the program.

The Teacher Education Program endeavors to select applicants who have the ability to become highly competent teachers. As an accredited teacher education program, the curriculum in teacher education adheres to the standards of the Montana Professional Educator Preparation Program Standards outlined by the Montana Office of Public Instruction (OPI) and the Council for the Accreditation of Educator Preparation (CAEP). Within these guidelines, the Teacher Education faculty have the freedom and ultimate responsibility for the selection and evaluation of its students; the design, implementation, and evaluation of its curriculum; and the determination of who should be recommended for a degree and state licensure. Admission and retention decisions are based not only on prior satisfactory academic achievement, but also on a range of factors which serve to ensure that the teacher candidate can demonstrate the Professional Expectations required in the Teacher Education Program.

The program does not discriminate on the basis of race, color, creed, religion, national origin, gender, sexual orientation, age, marital status, or disability. When requested, the University will provide reasonable accommodations to otherwise qualified students with disabilities.

Admission to the Teacher Education Program

Admission to the Teacher Education Program requires completion of the "Application for Admission." These forms are available at www.montana.edu/ehhd/educ/advising/index.shtml and must be turned into the Education Advising Center, Reid Hall 132. Students should apply to the Teacher Education Program during the semester prior to taking their methods/practicum coursework.

For Elementary Education majors, the requirements for admission to the Teacher Education Program are:

1. a cumulative grade-point average of at least 2.75
2. a 2.75 grade-point average in the teaching major and minor, with no grade below a "C" in any of these areas
3. a current background check completed as outlined by Sec. 20-4-110 of the MCA

For Secondary Education majors, the requirements for admission to the Teacher Education Program are:

1. a cumulative grade-point average of at least 2.75
2. a 2.75 grade-point average in the teaching major and minor, with no grade below a "C" in any of these areas
3. a current background check completed as outlined by Sec. 20-4-110 of the MCA

Application and Approval for Student Teaching

Certain requirements must be met by all students desiring to student teach:

1. maintenance of the same standards required for admission into the program including satisfactory clearance on a federal criminal background check
2. completion of all required courses (meeting academic requirements as listed above) prior to student teaching
3. certification in first aid with CPR

Student teaching is limited to seniors. A completed application must be submitted to the Office of Field Placement and Licensure before any placement is made.

If special services or accommodations (for a disability) are needed or required while student teaching, requests must be submitted to the Office of Field Placement and Licensure and arrangements will be made.

Recommendation and Approval for Licensure

The requirements for recommendation by Montana State University for licensure include:

- completion of all courses in the Teacher Education Program as outlined in the individual's approved plan
- maintenance of the same standards as are required for student teaching
- attaining a passing score on the Praxis II exam in every teaching major and minor
- completion of the licensure application (http://www.montana.edu/fieldplacement/licensure/application.html)
Residency Requirements for Professional Education Courses
In order to recommend prospective teachers in elementary and/or secondary education for Montana teacher licensure, students must enroll in most methods, teaching practicum(s), and student teaching through the MSU-Bozeman campus.

Based on MSU graduation requirements, twenty-three of the last thirty credits earned to meet the graduation requirement (p. 54) must be MSU credits. Specific majors may have program-specific requirements for courses that must be taken from MSU to meet graduation requirements. Such requirements are clearly identified in the curriculum description for that department.

Second Degree and Non-degree Licensure
Students already holding valid Bachelor’s degrees may fulfill licensure requirements by completing a second undergraduate degree, or in some cases, a non-degree program. Students completing a second degree are required to complete 30 credits, nine of which must be 300-400 level. Students should contact the Office of Field Placement and Licensure for further information. Non-degree and second-degree students must meet the same standards for program entrance and student teaching as first-degree students.

Professional Expectations For Prospective Teachers
The Professional Expectations for prospective teachers required by the Department of Education at Montana State University include communication competencies, intellectual (conceptual, integrative, and quantitative) abilities for problem solving and effective teaching, and professional, behavioral, and social competencies relevant to the performance of a professional educator.

Communication competencies are demonstrated by behaviors such as:

• Using appropriate grammar (syntax, inflection, and word choice) in oral communication
• Speaking distinctly and with confidence
• Communicating with sensitivity to the situation and circumstances of professors, students, peers, and colleagues
• Using correct spelling, standard English language mechanics, and meaningful word choice in written expression

Intellectual competencies are demonstrated by behaviors such as:

• Ability to master relevant content in subjects commonly taught in K-12 schools
• Ability to master pedagogical principles and their application in field settings at a level deemed appropriate by the faculty
• Ability to comprehend, memorize, analyze, and synthesize material
• Ability to develop reasoning and decision-making skills appropriate to the practice of teaching

Professional, behavioral, and social competencies are demonstrated by behaviors such as:

• Completing assignments and meeting responsibilities on time
• Participating fully in class and field settings
• Seeking assistance from instructors and supervisors when appropriate
• Developing positive relationships with peers and education professionals
• Working effectively in groups, actively listening to other viewpoints, and treating individuals with respect
• Perceiving a wide range of interpersonal cues from others and responding appropriately
• Displaying openness to new ideas and constructive criticism and using that criticism to improve performance
• Recognizing one’s own strengths and weaknesses and taking personal responsibility to respond appropriately
• Displaying professional appearance, poise, flexibility, and a positive attitude
• Prioritizing responsibilities
• Taking initiative
• Using good judgment, tact, and discretion

Teaching Minors
Teaching Minors
A number of teaching minors are available for students majoring in Secondary Education or Elementary Education.

• Art (K-12) (p. 136)
• Biology (5-12) (p. 137)
• Chemistry (5-12) (p. 137)
• Earth Science (5-12) (p. 137)
• Economics (5-12) (p. 137)
• Family and Consumer Sciences (5-12) (p. 137)
• French (K-12) (p. 138)
• German (K-12) (p. 138)
• Government (5-12) (p. 138)
• History (5-12) (p. 138)
• Mathematics (5-12) (p. 138)
• Physics (5-12) (p. 138)
• Reading (K-12) (p. 139)
• Spanish (K-12) (p. 139)
• Technology Education (5-12) (p. 139)

Art K-12 Minor
A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTZ 109RA</td>
<td>Visual Language: Comprehensive Foundation</td>
<td>4</td>
</tr>
<tr>
<td>(formerly ARTZ 106RA)</td>
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<td></td>
</tr>
<tr>
<td>ARTZ 110RA</td>
<td>Visual Language: Ideation and Creativity</td>
<td>4</td>
</tr>
<tr>
<td>(formerly ARTZ 108RA)</td>
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<tr>
<td>ARTZ 105RA</td>
<td>Visual Language - Drawing</td>
<td>3</td>
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<tr>
<td>ARTH 200IA</td>
<td>Art of World Civilization I</td>
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<tr>
<td>ARTH 201IA</td>
<td>Art of World Civilization II</td>
<td>4</td>
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<tr>
<td>Choose one of the following:</td>
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<tr>
<td>ARTZ 211RA</td>
<td>Drawing I</td>
<td></td>
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<tr>
<td>ARTZ 221</td>
<td>Painting I</td>
<td></td>
</tr>
<tr>
<td>ARTZ 231RA</td>
<td>Ceramics I</td>
<td></td>
</tr>
<tr>
<td>ARTZ 251</td>
<td>Sculpture I</td>
<td></td>
</tr>
<tr>
<td>ARTZ 261</td>
<td>Metals I</td>
<td></td>
</tr>
<tr>
<td>ARTZ 271</td>
<td>Printmaking I</td>
<td></td>
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<tr>
<td>Choose one of the following:</td>
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<tr>
<td>ARTZ 312</td>
<td>Intermediate Drawing</td>
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<tr>
<td>ARTZ 322</td>
<td>Intermediate Painting</td>
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</tr>
<tr>
<td>ARTZ 332</td>
<td>Intermediate Ceramics</td>
<td></td>
</tr>
<tr>
<td>ARTZ 352</td>
<td>Intermediate Sculpture</td>
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</tbody>
</table>
ARTZ 373 Intermediate Printmaking - Lithography
ARTZ 374 Intermediate Printmaking - Serigraphy
ARTZ 375 Intermediate Printmaking - Intaglio
ARTZ 376 Intermediate Printmaking - Relief
ARTZ 379 Alternative Print Media
EDU 397 Methods (K-5 Art) 3
EDU 497 Methods (5-12 Art) 3
Total Credits 34

Biology Teaching Minor
A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

BIOB 160 Principles of Living Systems 4
BIOB 170IN Principles of Biological Diversity 4
BIOE 370 General Ecology (equiv to 270) 3
BIOB 420 Evolution 3
Choose one of the following: 2
BIOB 377 Practical Genetics
BIOB 375 General Genetics
BIOE 408 Rocky Mountain Vegetation
BIOE 416 Alpine Ecology
Choose one of the following: 3-5
BIOM 103IN Unseen Universe: Microbes
BIOM 360 General Microbiology
Choose one of the following: 3
BIOO 433 Plant Physiology
BIOO 412 Animal Physiology
Biology Electives (except BIOB 100IN) 3
EDU 497 Methods (5-12 Science) 3
Total Credits 31-33

Chemistry Teaching Minor
A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

BCH 380 Biochemistry 5
CHMY 141 College Chemistry I 4
CHMY 143 College Chemistry II 4
CHMY 211 Elements of Organic Chemistry 5
CHMY 361 Elements of Physical Chemistry 4
CHMY 362 Elements of Physical Chemistry Lab 1
Choose one of the following: 3
CHMY 311 Fundamental Analytical Chem
CHMY 401 Advanced Inorganic Chemistry
EDU 497 Methods (5-12 Science) 3
Total Credits 29

Earth Science Teaching Minor
A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

ERTH 101IN Earth System Sciences 4
ERTH 102CS Topics in Earth Sciences (Must take a minimum of 3 credits of ERTH 102CS) 1
ERTH 307 Principles of Geomorphology 4
ERTH 303 Weather and Climate 3
GEO 302 Mineralogy and Optical Mineral 4
GEO 211 Earth History and Evolution 3
Choose one of the following: 3
GEO 312 Dinosaur Paleontology
GEO 310 Invertebrate Paleontology
EDU 497 Methods (5-12 Science) 3
Total Credits 27

Students who are required to take more than 8 credits listed above in their major must take additional elective physical science courses in the Earth Sciences, Geophysics, or Geology rubric with the advice and consent of their minor advisor in Earth Sciences.

Economics Teaching Minor
A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

ECNS 101IS Economic Way of Thinking * 3
ECNS 202 Principles of Macroeconomics * 3
ECNS 204IS Microeconomics * 3
ECNS 301 Intermediate Micro with Calc 3
ECNS 311 Intermediate Microeconomics with Economics Education Applications 3
ECNS 313 Money and Banking 3
One additional ECNS course at the 300 or 400 levels (no seminars, 492’s, or 490’s) 3-4
Approved Math course 3-4
EDU 497 Methods (5-12 Social Studies) 3
Total Credits 27-28

* NOTE: ECNS 251IS (Honors Economics, 4 credits) may be substituted for the three-course sequence: ECNS 101IS, ECNS 202, and ECNS 204IS.

Family Consumer Sciences Teaching Minor
A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

Choose one of the following two options: 3-6
HDFS 101IS Indiv and Fam Dev: Lifespan
EDEC 160 Early Childhood Development & HDFS 261 Adult Development and Aging
HDFS 138 Survey of Family Finance and Consumer Issues 3
EDU 497 Methods (5-12 Family & Cons Sci) 3
HDFS 218 Design, Fashion, and Textiles 3
HDFS 219 Apparel Construction 3
HDFS 263 Relationships and Fam Systems 3
HDFS 337 Personal and Family Finance I 3
HDFS 450 Curric Dev in FCS Education 3
NUTR 221CS Basic Human Nutrition 3
NUTR 226 Food Fundamentals 3
NUTR 226 Food Fundamentals 3
French K-12 Minor

A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

**Freshman Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 101 - Elementary French I</td>
<td>3</td>
</tr>
<tr>
<td>FRCH 102D - Elementary French II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 201D - Intermediate French I</td>
<td>3</td>
</tr>
<tr>
<td>FRCH 202D - Intermediate French II</td>
<td>3</td>
</tr>
<tr>
<td>EDU 496 - Methods: K-12 Modern Languages</td>
<td>4</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

**Junior and Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 301 - French Oral and Written Expression</td>
<td>3</td>
</tr>
<tr>
<td>Take 9 additional upper division FRCH credits.</td>
<td>9</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td><strong>12</strong></td>
</tr>
<tr>
<td><strong>Total Program Credits:</strong></td>
<td><strong>28</strong></td>
</tr>
</tbody>
</table>

German K-12 Minor

A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRMN 101 - Elementary German I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 102D - Elementary German II</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 201D - Intermediate German I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 202D - Intermediate German II</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 301 - Oral and Written Expression I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 302 - Oral and Written Expression II</td>
<td>3</td>
</tr>
<tr>
<td>EDU 496 - Methods: K-12 Modern Languages</td>
<td>4</td>
</tr>
<tr>
<td>Take 6 additional upper division GRMN credits (2 courses). At least one of these courses must be taught in German. ML100 may count toward the upper division course requirement.</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total Program Credits:</strong></td>
<td><strong>28</strong></td>
</tr>
</tbody>
</table>

Government Teaching Minor

A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PSCI 201 - Scope and Methods of Political Science</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 210H - Introduction to American Government</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 230D - Introduction to International Relations</td>
<td>3</td>
</tr>
<tr>
<td>Choose two of the following (American Institution or Advisor approved course):</td>
<td></td>
</tr>
<tr>
<td>PSCI 346 - American Presidency</td>
<td></td>
</tr>
<tr>
<td>PSCI 306 - Legislative Process</td>
<td></td>
</tr>
<tr>
<td>PSCI 341 - Political Parties and Elections</td>
<td></td>
</tr>
<tr>
<td>PSCI 471 - American Constitutional Law</td>
<td></td>
</tr>
<tr>
<td>PSCI 302 - Media &amp; Politics</td>
<td></td>
</tr>
<tr>
<td>Choose two of the following (Political Processes and International/Political Theory or Advisor approved course):</td>
<td></td>
</tr>
<tr>
<td>PSCI 436 - Politics of Food &amp; Hunger</td>
<td></td>
</tr>
<tr>
<td>PSCI 356 - Classical Political Thought</td>
<td></td>
</tr>
</tbody>
</table>

History Teaching Minor

A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSTR 101IH - Western Civilization I</td>
<td>4</td>
</tr>
<tr>
<td>HSTR 102IH - Western Civilization II</td>
<td>4</td>
</tr>
<tr>
<td>HSTA 101IH - American History I</td>
<td>4</td>
</tr>
<tr>
<td>HSTA 102IH - American History II</td>
<td>4</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
</tr>
<tr>
<td>HSTR 130D - Latin American History</td>
<td></td>
</tr>
<tr>
<td>HSTR 135D - The Modern Middle East</td>
<td></td>
</tr>
<tr>
<td>HSTR 140D - Modern Asia</td>
<td></td>
</tr>
<tr>
<td>HSTR 145D - Reinventing Japan</td>
<td></td>
</tr>
<tr>
<td>Upper Division History Elective</td>
<td>3</td>
</tr>
<tr>
<td>Upper Division History Elective</td>
<td>3</td>
</tr>
<tr>
<td>Upper Division History Elective</td>
<td>3</td>
</tr>
<tr>
<td>EDU 497 - Methods (5-12 Social Studies)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>32</strong></td>
</tr>
</tbody>
</table>

Mathematics Teaching Minor

A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 171Q - Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>M 172Q - Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>M 273Q - Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>M 242 - Methods of Proof</td>
<td>3</td>
</tr>
<tr>
<td>M 328 - Higher Math for Sec Teachers</td>
<td>3</td>
</tr>
<tr>
<td>M 329 - Modern Geometry</td>
<td>3</td>
</tr>
<tr>
<td>M 428 - Mathematical Modeling for Teachers</td>
<td>3</td>
</tr>
<tr>
<td>STAT 332 - Statistics for Scientists and Engineers</td>
<td>3</td>
</tr>
<tr>
<td>EDU 497 - Methods (9-12 Mathematics)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

Physics Teaching Minor

A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose one of the following:</td>
<td></td>
</tr>
<tr>
<td>PHSX 220 - Physics I (w/ calculus)</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 240 - Honors Gen &amp; Mod Phys I</td>
<td></td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
</tr>
<tr>
<td>PHSX 222 - Physics II (w/ calculus)</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 242 - Honors Gen &amp; Mod Phys II</td>
<td></td>
</tr>
<tr>
<td>PHSX 224 - Physics III</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 301 - Intro Theoretical Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 261 - Laboratory Electronics I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 262 - Laboratory Electronics II</td>
<td>2</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
</tr>
<tr>
<td>PHSX 320 - Classical Mechanics</td>
<td>3-4</td>
</tr>
</tbody>
</table>
PHSX 423 Electricity and Magnetism I
Physics elective (200 level or above) 3
Approved elective in Biology, Chemistry, or Earth Science 3
EDU 497 Methods (5-12 Science) 3
Total Credits 32-33

Reading K-12 Minor
A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

EDU 331 Lit and Literacy for Children 3
EDU 330 Emergent Literacy 3
EDU 397 Methods (K-8 Language Arts) 3
EDU 432 Lit and Literacy for Yng Adls 3
EDU 401 Intro Lit Leadership Ed 3
EDU 438 Lercy Asmnt, Diagnos and Instr 3
EDU 481 Literacy Across the Curriculum 2
EDU 498 Internship 2
Total Credits 22

Spanish K-12 Minor
A student must receive a grade of C or better in all the courses required for this minor and have a GPA of 2.75 or higher.

SPNS 101 Elementary Spanish I 3
SPNS 102D Elementary Spanish II 3
SPNS 201D Intermediate Spanish I 3
SPNS 202D Intermediate Spanish II 3
EDU 496 Methods: K-12 Modern Languages 4
Take 12 additional upper division SPNS credits (4 courses). 12
Total Credits 28

Technology Education Minor
A student must receive a grade of C or better in all the minor’s required courses and a student must have a GPA of 2.75 or higher.

TE 207 Materials and Processes 4
AGED 333 Construction Technology 3
or ARCH 241 Building Construction I
TE 101 Intro to Technology Ed 1
TE 406 Curriculum & Facilities Plan 3
DDSN 114 Introduction to CAD 3
TE 330 Alternative Power/Energy Tech 3
TE 331 Electronic Communication Technology 4
TE 353 Teaching Practices 1
TE 417 Manufacturing Technology 3
EDU 497 Methods (5-12 Ag. & Tech Ed.) 3
Total Credits 28

Technology Education
Technology Education is an integrated discipline designed to develop students’ technological literacy. Through the study of past, present, and future technological systems, and their resources, processes, and impacts on society, students will better understand the role of technology in society.

The Technology Education Program at MSU is for individuals wishing to teach technology at the middle or high school level or to work within an industry where a broad understanding of technological concepts is important.

Two Technology Education options are available to allow for diversity in personal interests and career aspirations. The Broadfield Teaching Option is designed for in-depth study of Technology Education. The Industrial Technology Option does not lead to teaching licensure and is tailored for those individuals who are pursuing a career in an industry which requires a broad background in technology.

The Technology Education Program is sequenced into three phases to develop a progression of interrelated information. The foundation phase constitutes the introduction to technology. This introduction forms the base for future study and an understanding of basic technological concepts. The synthesis phase begins the in-depth study of the primary technology education components of communication, construction, manufacturing, and power/energy. During this phase students in the teaching option are involved in professional education coursework, while students in the industrial technology option begin selecting coursework which is tailored to meet specific career goals. The capstone phase of the program is structured to integrate the information and experiences of the preceding phases through applied learning activities. Students in the teaching option student teach at the middle/high school level. Students in the non-teaching option intern in business and industry areas related to their career interests.

Students in 5-12 and K-12 teaching majors are required to take courses in certain areas of professional education. A grade of “C” or better is required in all professional education courses; a “C-” is not acceptable. See the Teacher Education Program (p. 127) website for entrance requirements.

<table>
<thead>
<tr>
<th>Technology Education Broadfield Teaching Option</th>
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</thead>
<tbody>
<tr>
<td><strong>Program Sequence</strong></td>
</tr>
<tr>
<td><strong>Freshman Year</strong></td>
</tr>
<tr>
<td>Freshman Year</td>
</tr>
<tr>
<td>Credits Year</td>
</tr>
<tr>
<td>CHMY 1211N - Introduction to General Chemistry</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>COMX 111US - Introduction to Public Speaking</td>
</tr>
<tr>
<td>(formerly COM 110US)</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>or EDU 101US - Teaching and Learning</td>
</tr>
<tr>
<td>EDU 202 - Early Field Experience</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>FCS 101IS - Indiv and Fam Dev: Lifespan</td>
</tr>
<tr>
<td>or EDEC 160 - Early Childhood Development</td>
</tr>
<tr>
<td>TE 101 - Intro to Technology Ed</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>EELE 101 - Intro Electrical Fundamentals</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>DDDN 114 - Introduction to CAD</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>Year Total:</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td><strong>Sophomore Year</strong></td>
</tr>
<tr>
<td>Freshman Year</td>
</tr>
<tr>
<td>Credits Year</td>
</tr>
<tr>
<td>TE 207 - Materials and Processes</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
</tr>
<tr>
<td>or EDU 222IS - Educ Psych &amp; Child Development</td>
</tr>
<tr>
<td>M 151Q - Precalculus</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>TE 250CS - Technology and Society</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>EDU 211D - Multicultural Education</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>PHSX 205 - College Physics I</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>University Core and Electives</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>Year Total:</td>
</tr>
<tr>
<td>30</td>
</tr>
</tbody>
</table>
Health and Human Development

The Department of Health and Human Development (http://www.montana.edu/hhd) prepares students for careers that are dedicated to the enrichment of human well-being. Consequently, rewarding career opportunities are available to graduates within education and human service professions in private and public settings. Specific areas of study include community health, dietetics or nutrition science, early childhood education and child services (child development) exercise science or kinesiology, hospitality management (food enterprise, lodging and facilities management, or restaurant management: farm-to-table options), human development and family science, and sustainable food systems. Students interested in teaching can pursue programs in early childhood education P-3, family and consumer sciences education 5-12, or health enhancement K-12 (health and physical education).

Health and Human Development offers master’s degrees with options in community health, counseling, including marriage, couples, and family counseling, mental health counseling, and school counseling; exercise and nutrition sciences, including exercise physiology and nutrition and sport and coaching sciences; family and consumer sciences, including early childhood education/child development and family science; family financial planning; and sustainable food systems. See the graduate catalog (p. 288) for additional information on graduate Health and Human Development programs (p. 338).

In addition to the career options, the department also offers recreational activity courses with an academic component for university credit. Physical activity courses under the ACT designated rubric are offered as an educational opportunity and as a service to the general student population. User fees vary depending on the activity. Each student enrolling in an activity course will be asked to sign an activity course waiver and release form.

Mission Statement

The Department of Health and Human Development (http://www.montana.edu/hhd) strives to enrich human well-being through teaching, research, and outreach.

Academic Advisors

The Health and Human Development academic advising office (http://www.montana.edu/hhd/advising), staffed with academic advisors to serve the needs of undergraduate students, is located in 121 Marga Hosaeus Fitness Center. Students are expected to meet with an advisor each semester to discuss their plan of study, academic progress, and course registration.

In addition, students are encouraged to meet with an academic advisor to discuss issues and questions regarding professional programs, career opportunities, and academic concerns. Academic advisors can assist students to appropriate referrals when necessary.

To receive advising or to inquire about programs in the Department of Health and Human Development (http://www.montana.edu/hhd), contact the Health and Human Development Advising Center by phone at (406) 994-4001, or by e-mail at hhdadvising@montana.edu.

Degrees and Options

The department offers six Bachelor of Science degrees. They include a B.S. in Community Health; a B.S. in Early Childhood Education and Child Services with options in Child Development or Preschool-Grade 3 Teaching; a B.S. in Food and Nutrition with options in Dietetics or Nutrition Science; a B.S. in Health Enhancement K-12 (health and physical education teaching); a B.S. in Health and Human Performance with options in Exercise Science or Kinesiology; a B.S. in Hospitality Management with options in Food Enterprise, Lodging and Facilities Management, and Restaurant Management: Farm-to-Table; and a B.S. in Human Development and Family Science with options in Family and Consumer Sciences Education (5-12) or Human Development and Family Science. For students who wish to pursue an interdisciplinary B.S. in Sustainable Food and Bioenergy Systems, the department offers an option in Sustainable Food Systems.

The department offers a Master of Science in the following areas: community health; counseling (including marriage and family counseling and mental health counseling); exercise and nutrition sciences (including exercise physiology and nutrition and sport and coaching sciences); family and consumer sciences (including early childhood education/child development and family science; family financial planning; and sustainable food systems). The department offers a Master of Education in school counseling.

Minor Fields of Study

Minors provide a concentration of courses outside the student’s major and are intended to complement major course work. The minor is posted on the student’s transcript. Non-teaching minors are available in coaching, human development, and personal and family finance. A teaching minor is available in family and consumer sciences 5-12. For additional information on minor fields of study and requirements, please see the minors (p. 69) section of this catalog.

Certificates

Two certificate programs are offered through the department. An online graduate certificate in addiction counseling is offered as well as an online undergraduate certificate in gerontology.
Degree Requirements

Bachelor of Science degrees in Community Health, Early Childhood Education and Child Services, Food and Nutrition, Health and Human Performance, and Human Development and Family Science (Human Development and Family Science option), shall be conferred upon the successful completion of specified requirements and a minimum of 120 credits. The Bachelor of Science in Human Development and Family Science option in Family and Consumer Sciences Education 5-12 and the Bachelor of Science degree in Health Enhancement K-12 (health and physical education), shall be conferred upon the successful completion of specified requirements and a minimum of 122 and 128 credits, respectively. All undergraduate students must complete a minimum of 42 upper division credits in settings such as social services, child care, health and welfare, recreation, youth programs, community action, drug/alcohol rehabilitation centers, senior citizen programs, parent education, family service agencies, extension, and retirement/convalescent care centers.

Certified Health Education Specialist
Completion of the community health major establishes eligibility to sit for the Certified Health Education Specialist (http://www.nchec.org) examination (CHES). The CHES exam measures the possession, application, and interpretation of knowledge essential to the practice of community health/health education. The CHES certification is a national standard for health education practice and assists employers in identifying qualified health education practitioners.

Certified Personal Trainer/Certified Strength Coach
The National Strength and Conditioning Association (http://www.nsca.com/Home) provides opportunities to become a certified personal trainer or a certified strength coach.

Coaching Certification
Faculty in Health and Human Development partner with the Montana High School Association (http://www.mhsa.org) (MHSA) in the development and implementation of a coaching certification program. Although MHSA awards the certification, successful completion of the coaching minor offered in the department will prepare the future coach for the profession.

Early Childhood Education and Child Services Preschool-Grade 3 Teacher
The Early Childhood Education and Child Services P-3 option is designed for students who wish to become licensed to teach preschool through grade 3. Upon completion of the degree, students are recommended for licensure through the State of Montana (http://www opi.mt.gov) in teaching preschool-grade 3.

Family and Consumer Sciences 5-12 Teacher
The Family and Consumer Sciences teacher preparation program is designed for students who want to become teachers of Family and Consumer Sciences in public or private schools. Upon completion of the degree, students are recommended for licensure through the State of Montana (http://www opi.mt.gov) in teaching grades 5-12.

Health Enhancement K-12 (Health and Physical Education) Teacher
The health enhancement K-12 teacher preparation program is designed for students who want to become teachers of health enhancement (health and physical education) in public or private schools. Upon completion of the degree, students are recommended for licensure through the State of Montana (http://www opi.mt.gov) in teaching grades K-12.

Health Fitness Instructor and Exercise Test Technologist
The American College of Sports Medicine (http://acsm.org), the premier organization for health/fitness professionals and clinicians, offers the Health/Fitness Instructor and Exercise Test Technologist certifications at sanctioned test locations throughout the Pacific Northwest. The certification exams include written and practical components that emphasize the application of knowledge and hands-on skills typically acquired in an undergraduate exercise science or kinesiology program.

Licensed Professional Counselor or Licensed Clinical Professional Counselor
Counseling programs in the graduate program in Health and Human Development lead to the opportunity to become licensed in Montana (http://bsd.dli.mt.gov/license/bsd_boards/swp_board/board_page.asp) as
a Licensed Professional Counselor (LPC) or Licensed Clinical Professional Counselor (LCPC). Following completion of a master's degree, the student must complete a minimum of 1500 hours of supervised counseling practice prior to sitting for and passing the LPC examination.

Registered Dietitian Nutritionist
Upon completion of all Didactic Program in Dietetics classes in the dietetics option of the food and nutrition major with a C or better, students are given a verification statement that allows them to apply to a national post-baccalaureate supervised professional experience or internship. Upon its completion, the student may sit for the RDN examination given by the Commission on Dietetic Registration (http://www.cdrnet.org), the credentialing agency for The Academy of Nutrition and Dietetics (http://www.eatright.org). The RDN status enables a person to become licensed in Montana as a Licensed Nutritionist by the Board of Medical Examiners (http://bsd.dli.mt.gov/license/bsd_boards/med_board/board_page.asp).

Course Requirements and Curricula for Majors
The curriculum and specific course requirements for each major, minor, and certificate within the Department of Health and Human Development are listed below.

Undergraduate Programs
- Community Health Major (p. 143)
- Early Childhood Education and Child Services Major with options in Child Development or Preschool-Age 3 (p. 144)
- Food and Nutrition Major with options in Dietetics or Nutrition Science (p. 146)
- Health Enhancement K-12 (Health and Physical Education Teaching) Major (p. 147)
- Health and Human Performance Major with options in Exercise Science or Kinesiology (p. 153)
- Hospitality Management with options in Food Enterprise, Lodging & Facilities Management, or Restaurant Management: Farm-to-Table (p. 149)
- Human Development and Family Science Major with options in Family & Consumer Sciences Education or Human Development & Family Science (p. 151)
- Sustainable Food Systems Option (p. 156)

Undergraduate Minors
- Coaching Minor (Non-Teaching) (p. 142)
- Human Development Minor (Non-Teaching) (p. 156)
- Personal and Consumer Finance (Non-Teaching) (p. 156)

Certificate Program
- Gerontology (p. 147)

Graduate Programs
Master of Science degrees in:
- Community Health (p. 341)
- Counseling with options in Marriage, Couples, and Family; and Mental Health (p. 339)
- Exercise and Nutrition Sciences with options in Exercise Physiology and Nutrition; and Sport and Coaching Sciences (p. 342)
- Family and Consumer Sciences (p. 342)
- Family Financial Planning (http://eu.montana.edu/online/degrees/ffp)

- Sustainable Food Systems (http://catalog.montana.edu/graduate/education-health-human-development/health-human-development/sustainable-food-systems)

Master of Education in School Counseling (p. 339)
Certificate program in Addiction Counseling (p. 344)

Graduate programs in the Department of Health and Human Development lead to a Master of Science degree in community health, counseling (marriage, couples, and family; mental health), exercise and nutrition sciences (exercise physiology and nutrition; sport and coaching sciences), family and consumer sciences (early childhood education/child development; human development and family science), and sustainable food systems. The Master of Education degree is awarded to those completing the school counseling degree.

A minimum of 30 credits is required for the Master of Science degree in exercise and nutrition sciences, family and consumer sciences, and sustainable food systems. A minimum of 36 credits is required for both the community health degree and family financial planning. Both thesis and non-thesis plans are available. Because of professional licensure requirements, a minimum of 60 credits is required for the marriage, couples, and family counseling and mental health counseling programs, while the school counseling program requires a minimum of 48 credits. Transfer credits may not exceed the limit of nine set by The Graduate School and must be assessed by the graduate coordinator before acceptance to the program.

More detailed information regarding curricula and requirements may be obtained on the Department of Health and Human Development website at www.montana.edu/hhd.

Coaching Minor
This coaching minor is one of the few in the northern Rocky Mountain region and is specifically designed to prepare those interested in coaching any sport at any entry level. It was based upon the National Standards for Sport Coaches that was developed by professional coach educators from the National Association of Sport and Physical Education (NASPE) and other sport organizations and universities across the USA.

1. COA 205 Introduction to Coaching is the 'keystone' course for this major. All students should start here.
2. In most cases, there will be NO credits given for PRIOR coaching experience that has not resulted in a written evaluation from an athletic director, director of coaching, head coach or other sport administrator.
3. The sports-specific courses (theories of coaching football, basketball, soccer, track and field, volleyball, etc.) have COA 205 as their prerequisite. No student should attempt taking any of these classes without successful completion of COA 205.

Students must receive a "C" or better (with the exception of COA 395, which is P/F) for the following courses. Students receiving an "F" in COA 395 must repeat that course with the same supervisor.

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COA 205</td>
<td>Introduction to Coaching</td>
<td>3</td>
</tr>
<tr>
<td>COA 395</td>
<td>Practicum: Coaching Application</td>
<td>1</td>
</tr>
<tr>
<td>COA 405</td>
<td>Advanced Concepts in Coaching</td>
<td>3</td>
</tr>
<tr>
<td>HTH 455</td>
<td>The Ethic of Care</td>
<td>3</td>
</tr>
<tr>
<td>KIN 221</td>
<td>Hlth Anatomy &amp; Physiology</td>
<td>3</td>
</tr>
<tr>
<td>KIN 440R</td>
<td>Sport Psychology</td>
<td>3</td>
</tr>
<tr>
<td>NUTR 221CS</td>
<td>Basic Human Nutrition</td>
<td>3</td>
</tr>
</tbody>
</table>
Students must receive a grade of "C" or higher in all required courses as employers in identifying qualified health education practitioners. Certification is a national standard for health education practice and assists essential to the practice of community health/health education. The CHES exam measures the possession, application, and interpretation of knowledge completion of the community health major establishes eligibility to sit for their career.

community health major

Graduates of the community health major are employed in entry-level positions conducting planning, administration, evaluation, research, and teaching in community health settings. The undergraduate program is concerned with improving health and well-being for all through the promotion of healthful lifestyles, healthy family functioning, community actions for health, and conditions that make it possible to live healthful lives. The program draws on public health, education, psychology, sociology, family science, and other social and behavioral sciences. Students are prepared to work in a variety of settings including family planning agencies, nonprofit agencies, state and federal health agencies, schools, and community health centers. This program stresses community involvement because community health emphasizes an interactive process. Students will be prepared to assess individual and community needs; plan, implement, and evaluate effective health programs; coordinate provision of services; act as a resource person; and communicate health needs, concerns and resources. Persons enrolling in this option should seriously consider earning a graduate degree in public health or some related area at some point in their career.

Completion of the community health major establishes eligibility to sit for the Certified Health Education Specialist (CHES) examination. The CHES exam measures the possession, application, and interpretation of knowledge essential to the practice of community health/health education. The CHES certification is a national standard for health education practice and assists employers in identifying qualified health education practitioners.

Students must receive a grade of "C" or higher in all required courses as outlined in the major.

Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMX 111US</td>
<td>Introduction to Public Speaking</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>HDFS 101IS</td>
<td>Indiv and Fam Dev: Lifespan</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SOCI 101IS</td>
<td>Introduction to Sociology</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>M 105Q</td>
<td>Contemporary Mathematics (formerly M 145Q)</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CHTH 205</td>
<td>Drugs and Society</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PSYX 100IS</td>
<td>Intro to Psychology</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>University Core</td>
<td></td>
<td></td>
<td>15</td>
<td>16</td>
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</table>

Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHTH 210</td>
<td>Foundations in Community Health</td>
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<td>HDFS 365</td>
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Junior Year

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<td>CHTH 317</td>
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Senior Year

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<td>CHTH 443</td>
<td>Program Evaluation for Community Health</td>
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<td>CHTH 445</td>
<td>Program Planning for CH</td>
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Total Program Credits: 121

Supporting Courses (21-35 credits)

Select supporting courses from the list below. Select courses that will best compliment your professional goals in community health. Courses may be counted only once on your program of study. Check prerequisites to all courses.

BMGT 205    Prof Business Communication
            3
BMGT 469  Community Entrepreneurship & Nonprofit Management  3
CHTH 245  Physical Activity, Nutrition and Health in Aging  3
CHTH 325  Leadership & Public Policies in Aging  3
CHTH 405  Caregiving & Aging Families  3
CHTH 430  Mental Health & Social Issues in Aging  3
HDFS 138  Survey of Family Finance and Consumer Issues  3
HDFS 260  Middle Childhood and Adolescent Development  3
HDFS 261  Adult Development and Aging  3
HDFS 271  Statistical Measures of Well-Being  3
HDFS 337  Personal and Family Finance I  3
HDFS 338  Personal and Family Finance II  3
HDFS 461  Principles Wellbeing in Aging  3
HDFS 464  Gnrd, Rce, Clss, and Fam Diver  3
NUTR 321  Nutrition in the Life Cycle  3
NUTR 351  Nutrition and Society  3
PSCI 210IS  Introduction to American Government  3
PSCI 230D  Introduction to International Relations  3
PSCI 240  Introduction to Public Administration  3
PSCI 439  International Human Rights  3
PSCI 465  Public Administration and Policy  3
PSYX 230  Developmental Psychology  3
PSYX 333  Psychology of Aging  3
PSYX 335  Psychology of Gender  3
PSYX 340  Abnormal Psychology  3
PSYX 360  Social Psychology  3
PSYX 385  Psychology of Personality  3
PSYX 462  Psychology of Prejudice  3
SOCI 150D  Social Difference  3
SOCI 320  Sociology of Religion  3
SOCI 325  Social Stratification  3
SOCI 326  Sociology of Gender  3
SOCI 344  Sociology of Race & Ethnicity  3
SOCI 355  Population and Society  3
SOCI 370  Sociology of Globalization  3
STAT 216Q  Introduction to Statistics  3
STAT 217Q  Intermediate Statistical Concepts  3

**Professional Units:** Supporting courses have been specified into professional units. These professional units provide a specific list of supporting courses that students should take if they are interested in a particular area of community health. Professional units include again, health administration, health disparities, health policy, and public health/epidemiology. Please contact the HHD Advising Office for professional unit course lists.

Community Health students may also consider the following minors as partial or complete fulfillment of supporting course credits. Approved minors include business administration, psychology, sociology, and Spanish.

**Certifications**
Graduates of the program may pursue certification as a Community Health Education Specialist (CHES). Please see a Community Health faculty member for additional information.

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### Early Childhood Education and Child Services Major

The early childhood education and child services (ECE&CS) major emphasizes the dual focus of education and services within the context of family, school, and community. Throughout the program, students are actively engaged in a variety of settings that include children, their families, and other early childhood professionals. Course work and field experience provide multiple opportunities for applied understanding of children's growth and development, building family and community relationships, conducting observations and assessments, understanding developmentally appropriate practices, and promoting the well-being of young children and their families.

Graduates of the ECE&CS program are highly qualified for preschool-grade 3 teaching, administration, and advocacy careers in a wide variety of settings including public and private early childhood education, early intervention and preschool special education settings, child-focused programs, and community agencies, state or federal agencies, and nonprofit settings that support children and families. The ECE&CS major provides a strong background for admission to graduate programs in early childhood education, child development, child and family studies, social work, counseling, and other related behavioral and social science disciplines.

Students must receive a grade of "C" or higher in all required courses as outlined in the major.

#### Child Development Option

The Child Development option of the Early Childhood Education and Child Services major will appeal to students with professional interests including parent education, early intervention, resource and referral, advocacy, and childcare administration. Students seeking teaching careers in non-public school settings with children birth through age 8 will also be well prepared through the Child Development option.

**Freshman Year**

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
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<td>US 101US</td>
<td>First Year Seminar</td>
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<td>WRIT 101W</td>
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**Sophomore Year**

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<td>NASX 105D</td>
<td>Introduction to Native American Studies</td>
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<td>Native Americans in Contemporary Society</td>
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<td>NASX 232D</td>
<td>MT Indians: Cultures, Histories, Current Issues</td>
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**Junior Year**

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<td>Relationships and Fam Systems</td>
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<td>Basic Human Nutrition</td>
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**Senior Year**

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<tr>
<td>EDEC 253</td>
<td>Health and Movement in Early Childhood</td>
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</table>
### Preschool-Grade 3 (P-3) Option

The Early Childhood Education & Child Services P-3 option is designed for students who wish to become licensed to teach preschool through grade 3. Upon completion of the degree, students are eligible for licensure in the state of Montana. For more information on admission to the Teacher Education Program, student teaching, licensure, professional expectations, and more, please visit: http://catalog.montana.edu/undergraduate/education-health-human-development/department-education/teacher-education-program/.

#### Freshman Year

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<td>M 132</td>
<td>Numbers &amp; Operations for K-8 Teachers</td>
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<td>Play and Learning in Early Childhood</td>
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<td>EDSP 306</td>
<td>Exceptional Learners</td>
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<td>HDFS 455R</td>
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#### Total Program Credits: 120

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### Montana State University

145

EDEC 271 - Paraprofessional Experience in Early Childhood

University Core and Electives

Year Total: 15 14

**Junior Year**

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**Year Total:** 16 16

**Sophomore Year**

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**Year Total:** 15 15

**Senior Year**

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Food and Nutrition Major

The Department of Health and Human Development offers a major in the study of food and nutrition. Students who choose the nutrition science option generally intend to pursue a health profession or research-related career such as medicine, dentistry, industry, academia, etc.

The dietetics option (p. 146) is designed for students wishing to become a registered dietitian. A post-baccalaureate non-degree graduate- or graduate degree-level dietetic internship is required in order to be eligible to take the exam for dietetic registration. Montana State University currently offers a non-degree graduate dietetic internship. Admission to the internship is on a competitive basis. Information about degree requirements can be obtained from the Health and Human Development advising office located in the Hosaecus Recreation and Fitness Center.

The nutrition science option (p. 147) is designed to prepare a student for admission to medical (allopathic or osteopathic), dental, or graduate school with an emphasis on nutrition and biochemistry.

Standards of Work

Students must receive a grade of "C" or higher in all required courses as outlined in the major.

Dietetics Option

The dietetics option at Montana State University-Bozeman is accredited as a Didactic Program in Dietetics by the Accreditation Council for Education in Nutrition and Dietetics (ACEND) of the Academy of Nutrition and Dietetics, 120 Riverside Plaza, Suite 2000, Chicago, IL, 60606-6995, (312) 899-0040, extension 5400. An MSU graduate will attain a verification statement upon completion of the ACEND-accredited dietetics program curriculum with a minimum of a "C" or better in each required program course. A graduate is then eligible to apply for an ACEND-accredited supervised practice/dietetic internship. Students who apply and are accepted to a post-graduate dietetic internship are eligible to take the national registration exam for dietitians upon completion of the dietetic internship. Once the individual has passed the exam, the individual has earned the credential "RD" (registered dietitian) or "RDN" (registered dietitian nutritionist) and must complete continuing education credits to maintain RD/RDN status.

The dietetics option has a strong foundation in food and nutrition, food service management, and clinical nutrition. Registered dietitians may find employment in health care facilities, industrial, school, and university food services, community nutrition services, private practice, sales for food service or health products, and other related fields.

Freshman Year

Choose one of the following:

- ANTY 101D - Anthropology and the Human Experience
- or SOCI 101IS - Introduction to Sociology

Choose one of the following:

- COMX 111US - Introduction to Public Speaking
- or Any US Core

Choose one of the following:

- HDFS 101IS - Indiv and Fam Dev: Lifespan
- PSYX 100IS - Intro to Psychology

Year Total: 16

Total Program Credits: 120

Sophomore Year

Choose one of the following:

- ACTG 201 - Principles of Financial Acct
- or BGEN 210 - Accounting & Finance Basics
- BIOB 160 - Principles of Living Systems
- CHMY 143 - College Chemistry II
- STAT 216Q - Introduction to Statistics
- Elective

Year Total: 15-16

Junior Year

Choose one of the following:

- BMGT 205 - Prof Business Communication
- or WRIT 201 - College Writing II
- or WRIT 221 - Intermediate Tech Writing
- BIOM 103IN - Unseen Universe: Microbes
- or BIOM 250 - Microbiology for Health Sciences: Infectious Diseases
- NUTR 226 - Food Fundamentals
- NUTR 227 - Food Fundamentals Lab

Year Total: 15

Senior Year

Choose one of the following:

- BIOH 201 - Human Anatomy and Physiology I
- CHMY 211 - Elements of Organic Chemistry
- NUTR 321 - Nutrition in the Life Cycle
- BCH 380 - Biochemistry
- HDFS 371 - Research Methods in HHD
- NUTR 401 - Nutrition Assessment/Counsel

Year Total: 14

Choose one of the following:

- CHTH 317 - Health Behavior Theories
- NUTR 322 - Food Service System Management
- NUTR 351 - Nutrition and Society
- NUTR 421 - Macronutrient Metabolism
- NUTR 425 - Medical Nutrition Therapy I
- NUTR 494 - Seminar
- NUTR 395 - Pract: Quant Foods Prod & Mgmt
- NUTR 422 - Macronutrient Metabolism
- NUTR 426 - Medical Nutrition Therapy II
- NUTR 499 - Capstone for Dietetics
- SFBS 451R - Sustainable Food Systems
- or SFBS 445R - Culinary Marketing: Farm/ Table
Montana State University

University Core

Year Total: 16

Total Program Credits: 120

**Nutrition Science Option**

The nutrition science option is designed to prepare a student for admission to medical (allopathic or osteopathic), dental, or graduate school with an emphasis on nutrition and biochemistry. A student can earn a verification statement if all dietetic course requirements are met for the ACEND-accredited Didactic Program in Dietetics. Although the nutrition science option provides a strong background for most professional schools, students must contact individual schools for specific post-baccalaureate entrance requirements.

**Freshman Year**

<table>
<thead>
<tr>
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<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
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<tr>
<td></td>
<td>COMX 111US - Introduction to Public Speaking</td>
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<td></td>
<td>or Any US Core</td>
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<tr>
<td>PSYX 100IS</td>
<td>Intro to Psychology</td>
<td>4</td>
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<tr>
<td>M 161Q</td>
<td>Survey of Calculus</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>NUTR 221CS</td>
<td>Basic Human Nutrition</td>
<td>3</td>
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<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
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<td>WRIT 101W</td>
<td>College Writing I</td>
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University Core

Year Total: 15

**Sophomore Year**

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<tr>
<td>BIOB 260</td>
<td>Cellular and Molecular Biology</td>
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<td>Organic Chemistry I</td>
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<tr>
<td>PHSX 205</td>
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<td>WRIT 201</td>
<td>College Writing II</td>
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<tr>
<td>BIOH 201</td>
<td>Human Anatomy and Physiology I</td>
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<td>CHMY 323</td>
<td>Organic Chemistry II</td>
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<td>PHSX 207</td>
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University Core

Year Total: 15

**Junior Year**

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<tr>
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<td>Human Anatomy and Physiology II</td>
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<td>HDFS 359</td>
<td>Theories and Skills for the Human Services</td>
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<td>NUTR 321</td>
<td>Nutrition in the Life Cycle</td>
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<td>NUTR 301 - Food and Culture</td>
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<td>NUTR 351 - Nutrition and Society</td>
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University Core

Year Total: 15

**Senior Year**

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<td>Nutrition Assessment/Counsel</td>
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Year Total: 16

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<tr>
<td>BIOH 313</td>
<td>Neurophysiology</td>
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<td>BIOM 360</td>
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<td>NUTR 421</td>
<td>Macronutrient Metabolism</td>
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<td>NUTR 425</td>
<td>Medical Nutrition Therapy I</td>
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<td>BIOH 323</td>
<td>Human Developmental Biology</td>
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<td>NUTR 422</td>
<td>Micronutrient Metabolism</td>
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Choose one of the following: 3

<table>
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<tr>
<td>or PSYX 380</td>
<td>Memory &amp; Cognition</td>
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Elective

Year Total: 14

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</thead>
<tbody>
<tr>
<td>University Core</td>
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</tbody>
</table>

**Certificate of Gerontology**

The certificate will provide courses specifically focused on aging to increase the knowledge and understanding of aging issues for individuals wishing to work with older adults and their families. In the field of gerontology, certificate programs are common due to the multi-disciplinary focus of gerontology. The intent of a gerontology certificate is to provide specific knowledge on aging issues to enhance students programs of study in other programs and disciplines.

The online gerontology certificate program is a joint endeavor shared by faculty (community health and human development and family science) in the Department of Health and Human Development at Montana State University. Students will need to complete 2 required courses (6 credits) and 3 elective courses (9 credits), for a total of 15 credits with earned grades of “C” or higher to fulfill certificate requirements.

**Required Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CTHH 495</td>
<td>Practical Experience in Aging</td>
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Choose one of the following: 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CTHH 245</td>
<td>Physical Activity, Nutrition and Health in Aging</td>
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</tr>
<tr>
<td>HDFS 261</td>
<td>Adult Development and Aging</td>
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Choose three of the following: 9

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>CTHH 325</td>
<td>Leadership &amp; Public Policies in Aging</td>
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<tr>
<td>CTHH 405</td>
<td>Caregiving &amp; Aging Families</td>
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<tr>
<td>CTHH 430</td>
<td>Mental Health &amp; Social Issues in Aging</td>
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<tr>
<td>HDFS 461</td>
<td>Principles Wellbeing in Aging</td>
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Total Credits: 15

**Health Enhancement: Health and Physical Education Teaching K-12 Broadfield Major**

The health enhancement K-12 major is designed for students who wish to become licensed to teach health enhancement (health and physical education) in grades K-12. Upon completion of the degree, students are eligible for licensure in the state of Montana.

Obtaining a teaching minor will require more than eight semesters. For more information on admission to the Teacher Education Program, student teaching, licensure, professional expectations and more, please
visit: http://catalog.montana.edu/undergraduate/education-health-human-development/department-education/teacher-education-program/

Health enhancement is a comprehensive approach to combining the traditional areas of health education and physical education. It is a contemporary curriculum where healthy lifestyles and concepts are achieved through skillful movement with an emphasis on physical fitness, healthy lifestyle management skills, and understanding of the total self (physical, intellectual, emotional, and social). In addition to the traditional approach to teaching fundamental movement, skills, games, and dance, this curriculum emphasizes the overall health of the individual as a value in life and enhances critical thinking, decision-making and problem-solving skills of future teachers and their students. Courses within this curriculum represent a combination of content knowledge (health enhancement, health education, and physical education) along with a strong background in pedagogical content knowledge (teaching methods and curriculum). Students majoring in health enhancement develop a professional development portfolio based on national beginning teacher standards. The final semester consists of student teaching in two public school placements.

Criteria for Selection and Retention
Admission to the Teacher Education Program. Any student who wishes to enter the Teacher Education Program must complete an "Application for the Teacher Education Program." These forms are available at www.montana.edu/fieldplacement/. The plan must be signed by the advisor and the forms turned into the Education Advising Center, 132 Reid Hall. Students should apply to the Teacher Education Program by the end of their sophomore year.

The requirements for admission are:

1. cumulative grade point average of at least 2.75;
2. a grade of "C" or higher in all required courses;
3. approval of the advisor; and
4. no record of immoral conduct related to the teaching profession nor been judged guilty of a criminal offense as outlined by Section 20-4-110 of the Montana Code Annotated.

Application and approval for student teaching. Certain requirements must be met by all students desiring to student teach. These are:

1. maintenance of the same standards required for admission into the program including satisfactory clearance on a federal criminal background check;
2. completion of all required courses;
3. certification of first aid and CPR; and 4) approval of advisor.

Student teaching is limited to seniors. Application must be made to the Director of Field Placement and Certification no later than the following times:

- Fall student teaching: by the end of the first week in December of the year prior to student teaching.
- Spring student teaching: by the end of the second week of April of the year prior to student teaching.

The Praxis II exam in the area of physical education must be successfully passed one semester prior to student teaching.

Recommendation and approval for licensure. The requirements for recommendation by Montana State University for licensure include completion of courses in the Teacher Education Program as outlined in the individual’s approved plan; maintenance of the same standards as required for student teaching; and approval of the advisor and the Director of Field Placement and Certification.

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credits</th>
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<tr>
<td>Fall</td>
<td>Spring</td>
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<tr>
<td>COA 205 - Introduction to Coaching</td>
<td>3</td>
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<td>COMX 111US - Introduction to Public Speaking</td>
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<td>DANC 150 - Social Dance</td>
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<td>HDFS 101IS - Indiv and Fam Dev: Lifespan</td>
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<td>M 105Q - Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts)</td>
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<td>WRIT 101W - College Writing I</td>
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<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
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<tr>
<td>HEE 195 - Paraprofessional Experience I</td>
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<td>HEE 305 - Methods of Teaching Mvmt Expl</td>
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<td>KIN 105 - Foundations of Exercise Science</td>
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<td>LSCI 121 - Library Research Skills</td>
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<tr>
<td>Fall</td>
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<tr>
<td>CHTH 205 - Drugs and Society</td>
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<tr>
<td>COA 256 - Coaching Track and Field</td>
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<td>EDU 370 - Integrating Tech into Educ</td>
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<td>HEE 306 - Methods of Cond Act</td>
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<td>KIN 221 - Hlth Anatomy &amp; Physiology</td>
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<td>COA 316 - Football Coaching Theory</td>
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<td>EDU 211D - Multicultural Education</td>
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<tr>
<td>EDU 382 - Assessmt, Curric, Instructn</td>
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<tr>
<td>HTH 220 - Human Sexuality</td>
<td>3</td>
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<td>NUTR 221CS - Basic Human Nutrition</td>
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<tr>
<td>Fall</td>
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<tr>
<td>EDU 397 - Methods</td>
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<td>HDFS 371 - Research Methods in HHD</td>
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<td>KIN 322 - Kinesiology</td>
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<td>COA 319 - Volleyball Coaching Theory</td>
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<tr>
<td>EDU 497 - Methods</td>
<td>3</td>
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<td>HEE 310 - Methods of Adapted HE</td>
<td>3</td>
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<td>HEE 430 - Instrc Design in HE</td>
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<td>KIN 320 - Exercise Physiology</td>
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<tbody>
<tr>
<td>Fall</td>
<td>Spring</td>
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<tr>
<td>COA 317 - Basketball Coaching Theory</td>
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<td>COA 318 - Soccer Coaching Theory</td>
<td>1</td>
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<tr>
<td>HTH 455 - The Ethic of Care</td>
<td>3</td>
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<tr>
<td>KIN 440R - Sport Psychology</td>
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</table>
food and nutrition, business and entrepreneurship, and overlaps with many courses offered within the Restaurant Management: Farm-to-Table option.

The Food Enterprise option also includes practicum course work related to food processing, food safety and sanitation, sustainable food systems, food enterprises. The curriculum includes course work in food processing, experimental foods, food safety and sanitation, sustainable food systems, food and nutrition, business and entrepreneurship, and overlaps with many courses offered within the Restaurant Management: Farm-to-Table option. The Food Enterprise option also includes practicum course work related to food product development and a senior-level internship within the food enterprise sector.

The Food Enterprise option is focused on innovation and entrepreneurship in the food sector. Students within this option will explore strategies for adding value to Montana’s specialty crops while learning about food science, small-scale processing, product development, marketing, and distribution. Existing value-added food enterprises are often associated with sustainable practices, rural hospitality, and typically integrate a farm-to-table philosophy; thus, this option ties together the themes of the degree program. Graduates will find employment with existing food processing and distribution companies, or as entrepreneurs launching value-added food enterprises. The curriculum includes course work in food processing, experimental foods, food safety and sanitation, sustainable food systems, food and nutrition, business and entrepreneurship, and overlaps with many courses offered within the Restaurant Management: Farm-to-Table option. The Food Enterprise option also includes practicum course work related to food product development and a senior-level internship within the food enterprise sector.

The Hospitality Management program at Montana State University prepares students to become skilled professionals within the expanding local, regional, national and global hospitality industries. Students, choosing from one of three degree options (Food Enterprise, Lodging and Facilities Management, and Restaurant Management: Farm-to-Table) engage in an interdisciplinary and experiential curriculum. The curriculum draws from course work in food and nutrition, culinary arts, business, and agriculture as well as hospitality-specific course work emphasizing sustainability and quality customer service across the hospitality industry.

All options have practicum courses for skill development and field-based courses that integrate problem-based learning and service learning through community engagement. Additionally, all options include internships to ensure that graduates have sufficient practical experience to be prepared and competitive for job placement.

**Food Enterprise Option**

The Food Enterprise option is focused on innovation and entrepreneurship in the food sector. Students within this option will explore strategies for adding value to Montana’s specialty crops while learning about food science, small-scale processing, product development, marketing, and distribution. Existing value-added food enterprises are often associated with sustainable practices, rural hospitality, and typically integrate a farm-to-table philosophy; thus, this option ties together the themes of the degree program. Graduates will find employment with existing food processing and distribution companies, or as entrepreneurs launching value-added food enterprises. The curriculum includes course work in food processing, experimental foods, food safety and sanitation, sustainable food systems, food and nutrition, business and entrepreneurship, and overlaps with many courses offered within the Restaurant Management: Farm-to-Table option. The Food Enterprise option also includes practicum course work related to food product development and a senior-level internship within the food enterprise sector.

**Freshman Year**

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>BIOM 103IN - Unseen Universe: Microbes</td>
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<td>CULA 102 - Introduction to Culinary Arts</td>
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<td>CULA 105 - Food Safety Sanitation</td>
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**Sophomore Year**

<table>
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<tbody>
<tr>
<td>HTR 107 - Introduction to Hospitality Management</td>
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<td>M 121Q - College Algebra</td>
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<td>or M 105Q - Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts)</td>
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<td>NUHTR 211CS - Basic Human Nutrition</td>
<td>3</td>
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<td>WRIT 101W - College Writing I</td>
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**Junior Year**

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<tbody>
<tr>
<td>BMGT 335 - Management and Organization</td>
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<td>BMKT 325 - Principles of Marketing</td>
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<td>ECCHM 205C5 - Energy and Sustainability</td>
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<tr>
<td>HDFS 371 - Research Methods in HHD</td>
<td>3</td>
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<td>HTR 230 - Fundamentals of Tourism Management</td>
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<tr>
<td>NUTR 301 - Food and Culture</td>
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<td>NUTR 325 - Introduction to Food Processing</td>
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<td>NUTR 351 - Nutrition and Society</td>
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**Senior Year**

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<tr>
<td>BGEN 361 - Principles of Business Law</td>
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<tr>
<td>BMKT 343 - Integrated Marketing Communication</td>
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<td>HTR 498 - Hospitality Management Internship II</td>
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<td>HTR 499 - Capstone: Hospitality Management Systems and Strategy</td>
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<td>NUTR 435 - Experimental Foods</td>
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</tr>
<tr>
<td>NUTR 496 - Practicum Food Product Development</td>
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<td>SFBS 429 - Small Business and Entrepreneurship in Food and Health</td>
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<tr>
<td>SFBS 451R - Sustainable Food Systems or SFBS 445R - Culinary Marketing: Farm/Table</td>
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</table>

**Total Program Credits:** 120
recreation programs, and workplace or corporate health and fitness programs. Graduates may also choose an entrepreneurial path, launching their own lodging enterprise. The curriculum utilizes existing course work in business, overlapping with some with the Restaurant Management: Farm-to-Table option course work—as many fitness facilities also include a foodservice operation (coffee, juice bar, nutritional products, etc.). Course work specific to lodging operations, sustainability in the hospitality industry, rural hospitality, supervision and customer service and event planning are central to this option. This option also includes junior-level and senior-level internships operating and managing lodging and other facilities managing the student’s career interests.

**Restaurant Management: Farm-to-Table Option**

The Restaurant Management: Farm-to-Table option is focused on management of restaurant enterprises with an emphasis on farm-to-table sourcing and healthful cuisine. Graduates will find employment as foodservice and restaurant managers or as entrepreneurs launching their own restaurant or foodservice enterprise. This option is also tied to the provision of foodservices in healthcare facilities (hospitals, assisted living and retirement homes) and other institutions such as schools, workplaces, colleges/universities, and more. The curriculum includes hospitality-specific courses and draws from courses in sustainable food systems, food and nutrition, culinary arts, and business. Practicum courses are in foodservice systems management, quantity food preparation, and hyperlocal food production at Towne’s Harvest Garden, MSU’s organic campus farm. This option also includes restaurant/foodservice management internships.

**Freshman Year**

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<thead>
<tr>
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<tr>
<td>HDFS 371</td>
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<td>Management and Organization</td>
<td>3</td>
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<tr>
<td>BIOM 145Q</td>
<td>Math for Liberal Arts</td>
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<tr>
<td>BIOM 318</td>
<td>Biometry</td>
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<td>CULA 250</td>
<td>Hospitality Supervision and Customer Service</td>
<td>3</td>
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<tr>
<td>ECNS 145Q</td>
<td>Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>HTR 229</td>
<td>Sustainability in the Hospitality Industry</td>
<td>3</td>
</tr>
<tr>
<td>HTR 228</td>
<td>Hospitality Management Internship</td>
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<tr>
<td>NUTR 227</td>
<td>Food Fundamentals</td>
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<tr>
<td>STAT 216</td>
<td>Introduction to Statistics</td>
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<td>MATH 216</td>
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<tr>
<td>CULA 107</td>
<td>Food Safety Sanitation</td>
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<td>Introduction to Hospitality Management</td>
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<td>HTR 201</td>
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<td>M 150Q</td>
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<td>NUTR 228</td>
<td>Basic Human Nutrition</td>
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**Sophomore Year**

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<td>BMGT 205</td>
<td>Prof Business Communication</td>
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<td>ECNS 145Q</td>
<td>Economic Way of Thinking</td>
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<td>HTR 228</td>
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<td>NUTR 227</td>
<td>Food Fundamentals</td>
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**Junior Year**

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<td>3</td>
</tr>
<tr>
<td>BGEN 361</td>
<td>Principles of Business Law</td>
<td>3</td>
</tr>
<tr>
<td>BMGT 335</td>
<td>Management and Organization</td>
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</tr>
<tr>
<td>BMGT 335</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>HTR 498</td>
<td>Hospitality Management Internship II</td>
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<tr>
<td>HTR 499</td>
<td>Capstone: Hospitality Management Systems and Strategy</td>
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</tr>
<tr>
<td>SFBS 429</td>
<td>Small Business and Entrepreneurship in Food and Health</td>
<td>3</td>
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<td>SFBS 451R</td>
<td>Sustainable Food Systems</td>
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<td>or SFBS 445R</td>
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**Year Total:**

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**Senior Year**

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<td>Non-Formal Teaching Methods in Agriculture</td>
<td>3</td>
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<td>BGEN 361</td>
<td>Principles of Business Law</td>
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<td>BMGT 335</td>
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<td>SFBS 429</td>
<td>Small Business and Entrepreneurship in Food and Health</td>
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<td>Sustainable Food Systems</td>
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<td>or SFBS 445R</td>
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**Total Program Credits:**

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<tbody>
<tr>
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</table>
empower individuals and families across the lifespan to manage the challenges of living and working in a diverse, global society. The unique focus is on families, work, and their interrelationships. The curriculum at MSU follows the National Standards for Family and Consumer Sciences Teachers and the National Standards for Family and Consumer Sciences Students. Therefore, students choosing this option will be well qualified to seek employment in a variety of educational settings including secondary public and private schools, extension, and public and private agencies. Upon successful completion of the program, candidates will be recommended for a Montana teaching license in Family and Consumer Sciences grades 5-12.

Students are encouraged to complete the Certified Family Life Educator (https://www.ncfr.org/sites/default/files/montana_state_univ_bozeman_1.pdf) and Accredited Financial Counselor (http://www.afcpe.org/certification/curriculum/accredited-financial-counselor) (HDFS 337, HDFS 338, and HDFS 339) designations as well as a teaching minor in a second field while attending MSU to further increase their professional opportunities. Obtaining a teaching minor will require more than eight semesters. For more information on admission to the Teacher Education Program, student teaching, licensure, professional expectations and more, please visit: http://catalog.montana.edu/undergraduate/education-health-human-development/department-education/teacher-education-program/.

Additionally, completion of the family and consumer sciences education option prepares undergraduate students to pursue graduate degrees in a variety of areas including family and consumer sciences, curriculum and instruction, school counseling, and adult education.

Students must receive a grade of "C" or higher in all required courses as outlined in the major.

Note: The teaching option requires 122 credits.

<table>
<thead>
<tr>
<th>Freshman Year</th>
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<tbody>
<tr>
<td>HDFS 101IS - Indiv and Fam Dev: Lifespan</td>
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<td>HDFS 138 - Survey of Family Finance and Consumer Issues</td>
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<td>M 105Q - Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts)</td>
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<tr>
<td>WRIT 101W - College Writing I or University Core</td>
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<tr>
<td>CHTH 205 - Drugs and Society</td>
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<td>EDEC 160 - Early Childhood Development</td>
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<td>EDU 202 - Early Field Experience</td>
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<td>HDFS 218 - Design, Fashion, and Textiles</td>
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<td>HDFS 219 - Apparel Construction</td>
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methods. Social, cultural, historical, political, and economic trends that
specific theoretical frameworks (family systems, family crisis) and research
program focuses on family behavior, strengths, and challenges using family-
integrates the in-depth study of the family as a dynamic social unit. The
adulthood). Individuals develop in family contexts, and this program
lifespan (infancy, middle childhood, adolescence, adulthood, and late
families. The program focuses on the social-emotional, physical, mental,
HDFS 271 - Statistical Measures of Well-Being 3
NUTR 226 - Food Fundamentals 3
NUTR 227 - Food Fundamentals Lab 2
University Core 3
Year Total: 17 14
Junior Year
Credits
Fall Spring
EDSP 306 - Exceptional Learners 3
EDSP 307 - Exceptional Learners Lab 1
EDU 382 - Assesmt, Curric, Instructn 3
HDFS 337 - Personal and Family Finance I 3
HDFS 371 - Research Methods in HHD 3
University Core 3
HDFS 338 - Personal and Family Finance II 3
HDFS 437 - Managing Work and Family 3
HDFS 450 - Curric Dev in FCS Education 3
HDFS 460 - Parenting 3
Choose one of the following: 3
HDFS 464 - Gndr, Rce, Clss, and Fam Diver
HDFS 465R - Family Law & Public Policy
Year Total: 16 15
Senior Year
Credits
Fall Spring
EDU 342 - Managing the Learning Envir 3
EDU 395 - Practicum 3
EDU 497 - Methods 3
HDFS 457 - Family Life Education 3
Electives 3
EDU 408 - Professional Issues: K-12 2
EDU 495R - Student Teaching 12
Year Total: 15 14
Total Program Credits: 122

Human Development and Family Science Option
The human development and family science option is an interdisciplinary
program that prepares students for careers working with individuals and
families. The program focuses on the social-emotional, physical, mental,
spiritual, cultural, and societal aspects of human development across the
lifespan (infancy, middle childhood, adolescence, adulthood, and late
adulthood). Individuals develop in family contexts, and this program
integrates the in-depth study of the family as a dynamic social unit. The
program focuses on family behavior, strengths, and challenges using family-
specific theoretical frameworks (family systems, family crisis) and research
methods. Social, cultural, historical, political, and economic trends that
influence family functioning and well-being are addressed. Students study
a wide range of family issues including relational dynamics, parenting,
human response to stress and crisis, family policies and laws, family finance
and economics, work and family issues, and human services delivery and
decision-making.

The human development and family science option provides a strong
background for students seeking careers in human services, family life
education, family policy, and financial counseling. The curriculum prepares
students to work in a wide range of organizations and settings (community-
based social services, family intervention, business, government and public
policy, faith-based organizations, healthcare and family wellness, and non-
profit organizations). The degree program also prepares students to be
strong candidates for graduate programs in marriage and family therapy,
counseling, family financial planning, human development, family science,
social work, law, and other related behavioral and social science disciplines.

Students completing the degree may apply for provisional certification
and family science major (formerly known as family and consumer
sciences major) is accredited by the National Council on Family Relations.
Provisional certification is awarded at the completion of a baccalaureate
degree and course work in the 11 family life substance areas. After two
years’ work experience, the student may apply for full CFLE certification.

Students are also encouraged to complete the courses required to take a
national exam for the certification as an Accredited Financial Counselor
(HDFS 337, HDFS 338, and HDFS 339).

Students must receive a grade of "C" or higher in all required courses as
outlined in the major.

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<th>Freshman Year</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
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<td>HDFS 101IS - Indiv and Fam Dev: Lifespan</td>
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<tr>
<td>HDFS 138 - Survey of Family Finance and Consumer Issues</td>
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<tr>
<td>M 105Q - Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts)</td>
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<td>US 101US - First Year Seminar or COMX 111US - Introduction to Public Speaking</td>
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<tr>
<td>Choose one of the following:</td>
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<td>WRIT 101W - College Writing I or University Core</td>
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<td>Choose one of the following:</td>
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<td>EDEC 160 - Early Childhood Development</td>
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<td>EDEC 260 - Middle Childhood and Adolescent Development</td>
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<td>EDEC 261 - Adult Development and Aging</td>
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<tr>
<td>CHTH 205 - Drugs and Society</td>
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<td>HDFS 239 - Contemporary Consumer Issues</td>
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<td>HDFS 263 - Relationships and Fam Sys</td>
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The undergraduate major in Health and Human Performance (HHP) at Montana State University is a general pre-health professional curriculum that prepares students for health-related graduate programs (e.g., physical therapy, occupational therapy, medical school, etc.), exercise science graduate programs (e.g., exercise physiology, health promotion, biomechanics), as well as entry-level occupations within the health and wellness industry. HHP majors can choose to focus their course work within one of the following curriculum options: exercise science or kinesiology. Students within the exercise science option intend to pursue a health-related graduate degree to meet their career aspirations, whereas students within the kinesiology option will pursue careers within the health and wellness industry that do not require a graduate degree.

### Health and Human Performance Major

The exercise science option within the Health and Human Performance (HHP) major focuses on both clinical and performance-based understandings of human movement. The exercise science option emphasizes a cross-disciplinary understanding of human movement through non-departmental courses in biology, anatomy and physiology, chemistry, physics, math, and statistics. These courses then serve as the foundation for mechanical (e.g., biomechanics), physiological, and nutritional perspectives within the departmental courses. The exercise science option specifically allows students to customize their junior and senior year course work as needed for later application to health-related graduate programs in physical therapy, occupational therapy, medical physician assistant, sports medicine, exercise science graduate programs (exercise physiology, health promotion, biomechanics), as well as medical school. Additional careers for exercise science students can include those within the health and fitness industry (e.g., those requiring ACSM Certified Health Fitness Specialist and/or Certified Clinical Exercise Specialist certifications, or the NCSA Certified Strength and Conditioning Specialist), corporate wellness programs, exercise rehabilitation programs (cardiac rehabilitation, gait laboratories, sport medicine facilities, older adult programs, etc.), as well as careers in the sport and rehabilitative medicine equipment industries. Regardless of a student’s career goals, each student’s course work will culminate in one of the following “capstone experience” courses: KIN 415 Advanced Exercise Testing and Prescription; KIN 430 Physical Fitness Program Design and Delivery; or a pre-approved internship (KIN 498).

Students must receive a grade of “C” or higher in all required courses as outlined in the major.

### Exercise Science Option

The undergraduate major in Health and Human Performance (HHP) at Montana State University is a general pre-health professional curriculum that prepares students for health-related graduate programs (e.g., physical therapy, occupational therapy, medical school, etc.), exercise science graduate programs (e.g., exercise physiology, health promotion, biomechanics), as well as entry-level occupations within the health and wellness industry. HHP majors can choose to focus their course work within one of the following curriculum options: exercise science or kinesiology. Students within the exercise science option intend to pursue a health-related graduate degree to meet their career aspirations, whereas students within the kinesiology option will pursue careers within the health and wellness industry that do not require a graduate degree.

#### Freshman Year

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<td>M 161Q</td>
<td>Survey of Calculus</td>
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<td>PSYX 100IS</td>
<td>Intro to Psychology</td>
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<td>Foundations of Exercise Science</td>
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<td>or University Core</td>
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<td>BIOB 160</td>
<td>Principles of Living Systems</td>
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<td>PHSX 207</td>
<td>College Physics I</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
<td>3</td>
<td></td>
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<tr>
<td>University Core</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>BIOH 201</td>
<td>Human Anatomy and Physiology I</td>
<td>5</td>
<td></td>
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<tr>
<td>PHSX 207</td>
<td>College Physics I</td>
<td>4</td>
<td></td>
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<tr>
<td>STAT 217Q</td>
<td>Intermediate Statistical Concepts</td>
<td>3</td>
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<tr>
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#### Junior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDFS 337</td>
<td>Personal and Family Finance I</td>
<td>3</td>
<td></td>
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<tr>
<td>HDFS 371</td>
<td>Research Methods in HHD</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directed Electives</td>
<td>6</td>
<td></td>
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<tr>
<td>Electives</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>CHTH 435</td>
<td>Human Response To Stress</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>HDFS 359</td>
<td>Theories and Skills for the Human Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or HDFS 338 and 339</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>HDFS 460</td>
<td>Parenting</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directed Electives</td>
<td>6</td>
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#### Senior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDFS 455R</td>
<td>Program Planning and Administration in Family &amp; Consumer Sciences</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>HDFS 457</td>
<td>Family Life Education</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>HDFS 465R</td>
<td>Family Law &amp; Public Policy</td>
<td>3</td>
<td></td>
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<tr>
<td>Directed Electives</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDFS 437</td>
<td>Managing Work and Family</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDFS 464</td>
<td>Gnrd, Res, Cis, and Fam Diver</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDFS 494</td>
<td>Seminar/Workshop</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>HDFS 498</td>
<td>Internship</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>Directed Electives</td>
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<tr>
<td>Electives</td>
<td>2</td>
<td></td>
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</tr>
</tbody>
</table>

#### Total Program Credits: 120

### Potential Career Options

- Exercise science students can pursue careers in health-related graduate programs (e.g., exercise physiology, health promotion, biomechanics), as well as medical school.
- Additional careers for exercise science students can include those within the health and fitness industry (e.g., those requiring ACSM Certified Health Fitness Specialist and/or Certified Clinical Exercise Specialist certifications, or the NCSA Certified Strength and Conditioning Specialist).
- Corporate wellness programs, exercise rehabilitation programs (cardiac rehabilitation, gait laboratories, sport medicine facilities, older adult programs, etc.), as well as careers in the sport and rehabilitative medicine equipment industries.
- Regardless of a student’s career goals, each student’s course work will culminate in one of the following “capstone experience” courses: KIN 415 Advanced Exercise Testing and Prescription; KIN 430 Physical Fitness Program Design and Delivery; or a pre-approved internship (KIN 498).
Year Total: 17 15

### Junior Year

**Fall** | **Spring**
---|---
BIOH 211 - Human Anatomy and Physiology II | 4
HDFS 371 - Research Methods in HHD | 3
Choose one of the following: | 4
KIN 320 - Exercise Physiology or KIN 322 - Kinesiology

**Directed Electives** | 3
Choose one of the following: | 4
KIN 322 - Kinesiology or KIN 320 - Exercise Physiology

Choose one of the following: | 3
KIN 410 - Adv Strength Training and Cond or KIN 335 - Tissue Injury and Adaptation or KIN 490R - Undergraduate Research or NUTR 411 - Nutrition for Sports/Exercise

**Directed Electives** | 6
**Electives** | 3

Year Total: 14 16

### Senior Year

Choose one of the following: | 3
NUTR 411 - Nutrition for Sports/Exercise or KIN 335 - Tissue Injury and Adaptation or KIN 410 - Adv Strength Training and Cond or KIN 490R - Undergraduate Research

**Directed Electives** | 12
Choose one of the following: | 2-6
KIN 415 - Adv Exercise Test and Prescrip or KIN 430 - Physical Fitness Program Design and Delivery or KIN 498 - Internship

**Directed Electives** | 6

Year Total: 15 12-16

Total Program Credits: 120

### Departmental Electives

Choose 15 credits from the list below:

- CHTH 317 Health Behavior Theories 3
- CHTH 435 Human Response To Stress 3
- CHTH 440 Principles Of Epidemiology 3
- HADM 445 Managing Healthcare Organizations 3
- HTH 455 The Ethic of Care 3
- KIN 335 Tissue Injury and Adaptation 3
- KIN 410 Adv Strength Training and Cond 3
- KIN 440R Sport Psychology 3
- KIN 490R Undergraduate Research 1-6
- NUTR 321 Nutrition in the Life Cycle 3
- NUTR 351 Nutrition and Society 3
- NUTR 411 Nutrition for Sports/Exercise 3
- NUTR 421 Macronutrient Metabolism 3
- NUTR 422 Micronutrient Metabolism 3
- NUTR 425 Medical Nutrition Therapy I 3

### Science Electives

Choose 3 credits from the list below:

- BCH 380 Biochemistry 5
- BIOL 260 Cellular and Molecular Biology 4
- BIOL 375 General Genetics 3
- BIOL 377 Practical Genetics 3
- BIOL 425 Adv Cell & Molecular Biology 3
- BIOL 309 Human Neuroanatomy 4
- BIOL 313 Neurophysiology 3
- BIOL 320 Biomedical Genetics 3
- BIOL 411 Adv Human Anatomy 4
- BIOL 360 General Microbiology 5
- BIOL 412 Animal Physiology 3
- CHMY 321 Organic Chemistry I 4
- CHMY 323 Organic Chemistry II 4
- EIND 313 Work Design and Analysis 3
- EIND 413 Ergonomics & Human Factors Engineering 3

### Social Science Electives

Choose 6 credits from the list below:

- PHL 321 Philosophy & Biomedical Ethics 3
- PHL 345 Philosophy of Science 3
- PHL 353 Philosophy and Technology 3
- PSYX 333 Psychology of Aging 3
- PSYX 340 Abnormal Psychology 3
- PSYX 350 Physiological Psychology 3
- PSYX 375 Behavior Modification 3
- PSYX 380 Memory & Cognition 3
- PSYX 383 Health Psychology 3
- SOCI 380 Sociology of Health & Medicine 3

### Kinesiology Option

The kinesiology option within the Health and Human Performance (HHP) major prepares graduates for careers requiring leadership in organizing, directing, and managing fitness and wellness programs in corporate and commercial settings. The overall goal of the kinesiology option is to develop basic knowledge, comprehension, and appreciation of a) historical and cultural perspectives of human movement, b) social and psychological influences of human movement, and c) physiological and biomechanical correlates of human performance. From this broad knowledge base, the program’s inherent flexibility allows students to pursue a variety of areas related to physical activity and sport. This option also prepares students for professional certifications in fitness and conditioning through professional organizations such as the American College of Sports Medicine (ACSM) and the National Strength and Conditioning Association (NSCA). Finally, each student’s course work will culminate in one of the following "capstone experience" courses: KIN 415 Advanced Exercise Testing and Prescription; KIN 430 Physical Fitness Program Design and Delivery; or a pre-approved internship (KIN 498). Students must receive a grade of “C” or higher in all required and approved elective courses as outlined in the major.

### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>COA 205 - Introduction to Coaching</td>
<td>3</td>
</tr>
<tr>
<td>M 151Q - Precalculus</td>
<td>4</td>
</tr>
</tbody>
</table>

### Credits

- Fall
- Spring
Choose one of the following: 3-4
- PSYX 100IS - Intro to Psychology
- or KIN 105 - Foundations of Exercise Science
Choose one of the following: 3
- WRIT 101W - College Writing I
  or University Core
COMX 111US - Introduction to Public Speaking 3
Choose one of the following: 3-4
- KIN 105 - Foundations of Exercise Science
  or PSYX 100IS - Intro to Psychology
NUTR 221CS - Basic Human Nutrition 3
Choose one of the following: 3
- University Core
  or WRIT 101W
University Core 3
Year Total: 17-18
15-16

**Sophomore Year**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Core 3</td>
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<td></td>
</tr>
<tr>
<td>Electives 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 205 - College Physics I 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOB 160 - Principles of Living Systems 4</td>
<td></td>
<td></td>
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<tr>
<td>KIN 270 - Exercise Prog for Older Adults 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directed Electives 3</td>
<td></td>
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<td>Year Total: 16-18</td>
<td>16</td>
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</table>

**Junior Year**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>HDFS 371 - Research Methods in HHD 3</td>
<td></td>
<td></td>
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<tr>
<td>Directed Electives 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electives 6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Choose one of the following: 3
- CHTH 317 - Health Behavior Theories
  or KIN 335 - Tissue Injury and Adaptation
  or KIN 410 - Adv Strength Training and Cond
  or KIN 490R - Undergraduate Research
  or NUTR 411 - Nutrition for Sports/Exercise
Choose one of the following: 4
- KIN 320 - Exercise Physiology
  or KIN 322 - Kinesiology
| Directed Electives 3 | | |
| Electives 3 | | |
| Year Total: 15 | 13 | |

**Senior Year**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
</table>
| Choose one of the following: 4
  - KIN 322 - Kinesiology
    or KIN 320 - Exercise Physiology | | |
Choose one of the following: 3
- KIN 410 - Adv Strength Training and Cond
  or CHTH 317 - Health Behavior Theories
  or KIN 335 - Tissue Injury and Adaptation
  or KIN 490R - Undergraduate Research
  or NUTR 411 - Nutrition for Sports/Exercise
| Directed Electives 6 | | |
| Electives 3 | | |
| Year Total: 16 | 12-16 | |

**Total Program Credits:** 120

**Departmental and Science Electives**

Choose 15 credits from the list below:

<table>
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<tr>
<th>Credits</th>
<th>Name</th>
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<tbody>
<tr>
<td>5</td>
<td>BCH 380 - Biochemistry</td>
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<tr>
<td>3</td>
<td>BIOB 375 - General Genetics</td>
</tr>
<tr>
<td>3</td>
<td>BIOB 377 - Practical Genetics</td>
</tr>
<tr>
<td>3</td>
<td>BIOB 425 - Adv Cell &amp; Molecular Biology</td>
</tr>
<tr>
<td>3</td>
<td>BIOH 313 - Neurophysiology</td>
</tr>
<tr>
<td>4</td>
<td>BIOH 411 - Adv Human Anatomy</td>
</tr>
<tr>
<td>4</td>
<td>BIOO 310 - Comparative Vertebrate Anatomy</td>
</tr>
<tr>
<td>3</td>
<td>BIOO 412 - Animal Physiology</td>
</tr>
<tr>
<td>4</td>
<td>CHMY 321 - Organic Chemistry I</td>
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<tr>
<td>4</td>
<td>CHMY 323 - Organic Chemistry II</td>
</tr>
<tr>
<td>3</td>
<td>CHTH 317 - Health Behavior Theories</td>
</tr>
<tr>
<td>3</td>
<td>CHTH 435 - Human Response To Stress</td>
</tr>
<tr>
<td>3</td>
<td>CHTH 440 - Principles Of Epidemiology</td>
</tr>
<tr>
<td>1-2</td>
<td>COA 395 - Practicum-Coaching Application</td>
</tr>
<tr>
<td>3</td>
<td>COA 405 - Advanced Concepts in Coaching</td>
</tr>
<tr>
<td>3</td>
<td>EIND 313 - Work Design and Analysis</td>
</tr>
<tr>
<td>3</td>
<td>EIND 413 - Ergonomics &amp; Human Factors Engineering</td>
</tr>
<tr>
<td>3</td>
<td>HADM 445 - Managing Healthcare Organizations</td>
</tr>
<tr>
<td>3</td>
<td>HTH 455 - The Ethic of Care</td>
</tr>
<tr>
<td>3</td>
<td>KIN 335 - Tissue Injury and Adaptation</td>
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<tr>
<td>3</td>
<td>KIN 410 - Adv Strength Training and Cond</td>
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<td>4</td>
<td>KIN 415 - Adv Exercise Test and Prescrip</td>
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<td>3</td>
<td>KIN 440R - Sport Psychology</td>
</tr>
<tr>
<td>3</td>
<td>NUTR 321 - Nutrition in the Life Cycle</td>
</tr>
<tr>
<td>3</td>
<td>NUTR 351 - Nutrition and Society</td>
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<td>3</td>
<td>NUTR 411 - Nutrition for Sports/Exercise</td>
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<tr>
<td>3</td>
<td>NUTR 421 - Macronutrient Metabolism</td>
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<tr>
<td>3</td>
<td>NUTR 422 - Micronutrient Metabolism</td>
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<tr>
<td>3</td>
<td>NUTR 425 - Medical Nutrition Therapy I</td>
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**Social Science Electives**

Choose 3 credits from the list below:

<table>
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<tr>
<th>Credits</th>
<th>Name</th>
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<tbody>
<tr>
<td>3</td>
<td>PHL 312 - Contemporary Moral Problems</td>
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<tr>
<td>3</td>
<td>PHL 321 - Philosophy &amp; Biomedical Ethics</td>
</tr>
<tr>
<td>3</td>
<td>PHL 345 - Philosophy of Science</td>
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</table>
PHL 353 Philosophy and Technology 3
PSYX 333 Psychology of Aging 3
PSYX 340 Abnormal Psychology 3
PSYX 350 Physiological Psychology 3
PSYX 375 Behavior Modification 3
PSYX 380 Memory & Cognition 3
PSYX 383 Health Psychology 3
SOCI 380 Sociology of Health & Medicine 3

Human Development Minor

The Department of Health and Human Development offers a non-teaching minor in Human Development. Students in the minor examine current research, theory, and practice across the lifespan and select 12 credits of supporting courses based upon their interests. The minor is designed to enhance the student’s major area of study and is a strong complement to all majors. The minor cannot be completed by students completing a major in Human Development and Family Science.

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>HDFS 101IS</td>
<td>Indiv &amp; Fam Dev: Lifespan</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 263</td>
<td>Relationships and Fam Systems</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Choose one of the following:</td>
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<tr>
<td>EDEC 160</td>
<td>Early Childhood Development</td>
<td></td>
</tr>
<tr>
<td>HDFS 260</td>
<td>Middle Childhood and Adolescent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development</td>
<td></td>
</tr>
<tr>
<td>HDFS 261</td>
<td>Adult Development and Aging</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Take 12 credits from the following:</td>
<td></td>
</tr>
<tr>
<td>EDEC 306</td>
<td>Exceptional Learners</td>
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</tr>
<tr>
<td>HDFS 271</td>
<td>Statistical Measures of Well-Being</td>
<td></td>
</tr>
<tr>
<td>HDFS 337</td>
<td>Personal and Family Finance I</td>
<td></td>
</tr>
<tr>
<td>HDFS 359</td>
<td>Theories and Skills for the Human</td>
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</tr>
<tr>
<td></td>
<td>Services</td>
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<tr>
<td>HDFS 457</td>
<td>Family Life Education</td>
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<tr>
<td>HDFS 460</td>
<td>Parenting</td>
<td></td>
</tr>
<tr>
<td>HDFS 464</td>
<td>Gndr, Rce, Cls, and Fam Diver</td>
<td></td>
</tr>
<tr>
<td>HDFS 465R</td>
<td>Family Law &amp; Public Policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Approved substitutions (3 credits)</td>
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</tr>
<tr>
<td></td>
<td>Total Credits</td>
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</tr>
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</table>

9 Credits of Upper Division is Required

Personal and Consumer Finance Minor

The personal and consumer finance minor through the Department of Health and Human Development includes course work in economics, financial counseling, consumer decision-making, managing work and family, and personal finance knowledge and practice related to insurance, consumer credit, investment, retirement, estate planning, and taxation. The minor is comprised of nine courses (27 credits), eight of which are required, giving students the flexibility to choose one course from a variety of options in the areas of economics, psychology, or counseling. Over one-third of the courses are upper division.

The minor in personal and consumer finance offers business accounting, business finance, pre-counseling, psychology, and agriculture students the opportunity to combine knowledge in personal finance with their skills and knowledge in their majors. This minor is also a strong offering to students in family and consumer sciences education and social studies broadfield education. Seventeen states currently require a course or course work in personal finance at the high school level.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 138</td>
<td>Survey of Family Finance and Consumer Issues</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 239</td>
<td>Contemporary Consumer Issues</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 263</td>
<td>Relationships and Fam Systems</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 337</td>
<td>Personal and Family Finance I</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 338</td>
<td>Personal and Family Finance II</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 339</td>
<td>Family Financial Counseling</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 437</td>
<td>Managing Work and Family</td>
<td>3</td>
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<tr>
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<td>Choose one of the following:</td>
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</tr>
<tr>
<td></td>
<td>BFIN 205 Personal Finance</td>
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<tr>
<td></td>
<td>ECNS 202 Principles of Macroeconomics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ECNS 204IS Microeconomics</td>
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</tr>
<tr>
<td></td>
<td>HDFS 359 Theories and Skills for the Human Services</td>
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<tr>
<td></td>
<td>PSYX 477 Science of Psych Well-Being</td>
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<tr>
<td></td>
<td>PSYX 481 Judgment &amp; Decision Making</td>
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<td></td>
<td>Total Credits</td>
<td>27</td>
</tr>
</tbody>
</table>

Sustainable Food & Bioenergy Systems

The Sustainable Food and Bioenergy Systems (SFBS) program offers an interdisciplinary, hands-on curriculum focused on the ecological, cultural, economic, and health aspects of food and bioenergy systems from production through consumption. The degree plan is intended to prepare and motivate students as agents of change to address society’s most pressing food and bioenergy issues towards sustained environmental and human well-being. Students of the program are provided with broad interdisciplinary training founded on a core SFBS curriculum while gaining disciplinary training by selecting one of four program options housed in either the College of Agriculture, or the College of Education, Health and Human Development: (1) Sustainable Food Systems, (2) Agroecology, (3) Sustainable Crop Production and, (4) Sustainable Livestock Production. The SFBS program seeks to enhance students’ practical and critical thinking skills to approach food systems through service-based learning internships, hands-on production, training on research methods, independent and group projects, story-telling, and community engagement. Students must receive a grade of “C” or higher in all required courses as outlined in the major.

Agroecology Option (p. 157)—Department of Land Resources and Environmental Sciences

Agroecology explores how crops and pest organisms interact with their environment, and the application of technology to efficiently and sustainability produce crops. Agroecology focuses on application of population principles and community ecology, environmental science, and cropland ecosystems. The curriculum is based on the philosophy that to be able to successfully predict management outcomes and thus make informed recommendations, one must understand fundamental principles of evolution, ecology, soil science, agronomy, and pest management.

The curriculum originates from a base in biological science which includes a broad knowledge of organisms (including plants, animals and microorganisms), and the physical and chemical characteristics of environments. In the Agroecology curriculum, students will develop a knowledge of the diversity of organisms and how they interact in natural and managed ecosystems. Furthermore, the curriculum will build on this knowledge in courses that demonstrate the application of ecology
and environmental science principles. Students will also learn how new technologies like remote sensing and geographic information systems are modernizing agriculture. In later stages of the curriculum, students may select from an array of upper division courses in natural ecosystems, cropping systems, pest management, applied ecology, soil and water science, biochemistry, and policy and planning courses that enable them to specialize in food or bioenergy-related areas best suited to their own career vision.

Career Opportunities

Graduates from this option find careers in environmental industries and consulting firms that solve problems associated with agroecosystems or agricultural practices; government jobs in environmental management and policy making; agricultural industry positions associated with precision agriculture, pest management, general agronomy, and information services. Students will be prepared for graduate training that leads to independent research in basic and applied ecology, environmental biology, cropping systems, precision agriculture, ecologically-based pest management, weed science, or agricultural entomology (pest management science).

Sustainable Crop Production Option (p. 158)—Department of Plant Sciences and Plant Pathology

Where does our food come from? Are there ways to sustainably maintain production levels and yet protect our natural resources? Is it possible to improve the quality and nutrition of our food supply? Are local food systems a viable alternative to corporate agricultural production? Can crops grown for bioenergy production reduce our use of fossil fuels and lessen carbon dioxide emissions? The answers to these questions and many more are discovered by students in the Sustainable Crop Production option. The curriculum is designed to train students in a broad range of principles and practices in sustainable crop production, including agronomy, soil fertility, plant genetics, plant physiology, greenhouse production, plant propagation, integrated pest management, and small business management. Both large- and small-scale food and bioenergy production systems are examined.

Career Opportunities

Graduates from this option find careers in conventional and organic farming; as crop production specialists and consultants; in pest management; in seed, fertilizer, and chemical industries; with banks and other lending institutions; and as managers of CSAs and local food organizations. Other career opportunities exist in the Extension Service, state and federal agencies, and private or nonprofit organizations.

Sustainable Food Systems Option (p. 159)—Department of Health and Human Development

The Sustainable Food Systems option trains students in the natural and social sciences to evaluate and mitigate outcomes of complex interactions in the food system for human health and nutrition. This option focuses on the interconnections between production, policy, food security, and health. Courses in this option provide disciplinary foundation in food and nutrition while providing an interdisciplinary framework that draws from ecology, environmental sciences, plant biology and chemistry, anthropology, sociology, economics, family and consumer sciences, and political science. Students develop practical and critical thinking skills through hands-on experience in service-based learning internships, organic farming, culinary fundamentals and management, training on research methods, and carrying out research projects in surrounding communities. Previous service-based learning experiences in this option have involved assessment of food access and food quality in health disparate environments, food processing, food cooperative management, alternative food distribution systems, and small business operations. It is expected that the multiple lenses and tools provided by this option to assess and manage food system outcomes for human health will empower graduates who are capable and enthusiastic to address food and health challenges such as obesity, food insecurity and poverty, food safety, and vulnerability of indigenous food systems.

Career Opportunities

Graduates from this option are prepared for a wide range of careers in basic and applied scientific research, community nutrition, community food security, public health, Extension education, food and nutrition policy, food enterprise, culinary arts and management, community-supported agriculture, food processing, food marketing, retailing, and distribution.

Sustainable Livestock Production Option (p. 104)—Department of Animal and Range Sciences

Sustainable Livestock Production focuses on the biological understanding of animal agriculture and its continued presence in sustainable grazing systems as well as its potential role in sustainable farming systems. Students will be introduced to the principles, practices and issues impacting the production, processing and preservation of safe, wholesome, nutritious, and palatable meat along with the regulatory requirements for selling animal products. Sustainable Livestock Production focuses on the science of animal production but expands students’ learning to a larger system of understanding, including the role of domestic livestock in sustainable systems. In addition, students will be exposed to the role of strategic grazing in landscape management as well as using livestock to manage potential waste streams from other industries.

Career Opportunities

Graduates from this option are prepared for careers in both the production and allied industries associated with animal agriculture. Graduates will also be prepared for opportunities in extension and graduate work.

Undergraduate Curricula in Sustainable Food and Bioenergy Systems

- Agroecology Option (p. 157)
- Sustainable Crop Production Option (p. 158)
- Sustainable Food Systems Option (p. 159)
- Sustainable Livestock Production Option (p. 104)

Agroecology Option

Land Resources and Environmental Sciences

Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENSC 110</td>
<td>Land Resources and Environmental Sciences</td>
<td>3</td>
</tr>
<tr>
<td>SFBS 146</td>
<td>Introduction to Sustainable Food and Bioenergy Systems</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 110CS</td>
<td>Introduction to Plant Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>M 121Q</td>
<td>College Algebra</td>
<td>3</td>
</tr>
<tr>
<td>M 105Q</td>
<td>Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts) (formerly M 145Q)</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
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<td>Year Total:</td>
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Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>BIOM 160</td>
<td>Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
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<td>Choose one of the following:</td>
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Sustainable Crop Production Option

Plant Sciences and Plant Pathology

Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFBS 146</td>
<td>Introduction to Sustainable Food and Bioenergy Systems</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
<td>3</td>
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<tr>
<td>BIOB 110CS</td>
<td>Introduction to Plant Biology</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 110</td>
<td>Land Resources and Environmental Sciences</td>
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</tr>
<tr>
<td>ENSC 245IN</td>
<td>Soils</td>
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Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>SFBS 296</td>
<td>Practicum: Towne’s Harvest</td>
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<td>SFBS 298</td>
<td>Internship</td>
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Junior Year

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<tbody>
<tr>
<td>ECHM 205CS</td>
<td>Energy and Sustainability</td>
<td>3</td>
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<tr>
<td>ENSC 245IN</td>
<td>Soils</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 121IN</td>
<td>Introduction to General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
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Senior Year

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<tr>
<th>Course Code</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>SFBS 498</td>
<td>Internship</td>
<td>2-12</td>
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<tr>
<td>SFBS 499</td>
<td>Senior Thesis/Capstone</td>
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</table>

Total Program Credits: 119-120
SFBS 451R - Sustainable Food Systems  
SFBS 445R - Culinary Marketing: Farm/Table  
Select one of the following:  
  SFBS 429 - Small Business and Entrepreneurship in Food and Health  
  BMGT 469 - Community Entrepreneurship & Nonprofit Management  
Select four of the following:  
  AGSC 342 - Forages  
  AGSC 401 - Integrated Pest Management  
  AGSC 441 - Plant Breeding & Genetics  
  AGSC 450 - Plant Disease Control  
  BIOM 421 - Concepts of Plant Pathology  
  ENSC 443 - Weed Ecology and Management  
  HORT 245 - Plant Propagation  
  HSTA 409 - Food in America  
  NASX 415 - Native Food Systems  
  NUTR 301 - Food and Culture  
  NUTR 491 - Special Topics  
  PSCI 406 - The Political Economy of Energy  
  PSCI 436 - Politics of Food & Hunger  
  SFBS 296 - Practicum: Towne’s Harvest  
  SFBS 327 - Measure Innovation in Food Sys  
Choose one of the following:  
  BIOM 103IN - Unseen Universe: Microbes  
  BIOM 250 - Microbiology for Health Sciences: Infectious Diseases  
  NUTR 226 - Food Fundamentals  
  STAT 216Q - Introduction to Statistics  
  University Core  
Year Total: 30  
Total Program Credits: 120  

**Sustainable Food Systems Option**  
**Health and Human Development**  

### Freshman Year  

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>ECNS 101IS - Economic Way of Thinking</td>
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<tr>
<td>M 121Q - College Algebra</td>
<td>3</td>
<td></td>
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<tr>
<td>SOCI 101IS - Introduction to Sociology</td>
<td>3</td>
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<td>WRIT 101W - College Writing I</td>
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<td>or University Core</td>
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<td>Choose one of the following:</td>
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<tr>
<td>Any US Core</td>
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<tr>
<td>BIOB 110CS - Introduction to Plant Biology</td>
<td>3</td>
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<tr>
<td>Choose one of the following:</td>
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<tr>
<td>CHMY 121IN - Introduction to General Chemistry</td>
<td>4</td>
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<tr>
<td>or CHMY 141 - College Chemistry I</td>
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<tr>
<td>SFBS 146 - Introduction to Sustainable Food and Bioenergy Systems</td>
<td>3</td>
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<tr>
<td>Choose one of the following:</td>
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<tr>
<td>SFBS 298 - Internship</td>
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<tr>
<td>or SFBS 296 - Practicum: Towne’s Harvest</td>
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<tr>
<td>Choose one of the following:</td>
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<tr>
<td>WRIT 101W - College Writing I</td>
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<td>or University Core</td>
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Total Program Credits: 120  

### Senior Year  

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>SFBS 429 - Small Business and Entrepreneurship in Food and Health</td>
<td>3</td>
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</tr>
<tr>
<td>BMGT 469 - Community Entrepreneurship &amp; Nonprofit Management</td>
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<td>SFBS 499 - Senior Thesis/Capstone</td>
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<td>Upper Division Directed Elective</td>
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<tr>
<td>SFBS 451R - Sustainable Food Systems</td>
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<tr>
<td>SFBS 466 - Food System Resilience, Vulnerability and Transformation</td>
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<td>SFBS 498 - Internship</td>
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<tr>
<td>Electives</td>
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<td>Upper Division Directed Elective</td>
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Total Program Credits: 120  

Directed Electives (choose 18 credits)  

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<tbody>
<tr>
<td>AGBE 315 - Ag in a Global Context</td>
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<td>AGBE 337 - Agricultural Law</td>
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<tr>
<td>AGED 482 - Non-Formal Teaching Methods in Agriculture</td>
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<tr>
<td>AGSC 242 - Crop Identification</td>
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<tr>
<td>Course Code</td>
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<tr>
<td>AGSC 428</td>
<td>Cropping Systems and Sustainable Ag</td>
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<tr>
<td>AGSC 465R</td>
<td>Health, Agriculture, Poverty</td>
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<tr>
<td>BIOE 375</td>
<td>Ecological Responses to Climate Change</td>
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<td>BMGT 410</td>
<td>Sustainable Business Practices</td>
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<td>BMKT 325</td>
<td>Principles of Marketing</td>
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<tr>
<td>ECNS 202</td>
<td>Principles of Macroeconomics</td>
</tr>
<tr>
<td>HORT 245</td>
<td>Plant Propagation</td>
</tr>
<tr>
<td>HORT 337</td>
<td>Vegetable Production</td>
</tr>
<tr>
<td>HORT 345</td>
<td>Market Gardening</td>
</tr>
<tr>
<td>HSTA 409</td>
<td>Food in America</td>
</tr>
<tr>
<td>NASX 232D</td>
<td>MT Indians: Cultures, Histories, Current Issues</td>
</tr>
<tr>
<td>NASX 415</td>
<td>Native Food Systems</td>
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<tr>
<td>NRSM 421</td>
<td>Holistic Thought/Mgmt</td>
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<tr>
<td>NUTR 301</td>
<td>Food and Culture</td>
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<tr>
<td>NUTR 491-001</td>
<td>Farm-to-Market</td>
</tr>
<tr>
<td>PSCI 230D</td>
<td>Introduction to International Relations</td>
</tr>
<tr>
<td>PSCI 406</td>
<td>The Political Economy of Energy</td>
</tr>
<tr>
<td>PSCI 436</td>
<td>Politics of Food &amp; Hunger</td>
</tr>
<tr>
<td>SFBS 346</td>
<td>Sustainable Food and Bioenergy Systems Summer Field Course</td>
</tr>
</tbody>
</table>

The College of Engineering provides administrative structure and support to the following academic departments and baccalaureate degree programs:

- Department of Chemical & Biological Engineering (p. 162)
  - BS Biological Engineering
  - BS Chemical Engineering
- Department of Civil Engineering (p. 165)
  - BS Civil Engineering
  - Bio-Resources Engineering Option

The College of Engineering offers several minors:

- Aerospace (p. 179)
- Computer Science (p. 172)
- Computer Engineering (p. 176)
- Electrical Engineering (p. 178)
- Engineering Management (p. 181)
- Financial Engineering (p. 74)
- Materials (p. 182)
- Mechatronics (p. 187)
- Military Studies: Air Force ROTC (p. 187) and Army ROTC (p. 188)

The College of Engineering provides administrative support for the Reserve Officers’ Training Corps (ROTC) programs in the Air Force and Army. A complete description of each individual degree program is provided later in this section under the heading of the appropriate department. The following is a highlight of the mission, goals, and objectives of the College of Engineering and applies to all of its programs.

**College Mission**

The College of Engineering will serve the State of Montana and the nation by:

- Fostering lifelong learning
- Integrating learning and discovery
- Developing and sharing technical expertise
- Empowering students to be tomorrow’s leaders

**College Vision**

The College of Engineering at Montana State University will be an outstanding collaborative community that achieves excellence in learning, innovation, discovery, and knowledge transfer. To realize this vision, the college will

- Leverage shared interests and talents among faculty and students in order to create knowledge across disciplinary lines.
- Effectively and efficiently balance breadth with depth in undergraduate education in order to prepare students for the global workforce.
• Be a leader in innovation and discovery in our identified focus areas.
• Successfully integrate research and innovation into the learning experience of both undergraduate and graduate students.
• Be recognized for the level of knowledge transfer to industry, governments, and citizens in the state of Montana.

College Core Values
Members of the MSU College of Engineering community approach all of their work with the following deeply held core values:

• Life-long learning. The college is a community that believes in and fosters life-long learning in all of its members—undergraduate students, graduate students, faculty, and staff. Life-long learning also extends beyond the college community to state and national constituencies.
• Knowledge Discovery. At the heart of the college community’s activities are knowledge discovery and dissemination and the creativity that accompanies these activities. We believe that knowledge discovery informs and enriches the life-long learning of the entire college community.
• Collaboration. We believe that collaboration and collegiality both inside and outside of our college community enrich all college activities.
• Inclusiveness. The college is a community that welcomes and encourages diverse points of view and backgrounds, believing that this inclusiveness enriches our creative learning environment.
• Professionalism. The College of Engineering community approaches all activities with a high degree of professionalism, working with integrity, honesty, and commitment to excellence.

College Goals
The goals of the College of the Engineering are as follows:

• Prepare the MSU COE community to engage effectively with the global community.
• Build on growing college synergy and increase cross-disciplinary activities at every level of the COE community, including not only faculty research and creative activity, but also the student experience.
• Establish the college as a leader in the state and national technological community.

Engineering Program Educational Objectives, Assessment, and FE Exam Requirement
ABET, Inc., the recognized accreditor for college and university programs in applied science, computing, engineering, and technology, has established standards and criteria for the accreditation of undergraduate computing, engineering and engineering technology programs. Individual programs have program educational objectives that are consistent with ABET and with the needs of the program’s constituents.

Assessment of program objectives is a dynamic and ongoing process. One assessment strategy is to examine the results of the Fundamentals of Engineering (FE) examination. The FE exam is a nationally normalized test that is required of graduating engineering seniors at MSU. Students are required to enroll in EGEN 488 (Fund of Engineering Exam) during their last semester, register for the exam on the NCEES website, take the FE Exam, and make an honest and serious effort to pass the exam.

For a complete and up-to-date listing of all program specific objectives as well as other educational outcomes assessment strategies, please refer to the College of Engineering website at www.coe.montana.edu.

Becoming a Registered Professional Engineer
Requirements to become a registered professional engineer are established by each state, and typically include provisions that address education and experience, direct demonstration of competence through prescribed examinations, and confirmation of personal and professional integrity by references. Generally, graduation from an accredited engineering degree program satisfies the educational requirement. Such graduation, coupled with passing the Fundamentals of Engineering Exam, and positive character references results in award of Engineer-in-Training status. Following accumulation of appropriate experience working under the supervision of a professional engineer (often for four years), an Engineer-in-Training can apply to take the professional engineer’s exam, and subsequently apply for full professional registration. In this process, a degree from the ABET accredited engineering programs at MSU typically satisfies the educational requirements for professional licensure. MSU engineering students are required to take the Fundamentals of Engineering (FE) Exam as part of their degree program, which is the first of the two nationally standardized exams required in seeking licensure.

Student Performance and Retention
Students admitted to MSU will automatically be eligible for admission to College of Engineering (COE) programs. The College of Engineering is committed to retaining each admitted student within the COE and MSU, and to helping them achieve their fullest academic potential.

Students are required by Board of Regents policy to achieve a C- or better grade in each class used to satisfy the COE Bachelor of Science degree requirements. If repeating a course is necessary in order to meet this requirement, students are expected to repeat the course successfully (C- or better) prior to taking a follow-on course for which the repeated course is a prerequisite.

Accreditation
The following engineering programs are specifically accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org:

• Chemical Engineering
• Civil Engineering
• Computer Engineering
• Electrical Engineering
• Industrial & Management Systems Engineering
• Mechanical Engineering

The Biological Engineering degree went through the accreditation review process in 2016 and will receive its formal accreditation in 2017.

The following engineering technology programs are accredited by the Technology Accreditation Commission of ABET, http://www.abet.org:

• Construction Engineering Technology
• Mechanical Engineering Technology


College of Engineering Program Fee
Engineering education is more expensive to deliver than education in most other disciplines, both at MSU and nationally. MSU strives to develop and maintain modern laboratories that benefit student learning. Because of increased equipment and maintenance costs, students enrolled within the College of Engineering (COE) at Montana State University in Bozeman are charged a program-wide fee with the following primary goals:

1. Help ensure that College programs maintain quality instructional laboratories, technical infrastructure within the College, and the ability to conduct staff-intensive program assessment (required for professional accreditation).
2. Help meet the higher cost of engineering education by augmenting existing state funds.
3. Help to support and increase student access to advanced technology within each of the COE programs.
4. Greatly increase the College’s ability to leverage private support for our programs, such as through matching grants.

Other engineering course fees (with the exception of CET and Fundamentals of Engineering exam fees) have been eliminated and the expenses formerly covered by these individual course fees will now be recovered from the program fee. The following fee structure is in place:

- $94.85 per semester for Freshmen (flat rate).
- $135.65 per semester for Sophomores through graduate level (flat rate).
- $53.85 flat rate for summer session collected once (one or more sessions), any level of student.

For more information about the Engineering Program Fee please refer to the College of Engineering website www.coe.montana.edu.

**Total Credit Requirements**

Montana State University requires a minimum of 120 semester credits for graduation. Of these, 42 credits must be in upper division courses (numbered 300 and above). All degree programs within the College of Engineering meet or exceed these standards, and specific requirements for each are tabulated in the sections describing these programs.

**General Education Core**

More than ever, engineers, technologists, and computer scientists must possess communication skills and an awareness of how design and policy decisions affect society. These topics plus other general education offerings are provided through a coherent program of general education required by all College of Engineering degree programs. University core requirements for communication, mathematics, and sciences are met or exceeded by all College of Engineering degree programs, and the College of Engineering encourages students’ participation in the broader areas of humanities, social sciences, arts and diversity. These areas are designed to complement the technical content of the degree program.

**Electives**

The engineering, technology, and computer science curricula as tabulated include “core curricula and elective” credits. Courses are selected by the student and advisor to fulfill block requirements in the core curriculum areas as well as professional electives. The student may also petition her or his department to include up to six advanced military science credits in her or his professional elective program.

**Design Projects with Student Teams**

The College of Engineering provides opportunities for students to engage in design projects, including working in multidisciplinary design teams.

Most programs require students to take EGEN 310, Multidisc Engineering Design, which is a multi-disciplinary design course. This course gives students the background and skills that they need to be successful in their senior capstone design course and also helps students understand the complexities and benefits of working with students from other engineering disciplines, as well as computer science.

In the senior capstone course, students generally work with other students from their own discipline to solve an engineering design problem. A typical design project involves a student team synthesizing a solution to meet the needs of a customer, which could be an engineering company, a faculty member, or a governmental organization.

The student design team presents results in written and oral formats, and in many cases, the result includes a working prototype. All engineering and computer science students engaged in these design projects work in student design teams based on the needs to accomplish the goals of the project.

Capstone design projects contribute to the educational objectives of the academic programs by engaging seniors in challenging, team-oriented, real-world design efforts. The teams include the students and professionals from the sponsors as well as faculty supervisors for each project. At the conclusion of their design experience, the students will have accomplished the following:

1. Designed and developed information, or built a prototype as necessary, for a system, component, or process to meet design objectives.
2. Used creativity in meeting the design objectives.
3. Independently learned new information and applied this information to meet design objectives.
4. Worked effectively as a design team member.
5. Prepared and presented an effective written and/or oral technical report to the sponsor.
6. Accomplished a logical and practical sequence of safe and workable operations while meeting the design objectives.
7. Provided a global, societal, and economic context to the design as appropriate for the project.

**Cooperative Education/Internship**

The College of Engineering encourages students to gain professional experience related to their discipline that can complement and enhance their academic studies. To help gain professional experience, departments within the College operate a variety of cooperative education and internship programs. Most College of Engineering departments partner with regional and national companies to provide a structured program for qualified students. Interested students should contact Career Services and their respective department offices for more information about these programs.

**Engineering Minority Program (EMPower)**

The College of Engineering at MSU is committed to equal access to educational opportunities for all students. This commitment has led to nationally recognized efforts to help provide such opportunities. The Engineering Minority Program (known as EMPower) provides enrichment programs for pre-college students and focuses on customized retention plans and support of social and academic networks including scholarships for underrepresented students in Engineering and Computer Science fields.

The EMPower program seeks to enhance outreach, recruitment and retention to increase the number of Native Americans who graduate from MSU with Engineering or Computer Science degrees. Our vision is to become firmly established as the premier institution of choice for Native American students in engineering, engineering technology and computer science in the northern Rockies and the northern Great Plains regions and to be a successful partner with Native American communities in developing the future workforce.

**Chemical and Biological Engineering**

The Department of Chemical and Biological Engineering (CHBE) prepares students with the knowledge and skills to contribute to society and their profession. Our Chemical engineering graduates practice in a variety of fields: chemical manufacturing and petroleum refining, environmental engineering, materials and microelectronics, pharmaceutical manufacturing and delivery, food processing, and many others. Our Biological engineering graduates also practice in a variety of fields: chemical manufacturing using biological processing, biofuel production, environmental engineering and remediation, biomaterial manufacturing
and biologically compatible materials, food processing, agrochemical processing, pharmaceutical production, medical device design, and biomedicine. Both lists will continue to expand as the fields continue to develop.

The preparation of women and men competent to develop, design, and operate new chemical or biological systems, or to perform the research and development to improve existing products and processes, is a comprehensive process. Thus the curricula in chemical engineering and biological engineering are founded on the study of engineering principles and basic science, particularly chemistry, physics, biology, and mathematics. Safety and concern for the environment and society must be overriding concerns to chemical engineering and biological engineering practitioners, and developing this awareness is another aspect of the department’s educational goals. Both chemical engineers and biological engineers typically work as teams of professionals, sharing expertise and knowledge for greater achievement, so teamwork and communication are emphasized. The curricula have been developed to provide these skills through faculty members who have extensive knowledge and experience in the field.

The department also offers a minor in biomedical engineering intended primarily for undergraduate students who have an interest in biomedical applications of engineering. The minor curriculum will give students the interdisciplinary expertise required to thrive in biomedical industry, professional programs, and graduate programs.

Mission

The Department of Chemical and Biological Engineering will serve the State of Montana and the nation through excellence in learning, discovery and engagement to meet the land grant mission of accessibility and value at Montana State University.

Chemical Engineering Program

The outcome of the undergraduate program in chemical engineering is an ABET accredited B.S. Chemical Engineering degree.

Our chemical engineering program educational objectives are as follows: Our graduates:

• will be confident in their ability to apply chemical engineering fundamentals
• will be effective communicators and team members
• will be highly ethical engineering professionals
• will have the ability to pursue lifelong learning
• will be proactive problem solvers
• will embrace process safety

Biological Engineering Program

The outcome of the undergraduate program in biological engineering is a B.S. Biological Engineering degree.

Our biological engineering program educational objectives are as follows: Biological Engineering graduates will:

1. Have fundamental engineering skills, current technical knowledge, and professional skills to effectively practice biological engineering.
2. Demonstrate professional responsibility in safely performing engineering tasks and be willing to accept ethical responsibility for the social and environmental impacts of engineering practices.
3. Be able to communicate with diverse, global audiences and to work with and lead integrated teams and communities.
4. Be critical, creative, and independent thinkers who use their technical expertise to address societal needs and advance their field.

To achieve the program educational objectives, the Department will recruit, support, and retain high-quality faculty and staff, and provide facilities and equipment to create an atmosphere conducive to learning, engagement, and discovery.

Graduate Programs

The Department provides graduate programs that lead to masters degrees in bioengineering, chemical engineering and environmental engineering, as well as the Ph.D. in Engineering, with chemical engineering and environmental engineering options. The graduate programs provide students with opportunities for advanced study and research.

Dual Degree Program in Bioengineering

In partnership with Istanbul Technical University (ITU), the department offers a dual degree program in Bioengineering intended for Turkish students enrolled at ITU. Students are resident at ITU during years 1 and 3 and at MSU during years 2 and 4, and graduates receive degrees from both institutions. Detailed curricular requirements are available from the Chemical and Biological Engineering department.

Undergraduate Programs

• Biological Engineering (p. 163)
• Chemical Engineering (p. 164)
• Biomedical Engineering Minor (http://catalog.montana.edu/undergraduate/engineering/chemical-biological-engineering/biomedical-engineering-minor)

The department offers graduate programs leading to the Master of Science in Chemical Engineering degree and a Master of Science degree in Environmental Engineering. The department participates in the Doctor of Philosophy degree in Engineering through the College of Engineering, with options available in Chemical Engineering and Environmental Engineering.

Degree Offered

• M.S. in Chemical Engineering (p. 346)
• M.S. in Environmental Engineering (p. 347)
• Master of Engineering In Chemical Engineering (p. 348)
• Master of Engineering in Bioengineering (p. 349)
• Ph.D. in Engineering (p. 351)
• Ph.D. in Materials Science (p. 409)

Biological Engineering

The curriculum is 128 credits comprised of a Basic Program plus Electives which students select to meet both University Core requirements and requirements of the Biological Engineering degree.

Student Performance and Retention Requirements: Students are required by Board of Regents policy to achieve a C- or better grade in each class used to satisfy the Bachelor of Science degree requirements. Moreover, students must achieve a C- or better grade prior to taking follow-on courses.

Basic Program

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBlO 100 - Intro to Biological Engr</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or ECHM 100 - Intro to Chemical Engr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHMY 141 - College Chemistry 1</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Univ Core Electives (IA, IH, IS or D)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Chemical Engineering

The curriculum is 128 credits comprised of a Basic Program plus Electives which students select to meet both University Core requirements and requirements of the Chemical Engineering degree. **Student Performance and Retention Requirements:** Students are required by Board of Regents policy to achieve a C- or better grade in each class used to satisfy the Bachelor of Science degree requirements. Moreover, students must achieve a C- or better grade prior to taking follow-on courses.

### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHM 100 - Intro to Chemical Engr</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or EBI0 100 - Intro to Biological Engr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 171Q - Calculus I</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Univ Core Electives (IA, IH, IS or D)</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CHMY 143 - College Chemistry II</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 172Q - Calculus II</td>
<td>4</td>
<td></td>
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</tbody>
</table>

**Year Total:** 16 17

### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 273Q - Multivariable Calculus</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 220 - Physics I (w/ calculus)</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHMY 211 - Elements of Organic Chemistry</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECHM 201 - Elementary Principles of Chemical and Biological Engineering</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBIO 216 - Elem Princ of Bioengineering</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECHM 321 - Chemical Engineering Fluid Mechanics Operations</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 274 - Introduction to Differential Equation</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOM 360 - General Microbiology</td>
<td>5</td>
<td></td>
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</tbody>
</table>

**Year Total:** 17 15

### Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHM 307 - Chem Engin Thermodynamics I</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECHM 322 - Chemical Engineering Heat Transfer Operations</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EGEN 350 - Applied Engineering Data Analysis</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Elective At least one Technical Elective course must be in the CHMY or BCH rubric</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Univ Core Electives (IA, IH, IS or D)</td>
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<td></td>
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</tr>
</tbody>
</table>

**Year Total:** 17 17

### Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHM 451 - Chemical Engineering Process Dynamics and Control</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Elective</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Univ Core Electives (IA, IH, IS or D)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Year Total:** 16 16

### Total Program Credits: 128

A minimum of 128 credits is required for graduation; 42 of which must be in courses numbered 300 and above.
Mission

- Foremost, we will provide undergraduate education founded on a rigorous treatment of engineering fundamentals coupled with modern engineering tools. We see competency in mathematics, physical science, and engineering mechanics as crucial to our mission.
- Provide graduate education opportunities in a majority of traditional civil engineering areas.
  - The department will maintain sufficient breadth to provide post-baccalaureate education focused on professional practice.
- The department will provide graduate opportunities in a subset of focus areas coupled to vibrant research programs with sound external funding.

Civil Engineering

Civil Engineers design and construct facilities which improve the welfare and raise the living standards of society. Civil Engineers are also involved with protecting and restoring our natural environment. These activities often are conducted at a large scale, involve a substantial investment of society’s resources, and are expected to perform their intended function well into the future; each such project is unique and demands ingenuity and creativity in its execution. A registered civil engineer is a professional with the legally recognized education and experience to work on these challenging projects under their own authority. Civil Engineering graduates enjoy extensive opportunities for employment in Montana, the Pacific Northwest, and the rest of the nation, both in private industry and government agencies involved in infrastructure development, operations and maintenance, and protection of the natural environment.

The following sub-areas comprise the field of civil engineering: environmental engineering for water and wastewater treatment, solid and toxic waste handling, and air and water pollution problems; geotechnical engineering for making use of soil, rock, and ice as foundation materials; structural engineering for buildings, bridges, dams, piers, towers, and other erected facilities; transportation engineering for pedestrian and bicycle facilities, highways, railroads, airports, and pipelines; water resources engineering for water supply, irrigation, flood control, aquatic habitat improvement, groundwater management, and hydroelectric power generation; construction of engineered facilities; and engineering measurements, which include surveying, photogrammetry, and mapping.

The Civil Engineering Bachelor of Science Program is a traditionally structured program that provides graduates with a strong background in math, basic sciences and engineering mechanics, and prepares graduates to become registered professional engineers capable of practicing civil engineering in the areas of environmental, geotechnical, structural, transportation and water resources engineering. The background of graduates that select the Bio-Resources option is focused on soil, water resources engineering for water supply, irrigation, flood control, aquatic habitat improvement, groundwater management, and hydroelectric power generation; construction of engineered facilities; and engineering measurements, which include surveying, photogrammetry, and mapping.

Upon graduating with a Bachelor of Science in Civil Engineering all students can expect to be able to:

- enter the profession of Civil Engineering and advance in the profession to become registered professional engineers and leaders in the field of Civil Engineering;
- work on multi-disciplinary teams and effectively communicate with Civil Engineers of various sub-disciplines, architects, contractors, the public and public agents, scientists and others to design and construct Civil Engineering projects;
- begin to develop expertise in one of the sub-disciplines of Civil Engineering and engage in the life-long learning necessary to advance in the Civil Engineering profession;
- contribute to society and the Civil Engineering profession through involvement in professional related and/or other service activity; and
- conduct their affairs in a highly ethical manner holding paramount the safety, health and welfare of the public and striving to comply with the principles of sustainable development.

Some students upon graduation can expect to be able to:

- earn advanced degrees in Civil Engineering or other fields.
Courses in the first two years of the program develop a student’s mathematical skills and understanding of the physical principles that underlie the practice of civil engineering. Engineering science courses in the second, third, and fourth years develop the student’s ability to apply mathematics and basic scientific principles to the solution of practical engineering problems. The third year student develops a broad perspective of the field and establishes the foundation for professional practice and further study. The student completes at least one course in each sub-area of civil engineering by the end of this year. Most of these courses are combinations of engineering science and design experiences. The fourth year includes a capstone professional practice and design experience, elective courses in a sub-area (or sub-areas) of civil engineering—most of which are combinations of engineering science and design experiences—and elective courses that help the student develop an appreciation for the role of the professional engineer in society. Additional experience in professional practice and design may be obtained through participation in the department’s optional internship program. Contemporary engineering aids are introduced in the first year and used in assignments throughout the rest of the program. Courses and assignments that develop oral and written communication skills are distributed throughout the curriculum and are components of the capstone professional practice and design experience in the fourth year.

The B.S. Degree in Civil Engineering at Montana State University offers students the flexibility to specialize in traditional civil engineering sub-disciplines at the senior level. Students may select their senior-level professional electives to focus on water resources, geotechnical, transportation, environmental, structural or construction engineering, and land surveying. A distinct pathway within the Bachelor of Science Degree in Civil Engineering is available to students that have, early in the curriculum, identified an interest in soil, water, and natural resources applications. The Bio-Resources Option focuses on these areas within civil engineering. In the first two years of their Civil Engineering curriculum, students in the Bio-Resources Option are directed to take specific science courses that support their bio-resource focus. Similarly, coursework in their third and fourth years focuses on soils, hydraulic, hydrologic, and environmental concerns. Civil engineering students in the Bio-Resources Option may take upper level professional electives in chosen areas of Civil Engineering or select from a few courses offered in other departments that are germane to the topic area. Professional employment opportunities for civil engineers choosing the Bio-Resources Option are similar to those for graduates not in the Option, but tend to focus on land reclamation, soil and water remediation, hydraulic and hydrologic design, environmental impact and assessment, and natural resource management.

The Civil Engineering Department also offers a minor in Land Surveying, as described in later sections of this catalog.

Graduating students are required to take the Fundamentals of Engineering exam as the first step toward professional engineering registration. EGEN 488 Fundamentals of Engineering Exam, a zero-credit course, is used to administer the exam. Students are encouraged to take the discipline-specific version. This examination is administered by the National Council of Examiners for Engineering and Surveying (NCEES). Students planning to take the comprehensive examination on surveying fundamentals as the initial step in becoming licensed as a registered land surveyor should review the education requirements for admission to this examination.

Graduate work leading to the Master of Science and Doctor of Philosophy degrees is recommended for qualified students desiring advanced professional attainment or careers in academic fields. The Civil Engineering Department offers a Master of Science degree targeted at qualified students interested in an advanced professional degree, for which the civil engineering work place is currently seeing an increased demand. The program consists of a concurrent schedule of undergraduate and graduate classes starting the senior year, allowing a Bachelor of Science degree and a Master of Science degree to be obtained in a total of ten semesters of study.

Construction Engineering Technology

The Construction Engineering Technology Bachelor of Science Program is a technically rigorous and production-oriented program that prepares graduates to enter and advance to leadership positions in the construction industry.

Upon graduating with a Bachelor of Science in Construction Engineering Technology all students can expect to be able to:

- enter the construction industry and advance toward leadership positions in the construction industry;
- work on multi-disciplinary teams and effectively communicate with constructors, architects, engineers, the public and public agents, scientists and others to complete construction projects;
- continue to develop professionally through work experiences and continuing education, expanding their knowledge base and keeping abreast of advances in construction and engineering practice;
- contribute to society and the construction industry through involvement in professional related and/or other service activity; and
- promote and advance the integrity of the construction industry, holding paramount the safety, health and welfare of their co-workers and the public, and striving to comply with the principles of sustainable development.

The curriculum provides a well rounded, four-year, technically specialized university education culminating in a Bachelor of Science degree in Construction Engineering Technology (CET). Knowledge of mathematics and physical sciences along with applied courses in business management, law, and human relations form a background to transform design, research and planning ideas into physical reality using contemporary construction practices. Faculty with industry experience instruct students in surveying, estimating, scheduling, quality control, safety, testing, and field analysis.

Graduates use their skills and abilities to construct transportation systems, utilities, buildings, dams, public health and environmental systems, irrigation, industrial facilities, municipal and public works, and also in surveying, mapping, and support of engineering design. Building, industrial, and heavy highway construction are emphasized with particular attention directed toward preparation for employment in management and supervisory positions in both field and office operations.

This curriculum provides the education necessary to work with engineers, architects, contractors, technicians, and owners. The student in this curriculum can be employed as field supervisor, estimator, scheduler, or superintendent; he or she may progress to the highest levels of management in the construction arena such as project and operations managers. Because effective communication is essential in carrying out management responsibilities, students in this curriculum are required to demonstrate good oral and written communication skills in their undergraduate studies. Other possible positions are employment with consulting engineers and architects in support activities involving plans and planning, acquisition of design data, surveying, construction inspection for quantity and quality control, sales engineering, plant expansion, and maintenance management activities.

Students planning to take the comprehensive examination on surveying fundamentals as the initial step to becoming licensed as a registered land surveyor should review the educational requirements for admission to this examination. Students who desire both the CET degree and land surveyor registration must complete a Land Surveying Minor.
Students are required to take the Constructor Qualification Examination Level I (CQE) administered by the American Institute of Constructors (AIC) which must be taken the semester that a student expects to graduate. Seniors are required to take the Fundamentals of Engineering (FE) examination administered by the National Council of Examiners for Engineering and Surveying (NCEES), which is required by the Montana Board of Professional Engineers and Land Surveyors to become a licensed professional engineer. Students who plan to take the FE examination are encouraged to take additional selected courses in calculus, dynamics, and thermodynamics.

**Student Performance and Retention Requirements**
Freshmen or transfer students entering the Civil Engineering Department cannot enroll in advanced courses until a suite of key entry-level courses is completed at a minimum performance level. The following mechanisms will be used in the Student Performance and Retention Initiative efforts:

1. Students will be required to successfully complete a suite of key courses (marked with an *) prior to taking any course from a select list of advanced courses (marked with a **), and must attain at least a C- in each of the key courses. In addition, each key course can be repeated at most one time.

2. Once the suite of key courses is satisfactorily completed, students are allowed to advance in their degree program. Intentional attempts by a student to circumvent the Student Performance and Retention Requirements will be considered academic misconduct.

3. Students who have difficulty meeting these requirements will work with their advisor to discuss changes that may enhance their academic performance and promote student success.

**Undergraduate Programs**
- Civil Engineering (p. 168)
- Bio-Resources Option (p. 167)
- Construction Engineering Technology (p. 169)
- Land Surveying Minor (p. 171)

**Graduate Programs**
- M.S. in Civil Engineering (p. 349)
- M.S. in Environmental Engineering (p. 347)
- M.S. in Land Rehabilitation (p. 300)
- Ph.D. in Engineering (p. 351)

The department offers graduate study leading to the Master of Science degrees in Civil Engineering, Environmental Engineering, and an interdisciplinary Master of Science degree in Land Rehabilitation. The department also participates in the Doctor of Philosophy in Engineering degree program through the College of Engineering, specifically in the Civil Engineering, Applied Mechanics and Environmental Engineering options.

The M.S. program is also available following a concurrent schedule of undergraduate and graduate classes starting the senior year, allowing a Bachelor of Science degree and a Master of Science degree to be obtained in a total of ten semesters of study. This program is intended for qualified students interested in an advanced degree for practitioners, for which the civil engineering work place is currently seeing an increased demand. Contact the department for further information on this program.

For the M.S. and Ph.D. degrees, major study is offered in various combinations of the subject areas of transportation engineering, geotechnical engineering, fluid mechanics, hydraulic and hydrologic engineering, structural engineering, engineering mechanics, and environmental engineering.

**Bio-Resources Option**

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
</tr>
<tr>
<td>CHMY 141 - College Chemistry I*</td>
<td>4</td>
</tr>
<tr>
<td>M 171Q - Calculus I*</td>
<td>4</td>
</tr>
<tr>
<td>University Core</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I*</td>
<td>3</td>
</tr>
<tr>
<td>DDNSN 131 - Introduction to Drafting and Design</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 202 - Applied Analysis</td>
<td>1</td>
</tr>
<tr>
<td>CHMY 143 - College Chemistry II*</td>
<td>4</td>
</tr>
<tr>
<td>M 172Q - Calculus II*</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 220 - Physics I (w/ calculus)*</td>
<td>4</td>
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<tr>
<td>University Seminar - Choose one of the following:</td>
<td>3</td>
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<tr>
<td>CLS 101US - Knowledge and Community</td>
<td></td>
</tr>
<tr>
<td>COMX 111US - Introduction to Public Speaking (formerly COM 110US)</td>
<td></td>
</tr>
<tr>
<td>HONR 201US - Texts and Critics: Knowledge &amp; Imagination I</td>
<td></td>
</tr>
<tr>
<td>US 101US - First Year Seminar</td>
<td>17</td>
</tr>
</tbody>
</table>

| Year Total: | 17 | 16 |

<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>BMGT 205 - Prof Business Communication</td>
<td></td>
</tr>
<tr>
<td>WRIT 201 - College Writing II</td>
<td></td>
</tr>
<tr>
<td>WRIT 221 - Intermediate Tech Writing</td>
<td></td>
</tr>
<tr>
<td>HONR 202H - Texts and Critics: Knowledge &amp; Imagination II</td>
<td></td>
</tr>
<tr>
<td>BIOB 160 - Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>SRVY 230 - Intro to Surveying for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 201 - Engineering Mechanics--Statics*</td>
<td>3</td>
</tr>
<tr>
<td>M 273Q - Multivariable Calculus*</td>
<td>4</td>
</tr>
<tr>
<td>EGEN 202 - Engineering Mechanics -- Dynamics**</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 205 - Mechanics of Materials**</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 350 - Applied Engineering Data Analysis**</td>
<td>2</td>
</tr>
<tr>
<td>or STAT 332 - Statistics for Scientists and Engineers</td>
<td></td>
</tr>
<tr>
<td>M 274 - Introduction to Differential Equation</td>
<td>4</td>
</tr>
<tr>
<td>University Core</td>
<td>3</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 170IN - Principles of Biological Diversity (Choose one of the following: )</td>
<td></td>
</tr>
<tr>
<td>BIOM 360 - General Microbiology</td>
<td></td>
</tr>
<tr>
<td>ENSC 245IN - Soils</td>
<td></td>
</tr>
<tr>
<td>ENSC 272CS - Water Resources</td>
<td></td>
</tr>
<tr>
<td>GPHY 284 - Intro to GIS Science &amp; Cartog</td>
<td></td>
</tr>
<tr>
<td>NRSM 240 - Natural Resource Ecology</td>
<td></td>
</tr>
<tr>
<td>PHSX 222 - Physics II (w/ calculus)</td>
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<tr>
<td>Year Total:</td>
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<table>
<thead>
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<th>Junior Year</th>
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<tr>
<td></td>
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<tr>
<td>ECIV 312 - Structures I**</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 320 - Geotechnical Engineering**</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 333 - Water Resources Engineering**</td>
<td>4</td>
</tr>
<tr>
<td>EENV 340 - Princ of Envir Engineering**</td>
<td>3</td>
</tr>
</tbody>
</table>
Professional Elective Courses

- **EGEN 335 - Fluid Mechanics**
- **ECIV 308 - Construction Practice**
- **EGEN 310R - Multidisciplinary Engineering Design**
- **EGEN 324 - Applied Thermodynamics**
- **EGEN 330 - Business Fundamentals for Technical Professionals**

University Core
- Total: 15

Senior Year
- Credits

**Fall**
- EENV 441 - Natural Treatment Systems: 3
- ECIV 401 - Civil Eng Practice and Ethics: 1
- ECIV 489R - Civil Engineering Design I: 2
- University Core and Prof. Electives: 9

**Spring**
- EENV 452 - Advanced Engineering Hydrology: 3
- ECIV 499R - Capstone: Civil Eng Design II: 2
- EGEN 488 - Fundamentals of Engineering Exam: 0
- Professional Electives: 9

Year Total: 15

Total Program Credits: 128

* Key courses
** Advanced courses

Additional requirements: Professional electives must include 15 credits total with 1 course from the Water Resources Engineering Group and 1 course from the Environmental Engineering Group. A maximum of 4 credits total from Individual Problems, and Undergraduate Research may be counted toward professional electives. The professional elective program must contain a minimum of 2 design intensive courses (see CE/BREN flow chart). Students must successfully complete all key courses prior to taking any professional electives. A maximum of 3 credit-hours may be included from a completed MSU minor, a prior or concurrent BS/BA degree in another major, or courses in a completed MSU Honors Program, or Internship (max. 3 credits). A student may petition to include other senior or graduate level courses consistent with the degree program but not listed here (requires Academic Adviser and Department Head approval). A minimum of 128 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

### Professional Elective Courses

#### Water Resources Engineering Group
- **ECIV 431** Open Channel Hydraulics: 3
- **ECIV 435** Closed-Conduit Hydraulics: 3
- **EENV 434** Groundwater Supply/Remediation: 3
- **EGEN 435** Fluid Dynamics: 3

#### Environmental Engineering Group
- **EENV 440** Water Chemistry for Envr Engr: 3
- **EENV 443** Air Pollution Control: 3
- **EENV 445** Hazardous Waste Treatment: 3
- **EENV 447** Hazardous Waste Management: 3

#### Supporting Topics Group
- **BIOE 370** General Ecology (equiv to 270): 3
- **ECIV 309** Building Information Modeling in Construction: 3
- **ECIV 311** Construction Project Documentation: 2
- **ECIV 315** Structures II: 3

#### Civil Engineering

- **ECIV 350** Transportation Engineering: 3
- **ECIV 406** Sustainability Issues in Construction: 3
- **ECIV 420** Earth and Foundation Engr: 3
- **ECIV 425** Geotechnical Structures: 3
- **ECIV 455** Survey Data Collection & Analysis for Transportation Engineering: 3
- **ECIV 461** Cold Regions Infrastructure Engineering: 3
- **ECIV 490R** Undergraduate Research: 1-4
- **ECIV 498** Internship: 2
- **EENV 490R** Undergraduate Research: 1-4
- **EGEN 498** Internship: 2

- **ENSC 353** Environmental Biogeochemistry: 3
- **ENSC 444** Watershed Hydrology: 3
- **ENSC 448** Stream Restoration Ecology: 3
- **ENSC 460** Soil Remediation: 3
- **ENSC 461** Restoration Ecology: 3
- **GPHY 384** Adv GIS and Spatial Analysis: 3
- **SRVY 375** Analytic Photogrammetry and Remote Sensing: 3

### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>M 171Q</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
<td>3</td>
</tr>
</tbody>
</table>

### University Seminar
- Choose one of the following:
  - **CLS 101US** - Knowledge and Community
  - **COMX 111US** - Introduction to Public Speaking (formerly COM 110US)
  - **HONR 201US** - Texts and Critics: Knowledge & Imagination I
  - **US 101US** - First Year Seminar

### University Core
- **BMGT 205** - Prof Business Communication

### Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRVY 230</td>
<td>Intro to Surveying for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 201</td>
<td>Engineering Mechanics--Statics</td>
<td>3</td>
</tr>
<tr>
<td>M 273Q</td>
<td>Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 222</td>
<td>Physics I (w/ calculus)</td>
<td>4</td>
</tr>
<tr>
<td>DDSN 131</td>
<td>Introduction to Drafting and Design</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 202</td>
<td>Engineering Mechanics -- Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 205</td>
<td>Mechanics of Materials</td>
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### Credits

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<tr>
<th>Term</th>
<th>Fall</th>
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<tr>
<td>Senior Year</td>
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<td>15</td>
</tr>
<tr>
<td>Total Program Credits</td>
<td>128</td>
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</table>
A student may petition to include other senior or graduate level courses in a completed MSU Honors Program, or Internship (max. 3 credits) or a MSU minor, a prior or concurrent BS/BA degree in another major, or electives. A maximum of 3 credit-hours may be included from a completed project. The project must successfully complete all key courses prior to taking any professional electives.

Individual Problems, and Undergraduate Research may be counted toward civil engineering sub-area are required. A maximum of 4 credits total from the 300 level or above. A minimum of 2 courses in civil engineering (i.e., EENV, EENV, SRVY, EGEN) and not more than 3 courses in any one civil engineering sub-area are required. A maximum of 4 credits total from Individual Problems, and Undergraduate Research may be counted toward professional electives. The professional electives program must contain a minimum of 2 design intensive courses (see the CE flow chart). Students must successfully complete all key courses prior to taking any professional electives. A maximum of 3 credit-hours may be included from a completed MSU minor, a prior or concurrent BS/BA degree in another major, or courses in a completed MSU Honors Program, or Internship (max. 3 credits). A student may petition to include other senior or graduate level courses consistent with the degree program but not listed here (requires Academic Adviser and Department Head approval).

A minimum of 128 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

**Professional Elective Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>DDSN 245</td>
<td>Civil Drafting</td>
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<tr>
<td>ECIV 307</td>
<td>Construction Estimating and Bidding</td>
</tr>
<tr>
<td>ECIV 309</td>
<td>Building Information Modeling in Construction</td>
</tr>
<tr>
<td>ECIV 311</td>
<td>Construction Project Documentation</td>
</tr>
<tr>
<td>ECIV 404</td>
<td>Heavy Const Equip and Methods</td>
</tr>
<tr>
<td>ECIV 405</td>
<td>Construction Project Planning and Scheduling</td>
</tr>
<tr>
<td>ECIV 406</td>
<td>Sustainability Issues in Construction</td>
</tr>
<tr>
<td>ECIV 414</td>
<td>Steel Design</td>
</tr>
<tr>
<td>ECIV 415</td>
<td>Design of Masonry Structures</td>
</tr>
<tr>
<td>ECIV 416</td>
<td>Design of Wood and Timber Structures</td>
</tr>
<tr>
<td>ECIV 420</td>
<td>Earth and Foundation Eng</td>
</tr>
<tr>
<td>ECIV 425</td>
<td>Geotechnical Structures</td>
</tr>
<tr>
<td>ECIV 431</td>
<td>Open Channel Hydraulics</td>
</tr>
<tr>
<td>ECIV 435</td>
<td>Closed-Conduit Hydraulics</td>
</tr>
<tr>
<td>ECIV 451</td>
<td>Highway Pavements</td>
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<tr>
<td>ECIV 452</td>
<td>Traffic Engineering and ITS</td>
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<tr>
<td>ECIV 454</td>
<td>Transportation Planning</td>
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<tr>
<td>ECIV 455</td>
<td>Survey Data Collection &amp; Analysis for Transportation Engineering</td>
</tr>
<tr>
<td>ECIV 456</td>
<td>Highway Geometric Design</td>
</tr>
<tr>
<td>ECIV 461</td>
<td>Cold Regions Infrastructure Engineering</td>
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<tr>
<td>ECIV 484</td>
<td>Reinforced Concrete Design</td>
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<tr>
<td>ECIV 490R</td>
<td>Undergraduate Research</td>
</tr>
<tr>
<td>ECIV 492</td>
<td>Independent Study</td>
</tr>
<tr>
<td>ECIV 498</td>
<td>Internship</td>
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<tr>
<td>EENV 432</td>
<td>Advanced Engineering Hydrology</td>
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<tr>
<td>EENV 434</td>
<td>Groundwater Supply/Remediation</td>
</tr>
<tr>
<td>EENV 440</td>
<td>Water Chemistry for Envir Engr</td>
</tr>
<tr>
<td>EENV 441</td>
<td>Natural Treatment Systems</td>
</tr>
<tr>
<td>EENV 443</td>
<td>Air Pollution Control</td>
</tr>
<tr>
<td>EENV 445</td>
<td>Hazardous Waste Treatment</td>
</tr>
<tr>
<td>EENV 447</td>
<td>Hazardous Waste Management</td>
</tr>
<tr>
<td>EGEN 415</td>
<td>Advanced Mechanics of Solids</td>
</tr>
<tr>
<td>EGEN 435</td>
<td>Fluid Dynamics</td>
</tr>
<tr>
<td>SRVY 355</td>
<td>Surveying Calculations</td>
</tr>
<tr>
<td>SRVY 361</td>
<td>Intro Legal Princ in Surveying</td>
</tr>
<tr>
<td>SRVY 362</td>
<td>Public Land Survey System</td>
</tr>
<tr>
<td>SRVY 375</td>
<td>Analytic Photogrammetry and Remote Sensing</td>
</tr>
<tr>
<td>SRVY 474</td>
<td>Project Design in Surveying</td>
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</tbody>
</table>

**Construction Engineering Technology**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHMY 121IN - Introduction to General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>DDSN 131 - Introduction to Drafting and Design</td>
<td>3</td>
</tr>
</tbody>
</table>

**Additional requirements:** 15 credits of approved professional electives at the 300 level or above. A minimum of 2 courses in civil engineering (i.e., EENV, EENV, SRVY, EGEN) and not more than 3 courses in any one civil engineering sub-area are required. A maximum of 4 credits total from Individual Problems, and Undergraduate Research may be counted toward professional electives. The professional electives program must contain a minimum of 2 design intensive courses (see the CE flow chart). Students must successfully complete all key courses prior to taking any professional electives. A maximum of 3 credit-hours may be included from a completed MSU minor, a prior or concurrent BS/BA degree in another major, or courses in a completed MSU Honors Program, or Internship (max. 3 credits). A student may petition to include other senior or graduate level courses consistent with the degree program but not listed here (requires Academic Adviser and Department Head approval).
ECNS 101IS - Economic Way of Thinking 3
M 165Q - Calculus for Technology I* 3

University Seminar - Choose one of the following: 3
CLS 101US - Knowledge and Community
COM 111US - Introduction to Public Speaking (formerly COM 110US)
HONR 201US - Texts and Critics: Knowledge & Imagination I

ECN 202 - Principles of Macroeconomics 3
EMAT 251 - Materials Structures and Prop 3
PHSX 205 - College Physics I* 4
M 166Q - Calculus for Technology II* 3
WRIT 101W - College Writing I* 3

Year Total: 16 16

Sophomore Year

<table>
<thead>
<tr>
<th>Credits</th>
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<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>SRVY 230 - Intro to Surveying for Engineers</td>
</tr>
<tr>
<td>Choose one of the following:</td>
</tr>
<tr>
<td>BMGT 205 - Prof Business Communication</td>
</tr>
<tr>
<td>WRIT 201 - College Writing II</td>
</tr>
<tr>
<td>WRIT 221 - Intermediate Tech Writing</td>
</tr>
<tr>
<td>HONR 202IH - Texts and Critics: Knowledge &amp; Imagination II</td>
</tr>
</tbody>
</table>

EGEN 203 - Applied Mechanics* 3
PHSX 207 - College Physics II 4
University Core 3
ECIV 308 - Construction Practice** 3
ETCC 204 - Appld Analysis for Const Tech 1
SRVY 273 - Route Surveying** 3
EGEN 208 - Applied Strength of Materials (University Core)** 3
University Core 3

Choose one of the following: 4
ERTH 101IN - Earth System Sciences
GPHY 284 - Intro to GIS Science & Cartog

Year Total: 16 17

Junior Year

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>ECIV 307 - Construction Estimating and Bidding**</td>
</tr>
<tr>
<td>ETCC 302 - Soils and Foundations</td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
</tr>
<tr>
<td>EGEN 330 - Business Fundamentals for Technical Professionals</td>
</tr>
<tr>
<td>Choose one of the following:</td>
</tr>
<tr>
<td>ACTG 220 - Survey of Accounting</td>
</tr>
<tr>
<td>ACTG 201 - Principles of Financial Acct</td>
</tr>
<tr>
<td>EIND 373 - Production Inventory Cost Analysis</td>
</tr>
</tbody>
</table>

ECIV 309 - Building Information Modeling in Construction 3
ETCC 310 - Concrete Technology** 3
EGEN 310R - Multidisciplinary Engineering Design** 3
EGEN 331 - Applied Mechanics of Fluids** 3
ARCH 241 - Building Construction I** 3

Year Total: 15 15

Senior Year

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>BGEN 361 - Principles of Business Law</td>
</tr>
<tr>
<td>ECIV 405 - Construction Project Planning and Scheduling**</td>
</tr>
<tr>
<td>ETCC 412 - Structural Elements**</td>
</tr>
<tr>
<td>ELEL 354 - Electric Power Applications**</td>
</tr>
<tr>
<td>ECIV 311 - Construction Project Documentation**</td>
</tr>
<tr>
<td>ARCH 331 - Environmental Controls I*</td>
</tr>
<tr>
<td>ETCC 499R - Capstone: Const Engin Tech***</td>
</tr>
<tr>
<td>ECIV 404 - Heavy Const Equip and Methods***</td>
</tr>
<tr>
<td>University Core and Tech. Prof. Electives**</td>
</tr>
</tbody>
</table>

Year Total: 18 15

Total Program Credits: 128

* Key courses
** Advanced courses

Additional requirements: At least 7 credits of technical-professional elections with a minimum of 2 credits of Internship Electives (maximum 4 credits). See the CET flow chart for a list of Internship Electives. A maximum of 4 credits total from Individual Problems, Internships (if taking 2 internships, must be from two separate employers), and Undergraduate Research may be counted toward professional electives. Students must successfully complete all key courses prior to taking any professional electives. A maximum of 3 credit-hours may be included from a completed MSU minor, a prior or concurrent BS/BA degree in another major, or courses in a completed MSU Honors Program. A student may petition to include other senior or graduate level courses consistent with the degree program but not listed here (requires Academic Adviser and Department Head approval).

A minimum of 128 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

Technical-Professional Electives

<table>
<thead>
<tr>
<th>Credits</th>
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<tbody>
<tr>
<td>ARCH 332 - Environmental Controls II</td>
</tr>
<tr>
<td>BFIN 322 - Business Finance</td>
</tr>
<tr>
<td>BFIN 420 - Investments I</td>
</tr>
<tr>
<td>BMGT 322 - Operations Management</td>
</tr>
<tr>
<td>BMGT 329 - Human Resource Management</td>
</tr>
<tr>
<td>BMGT 335 - Management and Organization</td>
</tr>
<tr>
<td>BMGT 410 - Sustainable Business Practices</td>
</tr>
<tr>
<td>BMGT 464 - International Management</td>
</tr>
<tr>
<td>BMKT 325 - Principles of Marketing</td>
</tr>
<tr>
<td>ECIV 350 - Transportation Engineering</td>
</tr>
<tr>
<td>ECIV 406 - Sustainability Issues in Construction</td>
</tr>
<tr>
<td>ECIV 461 - Cold Regions Infrastructure Engineering</td>
</tr>
<tr>
<td>ECIV 492 - Independent Study</td>
</tr>
<tr>
<td>ECIV 498 - Internship</td>
</tr>
<tr>
<td>EGEN 324 - Applied Thermodynamics</td>
</tr>
<tr>
<td>EGEN 498Z - Internship</td>
</tr>
<tr>
<td>EIND 313 - Work Design and Analysis</td>
</tr>
<tr>
<td>EIND 425 - Technology Entrepreneurship</td>
</tr>
<tr>
<td>EIND 434 - Project Management for Engineers</td>
</tr>
<tr>
<td>ETCC 490R - Undergraduate Research</td>
</tr>
<tr>
<td>ETCC 492 - Independent Study</td>
</tr>
<tr>
<td>ETCC 498 - Internship</td>
</tr>
<tr>
<td>SRVY 355 - Surveying Calculations</td>
</tr>
</tbody>
</table>
A computer science degree is highly marketable. Between 2010 and 2020, one study projects that there will be a shortfall of 32 million technically specialized professionals in the U.S., Europe, Japan, China and India. Consequently, students who graduate with a bachelor’s degree in CS are in high demand. The average starting salary is $65,000.

Our curriculum is designed with considerable flexibility, due to the numerous types of computer science jobs that exist. The bachelor’s degree provides every student with a strong fundamental understanding of the field. Students may then select from exciting computer science electives such as artificial intelligence, computational biology, computer networks, databases, machine learning, robotics, operating systems, software engineering, web design and special topics courses. Students who complete a bachelor’s degree will find themselves both highly marketable and well-prepared for graduate school.

The department also offers graduate programs leading to the M.S. and Ph.D. degrees in Computer Science.

The bachelor’s degree is accredited by the Computing Accreditation Commission of ABET, http://www.abet.org/.

Professional Option B.S.
The professional option allows a student to delve more deeply into both computer science and related technical areas. The compilers course, CSCI 468, serves as the capstone for this option.

Interdisciplinary Option B.S.
Many opportunities and challenges lie at the intersection of technology and other fields. The interdisciplinary option allows a student to pursue a minor of choice such as Entrepreneurship or Japanese Studies. During a student’s senior year, the minor area must be connected back to computer science through a senior project. CSCI 482R and CSCI 483R serve as the capstone for this option.

Bachelor of Arts
The computer science Bachelor of Arts degree serves students who want to couple knowledge of computing with knowledge from the Arts, Humanities, Business or other non-STEM (Science, Technology, Engineering, Mathematics) area. Students have more opportunity to pursue non-STEM coursework because in comparison to the B.S. options, fewer math and science courses are required ESOF 423 serves as the capstone for this option.

Undergraduate Programs
- Professional Option B.S. (p. 172)
- Interdisciplinary Option B.S. (p. 172)
- Bachelor of Arts (p. 357)

Undergraduate Minors
- Computer Science Minor (Non-Teaching) (p. 172)

Graduate Programs
- M.S. in Computer Science (p. 359)
- Ph.D. in Computer Science (p. 359)

M.S. Degree Program
A Bachelor’s degree in Computer Science is recommended. Students with non-computer science degrees at the Bachelor’s level or above are also encouraged to apply; such students will generally be required to take appropriate courses while enrolled at MSU to make up computer science and related subject matter deficiencies prior to full acceptance into the computer science Master’s program. Factors that the department uses in its admissions process include GRE scores, TOEFL scores (for non-native English speakers), reference letters, GPA and previous coursework. For
more information, please refer to www.cs.montana.edu/future-students-masters-program.html.

Details about applying can be found at www.montana.edu/gradschool/admissions/apply.html.

**Ph.D. Degree Program**

The degree is generally intended for students who have a B.S. or M.S. degree in Computer Science and who want to pursue a research and/or college-level teaching career. The program requires coursework, research, exams and the writing of a dissertation.

Admission to the doctoral program follows the requirements of The Graduate School. Factors that the department uses in its admissions process include GRE scores, TOEFL scores (for non-native English speakers), reference letters, GPA and previous coursework. For more information, please refer to www.cs.montana.edu/future-students-phd.html.

Details about applying can be found at www.montana.edu/gradschool/admissions/apply.html. The Gianforte School of Computing encourages applicants to use the online application procedure.

**Computer Science Minor (Non-Teaching)**

Because computational skills are vital in today’s world, the department offers a flexible minor that allows a student to customize much of the coursework to add value to his or her major. The minor strengthens a student’s opportunity for employment or for admission to graduate school.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 132</td>
<td>Basic Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 127</td>
<td>Joy and Beauty of Data</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 232</td>
<td>Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>Upper Division Computer Science Credits</td>
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<td></td>
</tr>
<tr>
<td>Additional Computer Science Credits at any level</td>
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</table>

Total Credits 27

**Interdisciplinary Option**

**Freshman Year**

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>M 171Q - Calculus I</td>
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<tr>
<td>CSCI 127 - Joy and Beauty of Data</td>
<td>4</td>
<td></td>
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<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
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<tr>
<td>University Core and Electives</td>
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<td></td>
</tr>
<tr>
<td>CSCI 132 - Basic Data Structures and Algorithms</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>M 172Q - Calculus II</td>
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<td>University Core Seminars Core</td>
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<td>University Core and Electives</td>
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Year Total: 14 15

**Sophomore Year**

<table>
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<tr>
<th>Course</th>
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<tr>
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<tr>
<td>CSCI 246 - Discrete Structures</td>
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<td>Science Electives</td>
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<td>WRIT 221 - Intermediate Tech Writing</td>
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<tr>
<td>CSCI 112 - Programming with C I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CSCI 232 - Data Structures and Algorithms</td>
<td>4</td>
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<tr>
<td>Science Electives</td>
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<td>University Core</td>
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Year Total: 14 15

**Junior Year**

<table>
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<tr>
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<tbody>
<tr>
<td>CSCI 361 - Computer Architecture</td>
<td>3</td>
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<tr>
<td>ESOF 322 - Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 310R - Multidisciplinary Design</td>
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<td>CS Electives</td>
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<tr>
<td>Minor Electives</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 305 - Concepts/Programming Languages</td>
<td>3</td>
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<tr>
<td>CSCI 338 - Computer Science Theory</td>
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<tr>
<td>Minor Electives</td>
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Year Total: 15 15

**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CSCI 482R - Interdisciplinary Project Instruction</td>
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<tr>
<td>Science or Math Electives</td>
<td>4</td>
</tr>
<tr>
<td>Math, Probability or Statistics Elective</td>
<td>3</td>
</tr>
<tr>
<td>CS Electives</td>
<td>4</td>
</tr>
<tr>
<td>Minor Electives</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 481 - Program Assessment</td>
<td>0</td>
</tr>
<tr>
<td>CSCI 483R - Interdisciplinary Project</td>
<td>3</td>
</tr>
<tr>
<td>Science or Math Electives</td>
<td>3</td>
</tr>
<tr>
<td>CS Electives</td>
<td>6</td>
</tr>
<tr>
<td>Minor Electives</td>
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</tbody>
</table>

Year Total: 15 15

Total Program Credits: 120

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. For more detailed requirements, please consult the Interdisciplinary Option Graduation Workshop, located at cs.montana.edu/forms.html.

**Professional Option**

**Freshman Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 171Q - Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 127 - Joy and Beauty of Data</td>
<td>4</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>3</td>
</tr>
<tr>
<td>University Seminar Core</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Total: 14 15

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 246 - Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 221 - Intermediate Tech Writing</td>
<td>3</td>
</tr>
<tr>
<td>Science Electives</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 215CS - Social &amp; Ethical Issues in CS</td>
<td>3</td>
</tr>
<tr>
<td>University Core</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Total: 14 15

**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 112 - Programming with C I</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 232 - Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>Science Electives</td>
<td>3</td>
</tr>
<tr>
<td>University Core</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Total: 15 15

**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 127 - Joy and Beauty of Data</td>
<td>3</td>
</tr>
<tr>
<td>Science Electives</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 246 - Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 221 - Intermediate Tech Writing</td>
<td>3</td>
</tr>
<tr>
<td>Science Electives</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Total: 15 15
The mission of the Montana State University Electrical and Computer Engineering Department is to provide an excellent, diverse, and inclusive environment for the scholarly pursuits of education, discovery, and dissemination in electrical and computer engineering in support of Montana State University and the State of Montana. We strive to excel in teaching at both the undergraduate and graduate levels. We seek to attract and retain well-qualified undergraduate students and provide them with educational, research, and scholarship opportunities. We strive to train the next generation of academics and researchers by providing opportunities in world class research and experience in teaching. And, we seek to develop a competitive research program of regional, national, and international importance.

The goals of the Department are to:

1. Serve the State of Montana and the nation through education, research, and service to meet the mission of Montana State University and the College of Engineering.
2. Provide ABET accredited undergraduate programs in Electrical Engineering and Computer Engineering.
3. Be recognized by academic and industrial colleagues as delivering excellent undergraduate programs which provide students with a strong foundation in the contemporary and traditional areas of Electrical and Computer Engineering.
4. Encourage faculty members to maintain professional expertise through continued professional development so they can sustain excellence in teaching and advising and be competitive in research.
5. Provide excellent learning opportunities in lectures and modern laboratory facilities.
6. Provide graduate research opportunities which, coupled with undergraduate excellence, prepare students through advanced studies in current and emerging fields of state, national, and international importance.
7. Develop a competitive research program and disseminate new knowledge while mentoring graduate students completing requirements for advanced degrees.

Educational objectives for the BSEE and BSCpE degree programs are broad statements that describe what graduates are expected to attain within a few years after graduation.

In their first few years on the job, graduates of the Programs:

1. Pursue a professional career based on an education in the fundamentals of Electrical and Computer Engineering.
2. Engage in post-graduate education programs.
3. Provide a positive impact to the engineering community and to the community at large.

**Internship Opportunities**

Internships are encouraged for students seeking engineering experience during summer employment. A wide variety of engineering companies recruit undergraduate interns from MSU. A total of three credits of internship can be applied towards graduation as a professional elective at the rate of one credit per full-time summer engineering employment. An internship experience allows students to gain engineering industrial experience that complements their formal academic education. Students in the Electrical Engineering and the Computer Engineering degree programs are encouraged to investigate the possibilities of an internship experience according to opportunities announced each year. The MSU Career, Internship & Student Employment Services (http://www.montana.edu/careers) office located in 177 Strand Union Building also helps students in their internship opportunities.

**Research Opportunities**

Students in the Electrical Engineering and the Computer Engineering degree programs are also encouraged to investigate opportunities to work under the supervision of an ECE faculty member in a research lab either during the summer or during the academic year. All members of the ECE faculty have active research programs which regularly involve undergraduate students. Hands-on research experience complements the student’s formal academic education while providing familiarity with career opportunities in the research field. Students in the ECE department have opportunities for paid research positions in addition to receiving credit for conducting

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**Electrical and Computer Engineering**

The Electrical and Computer Engineering Department (ECE) offers degrees in several areas: a Bachelor of Science and Master of Science in Electrical Engineering, a Ph.D. in Engineering with an ECE option; a Master of Engineering with an EE option; and a Bachelor of Science in Computer Engineering. The programs leading to the B.S. in Electrical Engineering and B.S. in Computer Engineering are both accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The breadth and quality of each degree program are driven by the goals of the Electrical and Computer Engineering Department.

The mission of the Montana State University Electrical and Computer Engineering Department is to provide an excellent, diverse, and inclusive environment for the scholarly pursuits of education, discovery, and dissemination in electrical and computer engineering in support of Montana State University and the State of Montana. We strive to excel in teaching at both the undergraduate and graduate levels. We seek to attract and retain well-qualified undergraduate students and provide them with educational, research, and scholarship opportunities. We strive to train the next generation of academics and researchers by providing opportunities in world class research and experience in teaching. And, we seek to develop

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**Electrical and Computer Engineering Worksheet**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 232 - Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>Math, Statistics, or Probability Elective</td>
<td>3</td>
</tr>
<tr>
<td>Science Electives</td>
<td>3</td>
</tr>
<tr>
<td>University Core</td>
<td>3</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td><strong>15</strong></td>
</tr>
<tr>
<td><strong>Fall Credits</strong></td>
<td></td>
</tr>
<tr>
<td>ESOF 322 - Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 310R - Multidisciplinary Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Design</td>
<td></td>
</tr>
<tr>
<td>CS Electives</td>
<td>3</td>
</tr>
<tr>
<td>CS or Related Electives</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 361 - Computer Architecture</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 305 - Concepts/Programming Languages</td>
<td>3</td>
</tr>
<tr>
<td>CS Electives</td>
<td>6</td>
</tr>
<tr>
<td>CS or Related Electives</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 338 - Computer Science Theory</td>
<td>3</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
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</tr>
<tr>
<td><strong>Spring Credits</strong></td>
<td></td>
</tr>
<tr>
<td>Science or Math Electives</td>
<td>4</td>
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<tr>
<td>Math, Statistics, or Probability Elective</td>
<td>3</td>
</tr>
<tr>
<td>CS Electives</td>
<td>6</td>
</tr>
<tr>
<td>CS or Related Electives</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 468 - Compilers</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 481 - Program Assessment</td>
<td>0</td>
</tr>
<tr>
<td>Science or Math Electives</td>
<td>3</td>
</tr>
<tr>
<td>CS Electives</td>
<td>4</td>
</tr>
<tr>
<td>CS or Related Electives</td>
<td>3</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

Total Program Credits: 120

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. For more detailed requirements, please consult the Professional Option Graduation Worksheet, located at www.cs.montana.edu/forms.html.
research by registering for EELE 290R or EELE 490R Undergraduate Research, or EELE 292 or EELE 492 Independent Study.

Graduate Program
Graduate school can provide an opportunity to gain education and experience in specialty areas that go beyond the scope or depth of the undergraduate curriculum, and offers advanced work in such areas as design, development work, research, and university-level teaching. The Electrical and Computer Engineering Department offers graduate programs leading to the research-based M.S. in Electrical Engineering, the coursework-only M.Eng. in Engineering with an EE option, and Ph.D. in Engineering with an ECE option. Our research provides excellent learning opportunities, including participation in interdisciplinary teams. A number of research and teaching assistantships are available on a competitive basis to qualified graduate students. Information regarding the ECE graduate program can be found at http://ece.montana.edu/research/eograd1.htm.

For more information about the department and its programs, see the Electrical and Computer Engineering Department home page at http://ece.montana.edu

Undergraduate Programs
- Computer Engineering (p. 174)
- Electrical Engineering (p. 176)

Graduate Programs
- M.S. in Electrical Engineering (p. 360)
- M.Eng in Electrical Engineering (p. 360)
- Ph.D. in Engineering, Electrical & Computer Engineering option (p. 360)

Computer Engineering
The Electrical and Computer Engineering Department offers an accredited program for the Bachelor of Science Degree in Computer Engineering (BSCpE). The Montana State University Computer Engineering program is accredited by the Engineering Accreditation Commission of ABET http://www.abet.org.

In the fast-paced field of computers, the computer engineering graduate will be prepared for careers in exciting innovative technologies including embedded systems, programmable logic, hardware/software co-design, and digital signal processing. With increased processor capacity and processing speeds, re-programmable logic devices offer far-reaching opportunities for the computer engineer to create new applications unheard of today. The computer engineer uses knowledge of both electronics hardware and software to achieve state-of-the-art solutions, often involving programmable logic devices and microprocessors. The computer engineering curriculum is designed to prepare students for engineering careers where programming and software skills are blended with the understanding of hardware design.

The computer engineering program at MSU is interdisciplinary and incorporates substantial coursework from both the Electrical and Computer Engineering Department and the Computer Science Department. All students in the Electrical and Computer Engineering Department develop common skills in basic science, mathematics, basic electronics and circuits; however, the computer engineering student diverges from the electrical engineering student by taking more computer science and computer architecture courses, as well as a full complement of courses in microprocessors and programmable devices.

In the senior year each computer engineering student takes part in a capstone design project. This project allows the student to function as part of a team on a real world problem, and the student, in addition to accomplishing the design, must also communicate his or her work in both a written paper and an oral presentation. All projects are intended to bring the student’s academic training to a logical conclusion and further develop the problem-solving skills and the communication skills of the computer engineering graduate.

The computer engineering program educational outcomes are:

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component, or process to meet desired needs.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global and societal context.
- A recognition of the need for, and an ability to engage in lifelong learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
- Knowledge of the principles of project management and design trade-offs.
- An ability to program microcontroller/microcomputer systems using assembly and high-level languages.
- An ability to design digital systems using modern design tools.
- An ability to analyze electrical and electronic systems.
- An ability to implement real-time systems.

Student Performance and Retention Requirements
Students are required by Board of Regents policy to achieve a C- or better grade in each class used to satisfy the BSCpE degree requirements.

Undergraduate Programs
- Bachelor of Science in Computer Engineering (p. 175)
- Computer Engineering Minor (Non-Teaching) (p. 176)

Graduate Programs
Students enrolled in the Electrical Engineering (M.S. and M.Eng.) graduate program or the Electrical & Computer Engineering (Ph.D.) graduate program can pursue cutting edge computer engineering research projects.

Please refer to the ECE graduate program section (p. 360) of the catalog for more information.
### B.S. in Computer Engineering

#### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 171Q - Calculus I</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 101 - Intro Electrical Fundamentals</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>CLS 101US - Knowledge and Community or COMX 111US - Introduction to Public Speaking</td>
<td>3</td>
<td></td>
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<tr>
<td>CSCI 127 - Joy and Beauty of Data</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 172Q - Calculus II</td>
<td>4</td>
<td></td>
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<tr>
<td>PHSX 220 - Physics I (w/ calculus)</td>
<td>4</td>
<td></td>
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<tr>
<td>CSCI 112 - Programming with C I</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>CSCI 132 - Basic Data Structures and Algorithms</td>
<td>4</td>
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<td>Year Total:</td>
<td>14</td>
<td>15</td>
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#### Sophomore Year

<table>
<thead>
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<th>Course</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>M 274 - Introduction to Differential Equation</td>
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<tr>
<td>PHSX 222 - Physics II (w/ calculus)</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>EELE 201 - Circuits I for Engineering</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 261 - Intro To Logic Circuits</td>
<td>4</td>
<td></td>
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</tr>
<tr>
<td>University Core Elective*</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 273Q - Multivariable Calculus</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>EGEN 350 - Applied Engineering Data Analysis</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 203 - Circuits II for Engineering</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>16</td>
<td>16</td>
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</table>

#### Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Core Elective*</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 371 - Microprocess HW and SW Systems</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 308 - Signals and Systems Analysis</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 317 - Electronics</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSCI 246 - Discrete Structures</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EGEN 310R - Multidisciplinary Engineering Design</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEE 465 - Microcontroller Applications</td>
<td>4</td>
<td></td>
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<tr>
<td>EEE 367 - Logic Design</td>
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<tr>
<td>Choose one of the following:</td>
<td>3-4</td>
<td></td>
<td></td>
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<tr>
<td>- EEE 321 - Intro To Feedback Controls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- EEE 477 - Digital Signal Processing</td>
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</tr>
<tr>
<td>Year Total:</td>
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<td>15</td>
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</table>

#### Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Core Elective*</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 334 - Electromagnetic Theory I</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 467 - SoC FPGAs I: Hardware-Software Codesign</td>
<td>4</td>
<td></td>
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<tr>
<td>EEE 488R - Electric Engineering Design I</td>
<td>2</td>
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<tr>
<td>Two EELE/CSCI Electives*</td>
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<td></td>
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<tr>
<td>University Core Elective*</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEE 468 - SoC FPGAs II: Application Specific Computing</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEE 489R - Electrical Engr Design II</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>EELE 487 - Prof, Ethics &amp; Engr Practices</td>
<td>1</td>
<td></td>
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</tr>
</tbody>
</table>

#### Professional Electives

- **EGEN 488 - Fundamentals of Engineering Exam**: 0 credits
- Two EELE/CSCI Electives* : 5 credits

**Year Total**: 18 credits

**Total Program Credits**: 126 credits

*Elective requirements include 12 credits of humanities, social science, diversity, and arts classes as part of the University Core requirements, 11 credits of approved professional electives from the list below, including a minimum of 6 credits in Computer Science. There must be a minimum of 4 credits at the 300 level or above in the student’s professional elective package.

### Professional Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTG 201 - Principles of Financial Acct</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 202 - Principles of Managerial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>ASTR 371 - Fundamentals of Astronomy</td>
<td>4</td>
</tr>
<tr>
<td>ASTR 373 - Observational Astronomy</td>
<td>4</td>
</tr>
<tr>
<td>BCH 380 - Biochemistry</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 105CS - Introduction to Biotechnology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 160 - Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 170IN - Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 260 - Cellular and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOH 185 - Integrated Physiology I</td>
<td>4</td>
</tr>
<tr>
<td>BIOH 201 - Human Anatomy and Physiology I</td>
<td>5</td>
</tr>
<tr>
<td>BIOH 211 - Human Anatomy and Physiology II</td>
<td>4</td>
</tr>
<tr>
<td>BIOH 303 - Unseen Universe: Microbes</td>
<td>3</td>
</tr>
<tr>
<td>BMKT 325 - Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 143 - College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 211 - Elements of Organic Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHMY 321 - Organic Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 323 - Organic Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>CS 240 - Multimedia Dev Methods</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 232 - Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 300 &amp; 400 level courses (no more than 1 cr CSCI 494)</td>
<td>4</td>
</tr>
<tr>
<td>ECNS 309 - Managerial Economics</td>
<td>3</td>
</tr>
<tr>
<td>EELE 300 &amp; 400 level courses, excluding EELE 354</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 201 - Engineering Mechanics--Statics</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 202 - Engineering Mechanics -- Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 205 - Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 325 - Engineering Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 330 - Business Fundamentals for Technical Professionals</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 335 - Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>EIND 354 - Engineering Probability and Statistics I</td>
<td>3</td>
</tr>
<tr>
<td>EIND 364 - Principles of Operations Research I</td>
<td>3</td>
</tr>
<tr>
<td>EIND 373 - Production Inventory Cost Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EIND 425 - Technology Entrepreneurship</td>
<td>3</td>
</tr>
<tr>
<td>EIND 434 - Project Management for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>EIND 454 - Engr Probability and Stats II</td>
<td>3</td>
</tr>
<tr>
<td>EMEC 300 &amp; 400 level courses</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 101IN - Earth System Sciences</td>
<td>4</td>
</tr>
<tr>
<td>ESOF 322 - Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ESOF 422 - Advanced Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 121D - Human Geography</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 141D - Geography of World Regions</td>
<td>3</td>
</tr>
</tbody>
</table>
Electrical engineers are leaders in the development of such technological innovations as the Internet, high definition television, fiber optic communications, and personal communication systems. As an electrical engineer, employment opportunities are available in numerous engineering careers, such as advanced research and development, design and applications engineering, manufacturing engineering, sales, and management.

The undergraduate program is designed to provide the student with the fundamental background in Mathematics, basic science, engineering, and personal communication to allow the graduate to be a contributing member in the engineering community. The electrical engineering curriculum provides the integrated educational experience whereby the student develops the skills to identify and to solve technical problems by applying pertinent electrical engineering knowledge to the solution of practical problems. This breadth of engineering knowledge and the ability to communicate that knowledge requires a broad-based education in various fields as well as professional elective courses. These professional electives enable the student to study in depth one or more of the following areas: logic design, digital signal processing, computer and microprocessor applications, electromagnetic theory, optics and photonics, control systems, electrical power systems, electronic circuits, and telecommunications.

Technical electives available outside the department allow students to broaden their knowledge and understanding of other engineering and scientific areas. These electives can also be used to take relevant coursework in business, finance, law, and management.

The electrical engineering program educational outcomes are:

a. An ability to apply knowledge of mathematics, science, and engineering.
b. An ability to design and conduct experiments, as well as to analyze and interpret data.
c. An ability to design a system, component, or process to meet desired needs.
d. An ability to function on multi-disciplinary teams.
e. An ability to identify, formulate, and solve engineering problems.
f. An understanding of professional and ethical responsibility.
g. An ability to communicate effectively.
h. The broad education necessary to understand the impact of engineering solutions in a global and societal context.
i. A recognition of the need for, and an ability to engage in lifelong learning.
j. A knowledge of contemporary issues.
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
l. Knowledge of the principles of project management and design trade-offs.
m. An ability to analyze and synthesize electronic devices and electrical systems.

**Student Performance and Retention Requirements**

Students are required by Board of Regents policy to achieve a C- or better grade in each class used to satisfy the BSEE degree requirements.

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**Computer Engineering Minor (Non-Teaching Minor)**

The Department of Electrical and Computer Engineering offers a non-teaching minor in Computer Engineering that provides a focus in computer programming, digital logic design, and microprocessor hardware/software. The minor requires a minimum of 30 credits: 23 credits in seven specified CS and EE courses and at least 7 credits (2 or 3 courses of electives) selected from among a specified list of upper-division EE courses. This minor is a useful complement to majors in science or engineering for those seeking a cross-disciplinary academic program. An EE major can complete a minor in Computer Engineering by taking CSCI 127, CSCI 132, and CSCI 232 (a total of 12 credits) plus two courses (7 cr min) from the specified elective list for the CpE minor. Completing the Computer Engineering minor requires 3 credits of professional electives beyond the minimum of 18 professional elective credits required for EE majors. Thus, an EE degree with a CpE minor can be completed in 128 credits.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 127</td>
<td>Joy and Beauty of Data</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 112</td>
<td>Programming with C I</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 132</td>
<td>Basic Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 232</td>
<td>Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>EELE 261</td>
<td>Intro to Logic Circuits</td>
<td>4</td>
</tr>
<tr>
<td>EELE 371</td>
<td>Microprocess HW and SW Systems</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Choose seven credits minimum from the following:</td>
<td>7</td>
</tr>
<tr>
<td>EELE 367</td>
<td>Logic Design</td>
<td>4</td>
</tr>
<tr>
<td>EELE 465</td>
<td>Microcontroller Applications</td>
<td></td>
</tr>
<tr>
<td>EELE 467</td>
<td>SoC FPGAs I: Hardware-Software Codeign</td>
<td></td>
</tr>
<tr>
<td>EELE 468</td>
<td>SoC FPGAs II: Application Specific Computing</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits**: 30

Students must receive a grade of "C-" or better in all required courses for the CpE minor.

---

**Electrical Engineering**

The Electrical and Computer Engineering Department offers an accredited program leading to the Bachelor of Science degree in Electrical Engineering (BSEE). The Montana State University Electrical Engineering Program is accredited by the Engineering Accreditation Commission of ABET http://www.abet.org.

Electrical Engineering offers the graduate extensive opportunities in such fields as telecommunications, control systems, microprocessors, instrumentation, electromagnetic systems, optical and electro-optical systems, power electronics, fuel cells, electrical power, and computer-controlled devices. In addition, electrical engineers play key roles in interdisciplinary efforts such as communications networks, remote sensing, aerospace systems, medical instrumentation, transportation systems, manufacturing, and numerous other applications of great social impact.
Undergraduate Programs

- B.S. in Electrical Engineering (p. 177)
- Electrical Engineering Minor (Non-Teaching) (p. 178)
- Optics Minor (Non-Teaching) (p. 178)

Graduate Programs

Please refer to the ECE graduate programs section (p. 360) of the catalog.

B.S. in Electrical Engineering

Freshman Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>EELE 101 - Intro Electrical Fundamentals</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>M 171Q - Calculus I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CLS 101US - Knowledge and Community</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>or COMX 111US - Introduction to Public Speaking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 220 - Physics I (w/ calculus)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>M 172Q - Calculus II</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>PHSX 222 - Physics II (w/ calculus)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CSCI 112 - Programming with C I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>14</td>
<td>14</td>
</tr>
</tbody>
</table>

Sophomore Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 274 - Introduction to Differential Equation</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>PHSX 224 - Physics III</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>EELE 201 - Circuits I for Engineering</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>EELE 261 - Intro To Logic Circuits</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>University Core Elective*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EGEN 350 - Applied Engineering Data Analysis</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>M 273Q - Multivariable Calculus</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>EELE 203 - Circuits II for Engineering</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>16</td>
<td>17</td>
</tr>
</tbody>
</table>

Junior Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Core Elective*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EELE 308 - Signals and Systems Analysis</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EELE 317 - Electronics</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>EELE 334 - Electromagnetic Theory I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EELE 371 - Microprocess HW and SW Systems</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>University Core Elective*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EGEN 310R - Multidisciplinary Engineering Design</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Choose two of the following:</td>
<td>7-8</td>
<td></td>
</tr>
<tr>
<td>EELE 321 - Intro To Feedback Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 355 - Energy Conversion Devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EELE 445 - Telecommunication Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE Professional Elective*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>17</td>
<td>16-17</td>
</tr>
</tbody>
</table>

Senior Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>EELE 488R - Electric Engineering Design I</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>EELE 409 - EE Material Science</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Total Program Credits: 125

* Elective requirements include 12 credits of humanities, social science, diversity, and arts classes as part of University Core requirements, 18 credits of professional electives with a minimum of 9 credits in Electrical Engineering and a minimum of 6 credits outside of Electrical Engineering all from the professional electives list below. There must be a minimum of 4 credits at the 300 level or above in the student’s professional electives package.

Professional Electives

<table>
<thead>
<tr>
<th>Credits</th>
<th>Kunst</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTG 201</td>
<td>Principles of Financial Acct</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 202</td>
<td>Principles of Managerial Acct</td>
<td>3</td>
</tr>
<tr>
<td>ASTR 371</td>
<td>Solar System Astronomy</td>
<td>4</td>
</tr>
<tr>
<td>ASTR 373</td>
<td>Stars, Galaxies, and the Universe</td>
<td>4</td>
</tr>
<tr>
<td>BCH 380</td>
<td>Biochemistry</td>
<td>5</td>
</tr>
<tr>
<td>BIOB 105CS</td>
<td>Introduction to Biotechnology</td>
<td>3</td>
</tr>
<tr>
<td>BIOP 160</td>
<td>Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>BIOP 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>BIOP 260</td>
<td>Cellular and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOH 185</td>
<td>Integrated Physiology I</td>
<td>4</td>
</tr>
<tr>
<td>BIOH 201</td>
<td>Hum Anatomy &amp; Physiology I</td>
<td>5</td>
</tr>
<tr>
<td>BIOH 211</td>
<td>Hum Anatomy &amp; Physiology II</td>
<td>4</td>
</tr>
<tr>
<td>BIOM 103IN</td>
<td>Unseen Universe: Microbes</td>
<td>3</td>
</tr>
<tr>
<td>BMKT 325</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 211</td>
<td>Elements of Organic Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHMY 321</td>
<td>Organic Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 323</td>
<td>Organic Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>CS 204</td>
<td>Multimedia Dev Methods</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 111</td>
<td>Programming with Java I</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 132</td>
<td>Basic Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 232</td>
<td>Data Structures and Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 246</td>
<td>Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 300 &amp; 400 level courses, no more than 1 or CSCI 494</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECNS 309</td>
<td>Managerial Economics</td>
<td>3</td>
</tr>
<tr>
<td>EELE 300 &amp; 400 level courses, excluding EELE 354</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EGEN 201</td>
<td>Engineering Mechanics--Statics</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 202</td>
<td>Engineering Mech--Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 205</td>
<td>Mechanics of Mtls (equiv 305)</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 325</td>
<td>Engineering Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 330</td>
<td>Business Fundamentals for Technical Professionals</td>
<td>3</td>
</tr>
</tbody>
</table>
Electrical Engineering Minor (Non-Teaching)

The Department of Electrical and Computer Engineering offers a non-teaching minor in Electrical Engineering that provides interested students with an introductory understanding of electrical circuits, electronics, and properties of signals. Students then choose electives from among a variety of electrical engineering topics, such as telecommunications, optics, electronics, electrical power, and control systems. This minor requires a minimum of 30 credits in electrical engineering subjects, with 9 of those credits selected from a list of upper division elective courses. This minor complements majors in science or engineering for those seeking a cross-disciplinary academic program. A CpE major can complete a minor in Electrical Engineering by taking three EELE classes (9 cr min) from the specified elective list for the EE minor. This can be done within the 126 credits required for the major by careful selection of electives and by completing an optics-related capstone design project.

Required core courses for minor (12 credits):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EELE 101</td>
<td>Intro Electrical Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>EELE 201</td>
<td>Circuits I for Engineering</td>
<td>4</td>
</tr>
<tr>
<td>EELE 203</td>
<td>Circuits II for Engineering</td>
<td>4</td>
</tr>
<tr>
<td>EELE 308</td>
<td>Signals and Systems Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EELE 317</td>
<td>Electronics</td>
<td>4</td>
</tr>
<tr>
<td>EELE 334</td>
<td>Electromagnetic Theory I</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose at least nine credits from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EELE 321</td>
<td>Intro To Feedback Controls</td>
<td>3</td>
</tr>
<tr>
<td>EELE 355</td>
<td>Energy Conversion Devices</td>
<td>3</td>
</tr>
<tr>
<td>EELE 409</td>
<td>EE Material Science</td>
<td>3</td>
</tr>
<tr>
<td>EELE 411</td>
<td>Advanced Analog Electronics</td>
<td>3</td>
</tr>
<tr>
<td>EELE 414</td>
<td>Intro to VLSI Design</td>
<td>3</td>
</tr>
<tr>
<td>EELE 422</td>
<td>Intro to Modern Control</td>
<td>3</td>
</tr>
<tr>
<td>EELE 432</td>
<td>Applied Electromagnetics</td>
<td>3</td>
</tr>
<tr>
<td>EELE 445</td>
<td>Telecommunication Systems</td>
<td>3</td>
</tr>
<tr>
<td>EELE 447</td>
<td>Mobile Wireless Communications</td>
<td>3</td>
</tr>
<tr>
<td>EELE 477</td>
<td>Digital Signal Processing</td>
<td>3</td>
</tr>
</tbody>
</table>

Students must receive a grade of "C-" or better in all required courses for the EE minor.

Optics and Photonics Minor (Non-Teaching)

The undergraduate non-teaching minor in optics provides a core set of knowledge and skills necessary to participate in the rapidly growing opportunities in optics and photonics. Requirements include courses in optics, electrical engineering and physics, as well as electives chosen to match the interests and needs of each student.

Students pursuing the BS in Electrical Engineering can earn the Optics Minor within the 125 credits required for the major by careful selection of electives and by completing an optics-related capstone design project.

Required core courses for minor (12 credits):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EELE 482</td>
<td>Electro-Optical Systems</td>
<td>3</td>
</tr>
<tr>
<td>EELE 484</td>
<td>Laser Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Optics electives (choose at least 9 credits):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 371</td>
<td>Physical Chemistry-Quantum Chemistry and Spectroscopy</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 427</td>
<td>Advanced Optics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 437</td>
<td>Laser Applications</td>
<td>3</td>
</tr>
</tbody>
</table>

Students pursuing the BS in Physics Professional Option or the BS in Physics Interdisciplinary Option can earn the Optics Minor with no extra credits by carefully selecting physics electives, by taking EELE 482 as one of their university or declared area electives, and by completing optics-related research (PHSX 490R and PHSX 499R) as their required senior project.

Required core courses for minor (12 credits):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EELE 334</td>
<td>Electromagnetic Theory I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 423</td>
<td>Electricity and Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>EELE 432</td>
<td>Applied Electromagnetics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 425</td>
<td>Electricity and Magnetism II</td>
<td>3</td>
</tr>
<tr>
<td>EELE 482</td>
<td>Electro-Optical Systems</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 427</td>
<td>Advanced Optics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 437</td>
<td>Laser Applications</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 30

1 A maximum of four (4) credits of these classes may be used if the topic is directly related to optics, on approval by academic advisor and research advisor/instructor.

2 A maximum of three (3) credits of these classes may be used if the topic is directly related to optics, on approval by academic advisor and research advisor/instructor.
Note: The following 500-level classes can be taken as electives in the Optics minor by seniors with a cumulative grade-point average $\geq 3.25$ (by petition to the Registrar) and provided all prerequisites are met.

- EEE 538 Adv Top Electromagn & Optics
- EEE 581 Fourier Optics/Imaging Theory
- EEE 582 Optical Design
- EEE 583 Remote Sensing Systems
- PHSX 515 Advanced Topics In Physics (if topic is directly optics related)
- CHMY 527 Analytic Optical Spectroscopy
- CHMY 557 Quantum Mechanics
- CHMY 560 Symmetry, Orbitals, and Spectroscopy

### Mechanical & Industrial Engineering

The mission of the Mechanical & Industrial Engineering Department is to serve the State of Montana, the nation, and the region by providing outstanding leadership and contributions in knowledge discovery, student learning, innovation and entrepreneurship, and service to community and profession. Our vision is to be a leader in discovery, learning, innovation, and service through focus on core competencies, multidisciplinary collaborations, and investment in the Departmental community. The Department is particularly focused on excellence in the following areas: design and manufacture, energy systems, materials and structures, measurement systems, and systems modeling.

The Mechanical and Industrial Engineering Department provides undergraduate programs leading to BS degrees in Industrial Engineering, Mechanical Engineering, and Mechanical Engineering Technology. The Department provides graduate programs leading to the MS degrees in Industrial Engineering and Mechanical Engineering. The Department also participates in an inter-disciplinary doctoral program leading to the Ph.D. degree with options in Industrial Engineering, Mechanical Engineering, or Engineering Mechanics. Further information on all of these programs may be found at [http://www.coe.montana.edu/mie](http://www.coe.montana.edu/mie)

### Curricula in the Department of Mechanical and Industrial Engineering

#### Grade Policies

The Montana Board of Regents (BOR) grade policy requires C- or higher marks in all courses required for a degree. This policy affects students who entered or were readmitted to the system starting in Fall 2005. Students who enrolled prior to Fall 2005, and have not had a break in attendance of one year or more, are exempt from the Board of Regents C- policy. The complete policy is presented in the on-line catalog in the Curriculum, Enrollment, and Graduation (p. 51) section.

#### Prerequisite Policy

The Mechanical and Industrial Engineering Department enforces prerequisites. A prerequisite course is one which must be successfully completed before a student may enroll in the follow-on course. By Board of Regents policy, in order for a course to serve as a prerequisite, a grade of C- or higher must be earned. M&IE students who earn below a C- in a course will be instructed to repeat the course during its next offering. They will also be instructed to drop any follow-on course that is affected by the unsatisfactory prerequisite grade.

### Undergraduate Programs

- Financial Engineering (p. 73)
- Industrial and Management Systems Engineering (p. 181)
- Mechanical Engineering (p. 183)
- Mechanical Engineering Technology (p. 185)

### Undergraduate Minors

- Aerospace Minor (p. 179)
- Building Energy Systems (p. 180)
- Financial Engineering Minor (p. 74)
- Engineering Management Minor (p. 181)
- Materials Minor (p. 182)
- Mechatronics Minor (p. 187)

### Graduate Programs

- M.S. in Industrial and Management Engineering (p. 364)
- M.S. and M.E. in Mechanical Engineering (p. 364)
- Ph.D. in Engineering -- Industrial Engineering and Mechanical Engineering options (p. 351)

### Aerospace Minor

Montana State University, Bozeman offers a minor (minor for which there is no major) in aerospace called the Aerospace Minor. This minor provides a suite of courses from a wide variety of disciplines which are relevant to aerospace. The minor requires a minimum of 31 credits. Required courses comprise 16 credits in four (4) specified courses, which are common to Mechanical Engineering, Electrical Engineering, Physics, Civil Engineering, Chemical Engineering, Chemistry, and Industrial & Management Systems Engineering at MSU Bozeman. An additional required course, EMEC 368 Introduction to Aerospace, is the cornerstone, foundational course for the Aerospace Minor. An additional 12 elective credits (minimum of four courses) are required from a specified list which comprises the Aerospace Elective Courses. This minor is a useful complement to majors in science or engineering for those seeking a cross-disciplinary academic program with topics in aerospace. The required courses are carefully selected to ensure that students seeking the Aerospace Minor at MSU have the requisite math and science background to engage in specific applications to aerospace. The Aerospace Elective Courses were developed to provide students with the minimum background of specific topics applicable to aerospace. These are Materials and Structures (needed for development of aerospace systems; structures, hardware, sensors, system packages, etc.), Thermo/Fluids (needed for an understanding of aeronautical systems, momentum equations relevant to propulsion systems, environmental needs, etc.), and Focused Topics (a series of focused and advanced topics applicable to aerospace. These courses include design, dynamics and control, Computer Aided Design (CAD), space science, etc.) The Certifying Officer for the Aerospace Minor is the current MSU Lysle A. Wood Distinguished Professor, and students with questions are encouraged to seek him/her by contacting the MSU Mechanical & Industrial Engineering Department.

The MSU **Aerospace Minor** = 19 required credits + 12 minimum elective credits = 31 minimum course credits for the Aerospace Minor:

In some cases, this may be accomplished within the maximum 128 credits for certain B.S. degrees at MSU (with the Aerospace Minor inclusive). Students who have less than 19 course credits will fill the additional minimum 28 course credits with approved Aerospace Minor elective course credits. Students seeking a degree in ME or MET cannot use EMEC 368 as a Professional Elective for their major degree requirements.

#### Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 171Q</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>M 172Q</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 220</td>
<td>Physics I (w/ calculus)</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 222</td>
<td>Physics II (w/ calculus)</td>
<td>4</td>
</tr>
<tr>
<td>EMEC 368</td>
<td>Introduction to Aerospace</td>
<td>3</td>
</tr>
</tbody>
</table>
Credit Sub-Total
19

Aerospace Minor Courses
Students take one course from each category below, plus one additional course from any of the three categories (Materials and Structures, Thermo/Fluids, Focused Topics).

Materials and Structures
Choose at least one from the following:
- EMAT 350 Engineering Materials
- EMAT 460 Polymeric Materials
- EMAT 461 Friction and Wear of Materials
- EMAT 462 Manufacturing of Composites
- EMAT 463 Composite Materials
- EMEC 405 Finite Element Analysis
- EMEC 444 Mech Behavior of Materials
- EMEC 447 Aircraft Structures
- PHSX 442 Novel Mat for Physics/Engineer

Thermo/Fluids
Choose at least one from the following:
- ECHM 424 Transport Analysis
- EGEN 324 Applied Thermodynamics
- EGEN 335 Fluid Mechanics
- EGEN 435 Fluid Dynamics
- EMEC 326 Fundamentals of Heat Transfer
- EMEC 425 Advanced Thermal Systems
- EMEC 426 Thermodynamics of Propulsion Systems
- EMEC 430 Introduction to Combustion
- EMEC 436 Computational Fluid Dynamics
- ETME 430 Fluid Power Systems Design

Focused Topics
Choose at least one from the following:
- EELE 308 Signals and Systems Analysis
- EELE 321 Intro To Feedback Controls
- EELE 407 Intro To Microfabrication
- EELE 414 Intro to VLSI Design
- EELE 422 Intro to Modern Control
- EELE 447 Mobile Wireless Communications
- EELE 465 Microcontroller Applications
- EELE 481 Optical Design
- EELE 482 Electro-Optical Systems
- EELE 484 Laser Engineering
- EGEN 310R Multidisciplinary Engineering Design
- EGEN 365 Introduction to Mechatronics
- EGEN 415 Advanced Mechanics of Solids
- EIND 371 Introduction to Computer Integrated Manufacturing
- EIND 413 Ergonomics & Human Factors Engineering
- EIND 422 Introduction to Simulation
- EIND 434 Project Management for Engineers
- EIND 477 Quality Management Systems
- EMEC 403 CAE IV–Design Integration
- EMEC 467 Micro-Electromechanical Systems
- EMEC 491-AA System Dynamics and Control
- ETME 410 Computerized Numerical Control and Computer-aided Manufacturing Technology
- ETME 415 Design for Manufacturing and Tooling

ETME 462 Industrial Processing Automation and Controls
PHSX 427 Advanced Optics
PHSX 435 Astrophysics
PHSX 437 Laser Applications

Total Credits
31-35

Acceptable substitute is defined as meeting the pre-requisites for the specific course in Aerospace Minor courses listed above, or as allowed by the instructor as an acceptable pre-requisite for the given Aerospace Minor course.

Notes: The following constraints will be imposed on Aerospace Minor Courses:

- IF A COURSE (or redundant equivalent) IS A SPECIFICALLY REQUIRED COURSE FOR THE STUDENT’S MAJOR DEGREE PROGRAM, IT WILL NOT BE ACCEPTED AS AN AEROSPACE MINOR ELECTIVE.
- Additional Clarification: Elective courses in a student’s major degree program are not considered as required courses and can, therefore, be used as Aerospace Minor electives. Pre-requisites for courses will be enforced.
- An appeal to include additional classes for the Aerospace Minor can be made if the student/instructor can make a cogent argument as to how the course is relevant to aerospace.
- All academic policies relevant to MSU are in effect for the Aerospace minor; in particular, all courses used to fulfill the minor must have a grade of C- or better.

Building Energy Systems Minor

The students seeking Minor in Building Energy Systems must satisfy the degree requirements for an ME, MET, CE, CET, EE or Arch degree plus the following courses to obtain a Minor in Building Energy Systems. Montana State University, Bozeman, proposes to offer a non-teaching minor in building energy systems called the Building Energy Systems Minor. This minor provides a suite of courses from a wide variety of disciplines, which are relevant to the built environment. This minor requires a minimum of 23 credits comprised of 8 credits of required core coursework and 15 credits of elective coursework chosen from each of the 5 categories.

Core Coursework

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGEN 324</td>
<td>Applied Thermodynamics</td>
</tr>
<tr>
<td>or EGEN 321</td>
<td>Thermodynamics II</td>
</tr>
<tr>
<td>ETME 327</td>
<td>Commercial Building Energy Assessment Lab</td>
</tr>
<tr>
<td>ETME 424</td>
<td>Thermal Processes Lab</td>
</tr>
</tbody>
</table>

Integrated Building Design

Choose one from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETME 423</td>
<td>Principles of HVAC II</td>
</tr>
<tr>
<td>ARCH 450</td>
<td>Community Design Center</td>
</tr>
</tbody>
</table>

Power Systems

Choose one from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEE 250</td>
<td>Circuits, Devices and Motors</td>
</tr>
<tr>
<td>EEE 354</td>
<td>Electric Power Applications</td>
</tr>
<tr>
<td>EEE 355</td>
<td>Energy Conversion Devices</td>
</tr>
<tr>
<td>EEE 408</td>
<td>Photovoltaic Systems</td>
</tr>
<tr>
<td>EEE 454</td>
<td>Power Systems Analysis</td>
</tr>
</tbody>
</table>
Environmental Controls/HVAC 3-4
Choose one from the following:
- ARCH 331 Environmental Controls I
- ARCH 332 Environmental Controls II
- ETME 422 Principles of HVAC I

Building Construction/Design 3-4
Choose one from the following:
- ARCH 241 Building Construction I
- ARCH 340 Building Construction II
- EIND 308 Construction Practice
- ECIV 320 Geotechnical Engineering

Building Information Modeling 2-3
Choose one from the following:
- ARCH 363 Architectural Graphics III
- ECIV 309 Building Information Modeling in Construction
- ETME 309 Building Information Modeling in MEP

Required Pre-Requisite Courses
One of the following: 3
- EGEN 350 Applied Engineering Data Analysis
- EIND 354 Engineering Probability and Statistics I
One of the following: 3
- M 166Q Calculus for Technology II
- M 172Q Calculus II

Recommended Core Elective Courses
One or more of the following:
- BGEN 242D Intro to Int’l Business
- PSYX 100S Intro to Psychology
- SOCI 101S Introduction to Sociology

Required Courses
- EGEN 325 Engineering Economic Analysis 3
- EIND 300 Engineering Management & Ethics 3
- EIND 373 Production Inventory Cost Analysis 3
- EIND 434 Project Management for Engineers 3

Technical Problem Solving Elective
Choose One: 3
- EIND 455 DOE for Engineers
- EIND 457 Regres & Multivar Analysis
- EIND 458 Production & Engineering Mgmt
- EIND 477 Quality Management Systems

Managerial Problem Solving Elective Courses

Choose Two:
- BGEN 361 Principles of Business Law
- BMGT 329 Human Resource Management
- BMGT 406 Negotiation/Dispute Resolution
- BMGT 420 Leadership and Motivation
- BMGT 464 International Management
- ECNS 309 Managerial Economics
- EIND 425 Technology Entrepreneurship
- PSYX 360 Social Psychology
- PSYX 461 Indus & Organiz Psych
- PSYX 481 Judgment & Decision Making
- SOCI 345 Sociology of Organizations
- SOCI 370 Sociology of Globalization

Industrial and Management Systems Engineering

The mission of the undergraduate program in Industrial and Management Systems Engineering (IMSE) is to produce graduates well-grounded in industrial and management systems engineering knowledge and skills consistent with the land-grant mission of MSU. Graduates will be prepared to be productive citizens and contributors to the economic well-being of employers.

The educational objectives for the IMSE program are that Industrial and Management Systems Engineering graduates will:

1. Use industrial and management systems engineering tools and knowledge in their chosen career paths.
2. Employ effective communication.
3. Work in multidisciplinary professional teams.
4. Engage in life-long learning, including post-graduate education for some graduates.
5. Contribute to industry and society, including involvement in professional and other service activities.
6. Design, manage, improve, and integrate systems across a broad range of organizations.
7. Participate in ethical leadership in design and operational activities that contribute to their organization and community.

The undergraduate curriculum in Industrial and Management Systems Engineering (IMSE) includes mathematics, basic sciences, humanities, social sciences, engineering sciences, design, and communication courses distributed over a four-year period. An important feature of the program is to teach students to foster the ability to comprehend, define, and analyze problems; synthesize alternatives; and rationally choose appropriate solutions. This requires a broad technical education that motivates life-long learning to keep pace with technological and social changes.

Industrial and Management Systems Engineering is a broad engineering discipline. IMSEs are “people-oriented problem solvers” who enjoy diversity in their assignments and careers, and are employed in every facet of American business and industry. They are uniquely qualified to analyze a company’s customer needs, relate those to products or services, and examine the flow of materials, processes, people and information to “re-engineer” how people work. IMSE alumni include plant managers, manufacturing engineers, teachers, hospital administrators, consultants, quality assurance managers and engineers, technical sales engineers, production supervisors, and department heads. Today IMSEs are active in all kinds of manufacturing, as well as in service operations such as hospitals,
banks, airlines, transportation and distribution companies, retailers, utilities, and local, state, and federal governments.

The IMSE is an integrator of resources, people, material, and equipment. This is accomplished by designing systems so that the right people with the proper mix of skills, combined with the right quantities of equipment and materials, are available at the right time to produce a product or provide a service at a cost that will allow a profit to be made. Since these professionals frequently work on problem solving teams, the ability to communicate, coordinate, and work with others is essential. These qualities make the Industrial and Management Systems Engineer a valued asset for most any organization.

Graduate Program

Students who have graduated from a four-year degree program which has sharpened their mathematical and communication skills will greatly benefit by completing the Master of Science degree in Industrial & Management Engineering or the Doctor of Philosophy in Engineering with Industrial Engineering option. Emphases in Human Factors/Ergonomics, Service Engineering, and Systems Analysis and Modeling are available. Flexible guidelines permit broadening or customizing to meet career objectives. Further details may be found in the Graduate Catalog.

Student Performance and Retention Requirements

No further requirements apply in order to advance in the Industrial and Management Systems Engineering Program.

Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMX 111US</td>
<td>Introduction to Public Speaking (formerly COM 110US)</td>
<td>3</td>
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<tr>
<td>EIND 101</td>
<td>Introduction to Industrial &amp; Management Systems Engineering</td>
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<tr>
<td>University Core Electives</td>
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<td>6</td>
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<td></td>
</tr>
<tr>
<td>EMEC 103</td>
<td>CAE I-Engineering Graphics Communications</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 171Q</td>
<td>Calculus I</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>EIND 142</td>
<td>Introduction to Systems Engineering</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 220</td>
<td>Physics I (w/ calculus)</td>
<td>4</td>
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<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
<td>3</td>
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<td>CHMY 141</td>
<td>College Chemistry I</td>
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<tr>
<td>M 172Q</td>
<td>Calculus II</td>
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Sophomore Year

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Fall</th>
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<tbody>
<tr>
<td>M 273Q</td>
<td>Multivariable Calculus</td>
<td>4</td>
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<tr>
<td>EGEN 201</td>
<td>Engineering Mechanics--Statics</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 222</td>
<td>Physics II (w/ calculus)</td>
<td>4</td>
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<tr>
<td>EMAT 251</td>
<td>Materials Structures and Prop</td>
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<tr>
<td>University Core Elective</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIND 313</td>
<td>Work Design and Analysis</td>
<td>3</td>
<td></td>
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<tr>
<td>CSCI 127</td>
<td>Joy and Beauty of Data</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>M 221</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>EGEN 205</td>
<td>Mechanics of Materials</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>ETME 215</td>
<td>Manufacturing Processes</td>
<td>3</td>
<td></td>
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<td>Total:</td>
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Junior Year

<table>
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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIND 413</td>
<td>Ergonomics &amp; Human Factors Engineering</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIND 300</td>
<td>Engineering Management &amp; Ethics</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>EIND 354</td>
<td>Engineering Probability and Statistics I</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIND 364</td>
<td>Principles of Operations Research I</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIND 371</td>
<td>Introduction to Computer Integrated Manufacturing</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIND 410</td>
<td>Interaction Design</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EGEN 310R</td>
<td>Multidisciplinary Engineering Design</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EGEN 325</td>
<td>Engineering Economic Analysis</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take one of the following:</td>
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<td>3</td>
<td></td>
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<tr>
<td>EIND 455</td>
<td>DOE for Engineers</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>EIND 457</td>
<td>Regres &amp; Multivar Analysis</td>
<td></td>
<td></td>
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<tr>
<td>EIND 464</td>
<td>Prin of Operations Research II</td>
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<td></td>
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<tr>
<td>EIND 458</td>
<td>Production &amp; Engineering Mgmt</td>
<td>3</td>
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<tr>
<td>Year Total:</td>
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Senior Year

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>EIND 442</td>
<td>Facility and Material Handling Systems Design</td>
<td>3</td>
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<td></td>
</tr>
<tr>
<td>EIND 434</td>
<td>Project Management for Engineers</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIND 422</td>
<td>Introduction to Simulation</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Core Elective</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMSE Cognate Elective</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIND 499R</td>
<td>Industrial Engineering Design Capstone</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIND 477</td>
<td>Quality Management Systems</td>
<td>3</td>
<td></td>
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<tr>
<td>EGEN 488</td>
<td>Fundamentals of Engineering Exam</td>
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<tr>
<td>University Core Electives</td>
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<tr>
<td>IMSE Cognate Elective</td>
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<tr>
<td>Year Total:</td>
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<tr>
<td>Total Program Credits:</td>
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<td>128</td>
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<td></td>
</tr>
</tbody>
</table>

1 Students exempt from MSU writing requirement may substitute WRIT 201, WRIT 221, UH201, UH202, or add 3 credits to their Industrial and Management Systems Engineering cognate.

2 See IMSE Cognate Policy (http://www.montana.edu/mie/students/advising_forms_spring16/IMSE%20Cognate%20Policy.pdf) for details.

3 Engineering Core Elective: Choose EELE 250, EGEN 202, or EGEN 324.

A minimum of 128 credits is required for graduation; 42 of these credits must be in courses numbered 300 or above.

Materials Minor

Montana State University, Bozeman, offers a non-teaching minor in Materials Science & Engineering called the Minor in Materials. This minor provides courses from a variety of disciplines which are relevant to synergies of science and engineering in polymer, metallic, ceramic, hybrid, and composite materials for both structural and functional application. The minor requires a minimum of 32 credits comprised of 14 credits of required coursework (or equivalent) followed by 18 credits of elective coursework. EMAT 350 Engineering Materials is the cornerstone, foundational course for the Minor in Materials and is a required core class.
Students seeking the Minor in Materials must satisfy the core and additional course requirements, 32 credits total, as outlined below:

**Required Pre-requisite Courses**
(credits not counted towards minor):

- M 171Q Calculus I
- M 172Q Calculus II
- PHSX 220 Physics I (w/ calculus)
- PHSX 222 Physics II (w/ calculus)
- CHMY 141 College Chemistry I

**Required Courses**
(or equivalent courses as approved by the certifying officer):

- EMEC 250 Mechanical Engineering Materials 3
- EMAT 252 Materials Struct and Prop Lab 1
- EMAT 350 Engineering Materials 3
- EMEC 320 Thermodynamics I 3
- ETME 215 Manufacturing Processes 3
- ETME 217 Manufacturing Process Laboratory - Mechanical Engineering 1

These pre-requisite courses and required courses represent the core fundamentals of materials science and engineering which are applicable to students in the College of Engineering in addition to Physics and Chemistry. Students pursuing a BS in Engineering or the Physical Sciences will have to take 18 additional course credits (6 courses) out of the list below to obtain a Minor in Materials which may also serve as electives in the student’s major. Other courses may also be approved by the certifying officer with a written request detailing the merit of the course.

**Additional Courses**
Choose six from the following: 18

- CHMY 371 Physical Chemistry-Quantum Chemistry and Spectroscopy I
- CHMY 373 Physical Chemistry - Kinetics and Thermodynamics
- CHMY 401 Advanced Inorganic Chemistry
- ECHM 405 Sustainable Energy
- ECHM 424 Transport Analysis
- ECHM 452 Advanced Engineering Materials
- EMAT 460 Polymetric Materials
- EMAT 461 Friction and Wear of Materials
- EMAT 462 Manufacturing of Composites
- EMAT 463 Composite Materials
- EMAT 464 Biomedical Materials Engineering
- EMAT 550 Failure of Materials
- EMAT 551 Advanced Composite Materials
- EMAT 552 Advanced Ceramics
- EMAT 553 Advanced Composite Materials
- EMEC 444 Mech Behavior of Materials
- EMEC 465 Bio-inspired Engineering
- EMEC 467 Micro-Electromechanical Systems
- EMEC 565 Smart Structures
- PHSX 441 Solid State Physics
- PHSX 442 Novel Mat for Physics/Engineer

Total Credits 32

* Course pre-requisites not included in the lists above do not count towards the 18 credits.

**Mechanical Engineering**

The specific mission of the undergraduate Mechanical Engineering (ME) program is to prepare students for successful mechanical engineering careers, responsible citizenship, and continued intellectual growth. The goal of the program is to produce graduates strong in fundamentals, applications, design, communication, and professional responsibility. The ME undergraduate program is accredited by the Engineering Accreditation Commission of ABET, 415 N. Charles Street, Baltimore, MD, 21201, or by telephone: (410) 347-7700. The educational objectives for the ME program follow.

Mechanical Engineering graduates will:

1. Undertake professional careers
2. Solve problems using engineering skills and methods
3. Regularly communicate using modern tools
4. Work productively in a team environment
5. Acquire new knowledge and skills

The undergraduate Mechanical Engineering program is principally oriented toward career preparation, providing students with the engineering and technical education appropriate to the challenges presented by today’s technologically complex and difficult problems. The coursework in mechanical engineering provides four years of study in mathematics, basic sciences, university core subjects, and engineering topics. The overall curriculum provides an integrated educational experience directed toward the development of an ability to apply pertinent knowledge to the identification and solution of practical problems in mechanical engineering.

The profession of mechanical engineering is very broad, with practitioners employed in most areas of technological and industrial management endeavor. Examples of industrial employers which require mechanical engineering background are: process industries including pulp and paper, steel, aluminum, food, petroleum, chemicals and others; manufacturing industries including highway vehicles, instruments, airplanes, rockets and engines, toys, agricultural machinery, and many others; power plants including steam, nuclear, and hydroelectric plants; federal laboratories performing a wide variety of defense and non-defense related engineering design, analysis, and experimental work; and a wide variety of consulting work including heating, ventilating, and air conditioning system design, and forensic engineering. This brief sample gives a view of the wide spectrum of employment possibilities in mechanical engineering.

It is the mechanical engineer’s responsibility and challenge to conceive, plan, design, and perform analysis and testing related to devices, machines, and systems used by or manufactured by the employer. This work may include liaison with other engineers, engineering technologists, technicians, outside vendors, and departments within the company. Areas of responsibility following design and prototype testing may include direction of a manufacturing line.

It should be evident that career opportunities abound within this very wide array of employers and engineering activities. The job market for engineers often follows the nation’s economy in general. In spite of these natural fluctuations, however, it is expected that our nation will always depend on uses of technology for creating an improved standard of living and a more efficient industrial base to maintain and enhance international competitiveness. Therefore, we can expect that mechanical engineering graduates will have excellent employment opportunities.
Course requirements include mathematics, basic sciences (physics and chemistry), engineering design; arts, diversity, humanities and social sciences; and at least one year of engineering science. The program also includes engineering graphics, statistics, computer application, solid mechanics, materials science, manufacturing processes, thermodynamics, heat transfer, fluid mechanics, electronics, and design of structural, mechanical, and energy systems. Computing and computer applications are stressed throughout the curriculum. The program culminates with a capstone design experience in which the student is involved in a team that must create a solution to a real-world engineering design problem, and develop a working prototype. Often times these teams are multidisciplinary.

Graduate Program
Students who have completed a Bachelor of Science degree in engineering or closely related discipline may take graduate work leading to the Master of Science in Mechanical Engineering, Master of Engineering in Mechanical Engineering, or Doctor of Philosophy in Engineering with Mechanical Engineering or Engineering Mechanics options typical. Advanced degrees are necessary for university teaching and are increasingly important in industry, particularly in the areas of new product development and research. Further details may be found in the Graduate Catalog.

Freshman Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>COMX 111US - Introduction to Public Speaking (formerly COM 110US) or CLS 101US - Knowledge and Community</td>
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<tr>
<td>M 171Q - Calculus I</td>
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<tr>
<td>EMEC 100 - Introduction to Mechanical Engineering</td>
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<tr>
<td>EMEC 103 - CAE I-Engineering Graphics Communications</td>
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<tr>
<td>PHSX 220 - Physics I (w/ calculus)</td>
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<tr>
<td>CHMY 141 - College Chemistry I</td>
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<td>WRIT 111W - College Writing I*</td>
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<td>M 172Q - Calculus II</td>
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<tr>
<td>PHSX 222 - Physics II (w/ calculus)</td>
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Sophomore Year

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<tr>
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<tbody>
<tr>
<td>EGEN 201 - Engineering Mechanics--Statics</td>
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<tr>
<td>EMEC 203 - CAE II-Mechanical Engineering Computations</td>
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<td></td>
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<tr>
<td>EMEC 250 - Mechanical Engineering Materials</td>
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<td></td>
</tr>
<tr>
<td>EMAT 252 - Materials Struct and Prop Lab</td>
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<tr>
<td>M 273Q - Multivariable Calculus</td>
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<td>University Core Electives</td>
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<tr>
<td>EGEN 202 - Engineering Mechanics -- Dynamics</td>
<td>3</td>
<td></td>
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<tr>
<td>EGEN 205 - Mechanics of Materials</td>
<td>3</td>
<td></td>
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<tr>
<td>M 274 - Introduction to Differential Equation</td>
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<td>ETME 215 - Manufacturing Processes</td>
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<tr>
<td>ETME 216 - Manufacturing Process Laboratory</td>
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<tr>
<td>EELE 250 - Circuits, Devices and Motors</td>
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<td>Year Total:</td>
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Junior Year

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<tr>
<th>Credits</th>
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<tbody>
<tr>
<td>EGEN 335 - Fluid Mechanics</td>
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<tr>
<td>EMEC 303 - CAE III-- Systems Analysis</td>
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<td></td>
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<tr>
<td>EMEC 320 - Thermodynamics I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EMEC 341 - Adv Mechanics of Materials</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EGEN 350 - Applied Engineering Data Analysis</td>
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<td></td>
</tr>
<tr>
<td>EMEC 321 - Thermodynamics II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EMEC 326 - Fundamentals of Heat Transfer</td>
<td>3</td>
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<td>EMEC 342 - Mech Component Design</td>
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<td>EMEC 360 - Measurement &amp; Instrumentation</td>
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<td>EMEC 361 - Measurement &amp; Instrument Lab</td>
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<tr>
<td>EGEN 310R - Multidisciplinary Engineering Design</td>
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Senior Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>EGEN 330 - Business Fundamentals for Technical Professionals</td>
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<tr>
<td>EMEC 445 - Mechanical Vibrations</td>
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<tr>
<td>EMEC 489R - Mech Eng Design Capstone I</td>
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<td>Professional Electives2</td>
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<td>EMEC 499R - Mech Eng Design Capstone II</td>
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<td>EGEN 488 - Fundamentals of Engineering Exam</td>
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<tr>
<td>Professional Electives2</td>
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<tr>
<td>Professional Elective - Take one of the following:</td>
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<tr>
<td>EMEC 405 - Finite Element Analysis</td>
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<tr>
<td>EMEC 436 - Computational Fluid Dynamics</td>
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<td>University Core Electives</td>
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<td>Year Total:</td>
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<td>Total Program Credits:</td>
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Approved ME Professional Elective Courses

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<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>BCH 441</td>
<td>Biochemistry of Macromolecules</td>
<td>3</td>
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<tr>
<td>BIOL 425</td>
<td>Adv Cell &amp; Molecular Biology</td>
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<tr>
<td>EBIO 461</td>
<td>Principles of Biomedical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ECHM 424</td>
<td>Transport Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EELE 321</td>
<td>Intro To Feedback Controls</td>
<td>3</td>
</tr>
<tr>
<td>EELE 371</td>
<td>Microprocess HW and SW Systems</td>
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</tr>
<tr>
<td>EGEN 415</td>
<td>Advanced Mechanics of Solids</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 435</td>
<td>Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EIND 313</td>
<td>Work Design and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EIND 410</td>
<td>Interaction Design</td>
<td>3</td>
</tr>
<tr>
<td>&amp; EIND 411</td>
<td>and Interaction Design Project</td>
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<tr>
<td>EIND 413</td>
<td>Ergonomics &amp; Human Factors Engineering</td>
<td>3</td>
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<tr>
<td>EIND 425</td>
<td>Technology Entrepreneurship</td>
<td>3</td>
</tr>
<tr>
<td>EIND 434</td>
<td>Project Management for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>EMAT 350</td>
<td>Engineering Materials</td>
<td>3</td>
</tr>
<tr>
<td>EMAT 460</td>
<td>Polymeric Materials</td>
<td>3</td>
</tr>
<tr>
<td>EMAT 461</td>
<td>Friction and Wear of Materials</td>
<td>3</td>
</tr>
<tr>
<td>EMAT 462</td>
<td>Manufacturing of Composites</td>
<td>3</td>
</tr>
<tr>
<td>EMAT 463</td>
<td>Composite Materials</td>
<td>3</td>
</tr>
<tr>
<td>EMAT 464</td>
<td>Biomedical Materials Engineering</td>
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</tr>
<tr>
<td>EMEC 403</td>
<td>CAE IV--Design Integration</td>
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</tr>
<tr>
<td>EMEC 405</td>
<td>Finite Element Analysis</td>
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</table>
The educational objectives of the MET program follow.

The MET program seeks to produce graduates with a foundation in engineering fundamentals, applications, design, problem recognition and solution, project management, communication, and professional and ethical responsibility. The MET undergraduate program is accredited by the Engineering Technology Accreditation Commission of ABET, 415 N. Charles Street, Baltimore, MD, 21201, or by telephone: (410) 347-7700. The educational objectives of the MET program follow.

The undergraduate Mechanical Engineering Technology program is designed with an applications-oriented structure. Many of the technical science courses have an accompanying laboratory component providing hands-on activities. Coursework emphasizes mechanical design, measurement, data collection and analysis, documentation, and written/oral report preparation/presentation.

The program aims to develop core competencies in engineering fundamentals (statics, strengths of materials, materials science, fluid dynamics, and electrical circuits), manufacturing applications (manufacturing processes, machining, welding, design for manufacturing and tooling, and quality assurance), mechanical design (computer-aided design, mechanisms, machine design, fluid power technology, measurement and test, etc.), and thermal sciences (thermodynamics, heat transfer, and heating, ventilation, and air conditioning). Extensive course work in the physical sciences and Mathematics is included.

Technical elective courses are chosen by the student in consultation with an academic advisor. Core coursework includes offerings such as humanities, arts, and social sciences. The overall curriculum is designed to provide the student with an ability to apply scientific and engineering knowledge and methods combined with technical skills in support of engineering activities.

Mechanical engineering technology (MET) is concerned with the application of scientific and engineering knowledge in support of engineering activities. Specifically, the mechanical engineering technologist provides the professional services needed in transforming the results of scientific endeavors into useful products and services. Students who choose a career in mechanical engineering technology may pursue any number of career paths including, but not limited to: machine and product design, product and system evaluation, research laboratory experimental support, prototype evaluation, plant operation and management, quality assurance, technical sales, manufacturing methods improvement, HVAC systems design and installation, project management, and energy exploration.

The mechanical engineering technologist is equipped to perform analysis and planning steps to convert ideas into finished products, in the most efficient and safe manner. He or she may be the professional who produces computer models, design drawings, sets up and operates manufacturing equipment, handles inspections, analyzes production problems, and manages the implementation of product realization and product improvement activities.

The demand for the mechanical engineering technologists continues to be strong. Average starting salaries are very competitive, and indications are that this trend will continue. MSU Mechanical Engineering Technology graduates are actively recruited, and many of our alumni hold positions of considerable responsibility in industry and government.

### Student Performance and Retention Requirements

No further requirements apply in order to advance in the Mechanical Engineering Technology program.

#### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHMY 121IN - Introduction to General Chemistry</td>
<td>4</td>
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<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>M 165Q - Calculus for Technology I</td>
<td>3</td>
</tr>
<tr>
<td>ETME 100 - Introduction to Mechanical Engineering Technology</td>
<td>1</td>
</tr>
</tbody>
</table>

Mechanical Engineering Technology

The mission of the Mechanical Engineering Technology (MET) program is to prepare students for successful Mechanical Engineering Technology careers, responsible citizenship, and continued professional growth. The MET program seeks to produce graduates with a foundation in engineering fundamentals, applications, design, problem recognition and resolution, project management, communication, and professional and ethical responsibility. The MET undergraduate program is accredited by the Engineering Technology Accreditation Commission of ABET, 415 N. Charles Street, Baltimore, MD, 21201, or by telephone: (410) 347-7700.

The educational objectives of the MET program follow.

The Mechanical Engineering Technology program strives to prepare graduates who:

- Successfully establish themselves as professionals within a diverse range of engineering technology activities
- Conduct themselves ethically in all activities
- Contribute to industry and society, through service activities and professional organizations
- Advance in their profession, maintain currency within the profession, and demonstrate leadership qualities

The demand for the mechanical engineering technologists continues to be strong. Average starting salaries are very competitive, and indications are that this trend will continue. MSU Mechanical Engineering Technology graduates are actively recruited, and many of our alumni hold positions of considerable responsibility in industry and government.
University Core Electives 6
COMX 111US - Introduction to Public Speaking (formerly COM 110US) 3
or CLS 101US - Knowledge and Community or US 101US - First Year Seminar 3
M 166Q - Calculus for Technology II 3
EMEC 103 - CAE I-Engineering Graphics Communications 2
PHSX 205 - College Physics I 4
University Core Electives 3
Year Total: 17 15

**Sophomore Year**

<table>
<thead>
<tr>
<th>Fall</th>
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<tbody>
<tr>
<td>Business Elective 2</td>
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<tr>
<td>EMEC 250 - Mechanical Engineering Materials</td>
<td>3</td>
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<tr>
<td>EMAT 252 - Materials Strut and Prop Lab</td>
<td>1</td>
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<tr>
<td>EGEN 203 - Applied Mechanics</td>
<td>3</td>
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<td>ETME 202 - Mechanical Engineering Technology Computer Applications</td>
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<td>PHSX 207 - College Physics II</td>
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<td>EGEN 208 - Applied Strength of Materials</td>
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<td>ETME 215 - Manufacturing Processes</td>
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<tr>
<td>ETME 216 - Manufacturing Process Laboratory</td>
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<td>EGEN 324 - Applied Thermodynamics</td>
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<td>ETME 203 - Mechanical Design Graphics</td>
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<td>ELEE 250 - Circuits, Devices and Motors</td>
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<table>
<thead>
<tr>
<th>Spring</th>
<th>Credits</th>
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**Junior Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EGEN 331 - Applied Mechanics of Fluids</td>
<td>3</td>
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<td>EGEN 350 - Applied Engineering Data Analysis</td>
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<td>EMEC 360 - Measurement &amp; Instrumentation</td>
<td>3</td>
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<tr>
<td>EMEC 361 - Measurement &amp; Instrument Lab</td>
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<tr>
<td>ETME 310 - Machining and Industrial Safety</td>
<td>3</td>
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<td>ETME 340 - Mechanisms</td>
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<td>EGEN 310R - Multidisciplinary Engineering Design</td>
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<td>ETME 303 - CAE Tools in Mechanical Design</td>
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<td>ETME 321 - Applied Heat Transfer</td>
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<td>ETME 311 - Joining Processes</td>
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<td>ETME 341 - Machine Design</td>
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<table>
<thead>
<tr>
<th>Spring</th>
<th>Credits</th>
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<td>Year Total: 16 16</td>
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**Senior Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EGEN 325 - Engineering Economic Analysis or EGEN 330 - Business Fundamentals for Technical Professionals</td>
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<td>ETME 422 - Principles of HVAC I</td>
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<td>ETME 424 - Thermal Processes Lab</td>
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<td>ETME 489 - Capstone: Mechanical Engineering Technology Design I Professional Electives 3</td>
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<td>ETME 415 - Design for Manufacturing and Tooling</td>
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<td>ETME 499R - Capstone: Mechanical Engineering Technology Design II</td>
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Total Program Credits: 126

### Pre-Approved MET Professional Elective Courses:

<table>
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<tr>
<td>EGEN 365</td>
<td>Introduction to Mechatronics</td>
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<tr>
<td>EIND 300</td>
<td>Engineering Management &amp; Ethics</td>
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<td>EIND 313</td>
<td>Work Design and Analysis</td>
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<tr>
<td>EIND 371</td>
<td>Introduction to Computer Integrated Manufacturing</td>
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<tr>
<td>EIND 373</td>
<td>Production Inventory Cost Analysis</td>
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<td>EIND 410</td>
<td>Interaction Design</td>
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<tr>
<td>&amp; EIND 411</td>
<td>and Interaction Design Project</td>
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<tr>
<td>EIND 413</td>
<td>Ergonomics &amp; Human Factors Engineering</td>
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<tr>
<td>EIND 425</td>
<td>Technology Entrepreneurship</td>
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<td>EIND 434</td>
<td>Project Management for Engineers</td>
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<td>EIND 477</td>
<td>Quality Management Systems</td>
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<td>EMAT 350</td>
<td>Engineering Materials</td>
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<td>EMAT 461</td>
<td>Friction and Wear of Materials</td>
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<tr>
<td>EMAT 462</td>
<td>Manufacturing of Composites</td>
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<tr>
<td>EMAT 463</td>
<td>Composite Materials</td>
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<td>EMAT 464</td>
<td>Biomedical Materials Engineering</td>
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<td>Mech Behavior of Materials</td>
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<td>EMEC 447</td>
<td>Aircraft Structures</td>
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<td>Bio-inspired Engineering</td>
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<td>EMEC 467</td>
<td>Micro-Electromechanical Systems</td>
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<td>ETME 309</td>
<td>Building Information Modeling in MEP</td>
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<tr>
<td>&amp; ETME 327</td>
<td>and Commercial Building Energy Assessment Lab</td>
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<td>EIND 410</td>
<td>Computerized Numerical Control and Computer-aided Manufacturing Technology</td>
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<td>ETME 423</td>
<td>Principles of HVAC II</td>
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<td>ETME 430</td>
<td>Fluid Power Systems Design</td>
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<td>ETME 460</td>
<td>Advanced Instrumentation</td>
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<td>ETME 462</td>
<td>Industrial Processing Automation and Controls</td>
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<td>ETME 470</td>
<td>Renewable Energy Applications</td>
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<td>ETME 499R</td>
<td>Undergraduate Research 1-6</td>
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<tr>
<td>ETME 492</td>
<td>Independent Study 1-3</td>
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<tr>
<td>ETME 498</td>
<td>Internship 1-12</td>
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</tbody>
</table>

1 Students exempt from MSU writing requirement must still complete a 3 credit writing intensive course. See MIE Writing Policy (http://www.montana.edu/mie/students/advising_forms/documents/Advising_Forms_All_Terms/Writing%20Exemption%20Policy%202016-17.pdf).

2 Business Elective: Choose ACTG 201, ACTG 220, BGEN 204, BGEN 210, BMGT 241, ECNS 132, ECNS 202, or ECNS 204IS.

3 See MET PE Policy (http://www.montana.edu/mie/students/advisee_forms/documents/SummerFall2018/MET%20PE%20Policy%202018.pdf) for details.

A minimum of 126 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.
The College of Engineering offers a non-teaching minor in Mechatronics. The field of Mechatronics combines the principles of mechanical engineering with the principles of electronic instrumentation and computerized control. Mechatronics exploits the synergy of mechanical and electrical engineering to design unique and innovative electromechanical products, machines, robots, tools, and manufacturing processes.

The minor requires a minimum of 31 credits in specified subject areas: computer science, engineering mechanics, mechanical engineering, and electrical and computer engineering (see tables below).

Core Subject Areas
Courses listed for each subject area must be completed to earn the Mechatronics Minor.

### Mechatronics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>EGEN 365</td>
<td>Introduction to Mechatronics</td>
<td>3</td>
</tr>
<tr>
<td>EELE 261</td>
<td>Intro To Logic Circuits</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 127</td>
<td>Joy and Beauty of Data</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 111</td>
<td>Programming with Java I</td>
<td></td>
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<tr>
<td>CSCI 112</td>
<td>Programming with C I</td>
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<tr>
<td>EEE 321</td>
<td>Intro To Feedback Controls</td>
<td>3</td>
</tr>
<tr>
<td>EEE 317</td>
<td>Electronics</td>
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<tr>
<td>EEE 250</td>
<td>Circuits, Devices and Motors</td>
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<tr>
<td>EGEN 201</td>
<td>Engineering Mechanics -- Statics</td>
<td>3</td>
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<tr>
<td>EGEN 203</td>
<td>Applied Mechanics</td>
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<td>EGEN 202</td>
<td>Engineering Mechanics -- Dynamics</td>
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<tr>
<td>ETME 340</td>
<td>Mechanisms</td>
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<tr>
<td>EGEN 205</td>
<td>Mechanics of Materials</td>
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<tr>
<td>EGEN 208</td>
<td>Applied Strength of Materials</td>
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<tr>
<td>EEE 371</td>
<td>Microprocessor HW and SW Systems</td>
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<tr>
<td>CSCI 232</td>
<td>Data Structures and Algorithms</td>
<td></td>
</tr>
<tr>
<td>CSCI 361</td>
<td>Computer Architecture</td>
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</tr>
</tbody>
</table>

Total credits for Mechatronics Minor: 31

Students must receive a grade of "C-" or better in all required courses for the Mechatronics Minor.

### Military Science - Air Force ROTC

The development and preparation of future Air Force officers is provided through the Air Force Reserve Officer Training Corps (AFROTC) program. AFROTC is a voluntary elective which offers a four-year, a three-year, and a two-year program. All credits offered by the department may be counted as general electives toward completion of the requirements in other curricula. Students completing the program attend Field Training between their sophomore and junior years. Students not pursuing a commission in the Air Force may still enroll in any of the academic classes. These students do not wear the uniform or attend leadership lab; however, course materials are still provided at no cost.

The Air Force ROTC program has three general parts or elements:

1. The General Military Course (GMC) consists of one hour per week of classroom instruction, two hours per week of physical fitness, and two hours per week of leadership lab. For non-scholarship students, there is no military obligation during the GMC. For scholarship students, there is no obligation during the first year of the GMC. All students are furnished textbooks, uniforms, and equipment. The GMC is open to any student. Registration is the same as for other courses. Aptitude tests, physical fitness tests, and physical exams are given by the fall semester of the sophomore year for those who wish to compete for the Professional Officer Course or for a scholarship.

2. Field Training is scheduled during the summer months, normally between the sophomore and junior years. All Cadets must complete field training prior to entry into the POC. Cadets who wish to commission and are qualified will attend Field Training on an active Air Force base. Transportation to and from camp, meals and housing are furnished.

3. The two-year Professional Officer Course or POC (the advanced program) is designed to qualify designated cadets for a commission in the United States Air Force. The primary purpose of the Professional Officer Course is to provide education which will develop a knowledge of the Air Force, as well as skills and attitudes vital to the professional Air Force officer. Cadets practice communication techniques through cadet-led and cadet-centered seminars. The course consists of three hours of classroom instruction per week, two hours per week of physical fitness, and three hours per week of leadership lab. All cadets in the POC are contracted with the U.S. Air Force. If not on scholarship, the cadet will still receive the monthly stipend. Uniforms and course materials are furnished.

### Air Force ROTC College Scholarships

Three to four-year scholarships are awarded to qualified, selected cadets. All scholarships cover full tuition, fees, and provide a yearly allowance for books. Scholarship recipients also receive a non-taxable subsistence allowance that increases each year from the Freshman through the Senior year. Numerous majors are recognized as five-year programs and are eligible for extended scholarship benefits. Prospective applicants are encouraged to contact the Department of Military Aerospace Studies anytime to discuss options available. The most current information is available at www.montana.edu/wwa or http://afrotc.com.

### In College Scholarship Program

The ICSP offers 2.5 to 3.5 year scholarships to qualified college freshmen and sophomores in any major. Apply through the Air Force ROTC detachment. Selections take place in the spring for students enrolled in Air Force ROTC and in July for students not enrolled in Air Force ROTC. Please visit http://afrotc.com for the most current information on ICSP opportunities.

### Active Duty Obligation

Applying for an Air Force ROTC scholarship does not obligate a student in any way. Four-year scholarship recipients do not incur any obligation until the start of the sophomore year in college. There is no active duty obligation for enrolling in either the freshman or sophomore AFROTC courses. Students who complete the Air Force ROTC program and receive a commission incur a four-year active duty commitment. Flying officers serve additional commitments from the time they complete pilot training.
Army ROTC Scholarships and Financial Assistance

Army ROTC scholarships for two, three and four years are awarded on a competitive basis to the best qualified students who apply.

Four-year scholarships are awarded to students who will be entering college as freshmen. Based on the availability of scholarships, three- and two-year scholarships are awarded to students already enrolled in college.

Each scholarship covers tuition and fees, a specified amount for textbooks, supplies and equipment, plus an allowance of $2,800 to $5,400 for every year the scholarship is in effect.

Special consideration for an Army ROTC scholarship is given to students pursuing degrees in nursing, engineering, the physical sciences, and other technical skills in demand by the Army. Students who receive a scholarship must earn an undergraduate degree in the field in which the scholarship is awarded.
High Technology in Today’s Army

Today’s Army offers students the opportunity to learn valuable cutting-edge technology skills. Army careers in such fields as aviation, advanced electronics, laser technology, and computer programming are available to students who can accept the challenge of working within a rapidly changing technological environment. In the Army, students learn from experts and gain first-hand experience working with some of the most sophisticated equipment available.

Students who complete ROTC training and receive a degree in a high-tech area can look forward to an important career experience in the Army and a solid future in the world of rapidly expanding technology.

Minor in Military Studies

Choose four of the following: 6-8

- MAS 110 Foundations of The Air Force I
- MAS 111 Foundations of The Air Force II
- MAS 210 The Employment of Air and Space Power I
- MAS 211 The Employment of Air and Space Power II
- MSL 101 Leadership and Personal Development
- MSL 102 Intro to Tactical Leadership
- MSL 201 Innovative Team Leadership
- MSL 202 Found of Tactical Leadership

Choose five of the following: 15

- MAS 310 Air Force Leadership and Management I
- MAS 311 Air Force Leadership and Management II
- MAS 410 National Security Affairs/Preparation for Active Duty I
- MAS 411 National Security Affairs/Preparation for Active Duty II
- MSL 301 Adaptive Team Leadership
- MSL 302 Applied Team Leadership
- MSL 401 Adaptive Leadership
- MSL 402 Leadership in a Complex World

Total Credits 24-29

* If a student is not accepted into MAS 309 or MSL 305 by the respective military service, the student can substitute an additional upper division course along with MSL 106, physical fitness training.

College of Letters and Science

Nicol C. Rae, Dean
Bridget Kevane, Associate Dean
David Cherry, Associate Dean

The College of Letters and Science, offering nearly 50 majors and 25 minors for undergraduates, is the largest and most diverse college at MSU. Its fifteen departments, representing the four areas of the humanities, natural sciences, mathematics and social sciences, share a commitment to helping students think critically and solve problems, communicate clearly, understand various disciplines and cultures, and develop the engagement that will make them life-long learners and leaders.

College of Letters and Science faculty members are well-known for their contributions to their fields, and have an impressive record for winning competitive national grants to support research and scholarship. Letters and Science undergraduates benefit from numerous opportunities to work side-by-side with faculty on original research and scholarship, an experience that is elsewhere often available only to graduate students.

The following baccalaureate degrees are offered in the College of Letters and Science:

- B.A. in American Studies (p. 189)
- B.A. in Asian Studies (p. 191)
- B.S. in Anthropology (p. 193)
- B.S. in Biological Sciences (p. 82)
- B.S. in Cell Biology and Neuroscience (p. 194)
- B.S. in Chemistry and Biochemistry (p. 195)
- B.S. in Earth Sciences (p. 201)
- B.S. in Economics (p. 213)
- B.A. in English (p. 215)
- B.A. in History (p. 218)
- B.A. in Liberal Studies (p. 224)
- B.S. in Mathematics (p. 230)
- B.S. in Microbiology (p. 235)
- B.A. in Modern Languages and Literatures (p. 242)
- B.A. in Philosophy (p. 249)
- B.S. in Physics (p. 251)
- B.A. in Political Science (p. 254)
- B.S. in Psychology (p. 257)
- B.S. in Sociology (p. 258)

Non-degree program

- Pre-Medical/Pre-Health Professions (p. 256)
- Pre-Veterinary Program (p. 100)

In addition to various options within each degree, and minors in most of the areas listed above, the college administers the following minors:

- Minor in Astrobiology (p. 208)
- Minor in China Studies (p. 243)
- Minor in Genetics (p. 95)
- Minor in Global Studies (p. 228)
- Minor in Japan Studies (p. 245)
- Minor in Museum Studies (p. 222)
- Minor in Native American Studies (p. 248)
- Minor in Optics (p. 178)
- Minor in Water Resources (p. 207)
- Minor in Women’s, Gender, and Sexuality Studies (p. 260)

The selection of a minor provides students the opportunity to have a recognized second area of concentration.

American Studies

The American Studies program is designed to meet the needs of students, including non-traditional majors and lifelong learners, who want to pursue a flexible, multi-disciplinary curriculum in American Studies. Students explore the experiences and values of the people of the United States as embodied in their history, literature, art, and other forms of cultural expression. All students are required to choose one of three program focus areas: American Arts, American History, or American Literature.

Students must complete a minimum of 45 credits in the program after declaring themselves to be American Studies majors. Up to 12 credits required in a minor or in a second-degree program may be applied toward...
the American Studies degree requirements. Courses taken to complete requirements in the American Studies program may also be used to satisfy University Core requirements.

For details about the American Studies degree, please email amerstudies@montana.edu, call 406-994-4247, or check the American Studies website (http://www.montana.edu/americanstudies)

**Foundation Courses**

All students, regardless of program focus area, must complete the following courses:

**Freshman Year**

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMST 101D - Introduction to American Studies</td>
<td>3</td>
</tr>
<tr>
<td>NASX 105D - Introduction to Native American Studies</td>
<td>3</td>
</tr>
<tr>
<td>or AMST 202RA - The Arts in America</td>
<td></td>
</tr>
<tr>
<td>1 Year Foreign Language Courses</td>
<td>6</td>
</tr>
<tr>
<td>History Option - History Concentration Students Must take all 3</td>
<td></td>
</tr>
<tr>
<td>HSTA 101IH - American History I</td>
<td>4</td>
</tr>
<tr>
<td>or HSTA 102IH - American History II</td>
<td></td>
</tr>
<tr>
<td>or HSTA 160D - Introduction to the Am West</td>
<td></td>
</tr>
<tr>
<td>CORE Elective</td>
<td>6</td>
</tr>
<tr>
<td>Advisor Approved Electives</td>
<td>9</td>
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<tr>
<td>Year Total:</td>
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</table>

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credits</th>
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<tbody>
<tr>
<td>LIT 214D - Regional Literature</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 210IS - Introduction to American Government</td>
<td>3</td>
</tr>
<tr>
<td>AMST 201IH - American Identity, American Dreams</td>
<td>3</td>
</tr>
<tr>
<td>Arts Option- Art Concentration Students must take both</td>
<td></td>
</tr>
<tr>
<td>AMST 202RA - The Arts in America</td>
<td>3</td>
</tr>
<tr>
<td>or MUSI 203IA - American Popular Music</td>
<td></td>
</tr>
<tr>
<td>CORE Elective</td>
<td>6</td>
</tr>
<tr>
<td>Advisor Approved Elective</td>
<td>12</td>
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<tr>
<td>Year Total:</td>
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</table>

**Junior Year**

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Literature Option - Literature Concentration Students must take all 3</td>
<td></td>
</tr>
<tr>
<td>LIT 308 - Multicultural Literature</td>
<td>3</td>
</tr>
<tr>
<td>or LIT 310 - American Literature to 1900</td>
<td></td>
</tr>
<tr>
<td>or LIT 311 - American Literature after 1900</td>
<td></td>
</tr>
<tr>
<td>Upper Division AMST Elective</td>
<td>3</td>
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<tr>
<td>CORE Elective</td>
<td>6</td>
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<td>Advisor Approved Elective</td>
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<tr>
<td>Year Total:</td>
<td>30-36</td>
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**Senior Year**

<table>
<thead>
<tr>
<th>Course Description</th>
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<tr>
<td>AMST 401 - Seminar in American Studies</td>
<td>4</td>
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<tr>
<td>CORE Elective</td>
<td>3-6</td>
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<tr>
<td>Advisor Approved Elective</td>
<td>24</td>
</tr>
<tr>
<td>Year Total:</td>
<td>31-34</td>
</tr>
</tbody>
</table>

**Capstone Experience**

All students in the major take a common 4-credit capstone course in their final year (AMST 401 Seminar in American Studies). Students will work together in small groups to design solutions to contemporary issues in American society (e.g., immigration). Each small-group project will result in a scholarly product (typically a paper or presentation) that will serve as a measurable indication of the extent to which students have mastered the critical thinking, reading, writing, and oral communication skills that are the principal learning objectives of the program.

**American Studies Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>AMST 301</td>
<td>Reproduction in America</td>
<td>3</td>
</tr>
<tr>
<td>ANTY 332</td>
<td>Native North America</td>
<td>3</td>
</tr>
<tr>
<td>ANTY 351</td>
<td>Archaeology of North America</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 430</td>
<td>19th Century Art</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 440</td>
<td>20th Century Art</td>
<td>3</td>
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<tr>
<td>ECNS 372</td>
<td>Economic History of US</td>
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</tr>
<tr>
<td>GPHY 325</td>
<td>Cultural Geography</td>
<td>3</td>
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<tr>
<td>GPHY 431</td>
<td>Historical Geography</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 311</td>
<td>Early America</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 315</td>
<td>The Age of Jefferson and Jackson: The Early American Republic</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 316</td>
<td>American Civil War Era</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 318</td>
<td>Origins of Modern America: From the Civil War to WWII</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 322</td>
<td>Am History: WWII to Present</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 320</td>
<td>Birth of Modern US: 1865-1945</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 402</td>
<td>Sex and Sexuality in America</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 406</td>
<td>McCarthy/Ike/Truman</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 407</td>
<td>Gender in US &amp; Canadian West</td>
<td>3</td>
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<tr>
<td>HSTA 408</td>
<td>Gender in America</td>
<td>3</td>
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<tr>
<td>HSTA 409</td>
<td>Food in America</td>
<td>3</td>
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<tr>
<td>HSTA 412IH</td>
<td>American Thought and Culture</td>
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</tr>
<tr>
<td>HSTA 416</td>
<td>Race and Class in America</td>
<td>3</td>
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<tr>
<td>HSTA 450</td>
<td>History of American Indians</td>
<td>3</td>
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<tr>
<td>HSTA 460</td>
<td>Montana and the West</td>
<td>3</td>
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<tr>
<td>HSTA 464</td>
<td>Trans-Mississippi West</td>
<td>3</td>
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<tr>
<td>HSTA 468</td>
<td>History of Yellowstone</td>
<td>3</td>
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<tr>
<td>HSTA 470</td>
<td>American Environmental History</td>
<td>3</td>
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<tr>
<td>HSTA 482</td>
<td>History of American Technology</td>
<td>3</td>
</tr>
<tr>
<td>HSTR 372</td>
<td>The World at War</td>
<td>3</td>
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<tr>
<td>LIT 308</td>
<td>Multicultural Literature</td>
<td>3</td>
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<tr>
<td>LIT 310</td>
<td>American Literature to 1900</td>
<td>3</td>
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<td>LIT 311</td>
<td>American Literature after 1900</td>
<td>3</td>
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<td>LIT 335</td>
<td>Women and Literature</td>
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<td>LIT 431RH</td>
<td>Studies in Major Authors</td>
<td>3</td>
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<td>MUSI 130IA</td>
<td>History of Jazz</td>
<td>3</td>
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<tr>
<td>NASX 304</td>
<td>Native American Beliefs and Philosophy</td>
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<tr>
<td>NASX 310</td>
<td>Native Cultures of North America</td>
<td>3</td>
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<td>NASX 340</td>
<td>Native American Literature</td>
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</tr>
<tr>
<td>NASX 360</td>
<td>Native Americans and Cinema</td>
<td>3</td>
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<tr>
<td>NASX 340</td>
<td>American Indian Education</td>
<td>3</td>
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<td>NASX 476</td>
<td>American Indian Policy and Law</td>
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<tr>
<td>PHL 305</td>
<td>Contemporary Philosophy</td>
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<tr>
<td>PHL 328</td>
<td>Philosophy and Film</td>
<td>3</td>
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<tr>
<td>PHL 351</td>
<td>Philosophy and Feminism</td>
<td>3</td>
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<tr>
<td>PHL 354</td>
<td>Philosophy of Race</td>
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</tr>
<tr>
<td>PHOT 303</td>
<td>Early History of Photography</td>
<td>3</td>
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<tr>
<td>PHOT 304</td>
<td>Recent History of Photography</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 302</td>
<td>Media &amp; Politics</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 306</td>
<td>Legislative Process</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 323</td>
<td>Modern Political Thought</td>
<td>3</td>
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Total Program Credits: 122-131
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>PSCI 341</td>
<td>Political Parties and Elections</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 346</td>
<td>American Presidency</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 444</td>
<td>Congressional Campaign</td>
<td>3</td>
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<tr>
<td>PSCI 451</td>
<td>State and Local Government Policy Making</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 454</td>
<td>Cinema and Political Theory</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 471</td>
<td>American Constitutional Law</td>
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<tr>
<td>PSYX 335</td>
<td>Psychology of Gender</td>
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<tr>
<td>PSYX 462</td>
<td>Psychology of Prejudice</td>
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<tr>
<td>RLST 220H</td>
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<tr>
<td>SOCI 308</td>
<td>Becoming an Adult in America</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 320</td>
<td>Sociology of Religion</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 325</td>
<td>Social Stratification</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 326</td>
<td>Sociology of Gender</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 333</td>
<td>Sociology of Education</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 340</td>
<td>Social Movements</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 344</td>
<td>Sociology of Race &amp; Ethnicity</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 345</td>
<td>Sociology of Organizations</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 359</td>
<td>Crime, Justice and Media</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 425</td>
<td>Victims and Society</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 435</td>
<td>Law and Society</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 436</td>
<td>Law and Inequality</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 470</td>
<td>Environmental Sociology</td>
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</tr>
<tr>
<td>SOCI 485</td>
<td>Political Sociology</td>
<td>3</td>
</tr>
<tr>
<td>WGSS 378</td>
<td>LGBTQ Studies</td>
<td>3</td>
</tr>
<tr>
<td>WGSS 454</td>
<td>The Study of Men &amp; Masculinity</td>
<td>3</td>
</tr>
</tbody>
</table>

American Studies offers the degrees of Master of Arts and Doctor of Philosophy, with a special focus on the American West. Major fields include American Arts, American History, American Literature, American Pluralism, and Public History.

- Ph.D. of Philosophy in American Studies (p. 366)
- M.A. of Arts in American Studies (p. 367)

**Bachelor of Arts in Asian Studies**

In order to provide students with the skills needed in a globalized world that increasingly pivots on Asia, Montana State University offers an interdisciplinary Asian studies major. Students choose a language to study, and have latitude to take content courses that focus on a given region within Asia, or to spread their coursework over the continent.

**Core Asian Studies Requirements. Take three of the following (9-12 credits).**

- ANTY 242D Contemporary Japan
- CHIN 130D Historical and Literary Journey into Modern China
- CHIN 211D Chinese Culture & Civilization
- HSTR 135D The Modern Middle East
- HSTR 140D Modern Asia
- HSTR 145D Reinventing Japan
- JPNS 150D Japanese Culture & Civ
- PHL 270 Philosophies of Asia
- RLST 203D Buddhist Traditions

**Asian Language Requirement (12-16 credits). Take any 101-202D sequence. All courses must be taken in the same language.**

- ARAB 101 Elementary Modern Arabic I

**Upper-Division Electives. Take six of the following (18 credits).**

- ANTY 337 Sex, Gender, Sexuality Japan
- ANTY 343 Popular Culture - Japan
- ANTY 441 Social Movements in Japan
- ARTH 360 History of Asian Art and Architecture
- CHIN 320IH History of Chinese Cinema
- GPHY 446 East Asia in the Global System
- HSTR 340 Age of the Shoguns
- HSTR 342 Japan’s Meiji Revolution
- HSTR 345 Modern China
- HSTR 359 Russia to 1917
- HSTR 366 Middle East/20th Century
- HSTR 375 Eurasian Borderlands
- HSTR 407 Soviet Union: Rise & Fall
- HSTR 443 Gender in Asia
- HSTR 444 Gender in Japan
- HSTR 445 Environ, Health & Sci in Japan
- HSTR 448 Tradition and Reform in China
- JPNS 305 Japanese Adv Conversations
- JPNS 320 Classical Japanese Literature
- JPNS 321 Modern Japanese Literature
- JPNS 325IH Outcast Literature
- JPNS 340 Japanese Adv Reading & Grammar
- JPNS 361IH Japanese Text and Cinema
- ML 403D Monsoon Asian Civilization

**Research Experience. Take one of the following (3 credits).**

- ANTY 490R Undergraduate Research and Instruction
- ANTY 492 Independent Study
- HSTA 490R Undergraduate Research
- HSTR 490R Undergraduate Research
- HSTR 499R Sen Capstone: Hist Methodology
- JPNS 450R Sem: Japanese Lit and Culture
- other courses approved by a faculty advisor

**Total credits**

- 120

**University core and electives**

- 71-74

**Core Asian Studies Requirements. Take three of the following (9-12 credits).**

- ANTY 242D Contemporary Japan
- CHIN 130D Historical and Literary Journey into Modern China
- CHIN 211D Chinese Culture & Civilization
- HSTR 135D The Modern Middle East
- HSTR 140D Modern Asia

**Other courses approved by a faculty advisor**
### Asian Studies Minor

#### Required Courses for Asia Studies Minor

**Core Asian Studies Requirements** (take one of the following: 3-4 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTY 242D</td>
<td>Contemporary Japan</td>
</tr>
<tr>
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<td>Chinese Culture &amp; Civ</td>
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</tr>
<tr>
<td>JPNS 150D</td>
<td>Japanese Culture &amp; Civ</td>
</tr>
<tr>
<td>PHL 270</td>
<td>Philosophies of Asia</td>
</tr>
<tr>
<td>RLST 203D</td>
<td>Buddhist Traditions</td>
</tr>
</tbody>
</table>

**Asian Language Requirement** (6-8 credits). Take any 101-102D sequence in the same language, OR take any two 101 courses in different languages.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARAB 101</td>
<td>Elementary Modern Arabic I</td>
</tr>
<tr>
<td>ARAB 102D</td>
<td>Elementary Modern Arabic II</td>
</tr>
<tr>
<td>CHIN 101</td>
<td>Elementary Chinese I</td>
</tr>
<tr>
<td>CHIN 102D</td>
<td>Elementary Chinese II</td>
</tr>
<tr>
<td>JPNS 101</td>
<td>Elementary Japanese I</td>
</tr>
<tr>
<td>JPNS 102D</td>
<td>Elementary Japanese II</td>
</tr>
<tr>
<td>JPNS 201D</td>
<td>Intermediate Japanese I</td>
</tr>
<tr>
<td>JPNS 202D</td>
<td>Intermediate Japanese II</td>
</tr>
</tbody>
</table>

**Upper Division Electives. Take any four (12 credits) of the following courses.**

<table>
<thead>
<tr>
<th>Course Code</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ANTY 337</td>
<td>Sex, Gender, Sexuality Japan</td>
</tr>
<tr>
<td>ANTY 343</td>
<td>Popular Culture - Japan</td>
</tr>
<tr>
<td>ANTY 441</td>
<td>Social Movements in Japan</td>
</tr>
<tr>
<td>ARTH 360</td>
<td>History of Asian Art and Architecture</td>
</tr>
<tr>
<td>CHIN 320IH</td>
<td>History of Chinese Cinema</td>
</tr>
<tr>
<td>GPHY 446</td>
<td>East Asia in the Global System</td>
</tr>
<tr>
<td>HSTR 340</td>
<td>Age of the Shoguns</td>
</tr>
<tr>
<td>HSTR 342</td>
<td>Japan’s Meiji Revolution</td>
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<tr>
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<td>ML 403D</td>
<td>Monsoon Asian Civilization</td>
</tr>
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**Research Experience. Take one of the following (3 credits).**

<table>
<thead>
<tr>
<th>Course Code</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ANTY 490R</td>
<td>Undergraduate Research and Instruction</td>
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<tr>
<td>ANTY 492</td>
<td>Independent Study</td>
</tr>
<tr>
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<td>Undergraduate Research</td>
</tr>
<tr>
<td>HSTR 499R</td>
<td>Sen Capstone: Hist Methodology</td>
</tr>
<tr>
<td>JPNS 450R</td>
<td>Sem: Japanese Lit and Culture</td>
</tr>
</tbody>
</table>

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**Course Substitutions:** Other appropriate courses, including those taken abroad, may be substituted with the approval of an Asian Studies Advisor.

**Study Abroad:** Montana State maintains active exchange programs with overseas universities, including ones throughout Asia. Students may spend an entire academic year abroad while paying Montana State tuition. Contact the Office of International Programs for more information.

**Graduation Requirements:** A minimum of 120 credits is required for graduation; 42 of these credits must be upper-division.

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**Asian Studies Minor**

**Required Courses for Asia Studies Minor**

Core Asian Studies Requirements (take one of the following: 3-4 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
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</tr>
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<tbody>
<tr>
<td>ANTY 242D</td>
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Asian Language Requirement (6-8 credits). Take any 101-102 sequence in the same language, OR take any two 101 courses in different languages.

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</tr>
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<td>Elementary Japanese I</td>
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<tr>
<td>JPNS 102D</td>
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</tr>
</tbody>
</table>

Upper Division Electives. Take any four (12 credits) of the following courses.

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</tbody>
</table>

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**Research Experience. Take one of the following (3 credits).**

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<tr>
<td>JPNS 450R</td>
<td>Sem: Japanese Lit and Culture</td>
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</tbody>
</table>

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**University core and electives**

- **Total credits:** 120
Anthropology

Department of Sociology & Anthropology

Students earning a B.S. in anthropology obtain a broad, anthropological perspective on the study of humankind. As part of the curriculum, students are expected to become familiar with and understand the interrelationships among the diverse aspects of our humanity – both present and past. These include the biological evolution of our species, the adaptive advantage of human symbolic capacities and technological abilities, and the development of culture from earliest recognizable traces through the emergence of complex civilizations. Historical concerns include investigations of the diversity of human languages, the relationship between language and world view, the ethnography of speech practices, the cultural construction of the social and physical world, and the social and structural relationships that people use to make sense out of their daily activities. These concepts are introduced and applied through course offerings in the four sub-fields of anthropology: social/cultural anthropology, archaeology, evolutionary/biological anthropology, and linguistic anthropology. Students work closely with faculty to gain a well-grounded knowledge of anthropological theories and methods that allows them to pursue research in one or more sub-fields of study.

Anthropology is a diverse field that provides students with a solidly-grounded liberal arts education. At the same time it is a cornerstone for understanding issues of diversity in an increasingly global world. In order to gain the skills needed to pursue research, students will learn how to think critically, read in a discerning manner, formulate logical arguments, and write in a coherent fashion. The B.S. degree in Anthropology prepares students for graduate work in this discipline. Graduate degrees are typically required for professional participation in this field. In addition to professional employment as research scientists or college-level professors, anthropologists often find positions as consultants, teachers, museum curators, or as specialists in historic preservation. Equally, domestic and foreign assignments with international, federal, or state agencies and institutions, and jobs in private industry, are available. Anthropologists are also found in public service organizations, medical and public health programs, environmental organizations, non-governmental organizations, and in positions that require community organizing abilities or ethnographic and social survey research skills.

While students are not required to apply for formal admission to the anthropology program, students must obtain a grade of C- or better in all Anthropology courses in order to receive credit toward graduation. Before enrolling in 300 and 400 level ANTY courses, Anthropology majors must have completed the following university core courses: WRIT 101W, University Seminar, and Math Core. Students who enroll in anthropology courses without the required core or anthropology prerequisite(s) must obtain the permission of the instructor. Otherwise, those students will be required to withdraw from the course.

Academic advisors in anthropology work closely with each student to establish a viable educational plan. Ongoing interactions between students and advisors ensure that a student’s educational objectives are being met as she or he moves toward a degree.

Undergraduate Programs

- B.S. in Anthropology (p. 193)
- Anthropology Minor (non-teaching) (p. 193)

Anthropology Minor (Non-Teaching)

The Anthropology Minor is a non-teaching minor designed to encourage students from any discipline to explore the cross-cultural study of humankind in order to complement or supplement course work in their respective majors. The minor introduces students to the four subfields of anthropological study (evolutionary/biological anthropology, social/cultural anthropology, archaeology, and linguistics); it also allows students within the minor the flexibility to select among a range of advanced courses in prehistory, ethnography, theory, and topical domains relative to their particular interests. The curriculum stresses critical thinking, awareness of culture-specific meanings and values, consideration of the potential sustainability of various cultural adaptations, student involvement in the learning process, and opportunities for research. For graduation, students must have a C- or higher in all required and elective courses in the minor.

ANTY 215IS Human Prehistory 3
ANTY 225IS Culture, Language, and Society 3
Anthropology Electives 15
At least 12 of the 15 electives must be from upper division courses numbered 300 and above.

Total Credits 21

The maximum number of Anthropology transfer credits that may be applied toward the minor is 9; additional transfer credits may be accepted as negotiated with your advisor.

B.S. in Anthropology

**Freshman Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTY 101D - Anthropology and the Human Experience</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
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</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCI 101IS - Introduction to Sociology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SOCI 150D - Social Difference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCI 201D - Social Problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Core Seminar</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math Core</td>
<td>3</td>
<td></td>
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<tr>
<td>University Core and Electives</td>
<td>15</td>
<td></td>
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<tr>
<td>Year Total:</td>
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**Sophomore Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ANTY 215IS - Human Prehistory</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ANTY 225IS - Culture, Language, and Society</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td>3</td>
<td></td>
</tr>
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<td>University Core and Electives</td>
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<tr>
<td>Year Total:</td>
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</tr>
</tbody>
</table>

**Junior Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTY 313 - Biological Anthropology</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
ANTY 472 - Descriptive Linguistics 3
or ANTY 473 - Language & Culture

ANTY 300-400 - Archaeology elective 3

ANTY 300-400 - Cultural Anthropology Elective 3

ANTY 300-400 - Elective 6

ANTY 200-400 - Elective 3

University Core and Electives 9

Year Total: 30

Senior Year Credits

ANTY 300-400 - Electives 9

ANTY 450 - Archaeological Theory or ANTY 428RS - Anthropological Theory 3

University Core and Electives 18

Year Total: 30

Total Program Credits: 120

Anthropology majors must complete one of the following sequences of courses.

Sequence A
A minor or double major approved by the student’s advisor 21-27

Sequence B
18 credits towards a minor approved by the student’s advisor 18

Departmental Honors: Students may graduate with Departmental Honors if they meet the following requirements: GPA of 3.5 or higher and complete an undergraduate thesis in Anthropology.

For Anthropology majors, the maximum number of Anthropology transfer credits accepted is 18. Major requirements include 24 elective Anthropology credits of which 21 must be upper division (300 and above) and no more than 6 credits of ANTY 490R or ANTY 492 combined can count toward fulfillment of the elective credits.

For graduation in Anthropology students must have a grade of C- or higher in all Anthropology courses. A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

Cell Biology and Neuroscience

The department participates in MSU’s Genetics Minor and recommends this minor to students particularly interested in genetics.

Note: MSU’s programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology. For additional options see Biological Sciences (p. 82) at MSU.

Department of Cell Biology and Neuroscience

The Department of Cell Biology and Neuroscience offers a B.S. in Cell Biology and Neuroscience with options in Biomedical Sciences and Cell Biology and Neuroscience and a minor in Genetics.

Pre-medicine, Pre-dentistry, Pre-Physician Assistant, and Pre-optometry

Students may prepare for admission to medical, dental, optometry, physician assistant and many other health profession and graduate schools by following the option in Biomedical Sciences in the Department of Cell Biology and Neuroscience. The Department of Cell Biology and Neuroscience provides advising on matters pertaining to the cell biology and neuroscience and the biomedical sciences curriculums and the genetics minor. Advising on matters pertaining to admission to professional schools is provided by the Health Professions Advising Office.

Requirements for Admission to Upper Division Courses in Biology

For admission to upper division (numbered 300 and above) courses taught by the Department of Cell Biology and Neuroscience, students must have completed at least 30 total university credits with a cumulative GPA of at least 2.75.

Grade Requirements for Fulfillment of Degree Options

In order to graduate with a B.S. in the department, students must earn a grade of C- or better for every course required for the specific option, including courses taken to fulfill required elective credits.

Graduation In Absentia

Some professional programs accept students before their degree requirements are completed. It is often possible to transfer credits from the first year of professional school to MSU to graduate in absentia. The mechanics involve sending an official transcript for the first year of professional school to the MSU academic advisor. The student then writes a letter to the MSU Registrar explaining which credits transfer and how they fulfill the degree requirements. The student then registers in absentia at MSU for the semester in which the B.S. degree will be awarded.

Undergraduate Programs

• Biomedical Sciences Option (p. 195)

Undergraduate Minor

• Genetics Minor (Non-Teaching) (p. 95)

The Department of Cell Biology and Neuroscience offers exciting opportunities to work with nationally and internationally recognized faculty on a wide range of research topics, including cognitive neuroscience, neurophysiology, developmental biology, cell biology and biophysics. It is the goal of the faculty to prepare our students for successful careers in academic research, government, and/or the biotechnology industry. Successful applicants to the program will have already established a commitment to excellence through academic achievements and prior research experience.

We offer Ph.D. or M.S. degrees in Neuroscience or Biological Science to our graduate students. The Ph.D. Degree Program is designed for students who are committed to a scientific research career and are willing to commit an average of 5 to 6 years in pursuit of the training that is necessary to qualify for this degree. Prospective students must secure a faculty sponsor prior to applying for admission.

The M.S. degree is for students who wish to increase their knowledge base in basic research through an intensive 2- to 3-year training period. Students must identify a faculty sponsor prior to submitting an application to the CBN Graduate Program.

• Master of Science in Biological Sciences (p. 369)
• Master of Science in Neuroscience (p. 369)
• Doctor of Philosophy in Biological Sciences (p. 369)
• Doctor of Philosophy in Neuroscience (p. 369)

Prior to applying, all prospective graduate students need to secure a faculty sponsor. Contact a faculty member to arrange the sponsorship.

Direct your questions regarding the process to Thomas Hughes at thughes@montana.edu.
Biomedical Sciences Option

The curriculum of the biomedical sciences option provides a strong background for students who plan on a career in medicine or other health profession. This option is also for students that are interested in a biomedical sciences career in research or teaching in cell biology, molecular biology, developmental biology, or neuroscience. The curriculum provides the opportunity to take the courses necessary to make a competitive application to health profession school, graduate school or to obtain a technical position. The curriculum has sufficient breadth to introduce the student to a wide range of disciplines, but is flexible enough so that students can focus, in their last two years, on areas of specific interest. Students interested in a career in a health science profession should consult the Health Professions Advising Office for information regarding admission to professional schools.

Employment opportunities, especially at the technical level, are available with a B.S. in Cell Biology and Neuroscience. However, this curriculum is designed to better prepare students for professional or graduate training. The biomedical sciences curriculum is designed to allow the students to take basic courses in physical sciences while tailoring the courses in life sciences to meet their personal objectives and interests. This is done by allowing 24 of the required credits in Biology to be elective credits in life sciences; biology, biochemistry, microbiology, or other appropriate fields. Advanced students are strongly encouraged to enroll in undergraduate research. This provides an opportunity to gain valuable experience in biomedical research which is extremely useful for both an appreciation of the research effort required in graduate school and for gaining experience in technical methods for a technical position.

### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOH 185</td>
<td>Integrated Physiology I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
<td>3</td>
<td></td>
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<tr>
<td>WRIT 101W</td>
<td>College Writing I</td>
<td>3</td>
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<tr>
<td>University Core and Electives</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td>BIOB 260</td>
<td>Cellular and Molecular Biology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>M 161Q</td>
<td>Survey of Calculus</td>
<td>4</td>
<td></td>
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<tr>
<td>CLS 101US</td>
<td>Knowledge and Community</td>
<td>3</td>
<td></td>
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### Sophomore Year

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### Total Program Credits:

120

### Additional Requirements

A minimum of 24 additional elective credits in the life sciences must be completed, most typically from courses in Cell Biology & Neuroscience, Microbiology and Immunology, and Biochemistry. Of these 24 credits, at least 18 must be upper division. No more than 6 credits of research can be applied toward these 24 elective credits. See the department office for a full list of approved electives.

Examples of elective courses include, but are not limited to:

- BIOB 410 - Immunology
- BIOB 476R - Gene Construction
- BIOH 201 - Hum Anatomy & Physiology I
- BIOH 211 - Hum Anatomy & Physiology II
- BIOH 309 - Human Neuroanatomy
- BIOH 323 - Human Developmental Biology
- BIOH 395 - Human Pathophysiology
- BIOH 411 - Adv Human Anatomy
- BIOH 422 - Genes and Cancer
- BIOH 425 - Sensory Neurophysiology
- BIOH 435 - Cognitive Neuroscience
- BIOH 440 - Neuroscience of Mental Illness
- BIOH 445 - Intro Pharmacology
- BIOH 455 - Molecular Medicine
- BIOH 465R - Gene Expression Lab: From Genes to Proteins to Cells
- BIOL 409 - Advanced Human Torso Anatomy
- BIOM 435 - Virology

### Chemistry and Biochemistry

Note: MSU’s programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology. For additional options see Biological Sciences at MSU.

### Department of Chemistry and Biochemistry

The Department of Chemistry and Biochemistry offers programs that are certified by the American Chemical Society and that emphasize modern areas in chemistry and biochemistry at both the undergraduate and graduate levels. The curriculum for the Bachelor of Science degree in chemistry provides basic education in chemistry with sufficient breadth and flexibility to allow students to enter a variety of chemistry-related careers. Several curricular options are available, each of which is career- and employment-directed. Employment opportunities are extensive. For example, at least 36 percent of the research and development workforce in the United States have degrees in chemistry, more than any other discipline. The different
options allow the student to emphasize his or her personal choices in course selection.

All of the options emphasize current aspects of chemistry and biochemistry with particular attention given to instrumentation, modern concepts and methods, and use of computers to help solve chemical problems. Participation in undergraduate research within an active research group in the department is an important and rewarding part of the overall program. A wide range of fundamental research programs are ongoing in all major areas of chemistry: analytical, biochemistry, inorganic, organic and physical.

The Department of Chemistry and Biochemistry participates in several instructional and research programs of an interdisciplinary nature. These include nanomaterials, optical technology, thermal biology, biofilm engineering, computer modeling of proteins and nucleic acids, and the WWAMI medical education program. The department has active graduate programs leading to the degrees of Master of Science and Doctor of Philosophy. These degrees may be obtained in either chemistry or biochemistry.

The department encourages majors in allied fields to consider either a chemistry or a biochemistry minor.

**Chemistry (Professional) Option**

This option includes a central core of chemistry courses that, together with technical electives, allows the students to prepare for careers in chemistry or related fields such as medicine, patent law, chemical industry, or science writing. Students interested in the more quantitative and physical aspects of chemistry may wish to include additional mathematics and/or physics courses. Students electing this option will be well prepared both for graduate study and for immediate employment in industry, government, or business.

**Biochemistry Option**

This option includes a core of chemistry, biochemistry, and biology courses for students interested in the molecular nature of biological materials and life processes. A broad choice of biological science electives allow the students to prepare for careers in human, animal, plant, or microbial biochemistry. Trained biochemical scientists are in demand for research and teaching in universities and for research and development work in chemical, pharmaceutical, and bio-technical industries, in medical laboratories, and in state and federal governments. Students who complete the curriculum satisfactorily will be prepared to assume responsible professional positions or undertake graduate level work in the life sciences. The curriculum also provides an excellent preparation for medical, dental, or veterinary school.

**Teaching Option**

This option is designed to prepare prospective teachers of chemistry at the secondary level. It provides a thorough background in the basic fields of chemistry and an acquaintance with aspects of chemistry in society that are essential to the practicing teacher of chemistry. The chemistry teaching option qualifies graduates to teach secondary school chemistry. Employment opportunities will be enhanced by obtaining a second area of certification, usually a teaching minor. Obtaining a teaching major, a teaching minor, and certification will require more than 120 credits.

**Chemistry/Biochemistry Minors (Non-teaching)**

A minor in either chemistry or biochemistry is offered for students with other majors who wish to receive formal acknowledgement for taking a core of intermediate-level chemistry and/or biochemistry courses. The minor is designed to strengthen the students’ opportunities for admission to graduate school or medical, dental, veterinary, or pharmacy school, or for industrial employment.

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**Undergraduate Progams**

- Chemistry (Professional) Option (p. 199)
- Biochemistry Option (p. 196)
- Biochemistry (p. 198) Option: Pre-Med Track (p. 198)
- Teaching Option (p. 200)

**Undergraduate Minors**

- Astrobiology Minor (Non-Teaching) (p. 208)
- Biochemistry Minor (Non-Teaching) (p. 200)
- Chemistry Minor (Non-Teaching) (p. 201)

The Department of Chemistry and Biochemistry offers research-oriented programs culminating in the Doctor of Philosophy degree. The faculty in the department have expertise in a broad range of specialty areas including synthesis, structure, spectroscopy, and mechanism. In each of these fields, the strength of MSU Chemistry and Biochemistry Department has been recognized at the international level. MSU is a growing and dynamic university of 16,000 students. MSU is rapidly increasing in research prominence and is now ranked among the nation’s 100 leading research universities by the Carnegie Foundation. The Department of Chemistry and Biochemistry has the largest and best-funded doctoral program on campus. Our doctoral students receive world-class mentoring in a spectacular northern Rocky Mountain setting and graduate to superb career opportunities.

Graduate programs in chemistry and biochemistry are designed to provide students with a solid and broad foundation on which to base their careers. An appropriate combination of coursework and independent investigation is planned with individual faculty advisors. In consultation with their graduate advisor, graduate students can tailor their program to their own needs and interests. We believe that at the conclusion of their graduate education at Montana State University, students should have a professional command of the fundamentals of their disciplines. We cultivate the ability to think independently and to critically analyze scientific problems that span disciplinary boundaries. A high level of creativity and originality in research is expected of candidates for the Ph.D.

**Degrees Offered**

- M.S. in Chemistry (p. 371)
- M.S. in Biochemistry (p. 371)
- Ph.D. in Chemistry (p. 371)
- Ph.D. in Biochemistry (p. 371)

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**Biochemistry Option**

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<td>or CHMY 151 - Honors College Chemistry I</td>
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<tr>
<td>STAT 216Q - Introduction to Statistics</td>
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<td>University Core and Electives</td>
<td>7</td>
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<tr>
<td>BCH 294 - Seminar/Workshop</td>
<td>1</td>
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<tr>
<td>BIOB 260 - Cellular and Molecular Biology</td>
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<td>Please take one of the following:</td>
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<td>CHMY 143 - College Chemistry II</td>
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<td>or CHMY 153 - Honors College Chemistry II</td>
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<td>M 161Q - Survey of Calculus</td>
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<td>or M 171Q - Calculus I</td>
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Montana State University

University Core and Electives

Year Total: 15 16

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<tr>
<th>Sophomore Year</th>
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<td>Spring</td>
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Please take one of the following: 4
- CHMY 321 - Organic Chemistry I
- CHMY 331 - Honors Organic Chemistry I

Please take one of the following: 4
- PHSX 205 - College Physics I
- PHSX 220 - Physics I (w/ calculus)

University Core and Electives 6

CHMY 311 - Fundamental Analytical Chem 4

Please take one of the following: 4
- CHMY 323 - Organic Chemistry II
- CHMY 333 - Honors Organic Chemistry II

Please take one of the following: 4
- PHSX 207 - College Physics II
- PHSX 222 - Physics II (w/ calculus)

University Core and Electives 3

Year Total: 14 15

Junior Year

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Please take one of the following sequences: 2
- CHMY 361 - Elements of Physical Chemistry
- CHMY 362 - Elements of Physical Chemistry Lab

OR

- CHMY 371 - Physical Chemistry-Quantum Chemistry and Spectroscopy I
- CHMY 372 - Physical Chemistry Laboratory I
- CHMY 373 - Physical Chemistry - Kinetics and Thermodynamics

BCH 394 - Seminar/Workshop 1

BCH 441 - Biochemistry of Macromolecules 3

BCH 490R - Undergraduate Research 3

Physical and Biological Science Electives 4

CHMY 490R - Undergraduate Research 3

BCH 442 - Metabolic Regulation 3

BCH 444R - Biochemistry & Molecular Biology Methods 3

Physical and Biological Science Electives 4

University Core and Electives 3

Year Total: 15-17 15

Senior Year

<table>
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Physical and Biological Science Electives 4 6

University Core and Electives 9

BCH 494 - Seminar/Workshop 1

BCH 499 - Senior Thesis/Capstone 5

Physical and Biological Science Electives 4 6

University Core and Electives 7 or 8

Year Total: 15 14-15

Total Program Credits: 120

1. If you want to take a full year of Physical Chemistry (CHMY 371, CHMY 372 and CHMY 373) then you will need to take M 171Q, M 172Q, and M 273Q (see footnote 2).

2. Students should consider taking the full year of Physical Chemistry sequence (CHMY 371 and CHMY 372 in the fall and CHMY 373 in the spring) instead of the one-semester overview, particularly if planning to go to graduate school. As noted in footnote 1, this sequence requires more calculus as prerequisite coursework.

3. Six (6) credits of Undergraduate Research BCH 490R are tabulated. Students are encouraged to fulfill additional credits of research.

4. A minimum of 18 credits of physical and biological science electives are required.

5. BCH 499 (Senior Year) is required for majors who are writing a thesis for Departmental Honors consideration.

All students are encouraged to take a 200 level English writing course. Please note that this course would be in addition to the core requirement.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

Acceptable Physical and Biological Sciences Electives Include

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<td>BIOB 410</td>
<td>Immunology</td>
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<tr>
<td>BIOB 412</td>
<td>Hybridomas</td>
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<td>BIOB 413</td>
<td>Flow Cytometry</td>
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<td>BIOB 414</td>
<td>Advanced Microscopy</td>
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<td>BIOB 415</td>
<td>Adv Immunology Methods</td>
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<td>BIOB 420</td>
<td>Evolution</td>
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<td>BIOB 425</td>
<td>Adv Cell &amp; Molecular Biology</td>
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<td>BIOB 428</td>
<td>Molecular Evolution</td>
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<td>BIOB 430</td>
<td>Plant Biotechnology</td>
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<td>BIOB 438</td>
<td>Developmental Mechanisms</td>
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<td>BIOB 476R</td>
<td>Gene Construction</td>
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<td>Genome Science and Gene Expression</td>
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### Biochemistry Option: Pre-Med Track

#### Freshman Year

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#### Sophomore Year

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#### Junior Year

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<td>CHMY 361</td>
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**Recommended University Core & Electives**

- PSYX 100IS Intro to Psychology 4
- SOCI 101IS Introduction to Sociology 3

**Recommended Biological Sciences Electives**

- BIOH 320 Biomedical Genetics 3
- or BIOH 375 General Genetics 3

And

- BIOB 410 Immunology 3
- or BIOH 323 Human Developmental Biology 3

As a less desirable alternative, take: * Biol H 201 Human Anatomy and Physiology I 5/4
- & BIOH 211 and Human Anatomy and Physiology II 3

*these 2 courses do not count towards the 18 credits of 300+ electives

**Additional Biological Sciences Electives**

A total of 18 credits of physical and biological science electives numbered 300 or above are required. The following courses may also be substituted for any of the biology courses above, but do not match medical school prerequisites as closely:

- BIOB 425 Adv Cell & Molecular Biology 3
- BIOH 313 Neurophysiology 3
- BIOH 422 Genes and Cancer 3
- BIOH 455 Molecular Medicine 3
- BIOL 409 4
- BIOM 360 General Microbiology 5
- BIOM 400 Medical Microbiology 3
- BIOM 431 Medical Bacteriology 3
- BIOM 435 Virology 3

**Senior Year**

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</table>

**Total Program Credits:** 120

---

1. BCH 194: Students who transfer into Chemistry from another major or institution may skip BCH 194.

2. BCH 294: This course may be taken in the spring of Sophomore year.

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*Recommended Biological Sciences Electives*:

- BIOH 320 Biomedical Genetics 3
- or BIOH 375 General Genetics 3

And

Preferably take either:

- BIOB 410 Immunology 3
- or BIOH 323 Human Developmental Biology 3

As a less desirable alternative, take:

- BIOH 201 Human Anatomy and Physiology I 5/4
- & BIOH 211 and Human Anatomy and Physiology II 3

*these 2 courses do not count towards the 18 credits of 300+ electives

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**Additional Biological Sciences Electives**

A total of 18 credits of physical and biological science electives numbered 300 or above are required. The following courses may also be substituted for any of the biology courses above, but do not match medical school prerequisites as closely:

- BIOB 425 Adv Cell & Molecular Biology 3
- BIOH 313 Neurophysiology 3
- BIOH 422 Genes and Cancer 3
- BIOH 455 Molecular Medicine 3
- BIOL 409 4
- BIOM 360 General Microbiology 5
- BIOM 400 Medical Microbiology 3
- BIOM 431 Medical Bacteriology 3
- BIOM 435 Virology 3

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**Recommended University Core & Electives**

- PSYX 100IS Intro to Psychology 4
- SOCI 101IS Introduction to Sociology 3

---

**Senior Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Science Elective</td>
<td></td>
</tr>
<tr>
<td>University Core/Electives</td>
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<tr>
<td>BCH 494 - Seminar/Workshop</td>
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<tr>
<td>Biological Science Elective</td>
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<td>University Core/Electives</td>
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</tr>
<tr>
<td>Year Total:</td>
<td></td>
</tr>
</tbody>
</table>

**Total Program Credits:** 120

---

1. BCH 194: Students who transfer into Chemistry from another major or institution may skip BCH 194.

2. BCH 294: This course may be taken in the spring of Sophomore year.
NOTE: Medical schools with a writing or literature requirement will not waive it for students who placed out of WRIT 101W

### Chemistry (Professional) Option

#### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>or CHMY 151</td>
<td>Honors College Chemistry I</td>
<td></td>
<td></td>
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<tr>
<td>CHMY 194</td>
<td>Seminar/Workshop</td>
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<tr>
<td>M 171Q</td>
<td>Calculus I</td>
<td>4</td>
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<tr>
<td>or M 181Q</td>
<td>Honors Calculus I</td>
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<tr>
<td>CHMY 143</td>
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<td>4</td>
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<tr>
<td>or CHMY 153</td>
<td>Honors College Chemistry II</td>
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<tr>
<td>CHMY 294</td>
<td>Seminar/Workshop</td>
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<tr>
<td>M 172Q</td>
<td>Calculus II</td>
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<tr>
<td>or M 182Q</td>
<td>Honors Calculus II</td>
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#### Sophomore Year

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<tbody>
<tr>
<td>CHMY 321</td>
<td>Organic Chemistry I</td>
<td>4</td>
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<tr>
<td>or CHMY 331</td>
<td>Honors Organic Chemistry I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 273Q</td>
<td>Multivariable Calculus</td>
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<tr>
<td>PHSX 222</td>
<td>Physics II (w/ calculus)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>or PHSX 242</td>
<td>Honors Gen &amp; Mod Phys I</td>
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<td>University Core and Electives</td>
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<td>Year Total:</td>
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#### Junior Year

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<tbody>
<tr>
<td>CHMY 371</td>
<td>Physical Chemistry-Quantum Chemistry and Spectroscopy I</td>
<td>3</td>
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<td>CHMY 372</td>
<td>Physical Chemistry Laboratory I</td>
<td>1</td>
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<td>CHMY 394</td>
<td>Seminar/Workshop</td>
<td>1</td>
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<td>CHMY 417</td>
<td>Synthetic Chemistry</td>
<td>3</td>
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<tr>
<td>CHMY 490R</td>
<td>Undergraduate Research²</td>
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<td>University and Core Electives</td>
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#### Senior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Fall Credits</th>
<th>Spring Credits</th>
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</thead>
<tbody>
<tr>
<td>BCH 441</td>
<td>Biochemistry of Macromolecules</td>
<td>3</td>
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<tr>
<td>CHMY 401</td>
<td>Advanced Inorganic Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Physical Science Electives</td>
<td>6</td>
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<tr>
<td>University Core and Electives</td>
<td>3</td>
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<tr>
<td>CHMY 421</td>
<td>Advanced Instrument Analysis ¹</td>
<td>3</td>
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<tr>
<td>CHMY 494</td>
<td>Seminar/Workshop</td>
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<tr>
<td>CHMY 499</td>
<td>Senior Thesis/Capstone³</td>
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<tr>
<td>Physical Science Electives</td>
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<td>University Core and Electives</td>
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<td>14-16</td>
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</tbody>
</table>

Total Program Credits: 119-121

1 CHMY 421 is only offered during the spring semester of even numbered years (2018, 2020, etc)
2 Six (6) credits of CHMY 490R are tabulated. Students are encouraged to fulfill additional credits of research.
3 CHMY 499 (Senior year) is required for majors who are writing a thesis for Departmental Honors consideration.
4 A minimum of 9 credits of physical science electives are required.

A computer science (CS) course is highly recommended. A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. All students are encouraged to take a 200 level English writing course. Please note that this course would be in addition to the core requirement.

### Acceptable Physical Science Electives Include

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 442</td>
<td>Metabolic Regulation</td>
<td>3</td>
</tr>
<tr>
<td>BCH 444R</td>
<td>Biochemistry &amp; Molecular Biology Methods</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 350</td>
<td>Astrobiology</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 515</td>
<td>Structure and Bonding in Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 516</td>
<td>Mechanisms and Dynamics in Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 523</td>
<td>Organic Reaction Mechanisms</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 524</td>
<td>Mass Spectrometry</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 526</td>
<td>Adv Protein NMR Spectroscopy</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 533</td>
<td>Physical Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 535</td>
<td>Reagent Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 540</td>
<td>Organic Synthesis</td>
<td>3</td>
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<tr>
<td>CHMY 551</td>
<td>Organic Structure Elucidation</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 554</td>
<td>Organometallic Chemistry</td>
<td>3</td>
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<tr>
<td>CHMY 557</td>
<td>Quantum Mechanics</td>
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<td>CHMY 558</td>
<td>Classical &amp; Stat Thermodynamic</td>
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<tr>
<td>CHMY 559</td>
<td>Kinetics &amp; Dynamics</td>
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<tr>
<td>M 221</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
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<tr>
<td>M 274</td>
<td>Introduction to Differential Equation</td>
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<tr>
<td>M 333</td>
<td>Linear Algebra</td>
<td>3</td>
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</tbody>
</table>
Chemistry Teaching Option

The Chemistry – Teaching Option major is designed for students who wish to become licensed to teach Chemistry in grades 5 - 12. Upon completion of the degree, students are eligible for licensure in the state of Montana. Secondary education students are encouraged to pursue a teaching minor in an additional content area and should contact an advisor for details. Obtaining a teaching minor will require more than eight semesters. For more information on admission to the Teacher Education Program, Student Teaching, Licensure, Professional Expectations and more, please visit: http://catalog.montana.edu/undergraduate/education-health-human-development/departments-education/teacher-education-program/

Freshman Year

Please take one of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
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<tbody>
<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>4</td>
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<tr>
<td>or CHMY 151 - Honors College Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHMY 194 - Seminar/Workshop</td>
<td>1</td>
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<tr>
<td>M 151Q - Precalculus</td>
<td>4</td>
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<tr>
<td>HDFS 101IS - Indiv and Fam Dev: Lifespan</td>
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<tr>
<td>University and Core Electives</td>
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</tbody>
</table>

Please take one of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
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<tbody>
<tr>
<td>CHMY 143 - College Chemistry II</td>
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<td>or CHMY 153 - Honors College Chemistry II</td>
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<tr>
<td>CHMY 294 - Seminar/Workshop</td>
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<tr>
<td>EDU 202 - Early Field Experience</td>
<td>1</td>
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<tr>
<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
<td>3</td>
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<tr>
<td>M 161Q - Survey of Calculus</td>
<td>4</td>
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<tr>
<td>University and Core Electives</td>
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</table>

Year Total: 15 16

Sophomore Year

Please take one of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOB 160 - Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>or BIOB 260 - Cellular and Molecular Biology</td>
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Please take one of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 321 - Organic Chemistry I</td>
<td>4</td>
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<tr>
<td>or CHMY 331 - Honors Organic Chemistry I</td>
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<tr>
<td>EDU 211D - Multicultural Education</td>
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Please take one of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
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<tbody>
<tr>
<td>PHSX 205 - College Physics I</td>
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<tr>
<td>or PHSX 220 - Physics I (w/ calculus)</td>
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<tr>
<td>CHMY 311 - Fundamental Analytical Chem</td>
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Please take one of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
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<tbody>
<tr>
<td>CHMY 323 - Organic Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>or CHMY 333 - Honors Organic Chemistry II</td>
<td></td>
</tr>
</tbody>
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Please take one of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
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<tbody>
<tr>
<td>PHSX 207 - College Physics II</td>
<td>4</td>
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<td>or PHSX 222 - Physics II (w/ calculus)</td>
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<td>EDU 370 - Integrating Tech into Educ</td>
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University and Core Electives 3

Year Total: 15 17

Junior Year

BCH 441 - Biochemistry of Macromolecules 3
BCH 490R - Undergraduate Research 1
or CHMY 490R - Undergraduate Research 2
CHMY 361 - Elements of Physical Chemistry 4
CHMY 362 - Elements of Physical Chemistry Lab 1
CHMY 394 - Seminar/Workshop 3
or BCH 394 - Seminar/Workshop 1
EDU 382 - Assessmt, Curric, Instructn 3
or BCH 490R - Undergraduate Research 1
or CHMY 490R - Undergraduate Research 2
CHMY 494 - Seminar/Workshop 1
or BCH 494 - Seminar/Workshop 3
University Core and Electives 5
Biochemical and Chemical Electives 2 6

Year Total: 14 14

Senior Year

Chemical and Biochemical Electives 2 3
EDP 360 - Exceptional Learners 3
EDU 395 - Practicum 3
EDU 497 - Methods 3
University Core and Electives 3
EDU 408 - Professional Issues: K-12 2
EDU 495R - Student Teaching 5-16

Year Total: 15 7-18

Total Program Credits: 120

1 Six (6) credits of CHMY 490R are tabulated. Students are encouraged to fulfill additional credits of research.
2 A minimum of 9 credits of chemical and biochemical electives are required.
3 CHMY 499 (Senior Year) is required for majors who are writing a thesis for Departmental Honors consideration.

Acceptable Chemical and Biochemical Electives Include:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHMY 350 - Astrobiology</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 401 - Advanced Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 417 - Synthetic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 421 - Advanced Instrument Analysis</td>
<td>3</td>
</tr>
<tr>
<td>BCH 442 - Metabolic Regulation</td>
<td>3</td>
</tr>
<tr>
<td>BCH 444R - Biochemistry &amp; Molecular Biology Methods</td>
<td>3</td>
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</tbody>
</table>

Biochemistry Minor (Non-Teaching)

BCH 441 - Biochemistry of Macromolecules 3
BCH 442 - Metabolic Regulation 3
BCH 444R - Biochemistry & Molecular Biology Methods 3
demonstrate the interest and ability. Senior-level students may enroll in
Research opportunities are available to undergraduate students who
Undergraduate Research Participation
Science www.montana.edu/eces/.
The department collaborates with the interdisciplinary Master of Science
degrees usually emphasize some aspect of geology, geography, or geobiology
with specific course and research plans approved by a graduate committee.
The department also offers a Master of Science Degree and Doctor of
EarthScienceMinor10-12.pdf.
Earth Science Teaching (p. 137). The TEPP form is available at
Spatial Analysis/GIS (p. 203), Water Resources (p. 207) and
of the courses fulfill both departmental requirements and University
Science (p. 137). The TEPP form is available at
www.montana.edu/fieldplacement/TEPPForms/TEPPMinors2010-12/
Montana State University

<table>
<thead>
<tr>
<th>Required Course</th>
<th>College Chemistry I</th>
<th>Honors College Chemistry I</th>
<th>College Chemistry II</th>
<th>Honors College Chemistry II</th>
<th>Organic Chemistry I</th>
<th>Honors Organic Chemistry I</th>
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<td>CHMY 321</td>
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<td>or CHMY 151</td>
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<td>or CHMY 153</td>
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<td>or CHMY 331</td>
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<td>or CHMY 333</td>
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<td>CHMY 141</td>
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<td>or CHMY 331</td>
<td>Honors Organic Chemistry I</td>
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<td>or CHMY 331</td>
<td></td>
<td>or CHMY 331</td>
<td></td>
<td>or CHMY 333</td>
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</table>

Take one of the following sequences: 5-7

| Elements of Physical Chemistry | Physical Chemistry-Quantum Chemistry and Spectroscopy I | Physical Chemistry - Kinetics and Thermodynamics | Physical Chemistry Laboratory I |
| & CHMY 362 | & CHMY 373 & CHMY 372 | & CHMY 372 |

Any BCH/CHMY courses 301 or higher, except BCH 380 or BCH/CHMY 490, 492, 494 and 499 9

Total Credits 28

**Chemistry Minor (Non-Teaching)**

**Required Course**

| CHMY 141 | College Chemistry I 4 |
| CHMY 151 | Honors College Chemistry I 4 |
| CHMY 143 | College Chemistry II 4 |
| CHMY 153 | Honors College Chemistry II 4 |
| CHMY 321 | Organic Chemistry I 4 |
| CHMY 331 | Honors Organic Chemistry I 4 |
| CHMY 323 | Organic Chemistry II 4 |
| CHMY 333 | Honors Organic Chemistry II 4 |

Take one of the following sequences: 5-7

| Elements of Physical Chemistry | Physical Chemistry-Quantum Chemistry and Spectroscopy I | Physical Chemistry - Kinetics and Thermodynamics | Physical Chemistry Laboratory I |
| & CHMY 362 | & CHMY 373 & CHMY 372 | & CHMY 372 |

Any BCH/CHMY courses 301 or higher, except CHMY/BCH 490, 492, 494 & 499 9

Total Credits 30-32

**Earth Sciences**

The department offers a Bachelor of Science in Earth Sciences degree which may be earned in any one of five options (Geography, Geographic Information Science/Planning, Geology, Paleontology, and Snow science). Each option tabulated below requires courses from within the Department of Earth Sciences and courses outside the department. Some of the courses fulfill both departmental requirements and University Core Curriculum requirements. Academic minors are offered in Spatial Analysis/GIS (p. 203), Water Resources (p. 207) and Earth Science Teaching (p. 137). The TEPP form is available at www.montana.edu/fieldplacement/TEPPForms/TEPPMinors2010-12/EarthScienceMinor10-12.pdf.

The department also offers a Master of Science Degree and Doctor of Philosophy in Earth Sciences. Thesis and course work for these graduate degrees usually emphasize some aspect of geology, geography, or geobiology with specific course and research plans approved by a graduate committee. The department collaborates with the interdisciplinary Master of Science in Land Rehabilitation, the Ph.D. Program in Ecology and Environmental Science www.montana.edu/eces/.

**Undergraduate Research Participation**

Research opportunities are available to undergraduate students who demonstrate the interest and ability. Senior-level students may enroll in ERTH 490R (Undergraduate Research), which provides the opportunity to participate in a research project under the guidance of a faculty member. Successful completion of ERTH 490R credits requires that the student write a senior thesis report and orally present and defend the results in a public forum, such as an annual conference of a professional society. Collaborative opportunities exist with the university’s Undergraduate Scholars Program.

**Departmental Honors in Earth Sciences**

The Department of Earth Sciences awards Departmental Honors at graduation to students who demonstrate exceptional undergraduate performance through the following criteria:

1. a minimum 3.5 grade-point average (GPA) in the major;
2. a minimum 3.0 GPA overall;
3. completion of at least 4 credits of undergraduate research with a grade of “B” or better; and
4. completion of a Senior Thesis (ERTH 490R)—written, bound, and orally presented and defended by the last day of classes prior to graduation.

**Undergraduate Programs**

- Geography Option (p. 203)
- Geology Option (p. 204)
- GIS/Planning Option (p. 201)
- Paleontology Option (p. 205)
- Snow Science Option (p. 206)

**Undergraduate Minors**

- Earth Science Teaching (p. 137)
- GIS Minor (Non-Teaching) (p. 203)
- Water Resources Minor (Non-Teaching) (p. 207)

Earth Sciences offers M.S. and Ph.D. degrees in Earth Sciences (Geography, Geology, and Geobiology content areas). We stress independent thesis research with some supporting course work. Our expertise spans most of the subfields of Earth Sciences. Our Geography faculty includes specialties including historical and cultural geography, settlement geography, resource geography (energy and water), economic geography, planning, bioclimatology, applications of GIS and snow science. The interests of our Geology faculty include composition and structure of the crust, quantitative geomorphology, sedimentation and stratigraphy. Our Geobiology faculty have research interests in vertebrate palaeontology, palaeocology, biogeography, palaeoclimatology, and geomicrobiology. Our program strengths are in basin analysis and energy resources, dinosaur palaeontology, geography of the northern Rocky Mountains, architecture and composition of the lithosphere, snow science and cryospheric processes, and climate change.

**Degree Offered**

- M.S. in Earth Sciences (p. 373)
- M.S. in Land Rehabilitation (p. 300) (Interdisciplinary degree)
- Ph.D. in Earth Sciences (p. 373)

**GIS/Planning Option**

The GIS (Geographic Information Science)/Planning Option in the Department of Earth Sciences is designed to offer students a mix of technical skills and academic training that prepares them for careers in local, state, and federal planning as well as opportunities in private consulting firms that are involved in the planning process. The GIS/Planning Option recognizes the growing importance of Geographic Information Systems and
Science in our society and how these analytic tools are applied in a wide variety of settings. The GIS/Planning Option takes advantage of excellent GIS facilities, lab space, expertise, and software available on campus and allows students to learn in an active hands-on environment. Students are prepared as map makers (cartographers) spatial analysts, and planners. The Department of Earth Sciences has connections with various local, state, and federal planning agencies within Montana and throughout the West. As part of their training, students may also be able to take advantage of internship opportunities as a way to further prepare for a wide variety of professional careers within the fields of planning and resource management. The optimal degree for employment and advancement in the GIS/Planning area is the Master’s Degree, and this undergraduate option is an excellent preparatory degree for graduate study. Some students interested in college teaching or advanced research may require a Ph.D. degree.

At the Freshman and Sophomore level, students take introductory courses in physical and human geography, GIS and cartography, statistics, intermediate technical writing, and computer aided design (CAD). In addition, courses in economics and political science lay the foundation for understanding the broader context of the planning process. As juniors and seniors, students complete an advanced 2-course sequence in GIS/Spatial Analysis (GPHY 384/GPHY 484R) and take skills-related coursework in Remote Sensing and in GPS technologies. Focused electives include courses in geographical planning, urban and economic geography, tourism and recreational planning, and in the politics of development. Students also complete basic coursework in soils, geomorphology and weather and climate because these variables are critical in the planning process. Additional electives are available in advanced classes in geography, earth science, ecology, natural resources, water resources, and statistics allow students to specialize in areas of particular interest and develop their own emphases in subjects related to the geospatial sciences and the planning process. All students take the GIS Capstone course (GPHY 484R) which emphasizes independent study in the geospatial sciences through a semester project.

**Courses Required in Department**

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERTH 101IN - Earth System Sciences</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 102CS - Topics in Earth Sciences*</td>
<td>1</td>
</tr>
<tr>
<td>GPHY 121D - Human Geography</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 141D - Geography of World Regions</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 101IS - Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>MART 145RA - Web Design</td>
<td>3</td>
</tr>
<tr>
<td>M 151Q - Precalculus</td>
<td>4</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>University Core, Prerequisites and Electives</td>
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<td>Year Total:</td>
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<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>GPHY 284 - Intro to GIS Science &amp; Cartog</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 245IN - Soils</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 210IS - Introduction to American Government</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 111 - Programming with Java I</td>
<td>4</td>
</tr>
<tr>
<td>Take EITHER:</td>
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</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics &amp; STAT 217Q - Intermediate Statistical Concepts</td>
<td>3-6</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>STAT 332 - Statistics for Scientists and Engineers</td>
<td></td>
</tr>
<tr>
<td>Take ONE of the following:</td>
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</tr>
<tr>
<td>WRIT 201 - College Writing II</td>
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</tr>
<tr>
<td>WRIT 221 - Intermediate Tech Writing</td>
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<table>
<thead>
<tr>
<th>Take ONE of the following</th>
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</thead>
<tbody>
<tr>
<td>DDDN 114 - Introduction to CAD</td>
<td></td>
</tr>
<tr>
<td>SRVY 230 - Intro to Surveying for Engineers</td>
<td></td>
</tr>
<tr>
<td>University Core, Prerequisites and Electives</td>
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<tr>
<td>Year Total:</td>
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</table>

**Junior Year**

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERTH 303 - Weather and Climate</td>
</tr>
<tr>
<td>ERTH 307 - Principles of Geomorphology</td>
</tr>
<tr>
<td>GPHY 384 - Adv GIS and Spatial Analysis</td>
</tr>
<tr>
<td>GPHY 365 - Geographical Planning</td>
</tr>
<tr>
<td>GPHY 357 - GPS Fund/App in Mapping</td>
</tr>
<tr>
<td>Take ONE of the following:</td>
</tr>
<tr>
<td>GPHY 426 - Remote Sensing</td>
</tr>
<tr>
<td>GPHY 429R - Applied Remote Sensing</td>
</tr>
<tr>
<td>Take TWO of the following:</td>
</tr>
<tr>
<td>GPHY 321 - Urban Geography</td>
</tr>
<tr>
<td>GPHY 322 - Economic Geography</td>
</tr>
<tr>
<td>GPHY 325 - Cultural Geography</td>
</tr>
<tr>
<td>GPHY 326 - Geography of Energy Resources</td>
</tr>
<tr>
<td>GPHY 329 - Environment and Society</td>
</tr>
<tr>
<td>GPHY 445 - Adv. Regional Geography</td>
</tr>
<tr>
<td>PSCI 423 - Politics of Development</td>
</tr>
<tr>
<td>University Core, Prerequisites and Electives</td>
</tr>
<tr>
<td>Year Total:</td>
</tr>
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</table>

**Senior Year**

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPHY 484R - Applied GIS &amp; Spatial Analysis</td>
</tr>
<tr>
<td>Take SIX of the following:</td>
</tr>
<tr>
<td>BIOE 370 - General Ecology (equiv to 270)</td>
</tr>
<tr>
<td>BIOE 375 - Ecological Responses to Climate Change</td>
</tr>
<tr>
<td>BIOE 416 - Alpine Ecology</td>
</tr>
<tr>
<td>NRSM 421 - Holistic Thought/Mgmt</td>
</tr>
<tr>
<td>NRSM 430 - Natural Resource Law</td>
</tr>
<tr>
<td>NRSM 453 - Habitat Inventory and Analysis</td>
</tr>
<tr>
<td>NRSM 455 - Riparian Ecology &amp; Management</td>
</tr>
<tr>
<td>GPHY 402 - Water and Society</td>
</tr>
<tr>
<td>GPHY 411 - Biogeography</td>
</tr>
<tr>
<td>GPHY 425 - Geographic Thought</td>
</tr>
<tr>
<td>GPHY 431 - Historical Geography</td>
</tr>
<tr>
<td>GPHY 441R - Mountain Geography</td>
</tr>
<tr>
<td>GPHY 457 - Adv GPS Mapping for GIS</td>
</tr>
<tr>
<td>GPHY 461 - Tourism Planning</td>
</tr>
<tr>
<td>GPHY 492 - Independent Study</td>
</tr>
<tr>
<td>GPHY 498 - Internship</td>
</tr>
<tr>
<td>ERTH 432R - Surface Water Resources</td>
</tr>
<tr>
<td>ERTH 491-001 - Advanced Topics in Geomorphology</td>
</tr>
<tr>
<td>STAT 411 - Methods for Data Analysis I</td>
</tr>
<tr>
<td>STAT 412 - Methods for Data Analysis II</td>
</tr>
<tr>
<td>STAT 436 - Introduction to Time Series Analysis</td>
</tr>
<tr>
<td>STAT 446 - Sampling</td>
</tr>
<tr>
<td>CSCI 440 - Database Systems</td>
</tr>
<tr>
<td>SRVY 375 - Analytic Photogrammetry and Remote Sensing</td>
</tr>
<tr>
<td>University Core, Prerequisites and Electives</td>
</tr>
</tbody>
</table>
management, as well as the application of geographical skills in map making (cartography), remote sensing, and geographic information science (GIS). Geography also offers an outstanding background for more advanced education in environmental law, international business, resource planning, and other specialized graduate school opportunities. Students may enhance their employment opportunities with a Master's degree, or a Ph.D. if college teaching or advanced research positions are of interest.

The student, in consultation with an advisor, is given the opportunity to develop a program to meet his or her own particular interests and needs through a series of core geography courses and an emphasis in physical or human geography or an approved minor. The Geography Option introduces students to lower division course work in world regional, physical, and human geography. These courses emphasize the importance of spatial relationships, the global distributions of physical and cultural phenomena, the complex interplay between natural and human systems, and the factors contributing to the evolution of the earth’s varied landscapes. In addition, advanced skills courses and a capstone course prepare the student to apply their training in a variety of jobs and/or graduate school. Some courses listed below are offered alternate years. A student’s course sequence may differ from that shown depending upon the date the student enters the program and the availability of courses.

### Geography Option

The Geography Option offers students a liberal university education with an emphasis in geography. The Geography option provides a general education as well as the more specialized knowledge and skills necessary to pursue many career objectives. Geographers find professional opportunities in urban and land use planning as well as spatial analysis in the public and private sectors, analysis of regions, resource and environmental

**Geographic Information Science (GIS) Minor (Non-Teaching)**

The GIS (Geographic Information Science) Minor in the Department of Earth Sciences recognizes the growing importance of Geographic Information Systems and Science in our society and how these analytic tools are used in a wide variety of disciplines. The GIS Minor takes advantage of excellent GIS facilities, lab space, expertise, and software available on campus and allows students to learn in an active hands-on environment. The GIS Minor is rooted in a core of 5 courses that include concepts in cartography, spatial data principles, spatial data modeling, spatial analysis/synthesis/modeling, GPS mapping, and remote sensing. Focused electives allow students to explore topics in related disciplines including statistics, surveying, and computer aided design.

**Not Available to Geography Majors**

- GPHY 284 Intro to GIS Science & Cartog 3
- GPHY 384 Adv GIS and Spatial Analysis 3
- GPHY 484R Applied GIS & Spatial Analysis 3
- GPHY 357 GPS Fund/App in Mapping 3
- Take ONE of the following: 3
  - GPHY 426 Remote Sensing
  - GPHY 429R Applied Remote Sensing
- Take ONE of the following: 3
  - STAT 217Q Intermediate Statistical Concepts
  - STAT 332 Statistics for Scientists and Engineers
- Take TWO or THREE of the following: 4 or 5
  - SRVY 230 Intro to Surveying for Engineers
  - DSDN 114 Introduction to CAD
  - STAT 408 Statistical Computing and Graphical Analysis
  - STAT 446 Sampling
  - CSCI 440 Database Systems
  - SRVY 375 Analytic Photogrammetry and Remote Sensing
  - GPHY 457 Adv GPS Mapping for GIS
  - GPHY 492 Independent Study

**Total Credits**

- 22 or 23

**Note:** A C- minimum is required in all curriculum courses to graduate by Regents’ policy. This includes electives in the curriculum.

### Geography Option

The Geography Option offers students a liberal university education with an emphasis in geography. The Geography option provides a general education as well as the more specialized knowledge and skills necessary to pursue many career objectives. Geographers find professional opportunities in urban and land use planning as well as spatial analysis in the public and private sectors, analysis of regions, resource and environmental

**Not Available to Geography Majors**

- GPHY 284 Intro to GIS Science & Cartog 3
- GPHY 384 Adv GIS and Spatial Analysis 3
- GPHY 484R Applied GIS & Spatial Analysis 3
- GPHY 357 GPS Fund/App in Mapping 3
- Take ONE of the following: 3
  - GPHY 426 Remote Sensing
  - GPHY 429R Applied Remote Sensing
- Take ONE of the following: 3
  - STAT 217Q Intermediate Statistical Concepts
  - STAT 332 Statistics for Scientists and Engineers
- Take TWO or THREE of the following: 4 or 5
  - SRVY 230 Intro to Surveying for Engineers
  - DSDN 114 Introduction to CAD
  - STAT 408 Statistical Computing and Graphical Analysis
  - STAT 446 Sampling
  - CSCI 440 Database Systems
  - SRVY 375 Analytic Photogrammetry and Remote Sensing
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**Not Available to Geography Majors**

- GPHY 284 Intro to GIS Science & Cartog 3
- GPHY 384 Adv GIS and Spatial Analysis 3
- GPHY 484R Applied GIS & Spatial Analysis 3
- GPHY 357 GPS Fund/App in Mapping 3
- Take ONE of the following: 3
  - GPHY 426 Remote Sensing
  - GPHY 429R Applied Remote Sensing
- Take ONE of the following: 3
  - STAT 217Q Intermediate Statistical Concepts
  - STAT 332 Statistics for Scientists and Engineers
- Take TWO or THREE of the following: 4 or 5
  - SRVY 230 Intro to Surveying for Engineers
  - DSDN 114 Introduction to CAD
  - STAT 408 Statistical Computing and Graphical Analysis
  - STAT 446 Sampling
  - CSCI 440 Database Systems
  - SRVY 375 Analytic Photogrammetry and Remote Sensing
  - GPHY 457 Adv GPS Mapping for GIS
  - GPHY 492 Independent Study

**Total Credits**

- 22 or 23

**Note:** A C- minimum is required in all curriculum courses to graduate by Regents’ policy. This includes electives in the curriculum.
Methods Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPHY 357</td>
<td>GPS Fund/App in Mapping</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 426</td>
<td>Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 429R</td>
<td>Applied Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 484R</td>
<td>Applied GIS &amp; Spatial Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 411</td>
<td>Methods for Data Analysis I</td>
<td>3</td>
</tr>
</tbody>
</table>

Selected minor or minor emphasis

University Core and Electives

Year Total: 120

Total Program Credits: 120

* Students are required to take 3 credits of ERTH 102CS to fulfill department requirements as well as Core 2.0

** Students, in consultation with their Earth Science advisor, must also select a minor from a minor tabulated in the catalog OR one of the emphases listed below.

Human Geography Emphasis

Choose 12 credits from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTY 101D</td>
<td>Anthropology and the Human Experience</td>
<td>3</td>
</tr>
<tr>
<td>ANTY 225IS</td>
<td>Culture, Language, and Society</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 210IS</td>
<td>Introduction to American Government</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 101IS</td>
<td>Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 202</td>
<td>Principles of Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 212RN</td>
<td>Yellowstone: Scientific Lab</td>
<td>4</td>
</tr>
</tbody>
</table>

Take an additional 9 credits of Advisor-approved upper division electives

The advisor-approved upper division electives (minimum 9 credits) will be selected from course offerings in Anthropology, Economics, History, Native American Studies, Political Science, Sociology, as well as Earth Science, Geology, and Geography (1 course only from within the department). The courses used here cannot be used to fulfill the other course requirements in the Geography Option.

Physical Geography Emphasis

Choose 12 credits from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 121IN</td>
<td>Introduction to General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>GEO 105IN</td>
<td>Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 245IN</td>
<td>Soils</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 212RN</td>
<td>Yellowstone: Scientific Lab</td>
<td>4</td>
</tr>
</tbody>
</table>

Take an additional 9 credits of Advisor-approved upper division electives

The advisor-approved upper division courses (minimum 9 credits) will be selected from course offerings in the Animal and Range Science, Biology, Civil Engineering, Entomology, and Land Resources and Environmental Sciences, as well as Earth Science, Geology, and Geography (1 course only from within the department). The courses used here cannot be used to fulfill the other course requirements in the Geography Option.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

Geology Option

The Geology Option is a degree program designed for students who are motivated to apply the principles of chemistry, physics and mathematics to the study of the Earth’s surface and interior. There are outstanding opportunities for employment in the public and private sectors in fields such as petroleum geology, mining geology, seismology (including earthquake and volcanic risk assessment), hydrology (surface and ground water) natural-hazard geology, environmental clean-up and containment of environmental hazards, mitigation of future environmental problems related to development, preservation of water resources (both surface and ground water), and the study of the processes of climate change and global warming. The optimal degree for employment and advancement in the geological sciences in the private sector is the Master’s Degree, and the undergraduate Geology Option is an excellent preparatory degree for graduate study. Some students interested in college teaching or advanced research may require a Ph.D. degree. In the Geology Option, students are given the opportunity to learn in the world-class natural laboratory that surrounds Bozeman. Course work progresses from core courses that all students must take (Earth System Science, Topics in Earth Science, Earth History and Evolution, Mineralogy, Sedimentation and Stratigraphy, Structural Geology, Global Tectonics, Sedimentary Petrology, two geographic information science (GIS) courses, Field Methods, and Field Geology) to the summer capstone course. Also included are a variety of elective courses in geology, paleontology, hydrology, Weather and Climate, Geomorphology, and remote sensing. These courses prepare the student for a variety of jobs and/or graduate school.

Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHMY 141</td>
<td>- College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 143</td>
<td>- College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 101IN</td>
<td>- Earth System Sciences</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 201IN</td>
<td>- Honors Earth System Science</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 102CS</td>
<td>- Topics in Earth Sciences (3 Credits Needed)</td>
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</tr>
<tr>
<td>GEO 211</td>
<td>- Earth History and Evolution</td>
<td>3</td>
</tr>
<tr>
<td>M 171Q</td>
<td>- Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>M 172Q</td>
<td>- Calculus II</td>
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Year Total: 30

Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHMY 284</td>
<td>- Intro to GIS Science &amp; Cartog</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 384</td>
<td>- Adv GIS and Spatial Analysis</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 205</td>
<td>- College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 207</td>
<td>- College Physics II</td>
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Year Total: 30

Junior Year

<table>
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<th>Course Title</th>
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</thead>
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<tr>
<td>ERTH 303</td>
<td>- Weather and Climate</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 307</td>
<td>- Principles of Geomorphology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 302</td>
<td>- Mineralogy and Optical Mineral</td>
<td>4</td>
</tr>
<tr>
<td>GEO 309</td>
<td>- Sedimentation and Stratigraphy</td>
<td>4</td>
</tr>
<tr>
<td>GEO 315</td>
<td>- Structural Geology</td>
<td>4</td>
</tr>
<tr>
<td>STAT 332</td>
<td>- Statistics for Scientists and Engineers</td>
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Year Total: 30

Senior Year

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>GEO 429R</td>
<td>- Field Geology</td>
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<tr>
<td>GEO 448</td>
<td>- Sedimentary Petrology</td>
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<tr>
<td>GEO 449</td>
<td>- Metamorphic Petrology</td>
<td>3</td>
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<tr>
<td>or GEO 450</td>
<td>- Igneous Petrology</td>
<td></td>
</tr>
</tbody>
</table>

Year Total: 30

Total Program Credits: 120
the student for a variety of jobs and/or graduate school. Internships and summer field research experience are available to some students.

**Freshman Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 102IS</td>
<td>Earth System Sciences</td>
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</tr>
<tr>
<td>ERTH 102CS</td>
<td>Topics in Earth Sciences (3 Credits Needed)</td>
<td>1</td>
</tr>
<tr>
<td>GEO 211</td>
<td>Earth History and Evolution</td>
<td>3</td>
</tr>
<tr>
<td>M 171Q</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>M 172Q</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>University Core and Electives</td>
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<td>3</td>
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<tr>
<td>Year Total:</td>
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<td></td>
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</table>

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIBB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>GEO 208IN</td>
<td>Earth Materials</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 284</td>
<td>Intro to GIS Science &amp; Cartog</td>
<td>3</td>
</tr>
<tr>
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<td>PHSX 207</td>
<td>College Physics II</td>
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**Junior Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>ERTH 303</td>
<td>Weather and Climate</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 307</td>
<td>Principles of Geomorphology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 302</td>
<td>Mineralogy and Optical Mineral</td>
<td>4</td>
</tr>
<tr>
<td>GEO 309</td>
<td>Sedimentation and Stratigraphy</td>
<td>4</td>
</tr>
<tr>
<td>GEO 315</td>
<td>Structural Geology</td>
<td>4</td>
</tr>
<tr>
<td>STAT 332</td>
<td>Statistics for Scientists and Engineers</td>
<td>3</td>
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<tr>
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<td>8</td>
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**Senior Year**

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<tr>
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<th>Course Name</th>
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</tr>
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<tbody>
<tr>
<td>GEO 429R</td>
<td>Field Geology**</td>
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<td>GEO 448</td>
<td>Sedimentary Petrology</td>
<td>3</td>
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<tr>
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</tbody>
</table>

**Total Program Credits:** 120

---

**Paleontology Option**

The paleontology option focuses on understanding fossils within their geologic context, while Montana’s geology provides the opportunity for hands-on fieldwork. The paleontology option in the Department of Earth Sciences is designed for those students who have a strong interest in either invertebrate or vertebrate fossils (evolution, biology of ancient organisms, the environment in which the organism lived, and the changes the fossil has undergone since death). Students who study paleontology find employment with colleges and universities (e.g., teaching paleontology, earth sciences, comparative anatomy), natural history museums (e.g. fossil preparation, collection, curation, exhibit design, education), as scientific illustrators, writers, paleontology consultants for energy resource companies, and resource specialists for local, state, and federal land-management agencies or parks. Because students who study this option are trained in core geology courses, employment may be found in areas outside paleontology that require geologic expertise. Graduate training beyond the bachelor’s degree is recommended for those seeking careers in the paleontology (normally a master’s degree) or in teaching and/or research (typically a doctorate). This option combines training in geology and paleontology. The paleontology option builds on courses that form the core of the traditional geology option, while providing strong background in paleontology through four required courses (in addition to the paleontology field course) and three elective courses. All of the paleontology courses offered through the department provide upper division credits. These courses prepare the student for a variety of jobs and/or graduate school. Internships and summer field research experience are available to some students.

**Freshman Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
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<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 101IN</td>
<td>Earth System Sciences</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 102CS</td>
<td>Topics in Earth Sciences (3 Credits Needed)</td>
<td>1</td>
</tr>
<tr>
<td>GEO 211</td>
<td>Earth History and Evolution</td>
<td>3</td>
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<tr>
<td>M 171Q</td>
<td>Calculus I</td>
<td>4</td>
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<td>M 172Q</td>
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**Sophomore Year**

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<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
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<tr>
<td>GEO 208IN</td>
<td>Earth Materials</td>
<td>3</td>
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<tr>
<td>GPHY 284</td>
<td>Intro to GIS Science &amp; Cartog</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 384</td>
<td>Adv GIS and Spatial Analysis</td>
<td>3</td>
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<tr>
<td>PHSX 205</td>
<td>College Physics I</td>
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<td>PHSX 207</td>
<td>College Physics II</td>
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**Junior Year**

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<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ERTH 303</td>
<td>Weather and Climate</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 307</td>
<td>Principles of Geomorphology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 302</td>
<td>Mineralogy and Optical Mineral</td>
<td>4</td>
</tr>
<tr>
<td>GEO 309</td>
<td>Sedimentation and Stratigraphy</td>
<td>4</td>
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<tr>
<td>GEO 315</td>
<td>Structural Geology</td>
<td>4</td>
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<td>STAT 332</td>
<td>Statistics for Scientists and Engineers</td>
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<tr>
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<td>8</td>
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<td>Year Total:</td>
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</table>

**Senior Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO 429R</td>
<td>Field Geology**</td>
<td>6</td>
</tr>
<tr>
<td>GEO 448</td>
<td>Sedimentary Petrology</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td></td>
<td>21</td>
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<tr>
<td>Year Total:</td>
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</table>

**Total Program Credits:** 120

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**Required Upper Division Paleontology Course Electives:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>GEO 310</td>
<td>Invertebrate Paleontology</td>
<td>3</td>
</tr>
<tr>
<td>GEO 330</td>
<td>Paleontology Lab Techniques</td>
<td>2</td>
</tr>
<tr>
<td>GEO 411</td>
<td>Vertebrate Paleontology</td>
<td>3</td>
</tr>
<tr>
<td>GEO 417</td>
<td>Taphonomy: Fossil Preservation</td>
<td>3</td>
</tr>
<tr>
<td>GEO 419</td>
<td>Field Paleontology**</td>
<td>2</td>
</tr>
</tbody>
</table>

* Students are required to take 3 credits of ERTH 102CS to fulfill department requirements as well as Core 2.0

** GEO 429R Should be taken SUMMER of either Junior or Senior year.

*** Taken during summer of Sophomore or Junior year

---

**Required Elective Course Options:**

Take TWO of the following required electives: 6

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>BIOO 310</td>
<td>Comparative Vertebrate Anatomy</td>
</tr>
<tr>
<td>ERTH 484</td>
<td>Quaternary Environment</td>
</tr>
<tr>
<td>ERTH 494</td>
<td>Seminar</td>
</tr>
<tr>
<td>GEO 312</td>
<td>Dinosaur Paleontology</td>
</tr>
</tbody>
</table>
Snow Science Option

The Snow Science program in the Department of Earth Sciences provides a foundation for understanding the distribution of snow (geography), mechanics of snow (physics, engineering), composition of snow (chemistry), variability of snow (statistics), and ecological effects of snow (ecology, hydrology). Essentially, this degree is a strongly quantitative geo-science degree with a special emphasis on Snow Science and mountain system processes.

It is also one of the best pre-professional programs in the world for those who want to carry their interests in Snow Science into a professional career. Employment ranges from ski patrol, director of snow safety, avalanche-center employee, snow scientist with a federal agency, or consulting in the area of land use planning, transportation engineering, or avalanche protection.

The optimal degree for employment and advancement in snow science is the Master’s Degree. Some students interested in college teaching or advanced research may require a Ph.D. degree. The snow science option is an excellent preparatory degree both for employment and for advanced graduate studies, especially in quantitative geo-science fields.

In the Snow Science Option, students progress through a broad-based core of courses that includes introductory geology and geography, calculus, chemistry, physics, weather and climate, geographic information systems (GIS), geomorphology, glacial geology, and mountain geography. In addition to the core of Snow Science courses, students examine spatial analysis of factors important to snow distribution, snow hydrology, snow melt, and the analysis of factors which influence the spatial distribution of snow or snow avalanches. The capstone course is snow dynamics and accumulation. Students are strongly encouraged to consider a graduate degree in snow science to prepare for professional jobs, but such training is not always required.

Courses Required in Department

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>GEO 413</td>
<td>Macroevolution/Fossil Record</td>
<td></td>
</tr>
<tr>
<td>GEO 433</td>
<td>Global Tectonics</td>
<td></td>
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<tr>
<td>GEO 449</td>
<td>Metamorphic Petrology</td>
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<td>GEO 450</td>
<td>Igneous Petrology</td>
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<tr>
<td>GEO 490R</td>
<td>Undergraduate Research</td>
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<tr>
<td>GEO 491</td>
<td>Special Topics</td>
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<td>GEO 492</td>
<td>Independent Study</td>
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<tr>
<td>GEO 498</td>
<td>Internship</td>
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<tr>
<td>GPHY 411</td>
<td>Biogeography</td>
<td></td>
</tr>
<tr>
<td>GPHY 357</td>
<td>GPS Fund/App in Mapping</td>
<td></td>
</tr>
</tbody>
</table>

Note:

Only GEO 491 courses that cover a specific paleontology topic are applicable.

A C- minimum is required in all curriculum courses to graduate by Regents' policy. This includes electives in the curriculum.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 or above.

Snow Science Option

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Courses Required in Department

<table>
<thead>
<tr>
<th>Year</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Freshman</td>
<td>ERTH 101IN</td>
<td>Earth System Sciences</td>
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<td></td>
<td>ERTH 102CS</td>
<td>Topics in Earth Sciences (3 credits needed)</td>
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<td></td>
<td>GPHY 141D</td>
<td>Geography of World Regions</td>
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<td>M 171Q</td>
<td>Calculus I</td>
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<tr>
<td>Sophomore</td>
<td>CHMY 141</td>
<td>College Chemistry I</td>
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<td>CHMY 143</td>
<td>College Chemistry II</td>
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<td></td>
<td>ERTH 303</td>
<td>Weather and Climate</td>
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<td></td>
<td>GPHY 121D</td>
<td>Human Geography</td>
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<td>GPHY 284</td>
<td>Intro to GIS Science &amp; Cartog</td>
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<td>Principles of Geomorphology</td>
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<td>GPHY 384</td>
<td>Adv GIS and Spatial Analysis</td>
<td>3</td>
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<tr>
<td></td>
<td>GPHY 392</td>
<td>Environment and Society</td>
<td>3</td>
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<td></td>
<td>STAT 332</td>
<td>Statistics for Scientists and Engineers (***)</td>
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<tr>
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<td>Courses from Core and upper Division Electives (below)</td>
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<td>30</td>
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<tr>
<td>Senior Year</td>
<td>ERTH 450R</td>
<td>Snow Dynamics and Accumulation</td>
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<tr>
<td></td>
<td>GPHY 441R</td>
<td>Mountain Geography</td>
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<td></td>
<td>GEO 445</td>
<td>Glacial Geology</td>
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<td></td>
<td>STAT 401</td>
<td>Applied Methods in Statistics</td>
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<tr>
<td></td>
<td>Courses from Core and upper Division Electives (below)</td>
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<td>Total Program Credits:</td>
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</table>

* Students are required to take 3 credits of ERTH 102CS to fulfill department requirements as well as Core 2.0.
** No more than 10 credits from the departmental required courses can count towards the total credit requirements for Core 2.0.
*** Students with a grade less than B in calculus might consider taking STAT 216Q and STAT 217Q rather than STAT 332.

Upper Division Electives: Take 21 credits from the following

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ERTH 450R</td>
<td>Snow Dynamics and Accumulation</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 484</td>
<td>Quaternary Environment</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 357</td>
<td>GPS Fund/App in Mapping</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 365</td>
<td>Geographical Planning</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 402</td>
<td>Water and Society</td>
<td>3</td>
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<tr>
<td>GPHY 411</td>
<td>Biogeography</td>
<td>3</td>
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<tr>
<td>GPHY 425</td>
<td>Geographic Thought</td>
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<tr>
<td>GPHY 426</td>
<td>Remote Sensing</td>
<td>3</td>
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<tr>
<td>GPHY 457</td>
<td>Adv GPS Mapping for GIS</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 461</td>
<td>Tourism Planning</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 484R</td>
<td>Applied GIS &amp; Spatial Analysis</td>
<td>3</td>
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<tr>
<td>ENSC 444</td>
<td>Watershed Hydrology</td>
<td>3</td>
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<tr>
<td>ENSC 445</td>
<td>Watershed Analysis</td>
<td>3</td>
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<tr>
<td>STAT 411</td>
<td>Methods for Data Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 412</td>
<td>Methods for Data Analysis II</td>
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</tr>
<tr>
<td>STAT 431</td>
<td>Nonparametric Statistics</td>
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<tr>
<td>STAT 436</td>
<td>Introduction to Time Series Analysis</td>
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</table>
Water Resources Minor (Non-Teaching)

The Water Resources Minor is designed to encourage a student from any discipline to explore water resources beyond course work in their major. As a result, the minor includes courses from the College of Agriculture, the College of Engineering, and the College of Letters and Science. The minor is administered by the Water Resources Committee (WRM) under the guidance of the Montana Institute on Ecosystems. Any committee member may serve as an advisor for the minor (see list of Faculty Advisors below). The chair of the committee, IoE Director, serves as the certifying officer and signs the Application for a Non-Teaching Minor after approved and forwarded by departmental advisors.

This minor requires a minimum of 21 credits. The courses are grouped into basic and applied sciences and social sciences courses. Students are expected to create a diverse program, with the guidance of their faculty advisor, using courses from both the science and social science areas. No more than 12 credits may be used to simultaneously fulfill Water Resources Minor requirements, University Core and the student’s major. At least 9 credits must be unique to the minor. The student’s minor advisor must certify that the 12-credit restriction is not exceeded. Course substitutions are allowed only by appeal to and approval by the WRM advisor and must be sent to the committee chair. The written appeal should identify the substitution and present a brief rationale.

For more information, please visit the Water Resources Minor website (http://www.montana.edu/water-resources-minor).

Notes:
- A C- is required in all curriculum courses to graduate by Regents’ policy. This includes electives in this curriculum.
- A minimum of 120 credits is required for graduation.
- All offerings are dependent upon available staffing.

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ENSC 272CS</td>
<td>Water Resources (Week 1 in Fall, online in Spring)</td>
<td>3</td>
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Choose one of the following: 3

<table>
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<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>ENSC 498</td>
<td>Internship</td>
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<tr>
<td>GPHY 498</td>
<td>Internship</td>
<td></td>
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<tr>
<td>ECIV 498</td>
<td>Internship</td>
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<tr>
<td>PSCI 498</td>
<td>Internship</td>
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Restrict Electives

Take 15 credits; at least one from each subject area

Basic Science Courses

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOE 428</td>
<td>Freshwater Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 360</td>
<td>General Microbiology</td>
<td>5</td>
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<tr>
<td>BIOM 415</td>
<td>Microbial Diversity, Ecology, and Evolution</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 452</td>
<td>Soil &amp; Enviromntl Microbiology</td>
<td>3</td>
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<tr>
<td>CHMY 311</td>
<td>Fundamental Analytical Chem</td>
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</tr>
<tr>
<td>EENV 434</td>
<td>Groundwater Supply/Remediation</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 444</td>
<td>Watershed Hydrology</td>
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<td>ENSC 445</td>
<td>Watershed Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 454</td>
<td>Landscape Pedology</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 465</td>
<td>Environmental Biophysics</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 468</td>
<td>Ecosystem Biogeochem and Global Change</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 303</td>
<td>Weather and Climate</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 307</td>
<td>Principles of Geomorphology</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 450R</td>
<td>Snow Dynamics and Accumulation</td>
<td>4</td>
</tr>
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</table>

Applied Science Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>ECIV 331</td>
<td>Engineering Hydrology</td>
<td>2</td>
</tr>
<tr>
<td>EENV 340</td>
<td>Princ of Envr Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EENV 441</td>
<td>Natural Treatment Systems</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 353</td>
<td>Environmental Biogeochemistry</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 407</td>
<td>Environmental Risk Assessment</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 448</td>
<td>Stream Restoration Ecology</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 461</td>
<td>Restoration Ecology</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 384</td>
<td>Adv GIS and Spatial Analysis</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 426</td>
<td>Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 429R</td>
<td>Applied Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 457</td>
<td>Adv GPS Mapping for GIS</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 484R</td>
<td>Applied GIS &amp; Spatial Analysis</td>
<td>3</td>
</tr>
<tr>
<td>NRSM 455</td>
<td>Riparian Ecology &amp; Management</td>
<td>3</td>
</tr>
<tr>
<td>WILD 301</td>
<td>Princ of Fish &amp; Wildlife Mgmt</td>
<td>3</td>
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</tbody>
</table>

Social Science Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 332</td>
<td>Econ of Natural Resources</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 432R</td>
<td>Benefit-Cost Analysis</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 402</td>
<td>Water and Society</td>
<td>3</td>
</tr>
<tr>
<td>HSTA 470</td>
<td>American Environmental History</td>
<td>3</td>
</tr>
<tr>
<td>NRSM 421</td>
<td>Holistic Thought/Mgmt</td>
<td>4</td>
</tr>
<tr>
<td>NRSM 430</td>
<td>Natural Resource Law</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 362</td>
<td>Natural Resource Policy</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 470</td>
<td>Environmental Sociology</td>
<td>3</td>
</tr>
</tbody>
</table>

Any 290, 490, 291, 491, 292 or 492 course(s) related to water may be used in the minor

Note: A C- minimum is required in all curriculum courses to graduate by Regents’ policy. This includes electives in the curriculum. All students are responsible for meeting prerequisites for upper division courses.

Water Resources Minor Faculty Advisors

- Eric Austin - Political Science
- Joel Cahoon - Civil Engineering
- Wyatt Cross - Ecology
- Jordy Hendrikx - Earth Sciences
- Clayton Marlow - Animal & Range Sciences
- Bruce Maxwell, Chair - IoE/Land Resources and Environmental Sciences
- Jamie McEvoy - Earth Sciences
- Tom McMahon - Ecology
- Eric Austin - Political Science
- Rob Payn - Land Resources and Environmental Sciences
- Paul Stoy - Land Resources and Environmental Sciences

Ecology

Note: MSU’s programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology. For additional options see Biological Sciences at MSU (p. 82).
Department of Ecology
The Department of Ecology offers a Bachelor of Science in Biological Sciences which emphasizes a solid grounding in biology and the fundamental sciences, and which allows students to specialize within four options: Organismal Biology, Fish and Wildlife Ecology and Management, Conservation Biology and Ecology, and Biology Teaching. Organismal Biology emphasizes the basic sciences of zoology and botany; Fish and Wildlife Ecology and Management and Conservation Biology and Ecology emphasize the application of knowledge to the conservation of the biota and natural resources; Biology Teaching prepares students for careers as a high school biology teacher.

Many positions for professional biologists require a graduate degree. The degree options are intended to provide the solid knowledge and skills required of all college graduates as well as the prerequisite educational background for graduate programs.

Students interested in secondary school biology teaching and Montana state certification must fulfill the Biology Teaching option which includes professional education courses as well as a solid biology and basic science core; a teaching minor or second area of certification is recommended.

Requirements for Admission to Upper Division Courses in Biology
For admission to upper division (numbered 300 or higher) Biology (BIOB, BIOE, BIOO) and Fish and Wildlife Management (WILD) courses, students must have completed at least 45 total university credits with a cumulative GPA of at least 2.5 for all courses and have also earned a "C-" or better for any prerequisite courses. Limited exceptions may be made by consent of instructor. Any student who obtains enrollment in an upper division biology course without satisfying these requirements will be required to withdraw from the course.

Grade Requirements
To graduate with a B.S. in Biological Sciences, students must earn a grade of "C-" or better for every course required for the specific option (Conservation Biology and Ecology, Fish and Wildlife Ecology and Management, Organismal Biology, and Biology Teaching), including courses taken to fulfill required biology elective credits, all required courses in non-biology rubrics, and all upper division courses.

Undergraduate Programs
All students will earn a B.S. in Biological Sciences with at least one of the following options or concentrations to be completed.

- Biology Teaching (p. 209)
- Conservation Biology and Ecology (p. 209)
- Fish and Wildlife Ecology and Management (p. 211)
- Organismal Biology (p. 212)

Undergraduate Minors

- Genetics Minor (Non-Teaching) (p. 95)
- Water Resources Minor (Non-Teaching) (http://catalog.montana.edu/undergraduate/letters-science/earth-sciences/water-resources-minor-nonteaching)

The graduate degree programs offered in the Department of Ecology provide opportunities for students to pursue M.S. and/or Ph.D. degrees in various disciplines under the guidance of faculty. Graduate students may conduct research on a diversity of topics pertaining to their individual areas of interest: terrestrial and aquatic ecology, fish and wildlife management, evolutionary biology, quantitative ecology, and conservation biology. Both Master’s and Ph.D. degrees require a thesis or dissertation and a research publication.

Degrees Offered

- M.S. in Biological Sciences (p. 374)
- M.S. in Fish and Wildlife Management (p. 375)
- Ph.D. in Fish and Wildlife Biology (p. 375)
- Ph.D. in Biological Sciences (p. 375)
- Ph.D. in Ecology and Environmental Sciences (p. 375) (interdisciplinary)

Astrobiology Minor (Non-Teaching)
The Astrobiology Minor is designed to educate students in this interdisciplinary field covering the varied scientific disciplines that contribute to our general understanding of life, the origin of life, the past history of life on Earth, possible futures for life on Earth, and the possible existence of life on other planetary environments. The principal goal of the minor is to develop students’ literacy in astrobiology so they can critically evaluate claims related to this field that they encounter well after their college education has ended.

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 110IN</td>
<td>Introduction to Astronomy: Mysteries of the Sky</td>
<td>3</td>
</tr>
<tr>
<td>or ASTR 371</td>
<td>Solar System Astronomy</td>
<td></td>
</tr>
<tr>
<td>or ASTR 373</td>
<td>Stars, Galaxies, and the Universe</td>
<td></td>
</tr>
<tr>
<td>BIOB 170IN</td>
<td>Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>or BIOB 260</td>
<td>Cellular and Molecular Biology</td>
<td></td>
</tr>
<tr>
<td>or BIOB 160</td>
<td>Principles of Living Systems</td>
<td></td>
</tr>
<tr>
<td>ERTH 101IN</td>
<td>Earth System Sciences</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>3-4</td>
</tr>
<tr>
<td>or CHMY 121IN</td>
<td>Introduction to General Chemistry</td>
<td></td>
</tr>
<tr>
<td>or CHMY 102CS</td>
<td>Applying Chemistry to Society</td>
<td></td>
</tr>
<tr>
<td>GEO 211</td>
<td>Earth History and Evolution</td>
<td>3</td>
</tr>
<tr>
<td>PHL 278CS</td>
<td>Origins of Life</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 350</td>
<td>Astrobiology</td>
<td>3</td>
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</tbody>
</table>

Choose one upper division elective from the following rubrics: 3-4

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 3xx</td>
<td></td>
</tr>
<tr>
<td>CHMY 3xx</td>
<td></td>
</tr>
<tr>
<td>PHYS 3xx</td>
<td></td>
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</tbody>
</table>

Elective Courses

Choose 6 credits from the following: 6

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 371</td>
<td>Solar System Astronomy</td>
</tr>
<tr>
<td>ASTR 373</td>
<td>Stars, Galaxies, and the Universe</td>
</tr>
<tr>
<td>BCH 380</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>BCH 441</td>
<td>Biochemistry of Macromolecules</td>
</tr>
<tr>
<td>BCH 442</td>
<td>Metabolic Regulation</td>
</tr>
<tr>
<td>BIOB 375</td>
<td>General Genetics</td>
</tr>
<tr>
<td>BIOB 420</td>
<td>Evolution</td>
</tr>
<tr>
<td>BIOE 370</td>
<td>General Ecology (equiv to 270)</td>
</tr>
<tr>
<td>BIOM 360</td>
<td>General Microbiology</td>
</tr>
<tr>
<td>ERTH 505</td>
<td>Geomicrobiology</td>
</tr>
<tr>
<td>HSTR 207CS</td>
<td>Sci and Tech in World History</td>
</tr>
<tr>
<td>HSTR 282CS</td>
<td>Darwinian Revolution</td>
</tr>
<tr>
<td>HSTR 417</td>
<td>Early Modern Science</td>
</tr>
<tr>
<td>HSTR 419</td>
<td>Modern Science</td>
</tr>
</tbody>
</table>


The Biology Teaching Option in the Biological Sciences major is designed for students who wish to become licensed to teach Biology in grades 5-12. Upon completion of the degree, students are eligible for licensure in the state of Montana. Secondary education students are encouraged to pursue a teaching minor in an additional content area and should contact an advisor for details. Obtaining a teaching minor will require more than eight semesters. For more information on admission to the Teacher Education Program, Student Teaching, Licensure, Professional Expectations and more, please visit: The Teacher Education Page (p. 135)

The Biology Teaching Option includes 40 credits of Biology (28-30 credits of basic biology courses, plus 11-12 biology elective credits), supporting Chemistry, Physics, and Mathematics courses, 18 credits in the university Core 2.0, 24 credits of professional preparation, and Student Teaching. Biology electives must include 8 credits of advisor-approved upper division credits in biological sciences.

**Freshman Year**

- BIBO 170IN - Principles of Biological Diversity (Fall) 4
- CHMY 141 - College Chemistry I (Fall) 4
- WRIT 101W - College Writing I (Fall) 3
- M 161Q - Survey of Calculus (Fall) 4
- University Core and Electives 0-3
- BIBO 160 - Principles of Living Systems (Spring) 4
- CHMY 143 - College Chemistry II (Spring) 4
- HDFS 101IS - Indiv and Fam Dev: Lifespan (Spring) 3
- COMX 111US - Introduction to Public Speaking or CLS 101US - Knowledge and Community (Spring) 3
- University Core and Electives 1-4

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 211 - Elements of Organic Chemistry</td>
<td></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>PHSX 205 - College Physics I</td>
<td></td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EDU 202 - Early Field Experience</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>EDU 211D - Multicultural Education</td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td></td>
<td>2-5</td>
<td>3</td>
</tr>
<tr>
<td>BCH 380 - Biochemistry</td>
<td></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
<td></td>
<td>3-5</td>
</tr>
<tr>
<td>- BIOM 103IN - Unseen Universe: Microbes (Fall)</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>- BIOM 360 - General Microbiology (Fall)</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>PHSX 207 - College Physics II</td>
<td></td>
<td>4</td>
<td>4</td>
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<tr>
<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
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<td>3</td>
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<tr>
<td>University Core and Electives</td>
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**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIBO 375 - General Genetics</td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>or BIBO 377 - Practical Genetics</td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 360 - General Microbiology</td>
<td></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>EDU 370 - Integrating Tech into Educ</td>
<td></td>
<td>2</td>
<td>2</td>
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<tr>
<td>University Core and Electives</td>
<td></td>
<td>5-6</td>
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**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 395 - Practicum</td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>EDU 408 - Professional Issues: K-12</td>
<td></td>
<td>3</td>
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</tr>
<tr>
<td>University Core and Electives</td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>EDU 408 - Rocky Mountain Vegetation</td>
<td></td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>or BIBO 412 - Animal Physiology</td>
<td></td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>or BIBO 433 - Plant Physiology</td>
<td></td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>EDU 495 - Senior Thesis/Capstone</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>University Core and Electives</td>
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<td>5-6</td>
<td>5-6</td>
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<tr>
<td>Year Total:</td>
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<td>14</td>
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</table>

**Total Program Credits:** 120

* Must be taken in assigned semester

University requirements for graduation also must be completed, including university core requirements and a minimum of 120 total credits of which 42 must be in courses numbered 300 and above.

**Requirements for Admission to Upper Division Courses in Biology**

For admission to upper division (numbered 300 or higher) Biology (BIBO, BIBO, BIBO, BIOM) and Fish and Wildlife Management (WILD) courses, students must have completed at least 45 total university credits with a cumulative GPA of at least 2.5 for all courses and have also earned a "C-" or better for any prerequisite courses. Limited exceptions may be made by consent of instructor. Any student who obtains enrollment in an upper division biology course without satisfying these requirements will be required to withdraw from the course.

**Conservation Biology and Ecology Option**

The Conservation Biology and Ecology option will give students a clear understanding of the ways that natural and human-related processes affect species, communities, and ecosystems, and relate this knowledge to its broad societal context. This option provides students with strong preparation for graduate study which is necessary for most jobs in Ecology and Conservation Biology. The defining characteristics of the degree include:

- Understanding natural and human-related processes that affect populations, species, communities, and ecosystems
- Understanding methods to quantify and mitigate effects on populations, species, communities and ecosystems
- Strong emphasis on background in basic biology
• Required grounding in courses on physical environment & human dimensions of conservation, including economics, law, history and social science
• High standards for statistical knowledge
• Emphasis on classes in written and spoken communication

Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOE 103CS - Environmental Science and Society</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 170IN - Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>COMX 111US - Introduction to Public Speaking (formerly COM 110US)</td>
<td>3</td>
</tr>
<tr>
<td>or CLS 101US - Knowledge and Community</td>
<td></td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>0-3</td>
</tr>
<tr>
<td>PHSX 205 - College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>M 161Q - Survey of Calculus</td>
<td>4</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>BIB 160 - Principles of Living Systems (Chem pre-req)</td>
<td>4</td>
</tr>
<tr>
<td>University CORE and Additional Electives</td>
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Year Total: 14-17

Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHL 236Q - Logic</td>
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<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 143 - College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>ENSC 110 - Lnd Res Environ Sciences</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 201 - College Writing II</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 375 - General Genetics</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 211 - Elements of Organic Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>ECNS 101IS - Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>Take one of the following:</td>
<td>3-4</td>
</tr>
<tr>
<td>ERTH 101IN - Earth System Sciences</td>
<td></td>
</tr>
<tr>
<td>ERTH 102CS - Topics in Earth Sciences (3 of 16 offered)</td>
<td></td>
</tr>
<tr>
<td>STAT 217Q - Intermediate Statistical Concepts</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Total: 16-17

Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take one of the following:</td>
<td>3-5</td>
</tr>
<tr>
<td>ENSC 245IN - Soils</td>
<td></td>
</tr>
<tr>
<td>BCH 380 - Biochemistry</td>
<td></td>
</tr>
<tr>
<td>STAT 411 - Methods for Data Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>Take one of the following:</td>
<td>0-3</td>
</tr>
<tr>
<td>BIB 412 - Animal Physiology (3, Fall only)</td>
<td></td>
</tr>
<tr>
<td>BIB 433 - Plant Physiology (3, Spring only)</td>
<td></td>
</tr>
<tr>
<td>Social Sciences Elective</td>
<td>3</td>
</tr>
<tr>
<td>University CORE and Additional Electives</td>
<td>3</td>
</tr>
<tr>
<td>BIOE 370 - General Ecology (equiv to 270)</td>
<td>3</td>
</tr>
<tr>
<td>Take one of the following:</td>
<td>0-3</td>
</tr>
<tr>
<td>BIB 433 - Plant Physiology (3, Spring only)</td>
<td></td>
</tr>
<tr>
<td>BIB 412 - Animal Physiology (3, Fall only)</td>
<td></td>
</tr>
<tr>
<td>Social Sciences Elective</td>
<td>3</td>
</tr>
<tr>
<td>University CORE and Additional Electives</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Total: 12-18

Senior Year

SOCIO 375 - Ecological Responses to Climate Change | 3 |
SOCIO 420 - Evolution | 3 |

Year Total: 12-17 15-18

Social Sciences Elective Block

A minimum of six (6) credits of electives must be taken in the social sciences, including subjects such as economics, sociology, political science, history, philosophy, or language. It is acceptable to select electives broadly or to focus them in one area. The intention is to develop a better understanding of the ways that conservation biology and ecology are related to broader issues in society, and to develop additional areas of expertise that are useful in the formulation and implementation of conservation policy. If any of the courses selected have the IS suffix, they will simultaneously satisfy a requirement of the University CORE. Classes may be lower or upper division.

Suggested Electives for the Conservation Biology and Ecology Option

University requirements for graduation also must be completed, including university core requirements and a minimum of 120 total credits of which 42 must be in courses numbered 300 and above. The classes listed above satisfy university core requirements except that you must also take one class each for the Diversity, Arts and Humanities requirements (courses with suffixes of D, A and H). Some of the suggested electives meet these core requirements. The curriculum above completes 37-41 credits numbered 300 and above (including 6 credits in the Social Sciences elective block.). You have some flexibility in the classes that you select to fill your Junior and Senior years. It is intended that you use these credits to develop strength in an area of emphasis that matches your interests and goals. We recommend that you consult the list of suggested electives below and speak to your advisor.

Ecology and Evolution:

• BIOE 405 Behavioral and Evolutionary Ecology | 3 |
• BIOE 408 Rocky Mountain Vegetation | 2 |
• BIOM 415 Microbial Diversity, Ecology, and Evolution | 3 |
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOE 428</td>
<td>Freshwater Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOO 435</td>
<td>Plant Systematics</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 484</td>
<td>Population Genetics (not currently offered)</td>
<td>3</td>
</tr>
</tbody>
</table>

### Environmental Science:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ENSC 245IN</td>
<td>Soils</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 272CS</td>
<td>Water Resources</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 353</td>
<td>Environmental Biogeochemistry</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 410R</td>
<td>Biodiversity Methods</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 448</td>
<td>Stream Restoration Ecology</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 465</td>
<td>Environmental Biophysics</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 468</td>
<td>Ecosystem Biogeochern</td>
<td>3</td>
</tr>
</tbody>
</table>

### Fish & Wildlife Management:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>WILD 301</td>
<td>Princ of Fish &amp; Wildlife Mgmt</td>
<td>3</td>
</tr>
</tbody>
</table>

### Geography and Earth Science:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERTH 212RN</td>
<td>Yellowstone: Scientific Lab</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 303</td>
<td>Weather and Climate</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 284</td>
<td>Intro to GIS Science &amp; Cartog</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 411</td>
<td>Biogeography</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 426</td>
<td>Remote Sensing (consent of instructor or junior standing)</td>
<td>3</td>
</tr>
</tbody>
</table>

### Statistics:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 412</td>
<td>Methods for Data Analysis II</td>
<td>3</td>
</tr>
</tbody>
</table>

### Social Sciences:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 317</td>
<td>Economic Development</td>
<td>3</td>
</tr>
</tbody>
</table>

### Requirements for Admission to Upper Division Courses in Biology

For admission to upper division (numbered 300 or higher) Biology (BIOB, BIOE, BIOO) and Fish and Wildlife Management (WILD) courses, students must have completed at least 45 total university credits with a cumulative GPA of at least 2.5 for all courses and have also earned a "C-" or better for any prerequisite courses. Limited exceptions may be made by consent of instructor. Any student who obtains enrollment in an upper division biology course without satisfying these requirements will be required to withdraw from the course.

### Fish and Wildlife Ecology and Management Option

#### Freshman Year

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>WILD 201 - Intro to Fish and Wildlife</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BIOB 160 - Principles of Biological Diversity</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CHMY 121IN - Introduction to General Chemistry</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Choose one of the following*:</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

  * COMX 111US - Introduction to Public Speaking (Recommended)
  
  * CLS 101US - Knowledge and Community

<table>
<thead>
<tr>
<th>University Core and Electives</th>
<th>3-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 160 - Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>BIOE 103CS - Environmental Science and Society</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I (Semester assigned)</td>
<td>3</td>
</tr>
</tbody>
</table>

| University Core and Electives                    | 3-6  |

| Year Total:                                     | 15-18| 13-16  |

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 161Q - Survey of Calculus</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

  * ERTH 101IN - Earth System Sciences
  
  * ENSC 245IN - Soils
  
  * ENSC 272CS - Water Resources
  
  * GPHY 284 - Intro to GIS Science & Cartog

  **Recommended**

<table>
<thead>
<tr>
<th>University Core and Electives</th>
<th>3-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOO 230 - Identification of Seed Plants</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 123 - Introduction to Organic Chemistry and Biochemistry</td>
<td>4</td>
</tr>
<tr>
<td>WRIT 201 - College Writing II</td>
<td>3</td>
</tr>
<tr>
<td>or WRIT 221 - Intermediate Tech Writing</td>
<td></td>
</tr>
</tbody>
</table>

| University Core and Electives                    | 3-6  |

| Year Total:                                     | 10-14| 14-17  |

#### Junior Year

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOO 412 - Animal Physiology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BIOO 310 - Comparative Vertebrate Anatomy</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>BIOB 318 - Biometry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>or STAT 216Q - Introduction to Statistics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| University Core and Electives                    | 3-6  |

| WILD 301 - Princ of Fish & Wildlife Mgmt         | 3    |
| BIOB 375 - General Genetics                      | 3    |
| or BIOB 377 - Practical Genetics                 |      |
| BIOE 370 - General Ecology (equiv to 270)        | 3    |

| University Core and Electives                    | 3-6  |

| Year Total:                                     | 13-16| 12-15  |

#### Senior Year

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose two of the following:</td>
<td>0-6</td>
<td></td>
</tr>
</tbody>
</table>

  * BIOO 475 - Mammalogy (Fall only)
  
  * BIOO 470 - Ornithology (Spring only)
  
  * BIOO 415 - Ichthyology (Spring only)

| Choose one of the following pairs:               | 5-6  |

  * BIOE 408 - Rocky Mountain Vegetation
  
  * BIOE 455 - Plant Ecology
  
  * BIOE 428 - Freshwater Ecology
  
  & BIOE 427RN - Research in Freshwater Ecology

| Upper Division Biology Electives                 | 3-6  |

| BIOB 420 - Evolution                            | 3    |

| WILD 401RN - Fish and Wildlife Capstone          | 4    |

| Choose two of the following:                    | 3-6  |

  * BIOO 475 - Mammalogy (Fall only)
  
  * BIOO 470 - Ornithology (Spring only)
  
  * BIOO 415 - Ichthyology (Spring only)

| Upper Division Biology Electives                 | 3-6  |

| Year Total:                                     | 8-18 | 13-19  |

| Total Program Credits:                          | 120  |
A minimum of 120 credits is required for graduation; at least 42 of these credits must be in courses numbered 300 and above. The curriculum includes 35-39 credits numbered 300 and above, so an additional three to five credits must be selected. Additional upper division electives must be taken in biology, fish and wildlife, or a related field (ANSC, NRSM, ENSC, GPHY, and STAT). Students should consult with their advisor about the appropriateness of potential upper division electives taken outside the Biology set or WILD rubrics. This curriculum satisfies all except 12 credits of the University Core Requirements. Students are expected to be aware of all requirements for graduation and to ensure that they meet these requirements.

Requirements for Admission to Upper Division Courses in Biology

For admission to upper division (numbered 300 or higher) Biology (BIOB, BIOE, BIOO) and Fish and Wildlife Management (WILD) courses, students must have completed at least 45 total university credits with a cumulative GPA of at least 2.5 for all courses and have also earned a "C-" or better for any prerequisite courses. Limited exceptions may be made by consent of instructor. Any student who obtains enrollment in an upper division biology course without satisfying these requirements will be required to withdraw from the course. Specific courses may have additional prerequisites.

Organismal Biology Option

Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 170IN - Principles of Biological Diversity</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141 - College Chemistry I (Completed Level 3 math pre-requisite)</td>
<td>4</td>
</tr>
<tr>
<td>COMX 111US - Introduction to Public Speaking (take one in opposite semester from WRIT 101) or CLS 101US - Knowledge and Community</td>
<td>3</td>
</tr>
<tr>
<td>University Core, Electives, or Math pre-reqs</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOB 160 - Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 143 - College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I(^1)</td>
<td>3</td>
</tr>
<tr>
<td>University Core, Electives, or Math pre-reqs</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Year Total:

14-15 Fall  
14-15 Spring

Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 205 - College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 211 - Elements of Organic Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>University Core and Electives (^3)</td>
<td>3-6</td>
</tr>
<tr>
<td>STAT 217Q - Intermediate Statistical Concepts</td>
<td>3</td>
</tr>
<tr>
<td>BCH 380 - Biochemistry</td>
<td>5</td>
</tr>
<tr>
<td>M 161Q - Survey of Calculus</td>
<td>4</td>
</tr>
<tr>
<td>University Core and Electives (^3)</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Total:

15-18 Fall  
15 Spring

Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 375 - General Genetics</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives (^3)</td>
<td>9-12</td>
</tr>
</tbody>
</table>

University Core and Electives \(^3\) includes 35-39 credits numbered 300 and above, so an additional three to five credits must be selected. Additional upper division electives must be taken in biology, fish and wildlife, or a related field (ANSC, NRSM, ENSC, GPHY, and STAT). Students should consult with their advisor about the appropriateness of potential upper division electives taken outside the Biology set or WILD rubrics. This curriculum satisfies all except 12 credits of the University Core Requirements. Students are expected to be aware of all requirements for graduation and to ensure that they meet these requirements.

University requirements for graduation also must be completed, including university core requirements and a minimum of 120 total credits of which at least 42 credits must be in courses numbered 300 and above. Depending on courses selected, the curriculum includes 35 to 40 credits numbered 300 and above, so additional courses must be selected.

Requirements for Admission to Upper Division Courses in Biology

For admission to upper division (numbered 300 or higher) Biology (BIOB, BIOE, BIOO) and Fish and Wildlife Management (WILD) courses, students must have completed at least 45 total university credits with a cumulative GPA of at least 2.5 for all courses and have also earned a "C-" or better for any prerequisite courses. Limited exceptions may be made by consent of instructor. Any student who obtains enrollment in an upper division biology course without satisfying these requirements will be required to withdraw from the course. Specific courses may have additional prerequisites.

Water Resources Minor (Non-Teaching)

The Water Resources Minor is designed to encourage a student from any discipline to explore water resources beyond course work in their major. As a result, the minor includes courses from the College of Agriculture, the College of Engineering, and the College of Letters and Science. The minor is administered by the Water Resources Committee (WRC) under the guidance of the Montana Institute on Ecosystems. Any committee member may serve as an advisor for the minor (see list of Faculty Advisors below). The chair of the committee, IoE Director, serves as the certifying officer.
and signs the Application for a Non-Teaching Minor after approved and forwarded by departmental advisors.

This minor requires a minimum of 21 credits. The courses are grouped into basic and applied sciences and social sciences courses. Students are expected to create a diverse program, with the guidance of their faculty advisor, using courses from both the science and social science areas. No more than 12 credits may be used to simultaneously fulfill Water Resources Minor requirements, University Core and the student’s major. At least 9 credits must be unique to the minor. The student’s minor advisor must certify that the 12-credit restriction is not exceeded. Course substitutions are allowed only by appeal to and approval by the WRM advisor and must be sent to the committee chair. The written appeal should identify the substitution and present a brief rationale.

For more information, please visit the Water Resources Minor website (http://www.montana.edu/water-resources-minor).

<table>
<thead>
<tr>
<th>Required Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENSC 272CS</td>
</tr>
<tr>
<td>Choose one of the following:</td>
</tr>
<tr>
<td>ENSC 498</td>
</tr>
<tr>
<td>GPHY 498</td>
</tr>
<tr>
<td>ECIV 498</td>
</tr>
<tr>
<td>PSCI 498</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Restricted Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take 15 credits; at least one from each subject area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Basic Science Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOE 428</td>
</tr>
<tr>
<td>BIOM 360</td>
</tr>
<tr>
<td>BIOM 415</td>
</tr>
<tr>
<td>BIOM 452</td>
</tr>
<tr>
<td>CHMY 311</td>
</tr>
<tr>
<td>EENV 434</td>
</tr>
<tr>
<td>ENSC 444</td>
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<tr>
<td>ENSC 445</td>
</tr>
<tr>
<td>ENSC 454</td>
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<tr>
<td>ENSC 465</td>
</tr>
<tr>
<td>ENSC 468</td>
</tr>
<tr>
<td>ERTH 303</td>
</tr>
<tr>
<td>ERTH 307</td>
</tr>
<tr>
<td>ERTH 450R</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Applied Science Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECIV 331</td>
</tr>
<tr>
<td>EENV 340</td>
</tr>
<tr>
<td>EENV 441</td>
</tr>
<tr>
<td>ENSC 353</td>
</tr>
<tr>
<td>ENSC 407</td>
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<td>ENSC 448</td>
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<td>ENSC 461</td>
</tr>
<tr>
<td>GPHY 384</td>
</tr>
<tr>
<td>GPHY 426</td>
</tr>
<tr>
<td>GPHY 429R</td>
</tr>
<tr>
<td>GPHY 457</td>
</tr>
<tr>
<td>GPHY 484R</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social Science Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 332</td>
</tr>
<tr>
<td>ECNS 432R</td>
</tr>
<tr>
<td>GPHY 402</td>
</tr>
<tr>
<td>HSTA 470</td>
</tr>
<tr>
<td>NRSM 421</td>
</tr>
<tr>
<td>NRSM 430</td>
</tr>
<tr>
<td>PSCI 362</td>
</tr>
<tr>
<td>SOCI 470</td>
</tr>
</tbody>
</table>

Any 290, 490, 291, 491, 292 or 492 course(s) related to water may be used in the minor

Note: A C- minimum is required in all curriculum courses to graduate by Regents’ policy. This includes electives in the curriculum. All students are responsible for meeting prerequisites for upper division courses.

<table>
<thead>
<tr>
<th>Water Resources Minor Faculty Advisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Eric Austin - Political Science</td>
</tr>
<tr>
<td>• Joel Cahoon - Civil Engineering</td>
</tr>
<tr>
<td>• Wyatt Cross - Ecology</td>
</tr>
<tr>
<td>• Jordy Hendriks - Earth Sciences</td>
</tr>
<tr>
<td>• Clayton Marlow - Animal &amp; Range Sciences</td>
</tr>
<tr>
<td>• Bruce Maxwell, Chair - IoE/Land Resources and Environmental Sciences</td>
</tr>
<tr>
<td>• Jamie McEvoy - Earth Sciences</td>
</tr>
<tr>
<td>• Tom McMahon - Ecology</td>
</tr>
<tr>
<td>• Rob Payn - Land Resources and Environmental Sciences</td>
</tr>
<tr>
<td>• Paul Stoy - Land Resources and Environmental Sciences</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Economics Department of Agricultural Economics &amp; Economics</th>
</tr>
</thead>
</table>

The Bachelor of Science degree in economics stresses the use of economics as a means of understanding current economic activities and problems and their relationship to our social environment. Economics is the study of critical decision-making behavior. It is a mode of thinking and reasoning with widespread application. The skills that employers value most highly are the ability to think critically and carefully, the ability to learn new skills and the ability to solve problems. Some vocations may require very specific skills (for example, knowledge of a particular computer software package). However, skill requirements change over time. The need for people who can think, learn and solve problems is timeless. Economics hones these time-honored abilities.

The objective of the program is to provide the student with a liberal university education with particular emphasis on economics. In keeping with this objective, requirements are specified largely in terms of broad subject areas rather than designation of particular courses. The student, with the help of the advisor, is given the opportunity to develop a program to meet his or her own particular needs and interests. With this freedom, however, comes the responsibility of building an overall program that is both cohesive and academically sound. The program focuses on teaching students to think, to use logic and reason, and to organize their thoughts in order to solve problems rather than simply memorize and recite the subject.
matter. The courses also focus on instilling in students a desire to learn, so that they will leave our courses prepared and eager for lifelong learning.

The economics program, with its flexibility, offers the opportunity to acquire a general university education and the necessary background and preparation for many career objectives. Economics majors pursue a wide variety of careers after graduation. Students with a bachelor’s degree in economics are often employed in the financial, retailing, and industrial sectors of the economy. Economics majors also work in such diverse fields as actuarial science, elementary and secondary education, journalism, investment banking, securities analysis, corporate finance, insurance, law, politics, and environmental regulation, as well as in government and academia. Graduate schools regard a degree in economics as excellent preparation for advanced work toward a degree in law as well as a Ph.D. in a number of social science fields such as economics, international relations, public policy, and political science. Economics is also an excellent undergraduate major for students seeking an MBA. What can be done with an education in economics is unlimited!

Undergraduate Programs

- Economics (p. 214)

Undergraduate Minors

- Economics Minor (Non-Teaching) (p. 214)

Our Master of Science degree in Applied Economics encourages students to develop and apply their skills in economic analysis and examine a wide array of economic and political issues. Learning takes place through coursework in economic theory, quantitative methods and econometrics, through collaborative work with departmental faculty, and through an intensive research thesis that addresses an important economic issue selected by the student.

Degree Offered

- M.S. in Applied Economics (p. 292)

Economics

Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 101IS - Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>COMX 111US - Introduction to Public Speaking</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 202 - Principles of Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>M 161Q - Survey of Calculus</td>
<td>4</td>
</tr>
<tr>
<td>or M 171Q - Calculus I</td>
<td></td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>14</td>
</tr>
<tr>
<td>Year Total:</td>
<td>30</td>
</tr>
</tbody>
</table>

Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTG 201 - Principles of Financial Acct</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 204IS - Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 201 - College Writing II</td>
<td>3</td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>18</td>
</tr>
<tr>
<td>Year Total:</td>
<td>30</td>
</tr>
</tbody>
</table>

Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 301 - Intermediate Micro with Calc</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 303 - Intermediate Macro with Calc</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 432R - Benefit-Cost Analysis</td>
<td>3</td>
</tr>
<tr>
<td>or ECNS 403R - Intro to Econometrics</td>
<td></td>
</tr>
</tbody>
</table>

Year Total: 48

Total Program Credits: 120

Electives Must Include:

A student must receive a grade of C- or better in all courses required for the minor. A student must receive a grade of C or better in ECNS 101IS, ECNS 202, and ECNS 204IS.

University Core and Electives | 48

Total Program Credits: 120

NOTE: ECNS 251IS(4 credits) may be substituted for the 3 course sequence ECNS 101IS, ECNS 202, and ECNS 204IS.

Economics Requirements

- ECNS 101IS - Economic Way of Thinking
- ECNS 202 - Principles of Macroeconomics
- Electives

University Core and Electives

Year Total: 48

Total Program Credits: 120

Graduation Requirements

Economics students must receive a grade of C or better in ECNS 101IS, ECNS 202, ECNS 204IS, and M 161Q or M 171Q (or their equivalents), OR be an incoming transfer student or of freshman standing.

A minimum of 120 credits is required for graduation; 42 credits must be in courses numbered 300 and above.

Economics Minor (Non-Teaching)

A student must receive a grade of C- or better in all courses required for the minor.

Economics Requirements

- ECNS 101IS - Economic Way of Thinking
- ECNS 202 - Principles of Macroeconomics
relations, Intermediate Tech Writing and editing, and many other fields, as various industries continue to seek people who are literate and articulate.

In addition to these programs for its majors, the Department of English offers many courses that satisfy University core requirements.

Students desiring to obtain the B.A. in English will choose one of the following options. Those seeking endorsement as teaching majors will follow the teaching option. In order to graduate, students must earn a grade of "C-" or above in every course required for the English major except the Teaching option which requires a grade of "C" or above.

**Undergraduate Programs**
- Literature Option (p. 215)
- Teaching Option (p. 216)
- Writing Option (p. 217)

**Undergraduate Minors**
- Writing (Non-Teaching) (p. 218)
- Literature (Non-Teaching) (p. 217)

**Graduate Program**
- M.A. English (p. 376)

**Literature Option**
This option is designed for students wishing to specialize in the study of literature as preparation for graduate work or for general education.

**Required English Courses**
Take all:
- LIT 201 Intro to Literary Studies
- LIT 300 Literary Criticism
- LIT 494RH Seminar: Research Issues

**National Literature Courses**
Choose four from the following:
- LIT 310 American Literature to 1900
- LIT 311 American Literature after 1900
- LIT 320 Advanced British Literature I
- LIT 321 Advanced British Literature II (Formerly LIT 325)
- LIT 322 Advanced British Literature III (Formerly LIT 326)

**Six Literature Electives**
Any LIT course not counted elsewhere in the LIT option may be used in this category:
- LIT 110H Introduction to Literature
- LIT 169H Literature as Popular Culture
- LIT 214D Regional Literature
- LIT 202CS The Environmental Imagination
- LIT 203H Great Books
- LIT 240 The Bible as Literature
- LIT 285D Mythologies
- LIT 308 Multicultural Literature
- LIT 335 Women and Literature
- LIT 382 Literature for Children and Adolescents
- LIT 431RH Studies in Major Author/s
Language courses (excluding WRIT 101W and WRIT 205):

- CRWR 240RA Introduction to Creative Writing
- CRWR 340 Intermediate Creative Writing Workshop
- CRWR 437 Topics in Craft and Genre
- CRWR 440 Advanced Creative Writing Workshop
- ENGL 450 Rhetoric and Composition
- LING 210IH Intro to Language/Linguistics
- LING 238 Structure and Function of Language
- LING 338 Language and English Education
- WRIT 201 College Writing II
- WRIT 221 Intermediate Tech Writing
- WRIT 326 Advanced Writing
- WRIT 371 Digital Rhetorics and Multimodal Writing
- WRIT 372 Science Writing for Popular Non-Fiction
- WRIT 373 News and Pub Relations Writing
- WRIT 374 Magazine Editing
- WRIT 376 Public Rhetorics and Writing
- WRIT 429 Professional Writing

**Required Linguistics Courses**

Take All: 6
- LING 238 Structure and Function of Language
- LING 338 Language and English Education (Spring only)

**Required Writing Courses**

WRIT 201 College Writing II 3

**Required Literature Courses**

Take All: 9
- LIT 201 Intro to Literary Studies
- LIT 300 Literary Criticism
- LIT 473RH Studies in Shakespeare

**Writing and Language Electives**

Take Any Three: 9
- CRWR 240RA Introduction to Creative Writing
- CRWR 340 Intermediate Creative Writing Workshop
- CRWR 437 Topics in Craft and Genre
- CRWR 440 Advanced Creative Writing Workshop
- LING 210IH Intro to Language/Linguistics
- WRIT 221 Intermediate Tech Writing
- WRIT 326 Advanced Writing
- WRIT 371 Digital Rhetorics and Multimodal Writing
- WRIT 372 Science Writing for Popular Non-Fiction
- WRIT 373 News and Pub Relations Writing
- WRIT 374 Magazine Editing
- WRIT 376 Public Rhetorics and Writing
- WRIT 429 Professional Writing

**Literature Electives**

Take Any Four: 12
- LIT 202CS The Environmental Imagination
- LIT 203H Great Books
- LIT 214D Regional Literature
- LIT 240 The Bible as Literature
- LIT 285D Mythologies
- LIT 308 Multicultural Literature
- LIT 310 American Literature to 1900
- LIT 311 American Literature after 1900
- LIT 320 Advanced British Literature I
- LIT 321 Advanced British Literature II (Formerly LIT 325)
- LIT 322 Advanced British Literature III (Formerly LIT 326)
- LIT 335 Women and Literature
- LIT 382 Literature for Children and Adolescents
- LIT 431 Studies in Major Author/s
- LIT 437 Studies in Literary Genres
- LIT 438 Studies in Literary Topics
- LIT 440 Studies in World Literature
- NASX 340 Native American Literature
- NASX 440 Montana Indian Literature

**CORE 2.0 Requirements**

27-30

**Total English credits required:** 42

(30 of which must be upper division)

**Upper-Division credits required:** 42

**Total credits required for graduation:** 120

**English Teaching Option**

This option is designed for students wishing to prepare for secondary school teaching. Employment opportunities may be enhanced if students also obtain a second area of certification, usually a teaching minor. Obtaining a minor in addition to the English major will require more than eight semesters.

**Required English Education Courses**

Take All: 15
- ENGL 201 Introduction to English Education
- ENGL 237 Secondary English Curriculum
- ENGL 339 Teaching Writing in Secondary School (Fall only)
- ENGL 445 Teaching Reading and Literature (Spring only)
- ENGL 461R Issues in English Education (Fall only)
**Education Coursework Requirements**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<td>Indiv and Fam Dev: Lifespan</td>
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<tr>
<td>EDU 202</td>
<td>Early Field Experience</td>
<td>1</td>
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<tr>
<td>EDU 211D</td>
<td>Multicultural Education</td>
<td>3</td>
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<td></td>
<td>Take one:</td>
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<td>EDU 222IS</td>
<td>Educ Psych &amp; Child Development</td>
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<td>EDU 223IS</td>
<td>Educ Psych and Adolescent Dev</td>
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<td>EDU 370</td>
<td>Integrating Tech into Educ</td>
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<td>EDU 395</td>
<td>Practicum (45 hours in the classroom)</td>
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<tr>
<td>EDU 382</td>
<td>Assessmt, Curric, Instructn</td>
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<td>EDU 497</td>
<td>Methods (Spring only)</td>
<td>3</td>
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<tr>
<td>EDSP 306</td>
<td>Exceptional Learners</td>
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<tr>
<td>EDU 408</td>
<td>Professional Issues: K-12</td>
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<td>EDU 495R</td>
<td>Student Teaching</td>
<td>10-12</td>
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</table>

Total English credits required: 54
Upper division (Education and English combined) credits required: 42
Total credits required for graduation: 120

**Writing Option**

This option is designed for students wishing to specialize in the study of writing and rhetoric as preparation for graduate study, professional practice, or liberal education.

**Required English Courses**

Take all: 24

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<td>WRIT 205</td>
<td>Intro to Writing Studies</td>
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<tr>
<td>CRWR 240RA</td>
<td>Introduction to Creative Writing</td>
</tr>
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<td>WRIT 326</td>
<td>Advanced Writing</td>
</tr>
<tr>
<td>WRIT 371</td>
<td>Digital Rhetorics and Multimodal Writing</td>
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<td>WRIT 376</td>
<td>Public Rhetorics and Writing</td>
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<td>ENGL 450</td>
<td>Rhetoric and Composition</td>
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<tr>
<td>WRIT 494RH</td>
<td>Seminar: Writing Research and Publications</td>
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<tr>
<td>WRIT 498</td>
<td>Internship</td>
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**Four Writing Electives**

Choose four from the following: 12

<table>
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<th>Course Title</th>
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</thead>
<tbody>
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<td>Intermediate Creative Writing Workshop</td>
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<tr>
<td>CRWR 437</td>
<td>Topics in Craft and Genre</td>
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<td>CRWR 440</td>
<td>Advanced Creative Writing Workshop</td>
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<tr>
<td>ENGL 2101H</td>
<td>Intro to Language/Linguistics</td>
</tr>
<tr>
<td>LING 238</td>
<td>Structure and Function of Language</td>
</tr>
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<td>LING 338</td>
<td>Language and English Education</td>
</tr>
<tr>
<td>WRIT 201</td>
<td>College Writing II</td>
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<td>WRIT 221</td>
<td>Intermediate Tech Writing</td>
</tr>
<tr>
<td>WRIT 372</td>
<td>Science Writing for Popular Non-Fiction</td>
</tr>
<tr>
<td>WRIT 373</td>
<td>News and Pub Relations Writing</td>
</tr>
<tr>
<td>WRIT 374</td>
<td>Magazine Editing</td>
</tr>
<tr>
<td>WRIT 429</td>
<td>Professional Writing</td>
</tr>
</tbody>
</table>

**200 Level Literature Elective**

Choose one of the following (excluding LIT 201): 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>LIT 202CS</td>
<td>The Environmental Imagination</td>
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<tr>
<td>LIT 203IH</td>
<td>Great Books</td>
</tr>
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</table>

**Three Literature Electives**

Choose three 200-400 level LIT courses not counted elsewhere in the major (excluding LIT 201):

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
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<td>The Environmental Imagination</td>
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<tr>
<td>LIT 203IH</td>
<td>Great Books</td>
</tr>
<tr>
<td>LIT 214D</td>
<td>Regional Literature</td>
</tr>
<tr>
<td>LIT 240</td>
<td>The Bible as Literature</td>
</tr>
<tr>
<td>LIT 285D</td>
<td>Mythologies</td>
</tr>
<tr>
<td>LIT 300</td>
<td>Literary Criticism</td>
</tr>
<tr>
<td>LIT 310</td>
<td>American Literature to 1900</td>
</tr>
<tr>
<td>LIT 311</td>
<td>American Literature after 1900</td>
</tr>
<tr>
<td>LIT 320</td>
<td>Advanced British Literature I</td>
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<tr>
<td>LIT 321</td>
<td>Advanced British Literature II (Formerly LIT 325)</td>
</tr>
<tr>
<td>LIT 322</td>
<td>Advanced British Literature III (Formerly LIT 326)</td>
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<td>LIT 335</td>
<td>Women and Literature</td>
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<td>LIT 382</td>
<td>Literature for Children and Adolescents</td>
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<td>LIT 431RH</td>
<td>Studies in Major Authors’s</td>
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<td>Studies in Literary Genres</td>
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<td>LIT 438</td>
<td>Studies in Literary Topics</td>
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<td>LIT 440</td>
<td>Studies in World Literature</td>
</tr>
<tr>
<td>LIT 473RH</td>
<td>Studies in Shakespeare</td>
</tr>
</tbody>
</table>

Total English credits required: 48
(27 of which must be upper division)

Upper-Division credits required: 42
CORE 2.0 Requirements: 27-30
Total credits required for graduation: 120

WRIT 101W credits count for the Core Foundations written requirement. These credits are not counted as part of the total English Major, Writing Option.

**English Minor: Literature (Non-Teaching)**

Take One: 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>LIT 1101H</td>
<td>Introduction to Literature</td>
</tr>
<tr>
<td>LIT 201</td>
<td>Intro to Literary Studies</td>
</tr>
</tbody>
</table>

Choose six of the following (minimum three upper division): 18

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>LIT 169H</td>
<td>Literature as Popular Culture</td>
</tr>
<tr>
<td>LIT 202CS</td>
<td>The Environmental Imagination</td>
</tr>
<tr>
<td>LIT 203IH</td>
<td>Great Books</td>
</tr>
<tr>
<td>LIT 214D</td>
<td>Regional Literature</td>
</tr>
<tr>
<td>LIT 240</td>
<td>The Bible as Literature</td>
</tr>
<tr>
<td>LIT 285D</td>
<td>Mythologies</td>
</tr>
<tr>
<td>LIT 300</td>
<td>Literary Criticism</td>
</tr>
</tbody>
</table>
The Bachelor of Arts in History allows students to specialize in the study of the American west, U.S. history, environmental history, and the history of science and technology. The history degree also provides an analytical gateway to areas beyond the United States, with courses of advanced study related to South Asia, East Asia, Latin America, Europe, and the ancient world. Internships at historical societies, museums, and Yellowstone National Park are also an important part of the educational experience and are strongly encouraged by the department.

A degree in history prepares students for teaching, graduate studies, public resource management, government service, law school, journalism, and other career opportunities that require critical thinking and clarity of communication. Students participate in original research projects and student-centered learning activities; they learn to read and analyze primary texts, as well as secondary literature, and to write thoughtfully about them. Students learn to create knowledge by thinking creatively and basing their ideas in the empirical authority inherent in careful examination of historical documents.

At all levels of the curriculum, the history degree provides students with the tools to think rigorously, to research and thereby generate knowledge empirically, and to articulate their thoughts coherently. In consultation with an advisor, students may select from a range of fields of concentration that are consistent with his or her interests and educational objectives.

The department encourages students to engage in the Departmental Honors Option. This option has the following requirements:

1. Students must have a minimum 3.5 grade-point average in their major and a 3.0 GPA overall.
2. Students must present an acceptable, bound senior thesis and an oral defense of the thesis.

Qualified students may enroll in the honors option through their department advisors.

### Undergraduate Programs

- **History Option** (p. 219)
- **History Teaching Option** (p. 221)
- **Latin American & Latino Studies Option** (p. 245)
- **Science, the Environment, Technology, and Society (SETS) Option** (p. 223)

### Undergraduate Minors

- **History Minor (Non-Teaching)** (p. 218)
- **History Minor (Teaching)** (p. 138)
- **Japan Studies Minor (Non-Teaching)** (p. 245)
- **Latin American & Latino Studies Minor (Non-Teaching)** (p. 246)
- **Museum Studies Minor (Non-Teaching)** (p. 222)

The Department of History and Philosophy is dedicated to providing quality education in History for two graduate degree programs, the MA and the PhD. The Department offers concentrated training in three particular areas: the history of science, technology, and society; environmental history; and the history of the American West and Montana. While the degrees offered by the Department are grounded in American history, the faculty is committed to familiarizing students with World history, critical theoretical concerns, the history of women in a multi-cultural context, and to encouraging students to think about the history of the United States in a global context.

### Degree Offered

- MA in History (p. 377)
- PhD in History (p. 377)

---

### History Minor (Non-Teaching)

Choose 1 lower division European history class: 3-4
Choose two lower division World history classes: 6-8

HSTR 105  Making Our World in Ten Events
HSTR 130D  Latin American History
HSTR 135D  The Modern Middle East
HSTR 140D  Modern Asia
HSTR 145D  Reinventing Japan
HSTR 160D  Modern World History
HSTR 205CS  The World Environment
HSTR 207CS  Sci and Tech in World History
HSTR 282CS  Darwinian Revolution
HSTR 291  Special Topics

Choose one lower division American history class: 4

AMST 101D  Introduction to American Studies
HSTA 101IH  American History I
HSTA 102IH  American History II
HSTA 160D  Introduction to the Am West

Choose three upper division History electives: 9

AMST 301  Reproduction in America
HSTA 311  Early America
HSTA 315  The Age of Jefferson and Jackson: The Early American Republic
HSTA 316  American Civil War Era
HSTA 320  Birth of Modern US: 1865-1945
HSTA 322  Am History: WWII to Present
HSTA 402  Sex and Sexuality in America
HSTA 406  McCarthy/Ike/Truman
HSTA 407  Gender in US & Canadian West
HSTA 408  Gender in America
HSTA 409  Food in America
HSTA 412IH  American Thought and Culture
HSTA 416  Race and Class in America
HSTA 450  History of American Indians
HSTA 460  Montana and the West
HSTA 464  Trans-Mississippi West
HSTA 468  History of Yellowstone
HSTA 470  American Environmental History
HSTA 482  Technology and the Fate of Humanity
HSTA 491  Special Topics
HSTA 492  Independent Study
HSTR 302  Ancient Greece
HSTR 304  Ancient Rome
HSTR 308  Ancient Egypt
HSTR 322  19th Century Europe
HSTR 324  20th Century Europe
HSTR 330  History of Mexico
HSTR 340  Age of the Shoguns
HSTR 342  Japan’s Meiji Revolution
HSTR 345  Modern China
HSTR 346  Modern India

Choose one lower division American history class: 4

AMST 101D  Introduction to American Studies
HSTA 101IH  American History I
HSTA 102IH  American History II
HSTA 160D  Introduction to the Am West

Choose one European history course: 3-4

HSTR 101IH  Western Civilization I
HSTR 102IH  Western Civilization II
HSTR 282CS  Darwinian Revolution

Choose one lower division American history class: 4

AMST 101D  Introduction to American Studies
HSTA 101IH  American History I
HSTA 102IH  American History II
HSTA 160D  Introduction to the Am West

One Year Modern Language 6
University Core and Electives 14
Year Total: 28

The minimum number of credits for a non-teaching minor is twenty-one, with nine of those being upper-division credits.

**History Option**

**Freshman Year**

<table>
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<tr>
<td>HSTR 102IH - Western Civilization II</td>
<td>3-4</td>
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<tr>
<td>HSTR 282CS - Darwinian Revolution</td>
<td>3-4</td>
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</table>

Choose one lower division American history class: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AMST 101D - Introduction to American Studies</td>
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One Year Modern Language 6
University Core and Electives 14
Year Total: 28
### Sophomore Year

<table>
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<tr>
<td>HSTR 135D</td>
<td>The Modern Middle East</td>
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<td>HSTR 140D</td>
<td>Modern Asia</td>
<td></td>
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<td>HSTR 145D</td>
<td>Reinventing Japan</td>
<td></td>
</tr>
<tr>
<td>HSTR 160D</td>
<td>Modern World History</td>
<td></td>
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<tr>
<td>HSTR 205CS</td>
<td>The World Environment</td>
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<tr>
<td>HSTR 207CS</td>
<td>Sci and Tech in World History</td>
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<td>HSTR 208RH</td>
<td>Sci, Envr, Tech: Common Exp</td>
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<td>HSTR 232D</td>
<td>Religion in Latin America</td>
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<td>RLST 110D</td>
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Choose two lower division World History classes: 6-8

Choose 1 upper division American History class: 3

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>AMST 301</td>
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<td>AMST 410</td>
<td>Religion and the United States Supreme Court</td>
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<td>Early America</td>
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<td>The Age of Jefferson and Jackson: The Early American Republic</td>
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<td>HSTA 316</td>
<td>American Civil War Era</td>
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<td>Birth of Modern US: 1865-1945</td>
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<td>HSTA 406</td>
<td>McCarthy/Ike/Truman</td>
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<td>Am History: WWII to Present</td>
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<td>History of American Indians</td>
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<td>Montana and the West</td>
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<td>Trans-Mississippi West</td>
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<td>NAXS 450</td>
<td>History of American Indians</td>
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University Core and Electives 19

Year Total: 27-30

### Junior Year

Choose 1 upper division European history class: 3

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<th>Course Title</th>
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<td>Ancient Greece</td>
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<td>HSTR 304</td>
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<td>HSTR 322</td>
<td>19th Century Europe</td>
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<td>HSTR 324</td>
<td>20th Century Europe</td>
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<tr>
<td>HSTR 350</td>
<td>Modern Britain</td>
<td></td>
</tr>
<tr>
<td>HSTR 353</td>
<td>Modern France</td>
<td></td>
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<tr>
<td>HSTR 359</td>
<td>Russia to 1917</td>
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<tr>
<td>HSTR 362</td>
<td>Modern Germany</td>
<td></td>
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<td>HSTR 372</td>
<td>The World at War</td>
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<td>HSTR 376</td>
<td>Twentieth Century War</td>
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<tr>
<td>HSTR 407</td>
<td>Soviet Union: Rise &amp; Fall</td>
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<td>HSTR 419</td>
<td>Modern Science</td>
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<td>HSTR 423</td>
<td>European Intellectual History</td>
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<td>HSTR 425</td>
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Choose 2 upper division World History classes: 6

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<tr>
<td>HSTR 135D</td>
<td>The Modern Middle East</td>
<td></td>
</tr>
<tr>
<td>HSTR 140D</td>
<td>Modern Asia</td>
<td></td>
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<tr>
<td>HSTR 145D</td>
<td>Reinventing Japan</td>
<td></td>
</tr>
<tr>
<td>HSTR 160D</td>
<td>Modern World History</td>
<td></td>
</tr>
<tr>
<td>HSTR 205CS</td>
<td>The World Environment</td>
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</tr>
<tr>
<td>HSTR 207CS</td>
<td>Sci and Tech in World History</td>
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</tr>
<tr>
<td>HSTR 208RH</td>
<td>Sci, Envr, Tech: Common Exp</td>
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<tr>
<td>HSTR 232D</td>
<td>Religion in Latin America</td>
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<td>RLST 110D</td>
<td>Religion, Conflict &amp; Politics</td>
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<td>HSTR 467</td>
<td>History of Mountaineering</td>
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<td>HSTR 330</td>
<td>History of Mexico</td>
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<td>HSTR 340</td>
<td>Age of the Shoguns</td>
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<td>Japan’s Meiji Revolution</td>
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<td>HSTR 346</td>
<td>Modern India</td>
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<tr>
<td>HSTR 359</td>
<td>Russia to 1917</td>
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<td>HSTR 366</td>
<td>Middle East/20th Century</td>
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<td>HSTR 372</td>
<td>The World at War</td>
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<tr>
<td>HSTR 407</td>
<td>Soviet Union: Rise &amp; Fall</td>
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<td>Latin Amer Social History</td>
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<td>Race in Latin America</td>
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<td>HSTR 432</td>
<td>Colonial Latin America</td>
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<td>HSTR 433</td>
<td>Latin American Perspectives</td>
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<td>HSTR 434</td>
<td>Gender in Latin America</td>
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<td>HSTR 435</td>
<td>Latin America: Human Rights</td>
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<td>HSTR 436</td>
<td>Armed Conflict Mod Lat Am</td>
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<tr>
<td>HSTR 443</td>
<td>Gender in Asia</td>
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<td>HSTR 444</td>
<td>Gender in Japan</td>
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<td>HSTR 445</td>
<td>Environ, Health &amp; Sci in Japan</td>
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<td>HSTR 446</td>
<td>Science and Medicine in China</td>
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<td>HSTR 468</td>
<td>The Making of Modern Turkey</td>
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<td>HSTR 482</td>
<td>Animal Histories</td>
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<td>HSTR 484</td>
<td>World Environmental History</td>
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<td>SPNS 430</td>
<td>Latin Amer Perspectives</td>
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University Core and Electives 15

Year Total: 30

### Senior Year

Choose five of the following upper division electives, excluding courses taken to fulfill above requirements: 15

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<tr>
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<th>Course Title</th>
<th>Credits</th>
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<tr>
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<td>AMST 301</td>
<td>Reproduction in America</td>
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<td>HSTA 315</td>
<td>The Age of Jefferson and Jackson: The Early American Republic</td>
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<td>HSTA 316</td>
<td>American Civil War Era</td>
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<td>Birth of Modern US: 1865-1945</td>
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<td>HSTA 322</td>
<td>Am History: WWII to Present</td>
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</tr>
<tr>
<td>HSTA 406</td>
<td>McCarthy/Ike/Truman</td>
<td></td>
</tr>
<tr>
<td>HSTA 407</td>
<td>Gender in US &amp; Canadian West</td>
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<tr>
<td>HSTA 408</td>
<td>Gender in America</td>
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<td>HSTA 409</td>
<td>Food in America</td>
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<td>HSTA 412H</td>
<td>American Thought and Culture</td>
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<tr>
<td>HSTA 416</td>
<td>Race and Class in America</td>
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<td>HSTA 460</td>
<td>Montana and the West</td>
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<td>HSTA 464</td>
<td>Trans-Mississippi West</td>
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<tr>
<td>HSTA 470</td>
<td>History of Yellowstone</td>
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<tr>
<td>HSTA 482</td>
<td>Technology and the Fate of Humanity</td>
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<tr>
<td>NAXS 450</td>
<td>History of American Indians</td>
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<tr>
<td>HSTR 499R</td>
<td>Sen Capstone: Hist Methodology</td>
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</table>

Year Total: 30
A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. Students must receive a grade of C- or better in all required courses.

**History Teaching Option**

**Freshman Year**

<table>
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<tr>
<th>Course</th>
<th>Credits</th>
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<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
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<tr>
<td>Choose one of the following Development classes:</td>
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<tr>
<td>HDFS 101IS - Indiv and Fam Dev: Lifespan</td>
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<tr>
<td>EDEC 160 - Early Childhood Development</td>
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<tr>
<td>HSTA 101IH - American History I</td>
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<tr>
<td>HSTA 102IH - American History II</td>
<td>4</td>
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<tr>
<td>Choose 2 lower division European history classes:</td>
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</tr>
<tr>
<td>HSTR 101IH - Western Civilization I</td>
<td></td>
</tr>
<tr>
<td>HSTR 102IH - Western Civilization II</td>
<td></td>
</tr>
<tr>
<td>HSTR 282CS - Darwinian Revolution</td>
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<td>University Core and Electives</td>
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<td>Year Total:</td>
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**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>EDU 211D - Multicultural Education</td>
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<tr>
<td>EDU 370 - Integrating Tech into Educ</td>
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<tr>
<td>Choose 2 lower division World history classes:</td>
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<tr>
<td>HSTR 130D - Latin American History</td>
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<tr>
<td>HSTR 135D - The Modern Middle East</td>
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<tr>
<td>HSTR 140D - Modern Asia</td>
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<tr>
<td>HSTR 145D - Reinventing Japan</td>
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<tr>
<td>HSTR 160D - Modern World History</td>
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<td>HSTR 205CS - The World Environment</td>
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<tr>
<td>HSTR 207CS - Sci and Tech in World History</td>
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<tr>
<td>Choose 1 upper division American history class:</td>
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<tr>
<td>HSTA 311 - Early America</td>
<td></td>
</tr>
<tr>
<td>HSTA 316 - American Civil War Era</td>
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<tr>
<td>HSTA 318 - Origins of Modern America: From the Civil War to WWII</td>
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</tr>
<tr>
<td>HSTA 320 - Birth of Modern US: 1865-1945</td>
<td></td>
</tr>
<tr>
<td>HSTA 322 - Am History: WWII to Present</td>
<td></td>
</tr>
<tr>
<td>HSTA 406 - McCarthy/Ike/Truman</td>
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<tr>
<td>HSTA 407 - Gender in US &amp; Canadian West</td>
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<tr>
<td>HSTA 408 - Gender in America</td>
<td></td>
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<tr>
<td>HSTA 409 - Food in America</td>
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<tr>
<td>HSTA 412IH - American Thought and Culture</td>
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<td>HSTA 416 - Race and Class in America</td>
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<tr>
<td>HSTA 460 - Montana and the West</td>
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<td>HSTA 464 - Trans-Mississippi West</td>
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<tr>
<td>HSTA 470 - American Environmental History</td>
<td></td>
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<tr>
<td>HSTA 482 - History of American Technology</td>
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<tr>
<td>NASX 450 - History of American Indians</td>
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<td>University Core and Electives</td>
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<td>Year Total:</td>
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**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EDSP 306 - Exceptional Learners</td>
<td>3</td>
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</table>
Museum Studies Minor (Non-Teaching)

Museum Studies Minor

To understand the cultural significance of museums and to explore contemporary museum practices, Montana State University-Bozeman
Montana State University

offers an interdisciplinary minor in Museum Studies that is administered through the Department of History and Philosophy. The Museum Studies minor offers students in many disciplines the opportunity to learn about the role of museums in advancing public education and academic research, to deepen students' understanding of museums, and to better position them to learn about possible employment in the museum field.

The minor requires students to complete 12 credits of Museum Studies courses and 12 credits from one non-teaching minor for a total of 24 credits. Six credits must be at the 300 or 400 level. All 12 credits from the non-teaching minor must be in one area, though interdisciplinary fields may be considered where intellectually warranted.

Students must take the following Museum Studies Courses:

MOR 301 Museum Practices
HSTR 486 Museum History

Students must also fulfill the Museum Experiences requirement by completing a total of 6 credits of internship or undergraduate research. At least 3 of those 6 credits must be an internship in a field related to the student's major or minor. The additional 3 credits may be completed by another internship, or undergraduate research credits in the student's major or minor.

Science, the Environment, Technology, and Society (SETS)
The SETS major offers students a multi-disciplinary course of study that analyzes science, technology, and the environment within their broader cultural contexts, including intellectual and social history, environmental history, religious studies, and philosophy.

Students will choose one of several specialties as a focus for their coursework, such as Philosophy of Science, History of Science and Technology, Science and Technology Policy, or Environmental History. Moreover, students are required to become knowledgeable about one or more areas of science, technology, environmental studies, or public policy, as the department believes such literacy is an important part of a land-grant institution liberal arts education. Students will therefore be required to take at least 12 credits in an appropriate science, social science or engineering discipline. Finally, a capstone is required for all students; each will complete an original research paper synthesizing their scientific, technological, and humanistic knowledge.

SETS Option

Freshman Year

Choose two lower division history courses:
HSTA 101IH - American History I
HSTA 102IH - American History II
HSTA 160D - Introduction to the Am West
AMST 101D - Introduction to American Studies
HSTR 101IH - Western Civilization I
HSTR 102IH - Western Civilization II
HSTR 130D - Latin American History
HSTR 135D - The Modern Middle East
HSTR 140D - Modern Asia
HSTR 145D - Reinventing Japan
HSTR 160D - Modern World History

University Core and Electives

Year Total:

Sophomore Year

Choose 1 lower division Religious Studies course:
RLST 100D - Intro to the Study of Religion
RLST 110D - Religion, Conflict & Politics

Choose one of the following:
HSTR 207CS - Sci and Tech in World History
HSTR 282CS - Darwinian Revolution
PHL 205CS - Other Animals
PHL 242CS - Science/Philos. of Science

Choose an approved Science/Technology/Social Science course, consult with a SETS advisor
One Year Modern Language. The student may elect to take an additional nine credits of upper-division history courses instead of one-year modern language requirement.

University Core and Electives

Year Total:

Junior Year

Choose one of the following:
PHL 303 - Approaches to Epistemology
PHL 321 - Philosophy & Biomedical Ethics
PHL 322 - Philosophy & Environmental Ethics
PHL 353 - Philosophy and Technology
PHL 354 - Philosophy of Race
RLST 402 - Natural/Unnatural/Supernatural
RLST 326 - Topics in Religion

Choose 2 approved Science/Technology/Social Science course, consult with a SETS advisor.

University Core and Electives

Year Total:

Senior Year

Choose six of the following:
HSTA 412IH - American Thought and Culture
HSTR 417 - Early Modern Science
HSTR 419 - Modern Science
HSTR 445 - Environ, Health & Sci in Japan
HSTR 446 - Science and Medicine in China
HSTA 468 - History of Yellowstone
HSTA 470 - American Environmental History
HSTA 482 - History of American Technology
HSTR 482 - Animal Histories
HSTR 484 - World Environmental History
HSTR 486 - Museum History

Choose an approved Science/Technology/Social Science course, consult with a SETS advisor.

Choose one of the following:
HSTA 490R - Undergraduate Research
HSTR 499R - Sen Capstone: Hist Methodology
PHL 490R - Undergraduate Research
RLST 490R - Undergraduate Research

University Core and Electives

Year Total:

Total Program Credits:

223
Approved Science/Technology/Social Sciences Courses for SETS Option
In addition to satisfying the university core science requirements, students, only after consultation with their academic advisor, are required to take 12 credits of science in one science or engineering or social science or public policy discipline. One of these courses must be at the 300 or 400 level.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. Students must receive a grade of C- or better in all required courses.

Liberal Studies
The Liberal Studies degree offers an interdisciplinary approach to a well-rounded education which emphasizes reading, reasoning, and communication skills in addition to substantive knowledge that will allow graduates to thrive in a broad range of career contexts and to pursue lifelong learning.

All students are required to choose one of three program options, either the Quaternity option (also available online (http://www.montana.edu/online/degrees/completion)) which offers the more traditional broad-based liberal arts education, or a cross-disciplinary cluster of thematically related courses (option II), which currently includes the Environmental Studies and the Global and Multicultural Studies options. Courses that are used to satisfy one degree requirement cannot be used to satisfy another. Students must complete a minimum of 45 credits in the program after declaring themselves to be Liberal Studies majors.

For details about the Liberal Studies degree, contact the College of Letters and Science by calling 406-994-7805, sending e-mail to liberalstudies@montana.edu, or checking the Liberal Studies website at www.montana.edu/lsdegree.

Liberal Studies Seminars
All students in Liberal Studies, regardless of option, are encouraged to take a series of integrative seminars (LS 101US and LS 301) or other LS seminars. These seminars are designed to provide a sense of academic community, improved critical thinking and communication skills, and a better understanding of the factual knowledge and theoretical foundations of the disciplines encompassed by the arts, humanities, natural sciences, and social sciences.

Integrative Studies Requirement
Students are required to take 4 courses (minimum of 12 credits) in addition to the university’s Core curriculum, one course each in arts, humanities, natural science, and social sciences.

Foreign Language Requirement
Students in the Quaternity option are required to take two courses in a foreign language to demonstrate equivalent competency. Students in the Global and Multicultural option are required to take three courses in a foreign language to demonstrate equivalent competency.

Capstone Experience
All students in the major take a common 4-credit capstone course in the final year either via LS 499 / LS 490R. Students must have completed their foreign language requirement before taking the capstone course. Students work individually or in small groups to design solutions to contemporary public policy issues (e.g., overpopulation). Each project results in a scholarly product (typically a paper and a presentation) that serves as a tangible and measurable indication of the extent to which students have mastered the critical thinking, reading, writing, and oral communication skills that are the principal learning objectives of the program.

Undergraduate Programs
Environmental Studies Option (p. 224)
Global and Multicultural Studies Option (p. 225)
Quaternity Option (p. 228)

Undergraduate Minors
Global Studies Minor (p. 228)
Global Studies Health Minor (p. 230)

Environmental Studies Option
This option is designed for students interested in developing a broad understanding of environmental issues from scientific and public policy perspectives. In addition to some common foundations courses (BIOB 170IN, ERTH 101IN, GPHY 121D, STAT 216Q, and PHL 322 or HSTA 470), students select 21 credits each from approved list of science and public policy courses. Twelve credits of science and of public policy must be upper division courses (300 or 400 level). BIOB 170IN, ERTH 101IN, STAT 216Q, and LS 490R / LS 499 may overlap with Core. Proposed substitutions must be submitted in writing to the Program Director.

Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>LS 101US - Interdisciplinary Ways of Knowing</td>
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<td>WRIT 101W - College Writing I</td>
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<td>BIOB 170IN - Principles of Biological Diversity</td>
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<td>ERTH 101IN - Earth System Sciences</td>
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<td>GPHY 121D - Human Geography</td>
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Sophomore Year

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<td>STAT 216Q - Introduction to Statistics</td>
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Junior Year

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<tr>
<th>Course</th>
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<td>Public Policy Electives (see below)</td>
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Electives

Year Total:

Senior Year

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<td>LS 490R - Undergraduate Research</td>
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Per MSU requirements for the degree, a minimum of 42 credits must be in courses numbered 300 and above.

**Natural Sciences Electives to be chosen from**

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<tr>
<td>ANSC 491</td>
<td>Special Topics</td>
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<td>BIOB 420</td>
<td>Evolution</td>
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<td>BIOE 103CS</td>
<td>Environmental Science and Society</td>
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<td>BIOE 370</td>
<td>General Ecology (equiv to 270)</td>
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<td>BIOE 405</td>
<td>Behavioral and Evolutionary Ecology</td>
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<td>BIOE 416</td>
<td>Alpine Ecology</td>
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<td>BIOE 421</td>
<td>Yellowstone Wildlife Ecology</td>
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<td>BIOE 440R</td>
<td>Conservation Biology</td>
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<tr>
<td>BIOO 162CS</td>
<td>Insects and Human Society</td>
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<td>ERTH 212RN</td>
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<td>ERTH 303</td>
<td>Weather and Climate</td>
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<td>ERTH 307</td>
<td>Principles of Geomorphology</td>
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<td>GEO 105IN</td>
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<td>GEO 420</td>
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<td>Riparian Ecology &amp; Management</td>
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Up to 12 credits required in a minor or in a second degree program may be applied toward the Natural Science and Public Policy electives.

**Public Policy electives to be chosen from**

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<td>Econ &amp; the Environment</td>
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<td>The Political Economy of Energy</td>
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<td>Population and Society</td>
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<td>Environmental Sociology</td>
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Up to 12 credits required in a minor or in a second degree program may be applied toward the Natural Science and Public Policy electives.

**Global and Multicultural Studies Option**

The Global and Multicultural option offers students a broad perspective on international and American cultural, ethnic, and gender issues spanning a wide range of disciplines. Students will select 27 credits (18 of which need to be 300 or 400 level) from an approved list of global/multicultural courses spanning a wide range of disciplines, students in this option select a specific area studies focus (e.g. Latin America, Asia, Europe, Native American, or Women’s Studies) in which they take 12 additional credits (6 of which need to be 300 or 400 level) to provide deeper understanding of that region or
field of study. In addition, students are required to achieve competence, at an intermediate level, in a foreign language appropriate to their field of area studies. Students in this option are encouraged to study abroad in a region appropriate to their field of area studies. Credits earned abroad may, with the approval of the Program Director, be substituted for global/multicultural or area studies courses as appropriate. LS 490R / LS 499R may overlap with Core. Proposed substitutions must be submitted in writing to the Program Director.

**Freshman Year**

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<tr>
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<td>WRIT 101W - College Writing I</td>
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<td>Modern Language (all languages are 3cr, except Chinese which is 4cr)</td>
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<td>Modern Language (all languages are 3cr, except Arabic which is 4cr)</td>
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**Sophomore Year**

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<td>Integrative Studies</td>
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**Junior Year**

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<td>Area Studies Electives (see below)</td>
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<tr>
<td>Global &amp; Multicultural Electives (see below)</td>
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<td>Area Studies Electives</td>
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**Senior Year**

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<td>LS 301 - Integrative Seminar</td>
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Per MSU requirements for the degree, a minimum of 42 credits must be in courses numbered 300 and above.

**Global and multicultural electives to be chosen from:**

- AGSC 465R Health, Agriculture, Poverty 4
- ANTY 101D Anthropology and the Human Experience 3
- ANTY 225S Culture, Language, and Society 3
- ARCH 221 World Architecture: Modern to Contemporary 3
- ARCH 322IA World Architecture I 3
- ARCH 323IA World Architecture II 3
- ARTH 462 Islamic Art And Architecture 3
- BGEN 242D Intro to Int’l Business 3
- BGEN 245D Cultural Dimensions of International Business 3
- BMGT 464 International Management 3
- BMKT 441 International Marketing 3
- ECNS 314 International Economics 3
- ECNS 317 Economic Development 3
- EDU 211D Multicultural Education 3
- GPHY 121D Human Geography 3
- GPHY 141D Geography of World Regions 3
- GPHY 325 Cultural Geography 3
- HSTA 416 Race and Class in America 3
- HSTR 135D The Modern Middle East 4
- HSTR 160D Modern World History 4
- HSTR 366 Middle East/20th Century 3
- HSTR 468 The Making of Modern Turkey 3
- HSTR 484 World Environmental History 3
- LIT 214D Regional Literature 3
- LIT 285D Mythologies 3
- LIT 308 Multicultural Literature 3
- LIT 440 Studies in World Literature 3
- ML 100H Intro to World Cultures 3
- MUSI 307IA World Music 3
- PHL 110IH Intro Ethics:Good and Evil 3
- PHL 255D Philosophy and Culture 3
- PHL 308 Language and the World 3
- PHL 354 Philosophy of Race 3
- PSCI 230D Introduction to International Relations 3
- PSCI 331 International Relations Theory 3
- PSCI 434 International Law 3
- PSCI 436 Politics of Food & Hunger 3
- PSCI 437 International Political Econ 3
- PSCI 439 International Human Rights 3
- RLST 100D Intro to the Study of Religion 3
- RLST 110D Religion, Conflict & Politics 4
- RLST 402 Natural/Unnatural/Supernatural 3
- RLST 410 What is Religion? 3
- SOCI 344 Sociology of Race & Ethnicity 3
- SOCI 358 Crime and Inequality 3
- SOCI 370 Sociology of Globalization 3
- SOCI 434 Sociology of Human Sexuality 3
- SOCI 436 Law and Inequality 3
With consent of the program director, courses from the Area Studies categories below, excluding Europe, may be applied as Global and Multicultural Electives.

**Area studies electives to be selected from courses on one of the following areas**

##### Asia

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<tr>
<td>ANTY 337</td>
<td>Sex, Gender, Sexuality Japan</td>
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<td>ANTY 338</td>
<td>Contemporary Pacific Societies</td>
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<td>ANTY 343</td>
<td>Popular Culture - Japan</td>
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<td>ANTY 441</td>
<td>Social Movements in Japan</td>
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<td>ARTH 360</td>
<td>History of Asian Art and Architecture</td>
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<td>CHIN 130D</td>
<td>Historical and Literary Journey into Modern China</td>
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<td>CHIN 320H</td>
<td>History of Chinese Cinema</td>
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<td>GPHY 446</td>
<td>East Asia in the Global System</td>
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<td>HSTR 145D</td>
<td>Reinventing Japan</td>
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<td>Age of the Shoguns</td>
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<td>HSTR 342</td>
<td>Japan’s Meiji Revolution</td>
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<td>Environ, Health &amp; Sci in Japan</td>
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<td>HSTR 446</td>
<td>Science and Medicine in China</td>
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<td>Japanese Culture &amp; Civ</td>
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<td>JPNS 361H</td>
<td>Japanese Text and Cinema</td>
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##### Europe

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<td>FRCH 306IH</td>
<td>French: From Reflection to Rev</td>
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<td>Issues of German Cinema</td>
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<td>Modern France</td>
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<td>Russia to 1917</td>
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<td>HSTR 372</td>
<td>The World at War</td>
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<td>Studies in Shakespeare</td>
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<td>Hist of Philo/Ancient/Medieval</td>
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<td>History of Philosophy: Modern</td>
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##### Latin America

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<td>Gender in Latin America</td>
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##### Native American Studies

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<td>MT Indians: Cultures, Histories, Current Issues</td>
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Quaternity Option

The Liberal Studies Quaternity option is a student-centered option that aims at exploring four different, but interconnected concepts of knowledge—thinking, feeling, intuition, and sensation—which are derived from the complex interaction of mythos (story, fable, imagination) and logos (truth, fact, reality). Students in the Quaternity option are expected to approach and to integrate all of their courses through this epistemological lens, and to demonstrate that they have done so through writing assignments in the Liberal Studies seminars and other course assignments.

In addition to the integrative seminars, university core, and the liberal studies requirements, students in Quaternity require a foreign language (8 cr.) and an additional 4 courses (12 cr.) in each area of the Quaternity: arts, humanities, natural science or Mathematics, and social sciences. At least six credits in each area of Quaternity must be upper division (300 or 400 level).

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Quaternity - Social Sciences | 3       |      |        |

Year Total: 16 15

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Total Program Credits: 120

- Up to 6 credits required in a minor or in a second degree program may be applied toward the 12 credit elective requirement in arts, humanities, natural science or mathematics, or social sciences.

Per MSU requirements for the degree, a minimum of 42 credits must be in courses numbered 300 and above.

Global Studies Minor

Advisor Approved Study abroad Coursework 6
Capstone Seminar

14 Credits of International Course Work 9 Credits must be upper division (300-400 level).

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<td>PSCI 434</td>
<td>International Law</td>
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<tr>
<td>PSCI 436</td>
<td>Politics of Food &amp; Hunger</td>
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<tr>
<td>PSCI 437</td>
<td>International Political Econ</td>
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<tr>
<td>PSCI 439</td>
<td>International Human Rights</td>
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<tr>
<td>PSYX 462</td>
<td>Psychology of Prejudice</td>
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<tr>
<td>RLST 110D</td>
<td>Religion, Conflict &amp; Politics</td>
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<tr>
<td>SOCI 344</td>
<td>Sociology of Race &amp; Ethnicity</td>
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<tr>
<td>SOCI 355</td>
<td>Population and Society</td>
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<td>SOCI 370</td>
<td>Sociology of Globalization</td>
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<tr>
<td>SOCI 485</td>
<td>Political Sociology</td>
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<td>RLST 202D</td>
<td>Hindu Traditions</td>
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<tr>
<td>RLST 203D</td>
<td>Buddhist Traditions</td>
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<tr>
<td>SPNS 101</td>
<td>Elementary Spanish I</td>
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<td>SPNS 102D</td>
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<td>SPNS 201D</td>
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<tr>
<td>SPNS 202D</td>
<td>Intermediate Spanish II</td>
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<tr>
<td>SPNS 320</td>
<td>Spanish Culture &amp; Civilization</td>
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<tr>
<td>SPNS 330</td>
<td>Modern Cultures Latin America</td>
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<td>SPNS 332</td>
<td>Contemp Latin Amer Literature</td>
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<td>SPNS 335IH</td>
<td>Travel in Latin Am Lit &amp; Film</td>
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<tr>
<td>SPNS 361</td>
<td>Latin American Text and Cinema</td>
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<tr>
<td>SPNS 362</td>
<td>Hispanic Poetry</td>
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<tr>
<td>SPNS 416</td>
<td>Latin America: Culture and Revolution</td>
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<td>SPNS 430</td>
<td>Latin Amer Perspectives</td>
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<tr>
<td>SPNS 460</td>
<td>Contemporary Spain &amp; Nations</td>
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</tr>
<tr>
<td>SPNS 470R</td>
<td>Seminar: Hispanic Literature</td>
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</table>

Foreign Language Requirement: must complete a modern foreign language through the first semester of the second year or demonstrate an equivalent proficiency.
Global Health Minor

The Global Health minor will allow you to develop an interdisciplinary understanding of health issues and health care in a global context. Through the bundling of a broad range of courses, this minor will provide a solid foundation in social, cultural, epidemiological, environmental, and nutritional determinants of health, and will explore the challenges facing global health solutions. You will investigate the health implications of nutritional determinants of health, and will explore the challenges facing a solid foundation in social, cultural, epidemiological, environmental and nutritional determinants of health. You will investigate the health implications of globalization, as well as have the option for an engagement experience, both of which contribute to better understanding the determinants of health issues around the world.

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOH 303</td>
<td>Global Diseases and Health Disparities</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 101</td>
<td>Elementary Spanish I (Or equivalent in other languages)</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 250</td>
<td>Spanish for Healthcare Professionals</td>
<td>3</td>
</tr>
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</table>

Please note that 9 of your electives (from any of the three elective categories) must be upper division credits

Choose 6 credits from Biomedical Elective

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 250</td>
<td>Microbiology for Health Sciences: Infectious Diseases</td>
<td>3</td>
</tr>
<tr>
<td>or BIOM 100IN</td>
<td>Organism Function</td>
<td></td>
</tr>
<tr>
<td>or BIOM 160</td>
<td>Principles of Living Systems</td>
<td></td>
</tr>
<tr>
<td>or BIOM 410</td>
<td>Immunology</td>
<td></td>
</tr>
<tr>
<td>or BIOM 499</td>
<td>Senior Thesis/Capstone</td>
<td></td>
</tr>
<tr>
<td>or BIOH 185</td>
<td>Integrated Physiology I</td>
<td></td>
</tr>
<tr>
<td>or BIOH 201</td>
<td>Human Anatomy and Physiology I</td>
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</tr>
<tr>
<td>or BIOH 422</td>
<td>Genes and Cancer</td>
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</tr>
<tr>
<td>or BIOH 445</td>
<td>Intro Pharmacology</td>
<td></td>
</tr>
<tr>
<td>or BIOM 400</td>
<td>Medical Microbiology</td>
<td></td>
</tr>
<tr>
<td>or BIOM 415</td>
<td>Microbial Diversity, Ecology, and Evolution</td>
<td></td>
</tr>
<tr>
<td>or BIOM 435</td>
<td>Virology</td>
<td></td>
</tr>
<tr>
<td>or BIOM 441</td>
<td>Eukaryotic Pathogens</td>
<td></td>
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<tr>
<td>or CHTH 440</td>
<td>Principles Of Epidemiology</td>
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<tr>
<td>or KIN 221</td>
<td>Hlth Anatomy &amp; Physiology</td>
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<tr>
<td>or NUTR 221CS</td>
<td>Basic Human Nutrition</td>
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<tr>
<td>or BIOM 210RN</td>
<td>Environmental Health Science</td>
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<tr>
<td>or BIOM 460</td>
<td>Infectious Diseases Ecology and Spillover</td>
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Choose 6 Credits from Social/Economic Policy Elective

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<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AGBE 315</td>
<td>Ag in a Global Context</td>
<td>3</td>
</tr>
<tr>
<td>or AGSC 465R</td>
<td>Health, Agriculture, Poverty</td>
<td></td>
</tr>
<tr>
<td>or ANTY 101D</td>
<td>Anthropology and the Human Experience</td>
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</tr>
<tr>
<td>or ANTY 225IS</td>
<td>Culture, Language, and Society</td>
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</tr>
<tr>
<td>or ANTY 327</td>
<td>Medical Anthropology</td>
<td></td>
</tr>
<tr>
<td>or CHTH 210</td>
<td>Foundations in Community Health</td>
<td></td>
</tr>
<tr>
<td>or ECNS 317</td>
<td>Economic Development</td>
<td></td>
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<tr>
<td>or HTH 455</td>
<td>The Ethic of Care</td>
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<tr>
<td>or NRSG 418</td>
<td>Hlth Policy/Hlth Care Econ Cln</td>
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<tr>
<td>or PSCI 423</td>
<td>Politics of Development</td>
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<td>or PSCI 436</td>
<td>Politics of Food &amp; Hunger</td>
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<tr>
<td>or PSYX 383</td>
<td>Health Psychology</td>
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<tr>
<td>or SOCI 370</td>
<td>Sociology of Globalization</td>
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<tr>
<td>or SOCI 380</td>
<td>Sociology of Health &amp; Medicine</td>
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<tr>
<td>or SFBS 146</td>
<td>Introduction to Sustainable Food and Bioenergy Systems</td>
<td>3</td>
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Choose 3 Credits from Cultural Elective

<table>
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<tr>
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<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOB 492</td>
<td>Independent Study</td>
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<tr>
<td>or ML 492</td>
<td>Independent Study</td>
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</tr>
<tr>
<td>or CHTH 428</td>
<td>Health Disparities</td>
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</tr>
<tr>
<td>or GPHY 121D</td>
<td>Human Geography</td>
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</tr>
<tr>
<td>or HSTR 160D</td>
<td>Modern World History</td>
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</tr>
<tr>
<td>or ICS 491</td>
<td>Special Topics</td>
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<tr>
<td>or NASX 105D</td>
<td>Introduction to Native American Studies</td>
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</tr>
<tr>
<td>or NASX 415</td>
<td>Native Food Systems</td>
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<tr>
<td>or PHL 255D</td>
<td>Philosophy and Culture</td>
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<tr>
<td>or PSCI 230D</td>
<td>Introduction to International Relations</td>
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<tr>
<td>or RLST 100D</td>
<td>Intro to the Study of Religion</td>
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<tr>
<td>or RLST 111D</td>
<td>Religion, Conflict &amp; Politics</td>
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<tr>
<td>or SOCI 374</td>
<td>Sociology of Culture</td>
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<tr>
<td>or SPNS 350</td>
<td>US Latino Cultures</td>
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</tr>
</tbody>
</table>

Mathematical Sciences

The Department of Mathematical Sciences has programs leading to the Bachelor of Science, the Master of Science, and the Doctor of Philosophy degrees. The B.S. options in mathematics, applied mathematics, statistics, and teaching are listed below.

Many undergraduate courses are sufficiently basic to be of general interest. Detailed and current information on undergraduate course offerings is available from the department.

The four-year baccalaureate curriculum in mathematics is flexible and can accommodate students desiring to concentrate in mathematics, applied mathematics, mathematics teaching, or statistics. Programs in these concentrations are designed with the help of faculty advisors.
Mathematics Option
The mathematics option prepares students for graduate work in mathematics. The core of the program is built around three years of analysis, as well as courses in abstract and linear algebra. The program is flexible enough to accommodate students who wish to prepare for employment in business, industry, or government as analysts or specialists in the area of scientific computing. The core mathematics curriculum taken in conjunction with a secondary emphasis in other subject matter areas will prepare a student for employment as an analyst or computational specialist in those areas.

Applied Mathematics Option
Applied mathematicians learn to describe physical phenomena using deterministic models. These models are applicable to the biological and physical sciences and the student is trained to use differential equations, mathematical analysis and computational science to draw insights into various exciting fields.

Applied mathematics is primarily designed to prepare graduates for employment in business, industry, and government. However, an appropriate choice of electives can ensure the student a solid preparation for graduate work in mathematics, statistics, or scientific computing. The program demonstrates the utility of mathematics to solve problems arising in real industrial applications. Graduates will be qualified for professional careers in computational applications of mathematics, statistics, and other related fields.

Mathematics Teaching Option
The teaching option in the mathematics curriculum is designed specifically to prepare students to teach mathematics at the middle school and high school levels. The program includes the mathematics courses for a teaching major and the necessary courses in education which qualify the student for teacher’s licensure.

Students are encouraged to pursue a teaching minor in an additional area and should contact an advisor for details.

Statistics Option
Statisticians are trained in principles of quantitative reasoning. They learn how to discover patterns in data, how to display data, how to construct mathematical models for data, and how to detect biases and uncertainties in data summaries or models. They are trained to design and analyze observational studies, surveys, and scientific experiments. The computer is an essential tool for statistical work.

Statisticians are in demand; successful students should find that job opportunities are excellent. Although positions are available nationwide, the best employment opportunities are found in urban areas, industrial sites, and centers of government. The statistics option prepares students for such positions or for entry into a graduate program in statistics.

Undergraduate Programs
- Mathematics Option (p. 232)
- Applied Mathematics Option (p. 231)
- Statistics Option (p. 234)
- Mathematics Teaching Option (p. 233)

Undergraduate Minors
- Mathematics Minor (Non-Teaching) (p. 232)
- Mathematics Teaching Minor (p. 138)
- Statistics Minor (Non-Teaching) (p. 234)

Department of Mathematical Sciences
Degrees Offered
- M.S. in Mathematics (p. 378)
- M.S. in Mathematics (Mathematics Education Option) (p. 398)
- M.S. in Statistics (p. 379)
- Ph.D. in Mathematics (p. 380)
- Ph.D. in Mathematics (Mathematics Education Emphasis) (p. 381)
- Ph.D. in Statistics (p. 382)
- Graduate Certificate in Applied Statistics (p. 378)

Applied Mathematics Option
M 171Q Calculus I 4
or M 181Q Honors Calculus I
M 172Q Calculus II 4
or M 182Q Honors Calculus II
M 221 Introduction to Linear Algebra 3
M 242 Methods of Proof 3
M 273Q Multivariable Calculus 4
or M 283Q Honors Multivariable Calculus
M 274 Introduction to Differential Equations 4
or M 284 Honors Introduction to Differential Equations
M 383 Introduction to Analysis I 3
M 384 Introduction to Analysis II 3
M 386R Software Applications in Mathematics 3
M 441 Numerical Linear Algebra & Optimization 3
Choose six from the following math or statistics electives: * 18
M 333 Linear Algebra 3
M 348 Techniques of Applied Math I 3
M 349 Techniques of Applied Mathematics II 3
M 430 Mathematical Biology 3
M 431 Abstract Algebra I 3
M 442 Numerical Solution of Differential Equations 3
M 450 Applied Mathematics I 3
M 451 Applied Mathematics II 3
M 454 Introduction of Dynamical Systems I 3
M 455 Introduction to Dynamical Systems II 3
M 472 Introduction to Complex Analysis 3
M 476 Introduction to Topology 3
STAT 332 Statistics for Scientists and Engineers 3
STAT 421 Probability Theory 3
STAT 422 Mathematical Statistics 3
PHSX 220 Physics I (w/ calculus) ** 4
PHSX 222 Physics II (w/ calculus) ** 4
Total Credits 60

* At least nine credits must be 400 level.
** may be replaced with another mathematical application area with advisor approval.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. Core 2.0 must be completed for graduation.
# Mathematics Minor (Non-Teaching)

## Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>CLS 101US - Knowledge and Community</td>
<td>3</td>
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<tr>
<td>or COMX 111US - Introduction to Public Speaking</td>
<td></td>
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<tr>
<td>M 171Q - Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>or M 181Q - Honors Calculus I</td>
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<tr>
<td>PHSX 220 - Physics I (w/ calculus)</td>
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<td>University Core and Electives</td>
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<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>M 172Q - Calculus II</td>
<td>4</td>
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<tr>
<td>or M 182Q - Honors Calculus II</td>
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<tr>
<td>PHSX 222 - Physics II (w/ calculus)</td>
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## Sophomore Year

<table>
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<tr>
<td>M 221 - Introduction to Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>M 273Q - Multivariable Calculus</td>
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<tr>
<td>or M 283Q - Honors Multivariable Calculus</td>
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<tr>
<td>University Core and Electives</td>
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<tr>
<td>M 274 - Introduction to Differential Equation</td>
<td>4</td>
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<tr>
<td>or M 284 - Honors Introduction to Differential Equations</td>
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</tr>
<tr>
<td>M 242 - Methods of Proof</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>8</td>
</tr>
<tr>
<td><strong>Spring</strong></td>
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</tr>
<tr>
<td>M 273Q - Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>or M 283Q - Honors Multivariable Calculus</td>
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<tr>
<td>University Core and Electives</td>
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<td><strong>Year Total:</strong></td>
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## Junior Year

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<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>M 383 - Introduction to Analysis I</td>
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</tr>
<tr>
<td>Math or Stat Elect (See List Above)</td>
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<td>University Core and Electives</td>
<td>6</td>
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<tr>
<td>M 384 - Introduction to Analysis II</td>
<td>3</td>
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<tr>
<td>M 386R - Software Applications in Mathematics</td>
<td>3</td>
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<tr>
<td>Math or Stat Elect (See List Above)</td>
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<tr>
<td>University Core and Electives</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>M 242 - Methods of Proof</td>
<td>3</td>
</tr>
<tr>
<td>M 273Q - Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>or M 283Q - Honors Multivariable Calculus</td>
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<tr>
<td>University Core and Electives</td>
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<td><strong>Year Total:</strong></td>
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## Senior Year

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<tbody>
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<td><strong>Fall</strong></td>
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<tr>
<td>M 441 - Numerical Linear Algebra &amp; Optimization</td>
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<tr>
<td>Math or Stat Elect (See List Above)</td>
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<tr>
<td>University Core and Electives</td>
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<tr>
<td>M 274 - Introduction to Differential Equation</td>
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<tr>
<td>University Core and Electives</td>
<td>6</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>M 333 - Linear Algebra</td>
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<tr>
<td><strong>Year Total:</strong></td>
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## Total Program Credits: 120

### Mathematics Option

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>M 171Q - Calculus I</td>
<td>4</td>
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<tr>
<td>or M 181Q - Honors Calculus I</td>
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<tr>
<td>M 172Q - Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>or M 182Q - Honors Calculus II</td>
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<tr>
<td>M 221 - Introduction to Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>M 242 - Methods of Proof</td>
<td>3</td>
</tr>
<tr>
<td>M 273Q - Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>or M 283Q - Honors Multivariable Calculus</td>
<td></td>
</tr>
<tr>
<td>M 274 - Introduction to Differential Equation</td>
<td>4</td>
</tr>
<tr>
<td>or M 284 - Honors Introduction to Differential Equations</td>
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</tr>
<tr>
<td>M 333 - Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>M 383 - Introduction to Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>M 384 - Introduction to Analysis II</td>
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</tr>
<tr>
<td>M 431 - Abstract Algebra I</td>
<td>3</td>
</tr>
<tr>
<td><strong>Choose six from the following math or stat electives:</strong></td>
<td>18</td>
</tr>
<tr>
<td>M 348 - Techniques of Applied Math I</td>
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</tr>
<tr>
<td>M 349 - Techniques of Applied Mathematics II</td>
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</tr>
<tr>
<td>M 386R - Software Applications in Mathematics</td>
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<tr>
<td>M 430 - Mathematical Biology</td>
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<tr>
<td>M 441 - Numerical Linear Algebra &amp; Optimization</td>
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<tr>
<td>M 442 - Numerical Solution of Differential Equations</td>
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<tr>
<td>M 450 - Applied Mathematics I</td>
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<td>M 451 - Applied Mathematics II</td>
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<tr>
<td>M 454 - Introduction of Dynamical Systems I</td>
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<tr>
<td>M 455 - Introduction to Dynamical Systems II</td>
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<tr>
<td>M 472 - Introduction to Complex Analysis</td>
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<tr>
<td>STAT 332 - Statistics for Scientists and Engineers</td>
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<tr>
<td>STAT 421 - Probability Theory</td>
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<td>STAT 422 - Mathematical Statistics</td>
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<tr>
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<tr>
<td>PHSX 222 - Physics II (w/ calculus)</td>
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</table>

## Total Credits: 60
Mathematics Teaching Option

The Mathematics Teaching Option is designed for students who wish to become licensed to teach mathematics in grades 5-12. Upon completion of the degree, students are eligible for licensure in the state of Montana. Secondary education students are encouraged to pursue a teaching minor in an additional content area and should contact an advisor for details. Obtaining a teaching minor will require more than eight semesters. For more information on admission to the Teacher Education Program, Student Teaching, Licensure, Professional Expectations and more, please visit the Teacher Education Program (p. 135) page.

Freshman Year

<table>
<thead>
<tr>
<th>Fall Credits</th>
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<tbody>
<tr>
<td>University and Core Electives 5</td>
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<tr>
<td>WRIT 101W - College Writing I M 172Q - Calculus II or M 182Q - Honors Calculus II PHSX 222 - Physics II (w/ calculus) University Core and Electives 4</td>
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Sophomore Year

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<tr>
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<tr>
<td>EDU 223IS - Educ Psych and Adolescent Dev or EDU 370 - Integrating Tech into Educ M 221 - Introduction to Linear Algebra M 274 - Introduction to Differential Equation or M 284 - Honors Introduction to Differential Equations Math or Stat Elective (See List Above) University Core and Electives 4</td>
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<tr>
<td>EDU 202 - Early Field Experience M 242 - Methods of Proof M 273Q - Multivariable Calculus or M 283Q - Honors Multivariable Calculus University Core and Electives 3</td>
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<td>STAT 216Q - Introduction to Statistics EDU 211D - Multicultural Education M 242 - Methods of Proof M 274 - Introduction to Differential Equation STAT 217Q - Intermediate Statistical Concepts University Core and Electives 3</td>
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Junior Year

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<tr>
<th>Fall Credits</th>
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<tr>
<td>EDU 382 - Assessmt, Curric, Instructn M 333 - Linear Algebra M 383 - Introduction to Analysis I Math or Stat Elect (See List Above) University Core and Electives 6</td>
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<tr>
<td>M 384 - Introduction to Analysis II Math or Stat Elect (See List Above) University Core and Electives 3</td>
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Senior Year

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<tr>
<td>Math or Stat Elect (See List Above) University Core and Electives</td>
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<tr>
<td>M 431 - Abstract Algebra I Math or Stat Elect (See List Above) University Core and Electives 3</td>
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<td>Year Total: 15</td>
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</table>

Total Program Credits: 120
### Statistics Minor (Non-Teaching)

**STAT 217Q** Intermediate Statistical Concepts 3

or **STAT 332** Statistics for Scientists and Engineers

Eight credits of Math (171 or higher) 8

Twelve credits of STAT (408 or higher) 12

Total Credits 23

### Statistics Option

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>M 171Q</td>
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<td>M 172Q</td>
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<td>M 221</td>
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<td>M 242</td>
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<td>M 273Q</td>
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</tr>
<tr>
<td>M 333</td>
<td>3</td>
</tr>
<tr>
<td>or M 441</td>
<td></td>
</tr>
<tr>
<td>STAT 217Q</td>
<td>3</td>
</tr>
<tr>
<td>or STAT 332</td>
<td></td>
</tr>
<tr>
<td>STAT 408</td>
<td>3</td>
</tr>
<tr>
<td>STAT 411</td>
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<td>STAT 412</td>
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<td>STAT 421</td>
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<td>STAT 422</td>
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<td>STAT 441</td>
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<td>STAT 446</td>
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Choose four from the following: 12

<table>
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<tr>
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<tbody>
<tr>
<td>STAT 431</td>
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<td>STAT 436</td>
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<td>STAT 439</td>
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<td>STAT 448</td>
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<tr>
<td>STAT 490R</td>
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</tr>
<tr>
<td>STAT 491</td>
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</table>

Other courses approved by an advisor may be substitutes. At least one science must have a lab.

Total Credits 57

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. Core 2.0 must be completed for graduation. The following is a typical program of study:

### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CLS 101US - Knowledge and Community or COMX 111US - Introduction to Public Speaking</td>
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</tr>
<tr>
<td>M 171Q - Calculus I</td>
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<td>WRIT 101W - College Writing I</td>
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<td>M 172Q - Calculus II</td>
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Year Total: 15 16

### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>M 273Q - Multivariable Calculus</td>
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<tr>
<td>M 242 - Methods of Proof</td>
<td>3</td>
</tr>
<tr>
<td>STAT 217Q - Intermediate Statistical Concepts</td>
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</tr>
<tr>
<td>or STAT 332 - Statistics for Scientists and Engineers</td>
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<tr>
<td>Science Electives</td>
<td>4</td>
</tr>
<tr>
<td>M 221 - Introduction to Linear Algebra</td>
<td>3</td>
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<tr>
<td>STAT 408 - Statistical Computing and Graphical Analysis</td>
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<tr>
<td>Science Electives</td>
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<tr>
<td>University Core and Electives</td>
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Year Total: 15 16

### Junior Year

<table>
<thead>
<tr>
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<tr>
<td>M 333 - Linear Algebra or M 441 - Numerical Linear Algebra &amp; Optimization</td>
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<td>STAT 411 - Methods for Data Analysis I</td>
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<td>STAT 446 - Sampling</td>
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<tr>
<td>Science Electives</td>
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<tr>
<td>University Core and Electives</td>
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<tr>
<td>STAT 412 - Methods for Data Analysis II</td>
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<td>STAT 441 - Experimental Design</td>
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<td>Science Electives</td>
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<td>University Core and Electives</td>
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Year Total: 15 15

### Senior Year

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>STAT 421 - Probability Theory</td>
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<tr>
<td>STAT 422 - Mathematical Statistics</td>
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<td>University Core and Electives</td>
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</tbody>
</table>

Year Total: 15 15

Total Program Credits: 120

### Actuary Profession Bound Students

Actuary profession-bound students are advised to take STAT 421 and STAT 422 during the junior year in order to be prepared for the actuarial
exams given during the senior year. For further guidance, see the Actuary Advisor in the Dept. of Mathematical Sciences, 2-214 Wilson Hall.

Microbiology and Immunology

Note: MSU’s programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology. For additional options see Biological Sciences (p. 82) at MSU.

Department of Microbiology and Immunology

Programs are designed to prepare students for careers in microbiology with emphasis in medical microbiology, immunology, molecular biology, virology, microbial physiology, microbial ecology, microbial genetics, and environmental microbiology. The Microbiology curriculum has two options: Microbiology (with various tracks) and Medical Laboratory Science. There is also a Biotechnology curriculum with a Microbial Systems option. Some courses in these options require additional course fees.

Microbiology Option

In this option, students obtain a thorough education in the fields of medical, ecological, physiological, and environmental microbiology, immunology, virology, and molecular biology. This curriculum is excellent preparation for:

- graduate study in microbiology and other fields of the biological sciences
- medical, dental, and other professional schools
- careers in industry, university, institute, and government laboratories

There are several tracks a student can choose within this option to tailor their studies to their interests. These include the Microbiology Track, the Pre-Medical Track, the Pre-Veterinary Track, the Environmental Track, and the Environmental Health Track.

Medical Laboratory Science Option

This option is designed to prepare students for careers in Clinical Laboratory Science. Students develop competence in a range of medically-oriented fields including immunology, medical bacteriology, virology, parasitology, hematology, mycology, and chemistry. Foundations in molecular biology and statistics are also emphasized.

The Department of Microbiology and Immunology has two plans for students seeking a career in Medical Laboratory Science (MLS), Plan "A" and Plan "B."

Plan A (3+1) allows students to attend classes at MSU for three years and apply for an internship the fourth year with an affiliated MLS program. The Montana Medical Laboratory Science Training Program is located at MSU and meets the professional standards and is approved by the National Accrediting Agency for Clinical Laboratory Sciences, 5600 N. River Rd., Suite 720, Rosemont IL 60018-5119, (773) 714-8880. MSU also has an affiliation agreement with the Sacred Heart School of Medical Technology in Spokane and Health One Alliance School of Medical Technology, Denver. Students with a 2.5 GPA or greater who are accepted will spend their fourth year in this program. Upon completion of the one-year internship, students receive a BS degree in Microbiology from MSU and take a national examination through the American Society for Clinical Pathologists or the National Certification Agency. They will then be qualified to practice as a Medical Laboratory Scientist.

Plan B is for students who wish to attend four complete years at MSU and then independently seek an approved hospital training program in MLS for a one-year internship. Once training is complete, they will also be qualified to take a national registry exam and become certified as a MLS. This certification qualifies them for graduate education and careers in:

- clinical analysis (microbiology, hematology, chemistry, and immunohematology)
- medical research
- industry (product development, sales, maintenance of equipment, etc)
- public health laboratories
- health care administration

Microbiology Minor (Non-Teaching)

A Microbiology minor is available to provide interested students with an understanding of the microbial basis of health and disease and environmental microbiology. Eligibility for a minor in Microbiology requires 29 credits in Microbiology and supporting subjects. This minor will complement other majors for those pursuing graduate school and professional programs in medical, dental, veterinary, ecological, industrial, pharmaceutical and related areas. The minor will also strengthen the background of science majors who wish to become more competitive in the job market.

Genetics Minor

Genetics is one of the fundamental disciplines that supports the field of biology. The departments that contribute to genetics teaching and research collaborated to develop the Genetics Minor to provide students with a focused experience in microbial, plant and animal genetics, and to permit exploration of specialties ranging from bioinformatics through molecular, evolutionary and quantitative genetics. The Genetics Minor is available in the departments of Animal and Range Sciences, Cell Biology and Neurosciences, Computer Science, Ecology, Microbiology and Immunology, and Plant Sciences and Plant Pathology. Each participating department has a certifying officer for the Genetics Minor to help students decide whether this option is appropriate.

Standards for the Genetics Minor are consistent across all participating departments: a student must receive a grade of C- or better in all courses required for the minor. In consultation with the Genetics Advisor, the student will select a minimum of 16 credits from the list of elective courses.

Pre-veterinary Medical Certificate (Non-degree Program)

This program is ideal for students who have already obtained their B.S. degree and are seeking a structured approach to coursework necessary to apply to veterinary schools. The certificate may also be obtained by students currently seeking a degree in an unrelated field, as a means of tracking course work needed to complete an application to any AVMA accredited veterinary schools.

Undergraduate Research Participation

An undergraduate research program, available to students who demonstrate an interest and ability, is open to non-majors as well as majors in Microbiology. The aim of this program is to foster increased creativity, imagination, inquisitiveness, and independence.

Departmental Honors in Microbiology

When appropriate, majors should consider the opportunities afforded by the departmental honors program. This program has the following components:

- A minimum 3.5 grade-point average (GPA) in Microbiology, 3.0 GPA overall
- A minimum of four credits of undergraduate research credit
• An acceptable, bound senior thesis, and an oral defense of the thesis Participation in a Microbiology seminar (BIOM 494) during the senior year is the required capstone course for graduation. As many as two BIOM 494 seminars (1 credit each) may be applied toward graduation when taken in the junior or senior years. A detailed description of the microbiology program is available from the department.

Undergraduate Programs
• Microbiology Option: Microbiology Track (p. 239)
• Microbiology Option: Pre-Medical Track (p. 240)
• Microbiology Option: Pre-Veterinary Track (p. 241)
• Microbiology Option: Environmental Microbiology Track (p. 239)
• Microbiology Option: Environmental Health Track (p. 238)
• Medical Laboratory Science Option (p. 236)

Undergraduate Minors
• Genetics Minor (Non-Teaching) (p. 95)
• Microbiology Minor (Non-Teaching) (p. 237)

Certificates Offered
• Preveterinary Certificate (p. 242)

The Department of Microbiology and Immunology (MBI) conducts one of the premier infectious disease research programs in the Northwest, as demonstrated by the success of our faculty in competing nationally for extramural grant funding and publishing high-impact papers. Research funding comes from a range of sources such as the National Institutes of Health, US Department of Agriculture, National Science Foundation and the Montana Agricultural Experimental Station among others. Over the past five years, MBI averaged over $6 million for annual research expenditures. MBI is also home to an NIH Center of Biomedical Research Excellence in Zoonotic and Emerging Infectious Diseases, which provides substantial core facilities and training opportunities for junior investigators. MBI is housed in a state-of-the-art facility with core laboratories for flow cytometry, cell biology, and molecular sciences, as well as pathogen containment facilities for small (BSL-3) and large animal research (ABSL-2). Instrumentation suites house equipment for DNA sequencing, genomic analysis, flow cytometry and cell sorting, and confocal microscopy.

Graduate Programs
• M.S. in Microbiology and Immunology (Plan A) (p. 296)
• M.S. in Microbiology and Immunology (Plan B) (p. 297)
• Ph.D. in Microbiology and Immunology (p. 297)

Medical Laboratory Science Option
• Plan A (p. 236)
• Plan B (p. 237)

Plan A
Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
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<tbody>
<tr>
<td>BIOM 101 - Careers in Microbiology</td>
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<tr>
<td>CHMY 141 - College Chemistry I</td>
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<td>CHMY 143 - College Chemistry II</td>
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<td>BIOB 160 - Principles of Living Systems</td>
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<td>BIOH 201 - Hum Anatomy &amp; Physiology I</td>
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Sophomore Year

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<tr>
<td>CHMY 211 - Elements of Organic Chemistry</td>
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<td>BIOH 211 - Hum Anatomy &amp; Physiology II</td>
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<tr>
<td>BCH 380 - Biochemistry</td>
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<td>BIOM 360 - General Microbiology</td>
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<td>STAT 216Q - Introduction to Statistics</td>
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Junior Year

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<tr>
<td>BIOM 494 - Seminar/Workshop (two semesters) or BIOM 497 - Educational Methods: Microbiology</td>
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<td>BIOM 410 - Microbial Genetics</td>
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<tr>
<td>or BIOM 450 - Microbial Physiology</td>
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<td>BIOM 406 - Hematology Laboratory</td>
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<td>BIOB 410 - Immunology</td>
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<td>BIOM 435 - Virology</td>
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<td>or BIOM 400 - Medical Microbiology</td>
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<td>BIOM 405 - Hematology</td>
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<tr>
<td>BIOM 410 - Microbial Genetics</td>
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<tr>
<td>or BIOM 450 - Microbial Physiology</td>
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<td>BIOM 431 - Medical Bacteriology</td>
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<td>BIOM 432 - Med Bacteriology Lab</td>
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<td>BIOM 441 - Eukaryotic Pathogens</td>
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Total Program Credits: 91

Senior Professional Year Medical Laboratory Science - Plan A

Students with a 2.5 GPA or higher can apply for a senior year of professional training. They will obtain a degree in Microbiology/Medical Laboratory Science option from MSU-Bozeman. Total credits for graduation are 128; 42 of these credits must be in courses numbered 300 and above, and 32 of those credits must be in the distributed University Core. Note: Additional credits are required for this option because students take an additional summer session of courses. This additional semester is necessary because it meets the professional standards and is approved by the National Accrediting Agency for Clinical Laboratory Sciences, 5600 N. River Rd., Suite 720, Rosemont IL 60018-5119; (773) 714-8880.

Courses for Montana Medical Laboratory Science (MMLS) Training Program

If student attends the Montana Medical Laboratory Science Training Program:

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tbody>
<tr>
<td>BIOH 476 - Clinical Microbiology II</td>
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<tr>
<td>BIOH 477 - Clinical Chemistry and Urinalysis II</td>
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<tr>
<td>BIOH 478 - Clinic Immunohematology II</td>
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<td>BIOH 479 - Clinical Immunology/ Serology</td>
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<tr>
<td>BIOH 473 - Laboratory Practice II</td>
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</tbody>
</table>
BIOH 474 - Clinical Hematology II  2
BIOH 475 - Clinical Hemostasis  1
BIOH 482 - Laboratory Practice III  2
BIOH 484 - Clinical Hematology III and Molecular Diagnostics  2
BIOH 485 - Clinical Hemostasis  2
BIOH 486 - Clinical Microbiology III  2
BIOH 487 - Clinical Chemistry III  2
BIOH 488 - Clinical Immunohematology  3
BIOH 489 - Laboratory Management  1
BIOH 464 - Clinical Hematology and Body Fluids  2
BIOH 466 - Clin Microbiology I  3
BIOH 467 - Clinical Chemistry I  3
BIOH 468 - Clinical Immunohematology I  3
BIOH 469 - Essentials of Clinical Lab Practice  1

Total Program Credits:  37

If student is accepted and attends Sacred Heart Medical Center (Spokane) or Colorado Center for MLS (Denver) for their Senior Professional Year:

BIOH 470  Summer Clinical Laboratory (12 credits)
- Clinical Immunohematology I; Clinical Chemistry Theory; Clinical Laboratory I; Clinical Hemostasis; Clinical Microscopy and Urinalysis; Clinical Body Fluids; Clinical Immunohematology Theory; Clinical Microbiology Theory and Laboratory

BIOH 471  Professional Training I (Fall Semester)
- Clinical Immunohematology II; Clinical Chemistry I; Clinical Hematology I; Clinical Microbiology I; Clinical Laboratory III; Clinical Immunology; Medical Mycology

BIOH 472  Professional Training II (Spring Semester)
- Clinical Immunohematology III; Clinical Microbiology II; Clinical Hematology II

Suggested Electives for Plan A
- BIOM 405  Host-Associated Microbiomes  4
- BIOM 430  Applied and Environmental Microbiology  4
- BIOM 415  Microbial Diversity, Ecology, and Evolution  3
- BIOM 425  Toxicology: Science of Poisons  3
- BIOM 455R  Research Mthds in Microbiology  4
- BIOM 103IN  Unseen Universe: Microbes  3
- BIOM 250  Microbiology for Health Sciences: Infectious Diseases  4
- BIOM 160  Principles of Living Systems  5
- BIOM 141 & 143

Microbiology Minor (Non-Teaching)
- BIOM 103IN  Unseen Universe: Microbes  3
- BIOM 250  Microbiology for Health Sciences: Infectious Diseases  4
- BIOM 160  Principles of Living Systems  4
- BIOM 141 & 143
- BIOM 360  General Microbiology pre-req: BIOM 160, CHMY 141 & 143

Plan B

Freshman Year

<table>
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<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
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<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
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<tr>
<td>BIOM 101</td>
<td>Careers in Microbiology</td>
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<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
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</table>

Suggested Electives for Plan A
- BIOM 405  Host-Associated Microbiomes  4
- BIOM 430  Applied and Environmental Microbiology  4
- BIOM 415  Microbial Diversity, Ecology, and Evolution  3
- BIOM 425  Toxicology: Science of Poisons  3
- BIOM 455R  Research Mthds in Microbiology  4
- BIOM 103IN  Unseen Universe: Microbes  3
- BIOM 250  Microbiology for Health Sciences: Infectious Diseases  4
- BIOM 160  Principles of Living Systems  4
- BIOM 141 & 143
- BIOM 360  General Microbiology pre-req: BIOM 160, CHMY 141 & 143

Biological Sciences Major (Non-Teaching)

BIOH 470  Summer Clinical Laboratory (12 credits)
- Clinical Immunohematology I; Clinical Chemistry Theory; Clinical Laboratory I; Clinical Hemostasis; Clinical Microscopy and Urinalysis; Clinical Body Fluids; Clinical Immunohematology Theory; Clinical Microbiology Theory and Laboratory

BIOH 471  Professional Training I (Fall Semester)
- Clinical Immunohematology II; Clinical Chemistry I; Clinical Hematology I; Clinical Microbiology I; Clinical Laboratory III; Clinical Immunology; Medical Mycology

BIOH 472  Professional Training II (Spring Semester)
- Clinical Immunohematology III; Clinical Microbiology II; Clinical Hematology II

Suggested Electives for Plan A
- BIOM 405  Host-Associated Microbiomes  4
- BIOM 430  Applied and Environmental Microbiology  4
- BIOM 415  Microbial Diversity, Ecology, and Evolution  3
- BIOM 425  Toxicology: Science of Poisons  3
- BIOM 455R  Research Mthds in Microbiology  4
- BIOM 103IN  Unseen Universe: Microbes  3
- BIOM 250  Microbiology for Health Sciences: Infectious Diseases  4
- BIOM 160  Principles of Living Systems  4
- BIOM 141 & 143
- BIOM 360  General Microbiology pre-req: BIOM 160, CHMY 141 & 143
Microbiology Electives (need 13 cr. from list below) 13
BIOB 410  Immunology 3
BIOB 412  Hybridomas 2
BIOB 413  Flow Cytometry 1
BIOB 414  Advanced Microscopy 1
BIOB 415  Adv Immunology Methods 1
BIOB 424  Ethical Practice of Science 3
BIOB 428  Molecular Evolution 3
BIOB 477  Genome Science and Gene Expression 5
BIOH 405  Hematology 3
BIOH 406  Hematology Laboratory 1
BIOH 422  Genes and Cancer 3
BIOM 400  Medical Microbiology 3
BIOM 405  Host-Associated Microbiomes 4
BIOM 410  Microbial Genetics 3
BIOM 415  Microbial Diversity, Ecology, and Evolution 3
BIOM 421  Concepts of Plant Pathology 3
BIOM 423  Mycology 3
BIOM 425  Toxicology: Science of Poisons 3
BIOM 427  General Parasitology 3
BIOM 430  Applied and Environmental Microbiology 4
BIOM 431  Medical Bacteriology 3
BIOM 432  Med Bacteriology Lab 2
BIOM 435  Virology 3
BIOM 441  Eukaryotic Pathogens 4
BIOM 450  Microbial Physiology 3
BIOM 452  Soil & Environmental Microbiology 3
BIOM 455R  Research Mthds in Microbiology 4
BIOM 460  Infectious Diseases Ecology and Spillover 3
BIOM 490R  Undergraduate Research 3
BIOM 498  Microbiology Internship

Microbiology electives must be numbered 280 and above. A minimum of 9 credits total must be in courses numbered 300 and above. A maximum of 2 Undergraduate Research credits can be applied to the minor.

Microbiology Option: Environmental Health Track

**Freshman Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 141 - College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 143 - College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>BIOM 101 - Careers in Microbiology</td>
<td>1</td>
</tr>
<tr>
<td>BIOB 160 - Principles of Living Systems or BIOB 260 - Cellular and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>M 151Q - Precalculus</td>
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<td>CORE (University Seminar)</td>
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<tr>
<td>Advisor Approved Elective</td>
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<td><strong>Year Total:</strong></td>
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**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 211 - Elements of Organic Chemistry or CHMY 321 - Organic Chemistry I</td>
<td>4-5</td>
</tr>
<tr>
<td>PHSX 205 - College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>KIN 221 - Hlth Anatomy &amp; Physiology or BIOH 201 and BIOH 211</td>
<td>3</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td>30-33</td>
</tr>
</tbody>
</table>

**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERTH 101IN - Earth System Sciences</td>
<td>4</td>
</tr>
<tr>
<td>HDFS 271 - Statistical Measures of Well-Being or BIOB 318 - Biometry or STAT 216Q - Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>GPHY 284 - Intro to GIS Science &amp; Cartography</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 221 - Intermediate Tech Writing or WRIT 326 - Advanced Writing</td>
<td>3</td>
</tr>
<tr>
<td>CORE or Advisor Approved Elective</td>
<td>6</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td>30-31</td>
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**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHTH 440 - Principles Of Epidemiology</td>
<td>3</td>
</tr>
<tr>
<td>EENV 447 - Hazardous Waste Management</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 425 - Toxicology: Science of Poisons</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 407 - Environmental Risk Assessment</td>
<td>3</td>
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<tr>
<td>Required Elective</td>
<td>3-6</td>
</tr>
<tr>
<td>CORE or Advisor Approved Elective</td>
<td>15</td>
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<td><strong>Year Total:</strong></td>
<td>30-33</td>
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</tbody>
</table>

**Total Program Credits:** 120

**Required Electives**

Students must take a minimum of Two courses from the Required Electives below. Additional Courses can also be counted towards the additional 9 required Advisor Approved Electives.

**Disease Prevention**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 400 - Medical Microbiology</td>
<td>3</td>
</tr>
</tbody>
</table>

**Food Protection**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUTR 322 - Food Service System Management</td>
<td>3</td>
</tr>
</tbody>
</table>

**Vector Control**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 460 - Infectious Diseases Ecology and Spillover</td>
<td>3</td>
</tr>
</tbody>
</table>

**Hydrogeology**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ENSC 444 - Watershed Hydrology or ENSC 272CS - Water Resources</td>
<td>3</td>
</tr>
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</table>

**GIS**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPHY 357 - GPS Fund/App in Mapping or GPHY 384 - Adv GIS and Spatial Analysis</td>
<td>3</td>
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</tbody>
</table>

**Soils**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENSC 2451N - Soils or BIOM 452 - Soil &amp; Environmental Microbiology or ENSC 460 - Soil Remediation</td>
<td>3</td>
</tr>
</tbody>
</table>

**Advisor Approved Electives.**

Each student shall work closely with the EH Option Advisor to plan an integrated set of elective courses which are appropriate to their academic...
Montana State University

and professional goals while meeting both Graduation and Accreditation requirements.

MBEH 475 Field Project 1-4
MBEH 490R Undergraduate Research 1-6
MBEH 492 Independent Study 1-3
ARCH 231CS Issues in Sustainability 3
BCH 380 Biochemistry 5
BIOM 405 Host-Associated Microbiomes 3
BIOM 410 Microbial Genetics 3
BIOM 435 Virology 3
BIOM 450 Microbial Physiology 3
BIOO 262IN Introduction to Entomology 3
ENSC 353 Environmental Biogeochemistry 3
ENSC 461 Restoration Ecology 3
NASX 310 Native Cultures of North America 3
or NASX 450 History of American Indians 3
NASX 415 Native Food Systems 3
NASX 476 American Indian Policy and Law 3
NRSM 430 Natural Resource Law 3
STAT 217Q Intermediate Statistical Concepts 3

### Microbiology Option: Environmental Microbiology Track

#### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 160</td>
<td>Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>or CHMY 151</td>
<td>Honors College Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>or CHMY 153</td>
<td>Honors College Chemistry II</td>
<td></td>
</tr>
<tr>
<td>Math requirements</td>
<td></td>
<td>6-7</td>
</tr>
<tr>
<td>For General Plan:</td>
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<td></td>
</tr>
<tr>
<td>M 165Q - Calculus for Technology I</td>
<td></td>
<td></td>
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<tr>
<td>or M 171Q - Calculus I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 166Q - Calculus for Technology II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or M 172Q - Calculus II</td>
<td></td>
<td></td>
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<tr>
<td>Math for other Plans:</td>
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<tr>
<td>M 161Q - Survey of Calculus &amp; &amp; BIOB 318 - Biomtry</td>
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#### Sophomore Year

<table>
<thead>
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<th>Course Title</th>
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<tbody>
<tr>
<td>CHMY 321</td>
<td>Organic Chemistry I</td>
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</tr>
<tr>
<td>or CHMY 331</td>
<td>Honors Organic Chemistry I</td>
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</tr>
<tr>
<td>CHMY 323</td>
<td>Organic Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>or CHMY 333</td>
<td>Honors Organic Chemistry II</td>
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<tr>
<td>BIOM 360</td>
<td>General Microbiology</td>
<td>5</td>
</tr>
<tr>
<td>Choose one of the following sequences:</td>
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<td>For General Plan:</td>
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<td></td>
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<tr>
<td>PHSX 205 - College Physics I</td>
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<td></td>
</tr>
<tr>
<td>or PHSX 220 - Physics I (w/ calculus)</td>
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<td></td>
</tr>
<tr>
<td>PHSX 207 - College Physics II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or PHSX 222 - Physics II (w/ calculus)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For Population Biol. &amp; Ecology Plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOB 375 - General Genetics</td>
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</tr>
</tbody>
</table>

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

### Microbiology Option: Microbiology Track

#### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOB 160</td>
<td>Principles of Living Systems</td>
<td>4</td>
</tr>
<tr>
<td>or BIOB 260</td>
<td>Cellular and Molecular Biology</td>
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<tr>
<td>CHMY 141</td>
<td>College Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>or CHMY 151</td>
<td>Honors College Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHMY 143</td>
<td>College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>or CHMY 153</td>
<td>Honors College Chemistry II</td>
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<tr>
<td>Math Requirements</td>
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</table>

#### Junior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BCH 380 - Biochemistry</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>or BCH 441 and BCH 442</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOM 410 - Microbial Genetics</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>BIOM 430 - Applied and Environmental Microbiology</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>University Core and Electives</td>
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<td>18</td>
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<tr>
<td>Year Total:</td>
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</table>

#### Senior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 450 - Microbial Physiology</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>BIOM 494 - Seminar/Workshop (take twice for two credits total)</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Choose one of the following sequences:</td>
<td></td>
<td>9-12</td>
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</table>

For General Plan

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 405 - Host-Associated Microbiomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOM 452 - Soil &amp; Environmnt Microbiology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOM 455R - Research Mthds in Microbiology</td>
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<td></td>
</tr>
</tbody>
</table>

For Population Biol. & Ecology Plan

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 452 - Soil &amp; Environmnt Microbiology</td>
<td></td>
<td></td>
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<tr>
<td>BIOM 415 - Microbial Diversity, Ecology, and Evolution or BIOM 460 - Infectious Diseases Ecology and Spillover</td>
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<tr>
<td>BIOM 420 - Evolution</td>
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For Bioinformatics Plan

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHMY 441 - Biochemistry of Macromolecules</td>
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<tr>
<td>BIOM 455R - Research Mthds in Microbiology</td>
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<td></td>
</tr>
<tr>
<td>CHMY 444R - Biochemistry &amp; Molecular Biology Methods</td>
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<td></td>
</tr>
<tr>
<td>BIOM 428 - Molecular Evolution</td>
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</table>

For Ag & Bioremediation Plan (choose 4 of the following)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>BIOM 452 - Soil &amp; Environmnt Microbiology</td>
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</tr>
<tr>
<td>BIOM 421 - Concepts of Plant Pathology</td>
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<tr>
<td>AGSC 450 - Plant Disease Control</td>
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<td></td>
</tr>
<tr>
<td>ENSC 353 - Environmental Biogeochemistry</td>
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<td></td>
</tr>
<tr>
<td>ENSC 460 - Soil Remediation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOM 423 - Mycology</td>
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</tr>
</tbody>
</table>

| University Core and Electives |                                    | 12-16   |
| Year Total:                 |                                | 30      |

Total Program Credits: 120
University Core and Electives (see list below)  12
Year Total:  30

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHMY 321 - Organic Chemistry I</td>
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</tr>
<tr>
<td>or CHMY 331 - Honors Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHMY 323 - Organic Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>or CHMY 333 - Honors Organic Chemistry II</td>
<td></td>
</tr>
<tr>
<td>BIOM 360 - General Microbiology</td>
<td>5</td>
</tr>
<tr>
<td>PHSX 205 - College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>or PHSX 220 - Physics I (w/ calculus)</td>
<td></td>
</tr>
<tr>
<td>PHSX 207 - College Physics II</td>
<td>4</td>
</tr>
<tr>
<td>or PHSX 222 - Physics II (w/ calculus)</td>
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</tr>
<tr>
<td>Microbiology Electives**</td>
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</tr>
<tr>
<td>University Core and Electives</td>
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</tr>
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</table>

Year Total:  30

**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 380 - Biochemistry</td>
<td>5</td>
</tr>
<tr>
<td>BIOM 430 - Applied and Environmental Microbiology</td>
<td>3-4</td>
</tr>
<tr>
<td>or BIOM 415 - Microbial Diversity, Ecology, and Evolution</td>
<td></td>
</tr>
<tr>
<td>Microbiology Electives**</td>
<td>10</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>11-12</td>
</tr>
</tbody>
</table>

Year Total:  30

**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 494 - Seminar/Workshop (take two semesters)</td>
<td>2</td>
</tr>
<tr>
<td>BIOM 450 - Microbial Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 410 - Microbial Genetics</td>
<td>3</td>
</tr>
<tr>
<td>Microbiology Electives**</td>
<td>10</td>
</tr>
<tr>
<td>University Core and Electives</td>
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</tbody>
</table>

Year Total:  30

Total Program Credits:  120

**Math Requirements**

Choose one of the following sequences of two courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>M 161Q &amp; BIOB 318</td>
<td>Survey of Calculus and Biometry (or STAT 216Q)</td>
</tr>
<tr>
<td>M 171Q &amp; BIOB 318</td>
<td>Calculus I and Biometry (or STAT 216Q)</td>
</tr>
<tr>
<td>M 171Q &amp; M 172Q</td>
<td>Calculus I and Calculus II</td>
</tr>
<tr>
<td>M 181Q &amp; M 182Q</td>
<td>Honors Calculus I and Honors Calculus II</td>
</tr>
<tr>
<td>M 165Q &amp; M 166Q</td>
<td>Calculus for Technology I and Calculus for Technology II</td>
</tr>
</tbody>
</table>

**Microbiology Electives**

A minimum of 25 credits of additional Microbiology courses, some of which are listed below.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 101</td>
<td>Careers in Microbiology (1 cr)</td>
</tr>
<tr>
<td>BIOM 400</td>
<td>Medical Microbiology (3 cr)</td>
</tr>
<tr>
<td>BIOM 405</td>
<td>Host-Associated Microbiomes (4 cr)</td>
</tr>
<tr>
<td>BIOM 425</td>
<td>Toxicology: Science of Poisons (3 cr)</td>
</tr>
<tr>
<td>BIOM 427</td>
<td>General Parasitology (4 cr)</td>
</tr>
<tr>
<td>BIOM 431</td>
<td>Medical Bacteriology (3 cr)</td>
</tr>
<tr>
<td>BIOM 432</td>
<td>Med Bacteriology Lab (2 cr)</td>
</tr>
<tr>
<td>BIOM 435</td>
<td>Virology (3 cr)</td>
</tr>
<tr>
<td>BIOM 441</td>
<td>Eukaryotic Pathogens (4 cr)</td>
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<tr>
<td>BIOM 455R</td>
<td>Research Mthds in Microbiology (4 cr)</td>
</tr>
<tr>
<td>BIOM 460</td>
<td>Infectious Diseases Ecology and Spillover</td>
</tr>
<tr>
<td>BIOM 490R</td>
<td>Undergraduate Research (4 cr max for MB electives)</td>
</tr>
<tr>
<td>BIOM 497</td>
<td>Educational Methods: Microbiology (2 cr)</td>
</tr>
<tr>
<td>BIOM 498</td>
<td>Microbiology Internship</td>
</tr>
<tr>
<td>BIOB 410</td>
<td>Immunology (3 cr)</td>
</tr>
<tr>
<td>BIOB 412</td>
<td>Hybridomas (2 cr)</td>
</tr>
<tr>
<td>BIOB 413</td>
<td>Flow Cytometry (1 cr)</td>
</tr>
<tr>
<td>BIOB 414</td>
<td>Advanced Microscopy (1 cr)</td>
</tr>
<tr>
<td>BIOB 415</td>
<td>Adv Immunology Methods (1 cr)</td>
</tr>
<tr>
<td>BIOB 424</td>
<td>Ethical Practice of Science</td>
</tr>
<tr>
<td>BIOB 428</td>
<td>Molecular Evolution (3 cr)</td>
</tr>
<tr>
<td>BIOB 477</td>
<td>Genome Science and Gene Expression</td>
</tr>
<tr>
<td>BIOH 405</td>
<td>Hematology (3 cr)</td>
</tr>
<tr>
<td>BIOH 406</td>
<td>Hematology Laboratory (1 cr)</td>
</tr>
<tr>
<td>EMEC 424</td>
<td>Cellular Mechanotransduction</td>
</tr>
</tbody>
</table>

**Other suggested courses**

One course may be used toward the 25 credits of Microbiology electives.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOH 201</td>
<td>Human Anatomy and Physiology I</td>
</tr>
<tr>
<td>BIOH 211</td>
<td>Human Anatomy and Physiology II</td>
</tr>
<tr>
<td>BIOB 375</td>
<td>General Genetics</td>
</tr>
</tbody>
</table>

A minimum of 120 credits is required for graduation; 42 of those credits must be in courses numbered 300 and above.

**Microbiology Option: Pre-Medical Track**

**Freshman Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 160</td>
<td>Principles of Living Systems (or)</td>
</tr>
<tr>
<td>BIOB 260</td>
<td>Cellular and Molecular Biology</td>
</tr>
<tr>
<td>BIOB 170N</td>
<td>Principles of Biological Diversity (or)</td>
</tr>
<tr>
<td>CHMY 141</td>
<td>College Chemistry I (F)</td>
</tr>
<tr>
<td>CHMY 143</td>
<td>College Chemistry II (S)</td>
</tr>
<tr>
<td>M 161Q - Survey of Calculus (F,S,Su)</td>
<td>4</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>10</td>
</tr>
</tbody>
</table>

Year Total:  30

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 321 - Organic Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>or CHMY 331 - Honors Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHMY 323 - Organic Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>or CHMY 333 - Honors Organic Chemistry II</td>
<td></td>
</tr>
<tr>
<td>BIOM 360 - General Microbiology</td>
<td>5</td>
</tr>
<tr>
<td>PHSX 205 - College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>or PHSX 220 - Physics I (w/ calculus)</td>
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</tr>
<tr>
<td>PHSX 207 - College Physics II</td>
<td>4</td>
</tr>
<tr>
<td>or PHSX 222 - Physics II (w/ calculus)</td>
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</tr>
<tr>
<td>Microbiology Electives**</td>
<td>5</td>
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<tr>
<td>University Core and Electives</td>
<td>4</td>
</tr>
</tbody>
</table>

Year Total:  30

**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 380</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>BIOM 430</td>
<td>Applied and Environmental Microbiology</td>
</tr>
<tr>
<td>or BIOM 415</td>
<td>Microbial Diversity, Ecology, and Evolution</td>
</tr>
<tr>
<td>Microbiology Electives**</td>
<td>10</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>12</td>
</tr>
</tbody>
</table>

Year Total:  30

**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 494</td>
<td>Seminar/Workshop (take two semesters)</td>
</tr>
<tr>
<td>BIOM 450</td>
<td>Microbial Physiology</td>
</tr>
<tr>
<td>BIOM 410</td>
<td>Microbial Genetics</td>
</tr>
<tr>
<td>Microbiology Electives**</td>
<td>10</td>
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<tr>
<td>University Core and Electives</td>
<td>12</td>
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</tbody>
</table>

Year Total:  30

Total Program Credits:  120

**Other suggested courses**

One course may be used toward the 25 credits of Microbiology electives.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOH 201</td>
<td>Human Anatomy and Physiology I</td>
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<tr>
<td>BIOH 211</td>
<td>Human Anatomy and Physiology II</td>
</tr>
<tr>
<td>BIOB 375</td>
<td>General Genetics</td>
</tr>
</tbody>
</table>

A minimum of 120 credits is required for graduation; 42 of those credits must be in courses numbered 300 and above.
PHSX 207 - College Physics II (S)  4
University Core and Electives  11
Year Total:  30

Senior Year  Credits
BIOM 450 - Microbial Physiology (F)  3
BIOM 494 - Seminar/Workshop (take twice F and S)  2
BIOM 410 - Microbial Genetics (S)  3
BIOM 400 - Medical Microbiology (S)  3
or BIOM 431 - Medical Bacteriology
BIOM 405 - Host-Associated Microbiomes (F)  4
or BIOM 430 - Applied and Environmental Microbiology
University Core and Electives  15
Year Total:  30
Total Program Credits:  120

Electives (you need 13 credits)
Recommended
BIOM 425  Toxicology: Science of Poisons (S)  3
BIOM 435  Virology (F)  3
BIOM 432  Med Bacteriology Lab (S)  2
BIOM 441  Eukaryotic Pathogens (S)  4
BIOH 405  Hematology (F)  3
BIOM 490R  Undergraduate Research (F,S)  1-3

Electives: Other (One of the following can be substituted for a Microbiology Elective)
BIOH 313  Neurophysiology (F)  3
BIOH 323  Human Developmental Biology (S)  4
BIOB 420  Evolution (S)  3
BIOB 425  Adv Cell & Molecular Biology (S)  3
EMEC 424  Cellular Mechanotransduction (F)  3

Recommended University Core & Electives
SOCI 101IS  Introduction to Sociology (F,S)  3
PSYX 100IS  Intro to Psychology (F,S,Su)  4

A minimum of 120 credits is required for graduation; 42 of those credits must be in courses numbered 300 and above.

Microbiology Option: Pre-Veterinary Track

Department of Microbiology and Immunology

Pre-veterinary Curriculum
Freshman Year  Credits
BIOM 101 - Careers in Microbiology  1
BIOB 170IN - Principles of Biological Diversity  4
CHMY 141 - College Chemistry I  4
University Core and Electives  3
M 161Q - Survey of Calculus  4
STAT 216Q - Introduction to Statistics  3
ANSC 100 - Introduction to Animal Science  3
BIOB 160 - Principles of Living Systems  4
CHMY 143 - College Chemistry II  4
University Core and Electives  3
Year Total:  19  14

Sophomore Year  Credits
Fall  Spring
BIIO 260 - Cellular and Molecular Biology  4
CHMY 211 - Elements of Organic Chemistry  5
or CHMY 321 and CHMY 323
University Core and Electives  6
ANSC 265 - Anatomy and Physiology of Domestic Animals - Lecture  3
ANSC 266 - Anatomy and Physiology of Domestic Animals - Lab  1
BCH 380 - Biochemistry  5
BIOM 360 - General Microbiology  5
Year Total:  15  14

Junior Year  Credits
Fall  Spring
BIOM 427 - General Parasitology  4
PHSX 205 - College Physics I  4
IMID 475R - Preveterinary Internship  2-4
Restricted elective and University Core  3
PHSX 207 - College Physics II  4
Choose one of the following:  3
ANSC 322 - Principles of Animal Breeding and Genetics
BIOM 375 - General Genetics
BIOM 410 - Microbial Genetics
Restricted elective and University Core  6
Year Total:  13-15  13

Senior Year  Credits
Fall  Spring
BIOM 427 - General Parasitology  4
BIOB 420 - Seminar/Workshop
PHSX 205 - College Physics I  4
IMID 475R - Preveterinary Internship  2-4
Restricted elective and University Core  3
PHSX 207 - College Physics II  4
Choose one of the following:  3
ANSC 322 - Principles of Animal Breeding and Genetics
BIOM 375 - General Genetics
BIOM 410 - Microbial Genetics
Restricted elective and University Core  6
Year Total:  13-15  13

Recommended University Core & Electives
SOCI 101IS  Introduction to Sociology (F,S)  3
PSYX 100IS  Intro to Psychology (F,S,Su)  4

Restricted Upper Division Microbiology Electives 12 credits
BIOM 410 - Immunology
BIOM 400 - Medical Microbiology
BIOM 405 - Host-Associated Microbiomes
BIOM 425 - Toxicology: Science of Poisons
BIOM 431 - Medical Bacteriology
BIOM 432 - Med Bacteriology Lab
BIOM 435 - Virology
BIOM 460 - Infectious Diseases Ecology and Spillover

Upper Division Science Electives 9 Credits
Total Program Credits:  120
Courses taught in English. Spanish-speaking peoples may choose elective credits from a variety of the literature and culture of Chinese, French-, German-, Japanese-, and Spanish. Students without prior language study who are interested in teaching, K-12 teaching options are offered in French, German, and the study of culture (literature, history, art, etc.). For students interested in Intermediate level skills and develop Advanced level functions through a strong Intermediate level of proficiency. Upper division courses strengthen programs, lower division courses are designed to help students acquire a multicultural society.

Language & Cultural Studies and Area Studies Programs

Majors
- Asian Studies (p. 191)
- French and Francophone Studies Option (p. 244)
- German Studies Option (p. 244)
- Latin American and Latino Studies Option (p. 245)
- Hispanic Studies Option (p. 245)

Minors
- Asian Studies (p. 192)
- China Studies Minor (p. 243)
- French and Francophone Studies Minor (p. 243)
- German Studies Minor (p. 244)
- Japan Studies Minor (p. 245)
- Hispanic Studies Minor (p. 245)
- Latin American and Latino Studies Minor (p. 246)

Language Teaching Programs

Majors
- French K-12 Teaching Option (p. 243)
- German K-12 Teaching Option (p. 244)
- Spanish K-12 Teaching Option (p. 247)

Minors
- French Teaching Minor (p. 138)
- German Teaching Minor (p. 138)
- Spanish Teaching Minor (p. 139)

Students with previous language training will be placed based on scores from AP exams, IB exams, CLEP test, the WebCAPE exam, and/or an oral proficiency interview.

To be certified for graduation in a major option or a minor in the Department of Modern Languages and Literatures, students must take one-half of the required MLL upper division credits in the department. Students who have already completed a degree at another university and are seeking teaching certification from MSU may be required to take some additional course work in the language as determined by the language advisor. In addition, the department will not accept grades lower than "C" (2.0) or P in any of the upper division courses required for the degree. (Note: Department-approved study-abroad credits are considered to be the equivalent of resident credits.)
China Studies Minor

The Department of Modern Languages and Literatures offers a minor in China Studies (Chinese language and culture). The program’s mission is to provide students with the language skill and cultural understanding they need to succeed in Chinese contexts. This program is not designed for teacher certification. The minor requires basic Chinese language proficiency and a broad knowledge of Chinese history, literature, and culture. A total of 28 credits of coursework is required, including 16 credits in Chinese language, and 12 credits of non-language China-related courses, 9 credits of which are at the upper division level. In addition, as many as 9 credits may be taken from courses on China in other departments. In order to receive the minor, students must successfully complete the following course work:

**Language Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHIN 101</td>
<td>Elementary Chinese I</td>
<td>4</td>
</tr>
<tr>
<td>CHIN 102D</td>
<td>Elementary Chinese II</td>
<td>4</td>
</tr>
<tr>
<td>CHIN 201D</td>
<td>Intermediate Chinese I</td>
<td>4</td>
</tr>
<tr>
<td>CHIN 202D</td>
<td>Intermediate Chinese II</td>
<td>4</td>
</tr>
</tbody>
</table>

**Non-language Courses**

Choose one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHIN 130D</td>
<td>Historical and Literary Journey into Modern China</td>
</tr>
<tr>
<td>CHIN 211D</td>
<td>Chinese Culture &amp; Civilization</td>
</tr>
<tr>
<td>RLIST 203D</td>
<td>Buddhist Traditions</td>
</tr>
<tr>
<td>ANTY 225IS</td>
<td>Culture, Language, and Society</td>
</tr>
<tr>
<td>HSTR 140D</td>
<td>Modern Asia</td>
</tr>
</tbody>
</table>

Choose three of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTH 360</td>
<td>History of Asian Art and Architecture</td>
</tr>
<tr>
<td>CHIN 320H</td>
<td>History of Chinese Cinema</td>
</tr>
<tr>
<td>HSTR 345</td>
<td>Modern China</td>
</tr>
<tr>
<td>ML 403D</td>
<td>Monsoon Asian Civilization</td>
</tr>
<tr>
<td>HSTR 443</td>
<td>Gender in Asia</td>
</tr>
<tr>
<td>HSTR 446</td>
<td>Science and Medicine in China</td>
</tr>
<tr>
<td>ML 490R</td>
<td>Undergraduate Research **</td>
</tr>
<tr>
<td>or ML 492</td>
<td>Independent Study</td>
</tr>
</tbody>
</table>

**Total Credits:** 28

**Students** who are on the Chinese Government Scholarship or other scholarship to study in China will receive 1-3 study-abroad credits of CHIN93, CHIN293, CHIN393 and/or CHIN493 depending on the courses taken in China. We highly recommend students who are pursuing a China Studies minor to spend a short period of time in China.

French K-12 Teaching Option

The French Teaching major is designed for students who wish to become licensed to teach French in grades K-12. Upon completion of the degree, students are eligible for licensure in the state of Montana. Secondary education students are encouraged to pursue a teaching minor in an additional content area and should contact an advisor for details. Obtaining a teaching minor may require more than eight semesters. Prior to approval for student teaching placement, students will be required to achieve Intermediate High on the ACTFL proficiency scale as determined through an official Oral Proficiency Interview administered by Language Testing International. For more information on admission to the Teacher Education Program, Student Teaching, Licensure, Professional Expectations and more, please visit: http://catalog.montana.edu/undergraduate/education-health-human-development/department-education/teacher-education-program/

**Freshman Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 101</td>
<td>Elementary French I</td>
<td>3</td>
</tr>
<tr>
<td>FRCH 102D</td>
<td>Elementary French II</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 101IS</td>
<td>Indiv and Fam Dev: Lifespan</td>
<td>3</td>
</tr>
<tr>
<td>EDU 202</td>
<td>Early Field Experience</td>
<td>1</td>
</tr>
<tr>
<td>EDU 222IS</td>
<td>Educ Psych &amp; Child Development</td>
<td>3</td>
</tr>
<tr>
<td>or EDU 223IS</td>
<td>Educ Psych &amp; Adolescent Dev</td>
<td>3</td>
</tr>
</tbody>
</table>

University Core and Electives 15 (EDU 101US is recommended for teaching majors to fulfill a Core requirement)

**Year Total:** 30

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 201D</td>
<td>Intermediate French I</td>
<td>3</td>
</tr>
<tr>
<td>FRCH 202D</td>
<td>Intermediate French II</td>
<td>3</td>
</tr>
<tr>
<td>EDU 211D</td>
<td>Multicultural Education</td>
<td>3</td>
</tr>
<tr>
<td>EDU 370</td>
<td>Integrating Tech into Educ</td>
<td>2</td>
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University Core and Electives 19

**Year Total:** 30

**Junior and Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 301</td>
<td>French Oral and Written Expression</td>
<td>3</td>
</tr>
<tr>
<td>Take 25 additional FRCH credits. (ML 344 and ML 492 may be counted toward this elective requirement.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDSP 306</td>
<td>Exceptional Learners</td>
<td>3</td>
</tr>
<tr>
<td>EDU 382</td>
<td>Assessmt, Curric, Instructn</td>
<td>3</td>
</tr>
<tr>
<td>EDU 395</td>
<td>Practicum</td>
<td>3</td>
</tr>
<tr>
<td>EDU 408</td>
<td>Professional Issues: K-12</td>
<td>2</td>
</tr>
<tr>
<td>EDU 496</td>
<td>Methods: K-12 Modern Languages</td>
<td>4</td>
</tr>
<tr>
<td>EDU 495R</td>
<td>Student Teaching</td>
<td>12</td>
</tr>
<tr>
<td>FRCH 490R</td>
<td>Undergraduate Research</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

**Year Total:** 60

**Total Program Credits:** 120

1 Take either EDU 222IS or EDU 223IS depending upon your preference for an elementary or secondary focus. For language teaching majors, EDU 223IS is recommended.

2 Prior to approval for student teaching placement, students will be required to achieve Intermediate High on the ACTFL proficiency scale as determined through an official Oral Proficiency Interview administered by Language Testing International.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. Majors are encouraged to take more than the minimum 40 credits in the department.

French Minor

**Freshman Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 101</td>
<td>Elementary French I</td>
<td>3</td>
</tr>
<tr>
<td>FRCH 102D</td>
<td>Elementary French II</td>
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</table>

**Year Total:** 6

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 201D</td>
<td>Intermediate French I</td>
<td>3</td>
</tr>
<tr>
<td>FRCH 202D</td>
<td>Intermediate French II</td>
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</table>

**Year Total:** 6
### French and Francophone Studies Option

#### Junior and Senior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>FRCH 301</td>
<td>French Oral and Written Expression</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Take an additional 12 FRCH credits. ML 344 and ML 492 may count toward this requirement.</td>
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<tr>
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<td>Year Total:</td>
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<td>Total Program Credits:</td>
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#### Freshman Year

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>GRMN 101</td>
<td>Elementary French I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 102D</td>
<td>Elementary French II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>University Core and Electives</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Year Total:</td>
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</table>

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRMN 201D</td>
<td>Intermediate French I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 202D</td>
<td>Intermediate French II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>University Core and Electives</td>
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</tr>
<tr>
<td></td>
<td>Year Total:</td>
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</tr>
</tbody>
</table>

#### German K-12 Teaching Option

The German Teaching major is designed for students who wish to become licensed to teach German in grades K-12. Upon completion of the degree, students are eligible for licensure in the state of Montana. Secondary education students are encouraged to pursue a teaching minor in an additional content area and should contact an advisor for details. Obtaining a teaching minor may require more than eight semesters. Prior to approval for student teaching placement, students will be required to achieve Intermediate High on the ACTFL proficiency scale as determined through an official Oral Proficiency Interview administered by Language Testing International. For more information on admission to the Teacher Education Program, Student Teaching, Licensure, Professional Expectations and more, please visit: [http://catalog.montana.edu/undergraduate/education-health-human-development/department-education/teacher-education-program/](http://catalog.montana.edu/undergraduate/education-health-human-development/department-education/teacher-education-program/)

#### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRMN 101</td>
<td>Elementary German I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 102D</td>
<td>Elementary German II</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 101S</td>
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<td>3</td>
</tr>
<tr>
<td>EDU 202</td>
<td>Early Field Experience</td>
<td>1</td>
</tr>
<tr>
<td>EDU 222S</td>
<td>Educ Psych &amp; Child Development¹ or EDU 223S - Educ Psych and Adolescent Dev</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>University Core and Electives</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Year Total:</td>
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</table>

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRMN 201D</td>
<td>Intermediate German I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 202D</td>
<td>Intermediate German II</td>
<td>3</td>
</tr>
<tr>
<td>EDU 211D</td>
<td>Multicultural Education</td>
<td>3</td>
</tr>
<tr>
<td>EDU 370</td>
<td>Integrating Tech into Educ</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>University Core and Electives</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Year Total:</td>
<td>30</td>
</tr>
</tbody>
</table>

#### Junior and Senior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Take at least 27 GRMN credits. (ML 100IH, ML 344, and ML 492 may be counted toward this requirement.)</td>
<td>27</td>
</tr>
<tr>
<td>EDU 382</td>
<td>Assessmt, Curric, Instructn</td>
<td>3</td>
</tr>
<tr>
<td>EDU 395</td>
<td>Practicum</td>
<td>3</td>
</tr>
<tr>
<td>EDU 408</td>
<td>Professional Issues: K-12</td>
<td>2</td>
</tr>
<tr>
<td>EDU 496</td>
<td>Methods: K-12 Modern Languages</td>
<td>4</td>
</tr>
<tr>
<td>EDSP 306</td>
<td>Exceptional Learners</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 450R</td>
<td>Sem:German Lit and Culture</td>
<td>3</td>
</tr>
<tr>
<td>EDU 495R</td>
<td>Student Teaching²</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>University Core and Electives</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Year Total:</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Total Program Credits:</td>
<td>120</td>
</tr>
</tbody>
</table>

1. Take either EDU 222S or EDU 223S depending upon your preference for an elementary or secondary focus. For language teaching majors, EDU 223S is recommended.

2. Prior to approval for student teaching placement, students will be required to achieve Intermediate High on the ACTFL proficiency scale as determined through an official Oral Proficiency Interview administered by Language Testing International.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

### German Minor

#### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRMN 101</td>
<td>Elementary German I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 102D</td>
<td>Elementary German II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Year Total:</td>
<td>6</td>
</tr>
</tbody>
</table>

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRMN 201D</td>
<td>Intermediate German I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 202D</td>
<td>Intermediate German II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Year Total:</td>
<td>6</td>
</tr>
</tbody>
</table>

#### Junior and Senior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRMN 301</td>
<td>Oral and Written Expression I or GRMN 302 - Oral and Written Expression II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Take 12 additional upper division GRMN credits (4 courses).</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Year Total:</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Total Program Credits:</td>
<td>27</td>
</tr>
</tbody>
</table>

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. Majors are encouraged to take more than the minimum of 40 credits required in the department.

### German Studies Option

#### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRMN 101</td>
<td>Elementary German I</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 102D</td>
<td>Elementary German II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>University Core and Electives</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Year Total:</td>
<td>30</td>
</tr>
</tbody>
</table>
A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. GRMN 450R cannot be substituted with any course from study abroad. GRMN 450R can, however, be taken multiple times as ML 490R. It is also strongly recommended students take ML 100.

Hispanic Studies Minor

Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPNS 101 - Elementary Spanish I</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 102D - Elementary Spanish II</td>
<td>3</td>
</tr>
<tr>
<td>Year Total:</td>
<td>6</td>
</tr>
</tbody>
</table>

Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPNS 201D - Intermediate Spanish I</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 202D - Intermediate Spanish II</td>
<td>3</td>
</tr>
<tr>
<td>Year Total:</td>
<td>6</td>
</tr>
</tbody>
</table>

Junior and Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take 27 additional GRMN credits. ML100, ML344, and ML490 may be counted toward this requirement. GRMN 450R - Sem: German Lit and Culture</td>
<td>27</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>3</td>
</tr>
<tr>
<td>Year Total:</td>
<td>30</td>
</tr>
</tbody>
</table>

Total Program Credits: 120

Hispanic Studies Option

Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPNS 101 - Elementary Spanish I</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 102D - Elementary Spanish II</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>24</td>
</tr>
<tr>
<td>Year Total:</td>
<td>30</td>
</tr>
</tbody>
</table>

Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPNS 201D - Intermediate Spanish I</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 202D - Intermediate Spanish II</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>24</td>
</tr>
<tr>
<td>Year Total:</td>
<td>30</td>
</tr>
</tbody>
</table>

Junior and Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take 12 SPNS elective courses (36 credits; ML344 and ML497 may also be used to fulfill this requirement.) SPNS 470R - Sem: Hispanic Literature</td>
<td>36</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>3</td>
</tr>
<tr>
<td>Year Total:</td>
<td>21</td>
</tr>
<tr>
<td>Total Program Credits:</td>
<td>60</td>
</tr>
</tbody>
</table>

Total Program Credits: 120

Japan Studies Minor

The Japan Studies Program offers a non-teaching, interdisciplinary minor in Japan Studies through the Department of Modern Languages and Literatures. The program’s mission is to provide students with the skills and understanding they need to succeed in Japanese contexts. This program is not designed for teacher certification. The minor requires basic Japanese language proficiency and a broad knowledge of Japanese history, literature, and civilization. It includes 12 credits in Japanese language training and 15-16 credits in elective coursework, for a total of 27-28 credits.

In order to receive the minor, students must successfully complete the following course work:

Required

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPNS 101 - Elementary Japanese I</td>
<td>6</td>
</tr>
<tr>
<td>JPNS 102D - Elementary Japanese II</td>
<td>7</td>
</tr>
<tr>
<td>JPNS 201D - Intermediate Japanese I</td>
<td>6</td>
</tr>
<tr>
<td>JPNS 202D - Intermediate Japanese II</td>
<td>7</td>
</tr>
<tr>
<td>Choose two lower division electives:</td>
<td></td>
</tr>
<tr>
<td>JPNS 150D - Japanese Culture &amp; Civ</td>
<td>6</td>
</tr>
<tr>
<td>HSTR 145D - Reinventing Japan</td>
<td>7</td>
</tr>
<tr>
<td>ANTY 242D - Contemporary Japan</td>
<td>9</td>
</tr>
</tbody>
</table>

Choose three upper division electives:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTY 337 - Sex, Gender, Sexuality Japan</td>
<td>9</td>
</tr>
<tr>
<td>ANTY 343 - Popular Culture - Japan</td>
<td>9</td>
</tr>
<tr>
<td>HSTR 340 - Age of the Shoguns</td>
<td>9</td>
</tr>
<tr>
<td>HSTR 342 - Japan’s Meiji Revolution</td>
<td>9</td>
</tr>
<tr>
<td>HSTR 444 - Gender in Japan</td>
<td>9</td>
</tr>
<tr>
<td>HSTR 445 - Environ, Health &amp; Sci in Japan</td>
<td>9</td>
</tr>
<tr>
<td>JPNS 305 - Japanese Adv Conversations</td>
<td>9</td>
</tr>
<tr>
<td>JPNS 320 - Classical Japanese Literature</td>
<td>9</td>
</tr>
<tr>
<td>JPNS 321 - Modern Japanese Literature</td>
<td>9</td>
</tr>
<tr>
<td>JPNS 325IH - Outcast Literature</td>
<td>9</td>
</tr>
<tr>
<td>JPNS 340 - Japanese Adv Reading &amp; Grammar</td>
<td>9</td>
</tr>
<tr>
<td>JPNS 361IH - Japanese Text and Cinema</td>
<td>9</td>
</tr>
<tr>
<td>JPNS 450R - Sem: Japanese Lit and Culture</td>
<td>9</td>
</tr>
</tbody>
</table>

Total Credits: 27-28

Not all courses may be taken in the same department. Credits earned for Japanese language study abroad may be applied to both the Language Requirement and the Upper Division Electives; but students must fulfill the Lower Division Electives at MSU. Study abroad students may transfer a maximum of 3 content course credits per semester.

Latin American & Latino Studies Option

The Latin American and Latino Studies (LALS) major provides students interested in Latin American and Latino history, culture, and language with valuable interdisciplinary skills. Because this is an interdisciplinary program, students will enroll in courses in Modern Languages & Literatures and History & Philosophy. Students may also take courses with relevant content from other departments such as Sociology & Anthropology, Political Science, and Women’s, Gender, and Sexuality Studies. The LALS major complements other fields of study: health care, government, agriculture, engineering, history, literature, political science, sociology, international business, and more. The major strengthens the skill-sets of students who wish to become more competitive in the Spanish-speaking job market, both in Latin America and in the United States. A major in LALS will prepare students for the close relationship developing between Latin American and
the United States in trade agreements, the growing number of immigrant laborers, and the expansion of Latino communities in the United States with significant political and economic power.

The equivalent of four semesters of Spanish language is required. Students with prior experience in Spanish language or heritage speakers may have some requirements waived. Students interested in the LALS major should consult with LALS faculty in the Department of Modern Languages & Literatures immediately upon their decision to fulfill the major so that they can ascertain the language requirements that are appropriate for them.

**Required Courses**

**Language Requirements (15 credits)**

Students must demonstrate proficiency in a language (other than English) spoken in Latin America by completing one of the following:

- Coursework. Successfully complete the equivalent of two years of college language classes plus one advanced grammar or writing course.
- Placement Exam. Score must be equivalent to coursework level described above.
- Experience to be approved by LALS advisor.

Some examples of languages include Spanish, Portuguese, Nahuatl, Quechua, Creole, and Garifuna.

**Foundation courses (4 credits)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSTR 130D</td>
<td>Latin American History</td>
</tr>
</tbody>
</table>

**Area Requirements (24 credits)**

6 credits must be in HSTR and 6 credits in SPNS. The other 12 credits may come from courses in the list below or from courses with relevant content from any other field or combination of fields approved by an LALS faculty adviser.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPNS 250</td>
<td>Spanish for Healthcare Professionals</td>
</tr>
<tr>
<td>SPNS 329</td>
<td>Early Cultures of Latin America</td>
</tr>
<tr>
<td>SPNS 330</td>
<td>Modern Cultures Latin America</td>
</tr>
<tr>
<td>SPNS 332</td>
<td>Contemp Latin Amer Literature</td>
</tr>
<tr>
<td>SPNS 335H</td>
<td>Travel in Latin Am Lit &amp; Film</td>
</tr>
<tr>
<td>SPNS 350</td>
<td>US Latino Cultures</td>
</tr>
<tr>
<td>SPNS 351</td>
<td>US Latino Literature</td>
</tr>
<tr>
<td>SPNS 352H</td>
<td>US Latino Text and Cinema</td>
</tr>
<tr>
<td>SPNS 361</td>
<td>Latin American Text and Cinema</td>
</tr>
<tr>
<td>SPNS 371</td>
<td>Latin America in Focus</td>
</tr>
<tr>
<td>SPNS 416</td>
<td>Latin America: Culture and Revolution</td>
</tr>
<tr>
<td>SPNS 430</td>
<td>Latin Amer Perspectives</td>
</tr>
<tr>
<td>SPNS 445</td>
<td>Hispanic Caribbean: Cuba, Puerto Rico, Dominican Republic</td>
</tr>
<tr>
<td>HSTR 430</td>
<td>Latin Amer Soc History</td>
</tr>
<tr>
<td>HSTR 431</td>
<td>Race in Latin America</td>
</tr>
<tr>
<td>HSTR 432</td>
<td>Colonial Latin America</td>
</tr>
<tr>
<td>HSTR 433</td>
<td>Latin American Perspectives</td>
</tr>
<tr>
<td>HSTR 434</td>
<td>Gender in Latin America</td>
</tr>
<tr>
<td>HSTR 436</td>
<td>Armed Conflict Mod Lat Am</td>
</tr>
<tr>
<td>PSCI 423</td>
<td>Politics of Development</td>
</tr>
<tr>
<td>SOCI 485</td>
<td>Political Sociology</td>
</tr>
</tbody>
</table>

**Research Requirement (3 credits)**

Choose one (must focus on Latin American or Latino Studies theme):

- SPNS 470R  Seminar: Hispanic Literature
- ML 490R  Undergraduate Research
- HSTR 490R  Undergraduate Research

**Experiential Learning (1-3 cr)**

Choose one:

- ML 497  Teaching Language for Proficiency
- SPNS X96 Service/Experiential Learning
- Las Tías youth center in León, Nicaragua
- Health Clinic in León, Nicaragua
- Other opportunity approved by LALS advisor

**Summary of Requirements**

Total credits: 47-49

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language requirements</td>
<td>15</td>
</tr>
<tr>
<td>Foundation course</td>
<td>4</td>
</tr>
<tr>
<td>Area requirements</td>
<td>24</td>
</tr>
<tr>
<td>Research course</td>
<td>3</td>
</tr>
<tr>
<td>Experiential Learning</td>
<td>1-3</td>
</tr>
</tbody>
</table>

**Latin American and Latino Studies Minor**

A Latin American and Latino Studies minor (LALS) is available to provide students interested in Latin American and Latino history and language with valuable interdisciplinary skills. Because this is an interdisciplinary program, students will enroll in courses in History & Philosophy and Modern Languages & Literatures. Courses in Sociology & Anthropology, as well as other departments with relevant course content, will also be allowed for credit subject to approval by the program coordinator. This minor will complement majors for students pursuing graduate school and professional programs in agriculture, engineering, history, literature, political science, sociology, international business, and more. The minor will also strengthen the skill-sets of students who wish to become more competitive in the Spanish speaking job market, either abroad or in the United States. A minor in LALS will prepare students for the close relationship developing between Latin America and the United States in trade agreements, the growing immigrant laborers, and the expansion of Latin American and Latino communities in the United States with significant political and economic power. This program is not designed for teacher certification.

Those wishing to declare a minor in Latin American and Latino Studies must submit an "Application for a Non-teaching Minor" to the Registrar’s Office by the end of the semester one year prior to the semester of completion.

The equivalent of four semesters of Spanish language is required. Students with prior experience in Spanish language may have some requirements waived. Students interested in the LALS minor should consult with the Department of Modern Languages & Literatures immediately upon their decision to fulfill the minor so that they can ascertain the language requirements that are appropriate for them.

**Required Courses**

**Required courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPNS 101</td>
<td>Elementary Spanish I</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 102D</td>
<td>Elementary Spanish II</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 201D</td>
<td>Intermediate Spanish I</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 202D</td>
<td>Intermediate Spanish II</td>
<td>3</td>
</tr>
<tr>
<td>HSTR 130D</td>
<td>Latin American History</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Coursework in another language spoken in Latin America (excluding English) will also be accepted.
Elective Courses
Select 4 courses from at least two different disciplines (SPNS, SOCI, HSTR, etc):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSTR 431</td>
<td>Race in Latin America</td>
</tr>
<tr>
<td>HSTR 432</td>
<td>Colonial Latin America</td>
</tr>
<tr>
<td>HSTR 433</td>
<td>Latin American Perspectives</td>
</tr>
<tr>
<td>HSTR 436</td>
<td>Armed Conflict Mod Lat Am</td>
</tr>
<tr>
<td>PSCI 423</td>
<td>Politics of Development</td>
</tr>
<tr>
<td>SOCI 370</td>
<td>Sociology of Globalization</td>
</tr>
<tr>
<td>SOCI 485</td>
<td>Political Sociology</td>
</tr>
<tr>
<td>SPNS 250</td>
<td>Spanish for Healthcare Professionals</td>
</tr>
<tr>
<td>SPNS 329</td>
<td>Early Cultures of Latin America</td>
</tr>
<tr>
<td>SPNS 330</td>
<td>Modern Cultures Latin America</td>
</tr>
<tr>
<td>SPNS 332</td>
<td>Contemp Latin Amer Literature</td>
</tr>
<tr>
<td>SPNS 333</td>
<td>To Infinity and Beyond: Jorge LUIS Borges</td>
</tr>
<tr>
<td>SPNS 335H</td>
<td>Travel in Latin Am Lit &amp; Film</td>
</tr>
<tr>
<td>SPNS 350</td>
<td>US Latin Cultures</td>
</tr>
<tr>
<td>SPNS 351</td>
<td>US Latin Literature</td>
</tr>
<tr>
<td>SPNS 352H</td>
<td>US Latin Text and Cinema</td>
</tr>
<tr>
<td>SPNS 361</td>
<td>Latin American Text and Cinema</td>
</tr>
<tr>
<td>SPNS 371</td>
<td>Latin America in Focus</td>
</tr>
<tr>
<td>SPNS 416</td>
<td>Latin America: Culture and Revolution</td>
</tr>
<tr>
<td>SPNS 430</td>
<td>Latin Amer Perspectives</td>
</tr>
<tr>
<td>SPNS 445</td>
<td>Hispanic Caribbean: Cuba, Puerto Rico,</td>
</tr>
<tr>
<td></td>
<td>Dominican Republic</td>
</tr>
</tbody>
</table>

Total Credits: 27

Not all elective courses may be taken in the same department. A total of 9 credits must be at the 300 or 400 level. This list may expand as other disciplines develop courses that contain a substantial Latin American or Latino component. Upcoming SPNS courses include "Chicanos and the Southwest," "Indigenismo," "Borges," and "Service Learning: Experience Latin American Today."

Spanish K-12 Teaching Option
The Spanish Teaching major is designed for students who wish to become licensed to teach Spanish in grades K-12. Upon completion of the degree, students are eligible for licensure in the state of Montana. Secondary education students are encouraged to pursue a teaching minor in an additional content area and should contact an advisor for details. Obtaining a teaching minor may require more than eight semesters. Prior to approval for student teaching placement, students will be required to achieve Intermediate High on the ACTFL proficiency scale as determined through an official Oral Proficiency Interview administered by Language Testing International. Students (SAIGS). NAS houses the Native American Student Center and Engineering Society (AISES) and the Society of American Indian Graduate Student Support Services office, with staff providing Native students with academic advising, counseling, and mentoring. The Student Center offers tutorial assistance, telephone and fax access, and a computer lab.

Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPNS 101</td>
<td>Elementary Spanish I</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 102D</td>
<td>Elementary Spanish II</td>
<td>3</td>
</tr>
<tr>
<td>HDFS 101S</td>
<td>Indiv and Fam Dev: Lifespan</td>
<td>3</td>
</tr>
<tr>
<td>EDU 202</td>
<td>Early Field Experience</td>
<td>1</td>
</tr>
<tr>
<td>EDU 222IS</td>
<td>Educ Psych &amp; Child Development¹</td>
<td>3</td>
</tr>
<tr>
<td>or EDU 223IS</td>
<td>Educ Psych and Adolescent Dev</td>
<td></td>
</tr>
</tbody>
</table>

University Core and Electives (EDU 101US is recommended for teaching majors to fulfill a Core requirement)

Year Total: 30

Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPNS 201D</td>
<td>Intermediate Spanish I</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 202D</td>
<td>Intermediate Spanish II</td>
<td>3</td>
</tr>
<tr>
<td>EDU 211D</td>
<td>Multicultural Education</td>
<td>3</td>
</tr>
<tr>
<td>EDU 370</td>
<td>Integrating Tech into Educ</td>
<td>2</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>

Year Total: 30

Junior and Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 382</td>
<td>Assessmt, Curric, Instructn</td>
<td>3</td>
</tr>
<tr>
<td>EDU 395</td>
<td>Practicum</td>
<td>3</td>
</tr>
<tr>
<td>EDU 408</td>
<td>Professional Issues: K-12</td>
<td>2</td>
</tr>
<tr>
<td>EDU 409</td>
<td>Methods: K-12 Modern Languages</td>
<td>4</td>
</tr>
<tr>
<td>EDU 495R</td>
<td>Student Teaching²</td>
<td>12</td>
</tr>
<tr>
<td>EDSP 306</td>
<td>Exceptional Learners</td>
<td>3</td>
</tr>
<tr>
<td>SPNS 470R</td>
<td>Seminar: Hispanic Literature</td>
<td>3</td>
</tr>
<tr>
<td>Take 25 credits of SPNS courses. (ML 344 and ML 497 may count toward this elective requirement.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Core and Electives</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Year Total: 60

Total Program Credits: 120

¹ Take either EDU 222IS or EDU 223IS depending upon your preference for an elementary or secondary focus. For language teaching majors, EDU 223IS is recommended.

² Prior to approval for student teaching placement, students are required to achieve Intermediate High on the ACTFL proficiency scale as determined through an official Oral Proficiency Interview administered by Language Testing International.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above; Majors are encouraged to take more than the minimum 40 credits required in the department.

Native American Studies

P.O. Box 172340
Bozeman, MT 59717-2340
406-994-3881 Email: nas@montana.edu
Location: 2-179 Wilson Hall

Montana State University has an American Indian enrollment of approximately 650 students. There is an active American Indian Student Council (AIC) as well as chapter of the American Indian Science and Engineering Society (AISES) and the Society of American Indian Graduate Students (SAIGS). NAS houses the Native American Student Center and the American Indian and Alaska Native Student Support Services office, with staff providing Native students with academic advising, counseling, and mentoring. The Student Center offers tutorial assistance, telephone and fax access, and a computer lab.

Native American Studies offers an interdisciplinary program of study in American Indian culture and history, policy and law, community affairs, education, and other related areas through a non-teaching minor in Native American Studies, an online graduate certificate in Native American Studies, a Master of Arts in Native American Studies, as well as opportunities for all MSU undergraduate students to gain a multicultural perspective in meeting the university’s core curriculum requirements.
Research and Creative Activity
The Department takes pride in the scholarship of its faculty. In 2000 the Department established its endowed Katz Family Chair in Native American Studies. The scholarship and service offered by the holders of the Chair enhances the Department’s efforts to provide first-class scholarship on behalf of Native peoples and the university. Over the year faculty members have consistently published in professional journals, delivered papers at national and international meetings, held symposia at MSU, and, by invitation, chaired and participated in panels at national professional association conferences.

Consistent with its service commitment to Montana’s tribal communities, much of the faculty’s research and creative activity responds to the educational, cultural, and economic development needs of Native Americans. In addition to scholarly research, faculty members have devoted much time and energy to developing new programs and finding external funding sources for those programs.

Service
The Department firmly maintains that Montana State University must be responsive to Native communities in addressing tribally-identified educational, cultural, and economic development needs. Accordingly, the Department has directed much of its public service activity to Montana’s Native communities. In doing so, Department faculty members have established close working relationships with tribal and intertribal groups as well as with national Indian offices and organizations.

Upon request, faculty members have also provided technical assistance in the areas of adult, vocational, and community college development, needs assessments, proposal writing, and program evaluations.

Utilizing the resources of the university to assist in the development of Montana’s seven tribally-controlled community colleges has been a major goal of the Department. For example, the Department has administered projects to provide graduate-level training to tribal college faculty, to provide in-service training and technical assistance, and to conduct significant research in areas of importance to the tribal colleges.

In addition, faculty members have presented continuing education workshops on Montana reservations, evaluated reservation cultural and education programs, and provided other public service. Faculty members have also, by invitation, read proposals for the U.S. Office of Education, the National Endowment for the Humanities, the National Institute of Education, and the National Science Foundation.

American Indian Student Programs and Services
In addition to the traditional functions of an academic department, Native American Studies places a high priority on providing student support programs and services, reflecting a strong commitment to Indian student retention and success. The student who decides to attend MSU will find a University-wide commitment manifested by a varied and extensive support system which is unequalled in the Great Plains region. For the more information, and most recently updated list of programs and services, please visit the Native American Student Services Directory: www.montana.edu/wwwnas.

Further Information
For further information regarding the program, contact Native American Studies at (406) 994-3881 or e-mail Megan Gourneau at megangourneau@montana.edu. Also see the university home page (http://www.montana.edu) or the home page for Native American Studies (http://www.montana.edu/wwwnas).

Undergraduate Minor
• Native American Studies Minor (Non-Teaching) (p. 248)

Graduate Programs
• M.A. in Native American Studies (p. 384)
• Online certificate in Native American Studies (p. 400)

Native American Studies Minor (Non-Teaching)
The minor in Native American Studies is designed to enhance the student’s major area of study, offering an interdisciplinary program for Indian and non-Indian students who wish to concentrate in the study of Native American life or who are preparing for careers in tribal affairs.

Students who declare a minor in Native American Studies must complete 21 credits as outlined below:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASX 105D</td>
<td>3</td>
</tr>
<tr>
<td>NASX 232D</td>
<td>3</td>
</tr>
<tr>
<td>NASX 476</td>
<td>3</td>
</tr>
<tr>
<td>NASX Electives</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>21</strong></td>
</tr>
</tbody>
</table>

At least 9 credits must be in upper division courses (300 and 400 level), and at least 10 credits must be earned at Montana State University. Electives are to be selected in consultation with the minor adviser. NASX 490R Undergraduate Research, NASX 492 Independent Study and/or NASX 498 Internship/Cooperative Educ may be included among the electives. However, no more than four (4) semester credits (equivalent quarter hours or combination of semester and quarter hours) of NASX 492 Independent Study and/or NASX 290R Undergraduate Research/NASX 490R Undergraduate Research and no more than four (4) semester credits of NASX 498 Internship/Cooperative Educ may be included in the minor program. Transfer credits or credits earned in related courses offered in other departments may be included in the student’s program, upon approval of NAS departmental certifying officer.

Any student wishing to declare a minor in Native American Studies must file a "Curriculum & Catalog Changes" form and an "Application for a Non-teaching Minor" form with the Registrar’s Office a minimum of two terms prior to graduation. Please come to the Department of Native American Studies to meet with a minor adviser to complete this form.

To complete a minor in NAS, students can choose from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASX 105D</td>
<td>3</td>
</tr>
<tr>
<td>NASX 205D</td>
<td>3</td>
</tr>
<tr>
<td>NASX 232D</td>
<td>3</td>
</tr>
<tr>
<td>NASX 239</td>
<td>3</td>
</tr>
<tr>
<td>NASX 280IS</td>
<td>3</td>
</tr>
<tr>
<td>NASX 290R</td>
<td>1-8</td>
</tr>
<tr>
<td>NASX 292</td>
<td>1-3</td>
</tr>
<tr>
<td>NASX 294R</td>
<td>1-2</td>
</tr>
<tr>
<td>NASX 304</td>
<td>3</td>
</tr>
<tr>
<td>NASX 310</td>
<td>3</td>
</tr>
<tr>
<td>NASX 340</td>
<td>3</td>
</tr>
</tbody>
</table>
Further Information
For further information regarding the program, contact Native American Studies at (406) 994-3881 or e-mail Megan Gourneau at megangourneau@montana.edu (francesca.pine@montana.edu). Also see the university home page (http://www.montana.edu) or the home page for Native American Studies (http://www.montana.edu/wwwnas).

Philosophy
Philosophy is concerned with the underlying assumptions and broad implications of human knowledge and values. The curriculum in philosophy contains a wide range of courses that explore diverse topics through the writings of important philosophers of the past and present. Emphasis is placed on understanding different solutions to questions about such topics as the role of emotion in film, the moral questions surrounding medicine and bioethics, the importance of the environment and animals, the origin of life, the nature of consciousness, etc., and on analyzing and criticizing them.

The Bachelor of Art in Philosophy has traditionally served as a basis for further study in philosophy, law, religion, or related fields. It may also be used as background training for government, business, writing, information management, or any field that depends upon a strong liberal arts education. The department has traditionally encouraged taking a double major and has restricted the number of required courses in philosophy so that this may be possible.

The department also encourages students to engage in independent study through the departmental honors option. This option has the following requirements:

1. Students must have a minimum 3.5 grade-point average in their major and a 3.0 GPA overall.
2. Students must present an acceptable, bound senior thesis, and an oral defense of the thesis.

Students may attain 3-6 undergraduate independent study credits while working for their thesis. Qualified students may enroll in the honors option through their departmental advisors.

Undergraduate Programs
- Philosophy Option (p. 249)
- Philosophy and Religion Option (p. 250)

Undergraduate Minors
- Astrobiology Minor (Non Teaching) (p. 208)
- Philosophy Minor (Non-Teaching) (p. 249)

The Department of History, Philosophy and Religious studies currently offers no Graduate Studies in Philosophy.

Philosophy Minor (Non-Teaching)

Required

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHL 236Q</td>
<td>Logic</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose at least one of the following (both are recommended):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHL 361RH</td>
<td>Hist of Philo:Ancient/Medieval</td>
</tr>
<tr>
<td>PHL 362</td>
<td>History of Philosophy: Modern</td>
</tr>
</tbody>
</table>

15 credits of additional Philosophy electives, nine credits of which must be upper division.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHL 101IH</td>
<td>Intro Phil:Reason and Reality</td>
</tr>
<tr>
<td>PHL 103D</td>
<td>Philosophy and Popular Culture</td>
</tr>
<tr>
<td>PHL 110IH</td>
<td>Intro Ethics:Good and Evil</td>
</tr>
<tr>
<td>PHL 205CS</td>
<td>Other Animals</td>
</tr>
<tr>
<td>PHL 212RH</td>
<td>Morality and Society</td>
</tr>
<tr>
<td>PHL 242CS</td>
<td>Snc/Psuedo Snc &amp; Subjectivity</td>
</tr>
<tr>
<td>PHL 255D</td>
<td>Philosophy and Culture</td>
</tr>
<tr>
<td>PHL 270</td>
<td>Philosophies of Asia</td>
</tr>
<tr>
<td>PHL 270D</td>
<td>Philosophies of Asia</td>
</tr>
<tr>
<td>PHL 278CS</td>
<td>Origins of Life</td>
</tr>
<tr>
<td>PHL 303</td>
<td>Approaches to Epistemology</td>
</tr>
<tr>
<td>PHL 304</td>
<td>Metaphysics</td>
</tr>
<tr>
<td>PHL 305</td>
<td>Contemporary Philosophy</td>
</tr>
<tr>
<td>PHL 308</td>
<td>Language and the World</td>
</tr>
<tr>
<td>PHL 310</td>
<td>Moral Theory</td>
</tr>
<tr>
<td>PHL 312</td>
<td>Contemporary Moral Problems</td>
</tr>
<tr>
<td>PHL 321</td>
<td>Philosophy &amp; Biomedical Ethics</td>
</tr>
<tr>
<td>PHL 322</td>
<td>Philosophy &amp; Environmntl Ethics</td>
</tr>
<tr>
<td>PHL 327</td>
<td>Aesthetics and the Arts</td>
</tr>
<tr>
<td>PHL 328</td>
<td>Philosophy and Film</td>
</tr>
<tr>
<td>PHL 350RH</td>
<td>State, Community &amp; Individual</td>
</tr>
<tr>
<td>PHL 353</td>
<td>Philosophy and Technology</td>
</tr>
<tr>
<td>PHL 354</td>
<td>Philosophy of Race</td>
</tr>
<tr>
<td>PHL 383</td>
<td>Reason and Revolution</td>
</tr>
<tr>
<td>PHL 385</td>
<td>Existentialism and After</td>
</tr>
<tr>
<td>PHL 491</td>
<td>Special Topics</td>
</tr>
<tr>
<td>PHL 492</td>
<td>Independent Study</td>
</tr>
</tbody>
</table>

Total Credits: 15

Philosophy Option

Freshman Year

Choose one lower division Philosophy class:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHL 101IH</td>
<td>Intro Phil:Reason and Reality</td>
<td>3</td>
</tr>
<tr>
<td>PHL 103D</td>
<td>Philosophy and Popular Culture</td>
<td></td>
</tr>
<tr>
<td>PHL 110IH</td>
<td>Intro Ethics:Good and Evil</td>
<td></td>
</tr>
<tr>
<td>PHL 205CS</td>
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<tr>
<td>PHL 212RH</td>
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<td></td>
</tr>
<tr>
<td>PHL 242CS</td>
<td>Snc/Psuedo Snc &amp; Subjectivity</td>
<td></td>
</tr>
<tr>
<td>PHL 255D</td>
<td>Philosophy and Culture</td>
<td></td>
</tr>
<tr>
<td>PHL 270</td>
<td>Philosophies of Asia</td>
<td></td>
</tr>
<tr>
<td>PHL 278CS</td>
<td>Origins of Life</td>
<td></td>
</tr>
</tbody>
</table>

Year Total: 24

Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHL 236Q</td>
<td>Logic</td>
<td>3</td>
</tr>
</tbody>
</table>

University Core and Electives

Year Total: 21
One Year Modern Language* 8
Choose 1 of the following classes in Ethics/Aesthetics/Political Philosophy:
- PHL 310 - Moral Theory
- PHL 312 - Contemporary Moral Problems
- PHL 321 - Philosophy & Biomedical Ethics
- PHL 322 - Philosophy & Environmental Ethics
- PHL 327 - Aesthetics and the Arts
- PHL 328 - Philosophy and Film
- PHL 350RH - State, Community & Individual
- PHL 351 - Philosophy and Feminism
- PHL 354 - Philosophy of Race

University Core and Electives 18
Year Total: 32

Junior Year

PHL 361RH - Hist of Philos: Ancient/Medieval 3
PHL 362 - History of Philosophy: Modern 3
Choose one of the following in Metaphysics and Epistemology:
- PHL 303 - Approaches to Epistemology
- PHL 304 - Metaphysics
- PHL 305 - Contemporary Philosophy
- PHL 308 - Language and the World
- PHL 345 - Philosophy of Science
- PHL 353 - Philosophy and Technology
- PHL 365 - Phil of Mind and Consciousness
- PHL 370 - Philosophy of Religion

University Core and Electives 21
Year Total: 30

Senior Year

PHL 494 - Seminar 3

Choose 4 additional upper division Philosophy classes: 12
- PHL 303 - Approaches to Epistemology
- PHL 304 - Metaphysics
- PHL 305 - Contemporary Philosophy
- PHL 308 - Language and the World
- PHL 310 - Moral Theory
- PHL 312 - Contemporary Moral Problems
- PHL 321 - Philosophy & Biomedical Ethics
- PHL 322 - Philosophy & Environmental Ethics
- PHL 327 - Aesthetics and the Arts
- PHL 328 - Philosophy and Film
- PHL 345 - Philosophy of Science
- PHL 350RH - State, Community & Individual
- PHL 383 - Reason and Revolution
- PHL 385 - Existentialism and After
- PHL 491 - Special Topics
- PHL 490R - Undergraduate Research
- PHL 492 - Independent Study
- PHL 494 - Seminar
- PHL 498 - Internship

University Core and Electives 9

Year Total: 27

Total Program Credits: 113

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. Students must receive a grade of C- or better in all required courses.

* The 1 year language requirement will be waived for students who COMPLETE a second major or double degree.

Philosophy and Religion Option

The Philosophy and Religion major is currently unavailable for current or incoming students to declare. Please contact history@montana.edu for more information.

Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLS 101US - Knowledge and Community</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Total: 30

Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHL 236Q - Logic</td>
<td>3</td>
</tr>
<tr>
<td>One Year Modern Language*</td>
<td>8</td>
</tr>
<tr>
<td>RLST 202D - Hindu Traditions</td>
<td>3</td>
</tr>
<tr>
<td>or RLST 203D - Buddhist Traditions</td>
<td></td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>RLST 204IH - Intro to the Hebrew Bible</td>
<td></td>
</tr>
<tr>
<td>RLST 205IH - Introduction to New Testament</td>
<td></td>
</tr>
<tr>
<td>RLST 206IH - Origins of God</td>
<td></td>
</tr>
<tr>
<td>RLST 207IH - Myth and Belief</td>
<td></td>
</tr>
</tbody>
</table>

University Core and Electives 13
Year Total: 30

Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHL 361RH - Hist of Philos: Ancient/Medieval</td>
<td>3</td>
</tr>
<tr>
<td>PHL 362 - History of Philosophy: Modern</td>
<td>3</td>
</tr>
<tr>
<td>PHL 370 - Philosophy of Religion</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose one of the following in ethics:
- PHL 310 - Moral Theory
- PHL 312 - Contemporary Moral Problems
- PHL 321 - Philosophy & Biomedical Ethics
- PHL 322 - Philosophy & Environmental Ethics

Choose one of the following 300-level or 400-level Religious Studies:
- RLST 321 - Religion and Gender
- RLST 325 - Religion and Literature
- RLST 326 - Topics in Religion
- RLST 330 - Religion of Ancient Egypt
- RLST 332 - Archaeology & Religion
- RLST 402 - Natural/Unnatural/Supernatural
- RLST 405 - Text and Image
- RLST 407 - Violence & Religion
- RLST 410 - What is Religion?

University Core and Electives 18
Year Total: 30

Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHL 494 - Seminar</td>
<td>3</td>
</tr>
</tbody>
</table>

Max 9 credits, including required 6 cr.

University Core and Electives 9
physics and mathematics.

Professional Option

Intended primarily as preparation for graduate work in one of the physical sciences or for those who desire a career in the physical sciences, the professional option provides a sound background in the fundamentals of physics and mathematics.

Interdisciplinary Option

This option requires a minimum of 16 credits in the declared area and is designed for those students who desire a firm background in mathematics and physics coupled with a concentration in another discipline. Example declared areas are chemistry, biology, computer science, engineering, environmental studies, pre-law, pre-med, business, marketing, material science, optics, or technical writing. Each student will work out a specific coordinated program with their physics advisor and an advisor in the declared area. The 16 credits of coursework in the declared area must be 100 level or higher and approved by the student’s physics advisor. Courses at the 100 level will be approved as needed to allow the student to obtain the appropriate prerequisites for 200 and higher level courses in the declared area.

Teaching Option

This option is intended primarily as preparation for secondary school teachers. Teaching options require a teaching minor from the list under the Department of Education. However, the only teaching minor that can be completed within 128 credits is Mathematics. Please contact the department advisor for specifics on other options.

Physics Minor (Non-teaching)

The physics minor is designed to provide students with a fundamental background in physics and mathematics, strengthening analytic and problem solving skills, which can be applied to multiple disciplines.

Materials Minor (Non-teaching)

Montana State University, Bozeman, offers a non-teaching minor in Materials Science & Engineering called the Minor in Materials. This minor provides courses from a variety of disciplines which are relevant to synergies of science and engineering in polymer, metallic, ceramic, hybrid, and composite materials for both structural and functional application. The minor requires a minimum of 32 credits comprised of 14 credits of required coursework (or equivalent) followed by 18 credits of elective coursework.

Research Opportunities

Research programs in the Department of Physics are currently focused in several areas: optical science and laser technology, condensed matter physics, gravitational physics, astrophysics, solar physics, and science education. The MSU Gravity Group studies extreme astrophysical phenomena, such as the inspiral and merger of black holes and neutron stars, to further our understanding of astrophysics and fundamental physics. Our programs in astrophysics and relativity are directed toward a fundamental understanding of the behavior of matter and energy on the astrophysical scale. Our solar physics group studies phenomena such as solar flares and prominences associated with the star nearest us, the sun. Our research in the physics of lasers and condensed matter systems - such as magnetic and dielectric materials, semiconductor and metal surfaces and thin films, microwave photonic devices, laser materials and superconducting solids - enlarges the knowledge base on which future advances in technology are founded. Our research in science education...
aims to improve the understanding of how students can best learn science in the schools, colleges, and universities. All of the Department’s research activities enhance our instructional programs by involving undergraduate students in capstone research problems and techniques at the frontiers of physical knowledge. Faculty working with the most advanced techniques on current topics carry their research experience into the classrooms at all levels.

Our research groups foster interactions among the faculty, graduate and undergraduate students, research scientists, visiting scientists, and other departments and centers. Our research facilities in Barnard Hall include state-of-the-art laboratories and equipment. External collaborations bring national and international experts to the department and open opportunities for research to be conducted at other world-class laboratories around the globe. On-campus, interdisciplinary research include collaborations with the departments of Chemistry and Biochemistry, Electrical and Computer Engineering, Mechanical Engineering, and several research centers and institutes on campus including the Space Science and Engineering Laboratory (SSEL), the Imaging and Chemical Analysis Laboratory (ICAL), Montana Space Grant Consortium (MSGC), the Optical Technology Center (OpTeC), and the Spectrum Lab and interdisciplinary academic programs, such as Material Science and Optics and Photonics undergraduate and graduate degree programs. Research collaborations with local industries are numerous and actively pursued. For more information on each research program, click here (http://www.physics.montana.edu/research).

**Undergraduate Research Participation**

An integral component of all undergraduate major programs in physics is participation in undergraduate research. Based on student interest, the faculty work closely with students in identifying and addressing important problems in particular sub-fields. Completion of a minimum of 2 credits of undergraduate research/creative activity (PHSX 490R) is required prior to taking the capstone course PHSX 499R. Many students extend this experience beyond the minimum and work in research labs throughout their undergraduate program, including summers. Students from other majors who demonstrate interest and ability are also welcome to participate in undergraduate research in physics.

**Senior Project**

A student in the professional and interdisciplinary options will complete a senior project that integrate their physics knowledge and problem solving skills with research/creative activities. The senior project is designed to give a student the opportunity to develop skills that are necessary for work in a professional scientific environment by integrating their physics knowledge and problem solving skills with research/creative activities. The results of this senior project are generally the basis for the successful completion of the capstone course PHSX 499R.

The senior project will be based on a collaboration of a student with a mentor on a project that is of interest to the student, is either experimental or theoretical in nature, has a defined objective, and is primarily based on the student’s own work. Usually these senior projects are based on research guided by one of the faculty in the Physics Department as part of student’s minimum of 2 credits of undergraduate research/creative activity (PHSX 490R). However, there are several other options available to the student for these senior projects, including, but are not limited to, research projects done by the student in other departments at Montana State University, research projects done by the student at other institutions, which may occur during a student exchange program or on a summer intern program, and independent research/creative activity done by the student under the guidance of the student’s faculty advisor.

**Capstone Experience**

Students in the professional and interdisciplinary options will present the results of their senior project in oral and written forms in the capstone course PHSX 499R. Completion of a minimum of 2 credits of undergraduate research/creative activity (PHSX 490R) is required prior to taking the capstone course PHSX 499R. The capstone experience for those in the Physics Teaching Option is EDU 495 - Student Teaching. Each student will submit a written report from the supervising teacher and a written self-assessment.

**Departmental Honors in Physics**

When appropriate, majors should consider the opportunities afforded by the departmental honors program. This program has the following requirements:

1. A minimum 3.5 grade-point average (GPA) in physics; 3.0 GPA overall.
2. A minimum of four credits of undergraduate research credit.
4. Participation in a physics seminar for one semester in either the junior or senior year.

A detailed description of the program is available from the department.

**Undergraduate and Graduates Courses**

- Physics (PHSX) Courses (p. 541)
- Physics-Astronomy (ASTR) Courses (p. 433)

**Undergraduate Programs**

- Professional Option (p. 254)
- Interdisciplinary Option (p. 252)
- Physics Teaching Option (p. 253)

**Undergraduate Minor**

- Physics Minor (Non-Teaching) (p. 253)
- Optics and Photonics Minor (Non-Teaching) (p. 178)
- Materials Minor (Non-Teaching) (p. 182)

**Graduate Programs**

The Physics Department offers a Master of Science (M.S.) degree in physics and a Doctor of Philosophy (Ph.D.) degree in physics.

The Physics, Electrical Engineering, and Chemistry Departments offer a Master’s Degree in Optics and Photonics.

Information concerning the physics graduate program can be found at Physics Graduate Programs (p. 386)

**Interdisciplinary Option**

**Freshman Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 240 - Honors Gen &amp; Mod Phys I</td>
<td>4</td>
</tr>
<tr>
<td>M 181Q - Honors Calculus I (Recommended)</td>
<td>4</td>
</tr>
<tr>
<td>or M 171Q - Calculus I</td>
<td></td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>7</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 242 - Honors Gen &amp; Mod Phys II*</td>
<td>4</td>
</tr>
<tr>
<td>M 182Q - Honors Calculus II (Recommended)</td>
<td>4</td>
</tr>
<tr>
<td>or M 172Q - Calculus II</td>
<td></td>
</tr>
<tr>
<td>Biol, Chem, or Earth Science Electives</td>
<td>4</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>3</td>
</tr>
</tbody>
</table>

* These courses are offered for 3 credits, but students may take the 4-credit version if they choose.
<table>
<thead>
<tr>
<th>Year</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sophomore Year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 200 - Research Programs in Physics</td>
<td>1</td>
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<tr>
<td>PHSX 224 - Physics III</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 283Q - Honors Multivariable Calculus (Recommended) or M 273Q - Multivariable Calculus</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 261 - Laboratory Electronics I</td>
<td>3</td>
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<tr>
<td>Declared Area</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 262 - Laboratory Electronics II</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td>PHSX 301 - Intro Theoretical Physics</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 284 - Honors Introduction to Differential Equations (Recommended) or M 274 - Introduction to Differential Equation University Core and Electives</td>
<td>6</td>
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<tr>
<td><strong>Year Total:</strong></td>
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<td>15</td>
<td>15</td>
</tr>
<tr>
<td><strong>Junior Year</strong></td>
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</tr>
<tr>
<td>PHSX 320 - Classical Mechanics</td>
<td>4</td>
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<tr>
<td>PHSX 343 - Modern Physics</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 490R - Undergraduate Research</td>
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<td></td>
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<tr>
<td>Declared Area</td>
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<tr>
<td>Math Electives</td>
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<td></td>
<td></td>
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<tr>
<td>PHSX 423 - Electricity and Magnetism I</td>
<td>3</td>
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<tr>
<td>Declared Area</td>
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<tr>
<td>Math Electives</td>
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<tr>
<td>University Core and Electives</td>
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<tr>
<td><strong>Year Total:</strong></td>
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<td>15</td>
<td>15</td>
</tr>
<tr>
<td><strong>Senior Year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 461 - Quantum Mechanics I</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 490R - Undergraduate Research</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Physics Electives</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Declared Area</td>
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<tr>
<td>University Core and Electives</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 499R - Senior Capstone Seminar</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>Physics Electives</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>11</td>
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</tr>
<tr>
<td><strong>Year Total:</strong></td>
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<td>15</td>
</tr>
<tr>
<td><strong>Total Program Credits:</strong></td>
<td>120</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The 6 credits of mathematics electives are to be selected from M 221 and MATH and STAT courses numbered 300 and above. The 6 credits of physics electives are to be selected from PHSX 253 and PHSX and ASTR courses numbered 300 and above. The physics elective can include no more than 1 credit of PHSX 494, 3 credits of PHSX 490R, or 4 credits of the combination of PHSX 494, PHSX 492, and PHSX 490R. PHSX 401, PHSX 402, PHSX 403, and PHSX 405 can not be counted towards physics electives. Courses in declared area must be must be 100 level or higher and approved by the physics advisor. A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. A student changing majors or with unusual circumstances can substitute PHSX 220 for PHSX 240, or PHSX 222 for PHSX 242 with the academic advisor’s approval.

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**Physics Minor (Non-Teaching)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 240</td>
<td>Honors Gen &amp; Mod Phys I (Recommended)</td>
<td>4</td>
</tr>
<tr>
<td>or PHSX 220</td>
<td>Physics I (w/ calculus)</td>
<td></td>
</tr>
<tr>
<td>PHSX 242</td>
<td>Honors Gen &amp; Mod Phys II (Recommended)</td>
<td>4</td>
</tr>
<tr>
<td>or PHSX 222</td>
<td>Physics II (w/ calculus)</td>
<td></td>
</tr>
<tr>
<td>PHSX 224</td>
<td>Physics III</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 301</td>
<td>Intro Theoretical Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 343</td>
<td>Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>or PHSX 320</td>
<td>Classical Mechanics</td>
<td></td>
</tr>
</tbody>
</table>

Physics electives (PHSX 261 or PHSX 262 or PHSX or ASTR courses 300 level or above) 10

Total Credits: 28

Students who complete PHSX 343 require 10 credits of physics elective. Students who complete PHSX 320 require 9 credits of physics elective. The physics electives can include no more than 1 credit of PHSX 494, 3 credits of PHSX 490R, or 4 credits of the combination of PHSX 494, PHSX 492, and PHSX 490R. PHSX 401, PHSX 402, PHSX 403, and PHSX 405 can not be counted towards physics electives.

---

**Physics Teaching Option**

<table>
<thead>
<tr>
<th>Year</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freshman Year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDFS 1011S - Indiv and Fam Dev: Lifespan</td>
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</tr>
<tr>
<td>PHSX 240 - Honors Gen &amp; Mod Phys I</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 181Q - Honors Calculus I (Recommended) or M 171Q - Calculus I</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDU 202 - Early Field Experience</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 242 - Honors Gen &amp; Mod Phys II</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 182Q - Honors Calculus II (Recommended) or M 172Q - Calculus II</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biol, Chem, or Earth Science Electives</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Core and Electives</td>
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<td></td>
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</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td></td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td><strong>Sophomore Year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDU 223IS - Educ Psych and Adolescent Dev</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 224 - Physics III</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 261 - Laboratory Electronics I</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 283Q - Honors Multivariable Calculus (Recommended) or M 273Q - Multivariable Calculus</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDU 211D - Multicultural Education</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 301 - Intro Theoretical Physics</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 284 - Honors Introduction to Differential Equations (Recommended) or M 274 - Introduction to Differential Equation</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 242 - Methods of Proof</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td></td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td><strong>Junior Year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 328 - Higher Math for Sec Teachers</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The 6 credits of mathematics electives are to be selected from M 221 and MATH and STAT courses numbered 300 and above. The 6 credits of physics electives are to be selected from PHSX 253 and PHSX and ASTR courses numbered 300 and above. The physics elective can include no more than 1 credit of PHSX 494, 3 credits of PHSX 492, 3 credits of PHSX 490R, or 4 credits of the combination of PHSX 494, PHSX 492, and PHSX 490R. PHSX 401, PHSX 402, PHSX 403, and PHSX 405 can not be counted towards physics electives. Courses in declared area must be must be 100 level or higher and approved by the physics advisor. A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. A student changing majors or with unusual circumstances can substitute PHSX 220 for PHSX 240, or PHSX 222 for PHSX 242 with the academic advisor’s approval.*
PHSX 320 - Classical Mechanics 4
PHSX 343 - Modern Physics 3
ASTR 371 - Solar System Astronomy 4
or ASTR 373 - Stars, Galaxies, and the Universe 4
University Core and Electives 3
EDU 370 - Integrating Tech into Educ 2
EDU 382 - Assessmt, Curric, Instructn 3
EDSP 306 - Exceptional Learners 3
PHSX 423 - Electricity and Magnetism I 3
M 329 - Modern Geometry 3
University Core and Electives 3
Year Total: 17 17

<table>
<thead>
<tr>
<th>Senior Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 395 - Practicum</td>
<td>1-3</td>
</tr>
<tr>
<td>EDU 497 - Methods</td>
<td>3</td>
</tr>
<tr>
<td>EDU 497 - Methods</td>
<td>3</td>
</tr>
<tr>
<td>M 428 - Mathematical Modeling for Teachers</td>
<td>3</td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td>3</td>
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<tr>
<td>Physics Electives</td>
<td>3</td>
</tr>
<tr>
<td>EDU 495 - Student Teaching</td>
<td>12</td>
</tr>
<tr>
<td>EDU 408 - Professional Issues: K-12</td>
<td>2</td>
</tr>
<tr>
<td>Year Total:</td>
<td>16-18 14</td>
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<tr>
<td>Total Program Credits:</td>
<td>128</td>
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</tbody>
</table>

*The physics electives are to be selected from PHSX courses numbered 200 and above. The physics electives can include no more than 1 credit of PHSX 494. A minimum of 128 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. A student changing majors or with unusual circumstances can substitute PHSX 220 for PHSX 240, or PHSX 222 for PHSX 242 with academic advisor’s approval. It is recommended to take “RH” and “RA” designated core classes in order to simultaneously satisfy the requirement for 3 credits of Core 2.0 “R”.

### Professional Option

#### Freshman Year

<table>
<thead>
<tr>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHSX 240 - Honors Gen &amp; Mod Phys I*</td>
</tr>
<tr>
<td>M 181Q - Honors Calculus I (Recommended)</td>
</tr>
<tr>
<td>or M 171Q - Calculus I</td>
</tr>
<tr>
<td>University Core and Electives</td>
</tr>
<tr>
<td>PHSX 242 - Honors Gen &amp; Mod Phys II*</td>
</tr>
<tr>
<td>M 182Q - Honors Calculus II (Recommended)</td>
</tr>
<tr>
<td>or M 172Q - Calculus II</td>
</tr>
<tr>
<td>Biol, Chem, or Earth Science Electives</td>
</tr>
<tr>
<td>University Core and Electives</td>
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<tr>
<td>Year Total:</td>
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#### Sophomore Year

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 200 - Research Programs in Physics</td>
</tr>
<tr>
<td>PHSX 224 - Physics III</td>
</tr>
<tr>
<td>M 283Q - Honors Multivariable Calculus (Recommended)</td>
</tr>
<tr>
<td>or M 273Q - Multivariable Calculus</td>
</tr>
<tr>
<td>PHSX 261 - Laboratory Electronics I</td>
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<tr>
<td>University Core and Electives</td>
</tr>
<tr>
<td>PHSX 262 - Laboratory Electronics II</td>
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<tr>
<td>PHSX 301 - Intro Theoretical Physics</td>
</tr>
<tr>
<td>M 284 - Honors Introduction to Differential Equations (Recommended)</td>
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<tr>
<td>or M 274 - Introduction to Differential Equation</td>
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<tr>
<td>University Core and Electives</td>
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<td>Year Total:</td>
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### Junior Year

<table>
<thead>
<tr>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHSX 320 - Classical Mechanics</td>
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<tr>
<td>PHSX 331 - Meth of Computational Physics</td>
</tr>
<tr>
<td>PHSX 343 - Modern Physics</td>
</tr>
<tr>
<td>PHSX 490R - Undergraduate Research</td>
</tr>
<tr>
<td>Math Electives</td>
</tr>
<tr>
<td>University Core and Electives</td>
</tr>
<tr>
<td>PHSX 423 - Electricity and Magnetism I</td>
</tr>
<tr>
<td>PHSX 446 - Thermodynamics &amp; Stat Mech</td>
</tr>
<tr>
<td>Math Electives</td>
</tr>
<tr>
<td>Physics Electives</td>
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<tr>
<td>University Core and Electives</td>
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<tr>
<td>Year Total:</td>
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### Senior Year

<table>
<thead>
<tr>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHSX 425 - Electricity and Magnetism II</td>
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<tr>
<td>PHSX 461 - Quantum Mechanics I</td>
</tr>
<tr>
<td>PHSX 444 - Advanced Physics Lab</td>
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<tr>
<td>PHSX 490R - Undergraduate Research</td>
</tr>
<tr>
<td>Math Electives</td>
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<tr>
<td>University Core and Electives</td>
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<tr>
<td>PHSX 462 - Quantum Mechanics II</td>
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<td>PHSX 499R - Senior Capstone Seminar</td>
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<td>Physics Electives</td>
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<td>University Core and Electives</td>
</tr>
<tr>
<td>Year Total:</td>
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<tr>
<td>Total Program Credits:</td>
</tr>
</tbody>
</table>

* See note below on substitutions.

The 9 credits of mathematics electives are to be selected from M 221 and M and STAT courses numbered 300 and above. The 7 credits of physics electives are to be selected from PHSX 253 and PHSX and ASTR courses numbered 300 and above. The physics elective can include no more than 1 credit of PHSX 494, 3 credits of PHSX 492, 3 credits of PHSX 490R, or 4 credits of the combination of PHSX 494, PHSX 492, and PHSX 490R. PHSX 401, PHSX 402, PHSX 403, and PHSX 405 can not be counted towards physics electives. A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. A student changing majors or with unusual circumstances can substitute PHSX 220 for PHSX 240 or PHSX 222 for PHSX 242 with academic advisor’s approval.

### Political Science

#### Bachelors of Arts in Political Science

The Bachelors (BA) Degree in Political Science will develop knowledge of American political institutions, world politics, political theory, public administration, and policy. Our students learn to analyze, interpret, and
explain political phenomena through the lens, and with the methods, of a political scientist. Our integrated curriculum challenges students to develop their critical thinking, communication, and research skills, preparing our graduates for citizenship and leadership, post-graduate study and diverse employment possibilities. Political Science is an excellent background for students preparing for degrees in government, politics, civil society, the law, and the private sector.

As a Political Science major, you will construct an individualized course of study drawing on our rich curriculum, internship program, complimentary majors and minors, and study abroad opportunities. Students will take a lower division foundation block of five courses that introduces them to the sub-fields of Political Science and their modes of inquiry. After completion of the five-class foundation block, students individualize their course of study while fulfilling their upper division coursework requirements and a research design class.

Requirements for a degree in Political Science include:

1. Completion of five Political Science lower division foundation courses;
2. Completion of seven Political Science upper division courses;
3. Completion of PSCI 390R-Research Methods in Political Science your Junior year;
4. Completion of MSU general graduation requirements of 120 credits, including 42 upper division credits, and the MSU core.

*All Major requirements must be completed with a grade of “C” or better

**Curriculum**

Before a Political Science Major may enroll in any upper division course, the student is expected to have achieved a grade of “C” or better in the five Political Science foundation courses.

### First: Take all of the following lower division foundation courses:

- PSCI 201 - Scope and Methods of Political Science - Fall Only
- PSCI 210IS - Introduction to American Government
- PSCI 230D - Introduction to International Relations
- PSCI 240 - Introduction to Public Administration - Spring Only
- PSCI 250 - Introduction to Political Theory - Fall Only

### Second: Take seven of the following upper division courses:

- PSCI 302 - Media and Politics
- PSCI 306 - Legislative Process
- PSCI 323 - Modern Political Thought
- PSCI 331 - International Relations Theory
- PSCI 337 - Model United Nations
- PSCI 338 - Comparative Politics
- PSCI 341 - Political Parties and Elections
- PSCI 346 - American Presidency
- PSCI 355 - British Politics
- PSCI 354 - Contemporary Issues in Political Theory
- PSCI 356 - Classical Political Thought
- PSCI 362 - Natural Resource Policy
- PSCI 407 - Public Policy Analysis
- PSCI 418 - The Politics of War and Peace
- PSCI 423 - The Politics of Developing Countries
- PSCI 434 - International Law
- PSCI 436 - The Politics of Food and Hunger
- PSCI 437 - International Political Economy
- PSCI 439 - International Human Rights
- PSCI 444 - Congressional Campaigns
- PSCI 451 - State and Local Government
- PSCI 454 - Cinema and Political Thought
- PSCI 455 - Politics and Virtue
- PSCI 461 - Administrative Law
- PSCI 465 - Public Administration and Policy
- PSCI 471 - American Constitutional Law
- PSCI 491 - National Security Policy

### Third: Take your Senior Research Methods class

- PSCI 390R - Research Methods in Political Science

### Political Science Non-Teaching Minor

To earn a Political Science Non-Teaching Minor, a minimum of 21 credit hours are required, with 9 credits from upper division classes, 300-level and above.

- PSCI 201 - Scope and Methods of Political Science - 3
- PSCI 210IS - Introduction to American Government - 3
- PSCI 230D - Introduction to International Relations - 3
- PSCI 240 - Introduction to Public Administration - 3
- PSCI 250 - Introduction to Political Theory - 3

3 upper division Political Science classes 300- or 400-level (Internships not included)

Total Credits: 21

For previous catalog years and curriculum’s, please click here (http://catalog.montana.edu/archived-catalogs). Please reach out to the department at either politicalscience@montana.edu or (406) 994-4141 for more information or questions.

### Undergraduate Curriculum in Political Science

#### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSCI 201 - Scope and Methods of Political Science</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 210IS - Introduction to American Government</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 230D - Introduction to International Relations</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 240 - Introduction to Public Administration</td>
<td>3</td>
</tr>
<tr>
<td>WRIT 101W - College Writing 1</td>
<td>3</td>
</tr>
<tr>
<td>CLS 101US - Knowledge and Community or US 101US - First Year Seminar</td>
<td>3</td>
</tr>
<tr>
<td>M 105Q - Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts) or M 121Q - College Algebra</td>
<td>3</td>
</tr>
<tr>
<td>University Core</td>
<td>6</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSCI 390R - Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>Remaining PSCI Foundation and/or University CORE</td>
<td>12</td>
</tr>
<tr>
<td>Three PSCI Upper Division Courses</td>
<td>9</td>
</tr>
<tr>
<td>PSCI 498 - Internship and/or remaining electives, minor, double major requirements</td>
<td>9</td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

#### Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four PSCI Upper Division Courses</td>
<td>12</td>
</tr>
<tr>
<td>PSCI 390R - Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>Remaining PSCI Electives and/or University CORE</td>
<td>9</td>
</tr>
<tr>
<td>PSCI 498 - Internship and/or remaining electives, minor, double major requirements</td>
<td>6</td>
</tr>
</tbody>
</table>
Year Total: 30
Senior Year Credits
PSCI 498-Internship and/or remaining electives, minor, double major requirements 30
Year Total: 30
Total Program Credits: 120

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above. No political science course may be counted in more than one upper division sub-field requirement. Political science majors must fulfill Social Science Inquiry (IS) and Diversity (D) University Core requirements outside of the PSCI rubric. Before a political science major may enroll in any upper division political science course, the student must have achieved a grade of "C" or better in all lower division courses required for the political science major. To be credited toward graduation, a student must earn a "C" or better in any upper division political science course required for the major.

The Master of Public Administration (MPA) degree is a professional degree designed to prepare both pre- and mid-career professionals and administrators for supervisory, analytical support and policy-making positions in public sector agencies, and non-profit organizations, at local, state and federal levels. The program stresses sound preparation in wide range of administrative competencies. MPA coursework includes studies in public administration theory, human resource management, public budgeting, leadership, ethics, organization dynamics, and research methods for public administrators. Information on this program can be found at the MPA Graduate Program (p. 388) page.

Pre-Med Intake

The Pre-Med Intake Major is a program that encourages students to explore and prepare for academic majors leading to careers in the health professions. It is not a major from which students will graduate and it is not intended for Nursing students. Students may consult with the Health Professions Advising (HPA) Office (http://www.montana.edu/hpa) is committed to supporting undergraduate and graduate students, as well as alumni, as they prepare for careers in health care. This office helps students use an informed decision-making process to identify the most appropriate and individualized career choice. It also assists students from all majors to explore career options, understand the academic requirements of professional schools, and prepare the most competitive professional school application possible. While the HPA office works in partnership with the Pre-Med Intake major (p. 256) and the Pre-Med Advisor in the Academic Advising Center (http://www.montana.edu/wwwus/advising.html), it remains a resource for all MSU students, regardless of major.

Starting at Orientation and throughout their freshmen year, students will be advised by a dedicated academic advisor from the Academic Advising Center. (http://www.montana.edu/wwwus/advising.html) While students start on their CORE and math/science courses, the pre-med intake advisor provides students with one-on-one assistance in choosing a major to meet their interests, talents and future goals.

This major also works in partnership with the Health Professions Advising (HPA) Office (http://www.montana.edu/hpa). The HPA advisor offers workshops, advising, and coaching to prepare students in creating a competitive application to medical, dental, pharmacy, physical therapy and other health care professional schools. Assistance from the HPA office is available to all MSU students and alumni. The Pre-Med Intake major is designed to foster students’ awareness of the variety of academic majors and opportunities related to the health professions that MSU offers. Students in the program are encouraged to take advantage of special courses, such as MEDS 140, and workshops offered by the HPA office to broaden their knowledge of options in the health professions.

Curriculum in Pre-Med Intake Major

The following courses are recommended for Pre-Med Intake majors, assuming they enter the major with the appropriate Math level.

Fall Curriculum

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>BIOH 185</td>
<td>Integrated Physiology I</td>
<td>4</td>
</tr>
</tbody>
</table>

Choose one of the following:

- CHMY 141 College Chemistry I (4 cr)
- CHMY 151 Honors College Chemistry I (4 cr)

US Core: 3 - 4 cr (Students may select any University Seminar (US) core course)

Total Credits 14-15

Spring Curriculum

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 161Q</td>
<td>Survey of Calculus</td>
<td>4</td>
</tr>
<tr>
<td>BIOB 260</td>
<td>Cellular and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>MEDS 140</td>
<td>Intro Medicine Health</td>
<td>1</td>
</tr>
</tbody>
</table>

Take one of the following:

- CHMY 143 College Chemistry II (4 cr)
- CHMY 153 Honors College Chemistry II (4 cr)

Take one of the following:

- WRIT 101W College Writing II (3 cr) if needed, or take:
- WRIT 201 College Writing II (3 cr)
- LIT 110H Intro to Lit: Explorations in Literature (3 cr)

Total Credits 16-17

At the end of their freshman year, students in this major will choose an academic major and move from the intake program to an academic degree program. If they remain interested in a career in health care, it is recommended that the student stay engaged with the Health Professions Advising Office.

Pre-medical/Pre-Health Professional Programs

The Health Professions Advising (HPA) Office (http://www.montana.edu/hpa) is committed to supporting undergraduate and graduate students, as well as alumni, as they prepare for careers in health care. This office helps students use an informed decision-making process to identify the most appropriate and individualized career choice. It also assists students from all majors to explore career options, understand the academic requirements of professional schools, and prepare the most competitive professional school application possible. While the HPA office works in partnership with the Pre-Med Intake major (p. 256) and the Pre-Med Advisor in the Academic Advising Center (http://www.montana.edu/wwwus/advising.html), it remains a resource for all MSU students, regardless of major.

Students may consult with the Health Professions Advising (HPA) office throughout, or even prior to, their MSU career. The goal of the HPA Office is to provide guidance related to career choices and professional school preparation. It has been central to the creation of MEDS 140, an exploratory class that looks at the range of academic opportunities at MSU and the breadth of opportunity among health-related professions. Exploratory courses are available to learn more about medicine MEDS 440 and dentistry MEDS 340. The HPA office provides a structured professional school application process. It also coordinates several pre-health professional clubs and the pre-health professional honor society. To learn more about its services, please check the HPA website (http://www.montana.edu/hpa)

Undergraduate Programs

- Pre-Med Intake Major (p. 256)

The Health Professions Advising office hosts two graduate programs for students on the health professions trajectory, depending on whether they have the necessary professional school pre-requisites (Master of Science
in Health Sciences (http://www.montana.edu/hpa/graduate) or need to obtain said pre-requisites (Post Baccalaureate Pre-Medical Certificate (http://www.montana.edu/hpa/postbacc)). To learn more about these programs, please click on the aforementioned webpage links or catalog links below:

- Post Baccalaureate Pre-Medical Certificate (p. 408)
- Master of Science in Health Sciences (p. 404)

Psychology

Psychology is the scientific study and application of knowledge concerning the behavioral and cognitive processes of humans and other animals. The Psychology Department offers a Bachelor of Science (B.S.) degree in Psychology. This degree prepares students for employment in applied settings or for graduate study in psychology and related fields. Students who choose not to continue toward a graduate degree may find employment in a wide variety of organizations and agencies as well as in research settings where knowledge of behavior and cognition is useful. For such students, a B.S. in psychology offers a broad liberal arts background. Those students who obtain an advanced degree (typically an M.S. or a Ph.D.) may find employment in research settings, academic settings, or private practice, although individuals with advanced degrees also work in a wide variety of other organizations.

The psychology curriculum introduces students to the basic scientific and applied areas of the discipline. It emphasizes theories, methods, and terminology, as well as research findings in each of psychology’s major subareas. Students learn about various research methods used to study psychological phenomena, as well as the strengths and limitations of each. Students conduct psychological research or perform fieldwork in a setting related to psychology, gaining experience that forms the basis for the Senior Thesis Capstone course.

Prerequisite Requirements

Any student who enrolls in a psychology course without having passed all prerequisite(s) with a "C" or better grade will be required to withdraw from the course.

Undergraduate Programs

- Psychological Science and Applied Psychology Options (p. 257)
- Psychology Minor (Non-Teaching) (p. 258)

The program leading to a B.S. degree offers psychological science and applied psychology options. Within these options, students select the appropriate psychology electives and career electives in consultation with their advisors based on the student’s career goals and interests. Options and electives are described below. Psychology majors and minors cannot have a grade less than "C" in a PSYX course used to satisfy graduation requirements.

Applied Psychology Option

Students interested in areas of applied psychology such as counseling, industrial/organizational psychology, human resource management, or organizational behavior, may consider the Applied Psychology Option and may choose elective courses in such disciplines as health and human development, business, management, industrial and management engineering, or statistics.

Psychological Science Option

Students more interested in research-based graduate programs in psychology areas such as cognition, social, neuroscience, or health, or those interested in medical school. Students may choose elective courses in related disciplines such as cell biology and neuroscience, political science, sociology, or statistics.

Students interested in advanced study in clinical psychology may follow either the Psychological Science Option or the Applied Psychology Option and should choose elective courses in such disciplines as human development, pre-med, or statistics.

Students in either psychology option should consider developing a minor or second major in an area that enhances career interests. Information regarding these options is available through the Psychology Advising Office, Psychology Faculty Advisors, and the Psychology Department website (http://www.montana.edu/psychology).

Graduate Program

- Ph.D. in Psychological Science (p. 390)

Psychological Science and Applied Psychology Options

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYX 100IS - Intro to Psychology</td>
<td>4</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
</tr>
<tr>
<td>- Math placement exam at level 4 or higher</td>
<td></td>
</tr>
<tr>
<td>- M 105Q - Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts)</td>
<td></td>
</tr>
<tr>
<td>- STAT 216Q - Introduction to Statistics</td>
<td></td>
</tr>
<tr>
<td>Psychology Electives</td>
<td>6</td>
</tr>
<tr>
<td>Year Total</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYX 223 - Research Design and Analysis I</td>
<td>4</td>
</tr>
<tr>
<td>PSYX 225 - Research Design and Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>Psychology Electives</td>
<td>6</td>
</tr>
<tr>
<td>Year Total</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYX 490R - Undergraduate Research</td>
<td></td>
</tr>
<tr>
<td>or PSYX 495 - Field Pract in Applied Psy</td>
<td></td>
</tr>
<tr>
<td>Psychology Electives</td>
<td>6</td>
</tr>
<tr>
<td>Year Total</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Senior Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYX 499R - Senior Thesis/Capstone</td>
<td>3</td>
</tr>
<tr>
<td>Psychology Electives</td>
<td>6</td>
</tr>
<tr>
<td>Year Total</td>
<td>9</td>
</tr>
<tr>
<td>Total Program Credits:</td>
<td>41</td>
</tr>
</tbody>
</table>

Freshman, Sophomore, Junior & Senior Years

REQUIRED COURSES LISTED ABOVE 44

PSYCHOLOGY ELECTIVES (as noted above):

Choose at least one course from each of the following four groups (12 credits):

- Biological/Emotion/Motivation/Learning
  - PSYX 350 - Physiological Psychology
  - PSYX 370 - Psychology of Learning
- Cognitive
  - PSYX 354 - Sensation & Perception
  - PSYX 380 - Memory & Cognition
  - PSYX 481 - Judgment & Decision Making
- Social/Personality
Choose at least four of the following courses (12 credits). Courses listed above in the four groups are also available:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYX 230</td>
<td>Developmental Psychology</td>
<td></td>
</tr>
<tr>
<td>PSYX 235D</td>
<td>Contemp Issues in Human Sexual</td>
<td></td>
</tr>
<tr>
<td>PSYX 263CS</td>
<td>The Psychology of Film</td>
<td></td>
</tr>
<tr>
<td>PSYX 270</td>
<td>Fund Psychology of Learning</td>
<td></td>
</tr>
<tr>
<td>PSYX 274</td>
<td>Psychological Measurement</td>
<td></td>
</tr>
<tr>
<td>PSYX 325</td>
<td>Applied Critical Thinking</td>
<td></td>
</tr>
<tr>
<td>PSYX 335</td>
<td>Psychology of Gender</td>
<td></td>
</tr>
<tr>
<td>PSYX 375</td>
<td>Behavior Modification</td>
<td></td>
</tr>
<tr>
<td>PSYX 383</td>
<td>Health Psychology</td>
<td></td>
</tr>
<tr>
<td>PSYX 384</td>
<td>Consciousness</td>
<td></td>
</tr>
<tr>
<td>PSYX 400</td>
<td>History &amp; System in Psychology</td>
<td></td>
</tr>
<tr>
<td>PSYX 461</td>
<td>Indust &amp; Organiz Psych</td>
<td></td>
</tr>
<tr>
<td>PSX 663</td>
<td>Social Cognition</td>
<td></td>
</tr>
<tr>
<td>PSX 475</td>
<td>Advanced Behavior Analysis</td>
<td></td>
</tr>
<tr>
<td>PSX 477</td>
<td>Science of Psych Well-Being</td>
<td></td>
</tr>
<tr>
<td>PSX 482</td>
<td>Psycholinguistics</td>
<td></td>
</tr>
<tr>
<td>PSX 491</td>
<td>Special Topics</td>
<td></td>
</tr>
<tr>
<td>PSX 494</td>
<td>Seminar</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 120

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

**Sociology**

**Department of Sociology & Anthropology**

The Bachelor of Science in Sociology program provides students the opportunity to combine a liberal arts education with a unique focus on the empirical study of human societies including social dynamics, institutions, and inequality. Students are permitted a large number of elective courses.

A Bachelor’s degree in Sociology prepares students for employment in a number of arenas, including governmental agencies, nonprofit organizations, for-profit businesses, agricultural organizations, and academic institutions. The fields of law enforcement, probation and corrections, labor relations, business management, personnel administration, market analysis, and various types of industrial research employ students who major in sociology. Many graduates enter social services. Sociology also provides excellent preparation for graduate school and other educational and career opportunities.

The Department offers a Bachelor of Science degree with two options: (a) General Sociology, or (b) Criminology. Both options require 42 credits in Sociology courses.

**General Sociology Option**

This option is for the student who desires a broad and general foundation in Sociology with the ability to fully customize their major and substantive focus. For this option, the student is required to take SOCI 101IS, STAT 216Q, SOCI 318R, SOCI 455, and SOCI 499. The remaining 30 credits in Sociology will be comprised of ten courses of the student’s...
choosing, of which eight must be at the 300-level or above. Students that choose the General Sociology Option often take a set of courses that lead to a specific area of emphasis, such as Social Inequality, Family Relations and Children, Business and Management, Marketing and Public Relations, Social Services, Health and Medicine, and Pre-Law.

We strongly recommend that prior to enrolling in any upper division courses in Sociology, students complete their core in Writing, Quantitative Reasoning, Diversity, and Inquiry-Social Sciences with a grade of "C-" or better. We also recommend students complete their Quantitative Reasoning core by the end of their sophomore year and SOCI 318R in their junior year.

**Criminology Option**

This option is for the student who desires a strong foundation in Sociology with a specific focus on laws, the legal system, the social structure of criminal behavior, and society’s efforts to understand and control crime. This option allows students to pursue a sociology degree that integrates core coursework in sociology with sociology courses that focus on law, crime, and the criminal justice system. To achieve this integration, the student is required to take SOCI 101IS, STAT 216Q, SOCI 318R, SOCI 311, and SOCI 499. The remaining 30 credits in Sociology will be comprised of 15 credits in Criminology and Context courses and 15 credits in Criminology and Sociology elective courses.

We strongly recommend that prior to enrolling in any upper division courses in Sociology, students complete their core in Writing, Quantitative Reasoning, Diversity, and Inquiry-Social Sciences with a grade of "C-" or better. We also recommend students complete their Quantitative Reasoning core by the end of their sophomore year and SOCI 318R in their junior year.

**Prerequisite Requirements**

Any student who enrolls in a course offered by the Department of Sociology and Anthropology without the required prerequisite(s) will be required to withdraw from the course.

**Curricula in Sociology**

- General Sociology Option
- Criminology Option
- Sociology Minor (Non-Teaching) (p. 259)

**General Sociology and Criminology Options**

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>15</td>
</tr>
<tr>
<td>SOCI 101IS - Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>University Seminar Core</td>
<td>3</td>
</tr>
<tr>
<td>Diversity Core</td>
<td>3</td>
</tr>
<tr>
<td>Year Total</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOCI Electives</td>
<td>6</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>24</td>
</tr>
<tr>
<td>Year Total</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 455 - Classical Sociological Theory (General Sociology Option)</td>
<td></td>
</tr>
<tr>
<td>SOCI 311 - Criminology (Criminology Option)</td>
<td></td>
</tr>
<tr>
<td>SOCI 318R - Sociological Research Methods</td>
<td></td>
</tr>
</tbody>
</table>

SOCI Electives 9
University Core and Electives 15
Year Total: 30

<table>
<thead>
<tr>
<th>Senior Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOCI 499 - Senior Thesis Capstone</td>
<td>3</td>
</tr>
<tr>
<td>Sociology Electives</td>
<td>15</td>
</tr>
<tr>
<td>University Core and Electives</td>
<td>12</td>
</tr>
<tr>
<td>Year Total:</td>
<td>30</td>
</tr>
</tbody>
</table>

Total Program Credits: 120

Required Courses: Students must complete SOCI 101IS, STAT 216Q, SOCI 318R and SOCI 499 in sequence. Please note: SOCI 101IS is required for completion of the major but does not fulfill University IS Core Requirements for Sociology Majors. In addition, students must complete SOCI 455 (General Sociology Option) or SOCI 311 (Criminology Option) before they enroll in SOCI 499.

Sociology Electives for General Sociology option: Students must take 30 additional credits from any courses designated as SOCI. All but 6 credits must be in upper-division courses and no more than 6 credits of SOCI 492, SOCI 498, and SOCI 490R combined can count toward the fulfillment of elective credits. Students may request, in writing, to count up to 6 credits of upper division ANTY courses as SOCI electives.

Sociology Electives for Criminology option: Students must take 15 additional credits from the following courses: SOCI 150D or SOCI 201D, SOCI 221IS, SOCI 313, SOCI 325, SOCI 326, SOCI 327, SOCI 335, SOCI 344, SOCI 357, SOCI 358, SOCI 359, SOCI 362, SOCI 414, SOCI 423, SOCI 425, SOCI 435, SOCI 436, SOCI 437. Additional 15 upper-division credits must be taken from any courses designated as SOCI. All but 6 of the 30 elective credits must be in upper-division courses and no more than 6 credits of SOCI 492, SOCI 498, and SOCI 490R combined can count toward the fulfillment of these 9 elective credits.

In choosing specific SOCI classes and topics, it is recommended that students should frequently consult with their advisors and instructors to determine the best set of classes to fulfill the elective requirements. For students in both the General Sociology and Criminology options, it will be helpful to discuss your substantive and occupational interests with your advisor to better design and align your major coursework with these interests. We offer many SOCI classes that can be combined to create a focused and comprehensive plan of study, which will better prepare you to enter post-baccalaureate positions. Additionally, the department recommends that students consider adding a second major or a minor to their degree plans to further assist in preparing them for labor market or graduate education options. The choice of this major or minor should also be made in consultation with advisors and other faculty members.

The maximum number of Sociology transfer credits accepted is 18.

SOCI 318R, SOCI 455 or SOCI 311, and SOCI 499 must be taken at MSU-Bozeman. Transfer students who have taken these prior to transferring can petition to have these courses accepted. For graduation in the Sociology option, students must have a grade of "C-" or higher in all required and elective Sociology courses.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above.

**Sociology Minor (Non-Teaching)**

SOCI 101IS Introduction to Sociology 3
or SOCI 110IS Honors Sociological Inquiry
Women's, Gender and Sexuality Studies Minor

The College of Letters and Science, in conjunction with all other colleges at MSU, offers an interdisciplinary minor in Women's and Gender Studies. Students in the minor systematically study basic feminist theories and methodologies, as well as the experiences and contributions of women in a variety of cultures over time. Students in the minor will examine issues and theories of gender inequity and gender identity, and will engage in feminist analysis within their disciplines. Students find the minor a stimulating challenge to traditional assumptions in their academic programs. Because of its interdisciplinary nature, the minor is individually shaped in consultation with a Women's and Gender Studies advisor. Students who declare a minor in Women's and Gender Studies must complete 21 semester credits as outlined below. Contact the CLS Dean's Office for additional information and view the Women's and Gender Studies Minor site at http://www.montana.edu/wgs.

**Total Credits: 21**

15 of 21 credits must be from upper division courses numbered 300 or above.

**Women's, Gender and Sexuality Studies Minor**

**Goals**

1. To inspire baccalaureate and graduate students, within a diverse, challenging, and engaging learning environment, to become leaders in the practice of professional nursing.
2. To create an interactive environment in which faculty and students discover, learn, and integrate knowledge into nursing practice.
3. To serve as leaders in nursing by generating, translating, and disseminating knowledge through research and scholarly activities.
4. To promote health and wellness through professional practice, collaboration, consultation, civic engagement, education, and leadership.

**Philosophy**

**Introduction**

We believe in excellence in nursing education through a teaching-learning process that is the responsibility of both faculty and student. We promote the development of lifelong self-directed learning that fosters leadership in education, research, practice, and service. We believe in a learning environment that supports the diversity of people and ideas. Our efforts are directed toward achieving higher levels of education for all nurses and transforming healthcare in the United States and the world. We believe that nursing education is framed within the context of nursing's meta-paradigm: person, environment, health, and nursing.

**Person**

A person is any individual, family, group, community or population. Each person is unique and is entitled to treatment with dignity and respect.
Environment
Environment includes all factors influencing a person’s health perceptions, behaviors, and responses. The human experience is contextually defined by the interrelationship of spiritual, cultural, developmental, physical, psycho-social, political, and economic subsystems. The appropriate arena for nursing action extends beyond the person and includes promotion of healthy environments through social action.

Health
Health is a state of physical, mental, social, and spiritual well-being defined by the person. It is not merely the absence of disease or disability. Health is multifactorial and is influenced by many factors such as behaviors, environments, genetics, and resources. There are diverse cultural definitions of health. Health activities include those directed at maintenance, enhancement, prevention and promotion.

Nursing
Nursing is a discipline of science and art requiring synthesis of evidence-based knowledge, professional skills, ethical values, and human caring. Nurses assist persons in achieving optimal health. Nurses generate a unique body of knowledge to meet the complex needs of persons in a variety of health care settings from rural to urban.

Nursing education
Nursing education focuses on the knowledge, skills, and attitudes needed by nurses to practice effectively within a complex and changing environment. Nursing requires strong interpersonal skills and a solid understanding of human beings, human society, and the scientific basis of medicine and nursing. Nurses are responsible for clinical judgments based on your scientific reasoning. Graduates of MSU College of Nursing will not simply be a technician at the bedside; our graduates will be making decisions that impact the health of people in the local and global communities. Therefore, the education of nursing students is based on professional, regulatory, and organizational standards.

Programs
The undergraduate professional nursing program is approved by the Montana State Board of Nursing and is nationally accredited by the Commission on Collegiate Nursing Education (CCNE). The traditional BSN program includes two years of lower division study and two years of upper division study, at one of five sites (Bozeman, Billings, Great Falls, Kalispell, Missoula). It is possible for a student to complete all of the required prerequisite coursework at institutions other than Montana State University. All transfer credits are carefully evaluated to ensure equivalent content when students transfer to MSU and the College of Nursing curriculum. While it is possible to complete the program in four years, this requires careful planning and uninterrupted progression through the curriculum. Delays in progression related to reduced credit loads, repeated coursework, securing upper division placement, or change of curriculum commonly result in the student taking longer than four years to complete the program. All upper division coursework is taken at one of five upper division campus sites: Bozeman, Billings, Great Falls, Kalispell, and Missoula.

The College of Nursing at Montana State University offers an accelerated second degree BSN (ABSN) option for students to earn a baccalaureate degree in nursing. This option is available only to students who already have earned a baccalaureate degree in a discipline other than nursing. Applications to the option will not be processed for individuals who do not have a degree in another discipline at the time they submit the application. Students are required to have completed the same pre-requisite courses as the traditional students except for WRIT 101, CLS 101, and the art, humanities, and diversity Core 2.0 requirements (see required courses below). Once admitted to the nursing major, they complete the BSN degree in approximately 15 months, as opposed to the 29 months it takes the traditional student. The ABSN is offered at 4 of our 5 campus sites; all course work is completed at one of those 4 sites: Bozeman, Great Falls, Kalispell, and Missoula.

Undergraduate Program Objectives for Both Traditional and Accelerated Options
Graduates of the BSN program will:

- Use a foundation of community-based professional nursing to provide holistic client-centered health care in a variety of healthcare settings.
- Synthesize theoretical and empirical knowledge from nursing, the sciences, the arts and the humanities to practice safe and effective professional nursing across the lifespan.
- Practice basic leadership skills to create a safe caring environment and deliver quality care with an interprofessional healthcare team.
- Evaluate the applicability of research findings in evidence-based nursing practice.
- Utilize evidence-based clinical judgments to assist patients with the promotion, maintenance and restoration of health; prevention of disease; and death with dignity.
- Demonstrate professionalism by incorporating professional values of altruism, autonomy, human dignity, integrity, social justice and value-based behaviors into nursing practice and professional career development.
- Demonstrate basic knowledge of healthcare policy, finance, and regulatory environments, inducing local, state, national and global healthcare trends.
- Utilize effective communication in professional relationships with clients in order to influence health across the health-illness continuum.
- Utilize progressive technology and information management systems to support safe nursing practice and deliver effective, quality client care.
- Collaborate with communities to design, implement, and evaluate population-based approaches to care for diverse populations.
- Provide culturally sensitive direct and indirect care for clients across a variety of healthcare settings.

Admission to the Pre-Nursing Major
Enrollment in the pre-nursing major is available for students admitted to Montana State University-Bozeman provided they have met the University admission requirements (are not admitted on probation or into pre-university studies) and, if transferring from another institution, have at least a 3.0 cumulative grade point average. Montana State University students in another curriculum may process a change of curriculum request into pre-nursing provided their Montana State University-Bozeman cumulative GPA is 3.0 or better. Pre-nursing majors are assigned to advisors in the College of Nursing and encouraged to meet with their advisor at least once each semester.

Admission to the Nursing Major
Admission to the College of Nursing as a nursing major is achieved through a competitive application process. Acceptance into the nursing major (placement on a specific upper division campus site) is based on the student’s grades in the required prerequisite courses for the nursing major. Pre-nursing majors (at both Montana State University-Bozeman and transfer institutions) apply for admission to the nursing major during spring or fall one year before beginning upper division study (see Application for Nursing Major and Upper Division Placement). Admission to the nursing major permits students to be enrolled in sophomore, junior, and senior restricted entry nursing courses.
Progression through the Nursing Curriculum

Lower division courses, including pre-requisite nursing courses, must be completed prior to upper division courses. Nursing courses are generally offered every fall and spring semester. Some summer courses may be offered. Not all required non-nursing courses are offered every semester.

1. A calculated GPA of 3.0 or higher in required prerequisite courses is required to apply to the nursing program. Students are awarded placement based on their pre-requisite course work GPA. Selection moves from the highest GPA downward until all seats are filled. Historically, this has been a GPA of at least 3.5; this does vary with each applicant pool, however. Students should work closely with their advisor each semester to ensure readiness for application.

2. All required prerequisite courses must be completed with a grade of C or better (C- grades are not acceptable) and no more than 2 of the required prerequisites courses may be repeated 1 time.

3. The College of Nursing considers a "W" grade on a transcript the same as C-, D, or F grade. "W" grades indicate an unsuccessful attempt to achieve a grade of C or better in a course.

4. Prerequisite courses for any nursing course must be completed with a grade of C or better (C- grades are not acceptable) before enrolling in the nursing course for which the prerequisite course is required.

5. Restricted entry lower division nursing courses are first offered to students in the nursing major. Students in the pre-nursing major, near the top of the wait list, may be enrolled pending availability.

6. A student’s cumulative MSU GPA must be at least 3.0 prior to beginning upper division study.

7. Unsatisfactory grades in required clinical nursing course(s) in two different semesters prohibits continuation in the nursing curriculum.

8. Exceptions to any requirements or readmission to the nursing major after removal, withdrawal or failure from the nursing curriculum in which there were documented extraordinary circumstances (e.g. death in family, personal illness requiring extended hospitalization, military orders, etc.) are dependent upon a successful appeal to the College of Nursing Scholastic Committee. Placement of students who have failed, have been removed, or have withdrawn from coursework is dependent upon space availability.

9. The lab portion of science courses must be Face to Face. We do not accept online lab science courses.

Application for Upper Division Placement in the Traditional Bachelor of Science Degree in Nursing (BSN) Program

The number of students admitted to the nursing major and offered placement on one of the upper division campus sites is regulated to provide the best utilization of financial, clinical, and faculty resources. The application procedure for admission to the nursing major has been developed in order to:

1. provide the most highly qualified students a place in upper division coursework (pending successful completion of required lower division courses),

2. achieve maximum utilization of limited resources

3. increase the supply of professional registered nurses.

Applications are submitted during two specified periods each year; January 2nd for spring upper division placement and August 1st for fall upper division placement. These periods are publicly announced six weeks in advance on the College of Nursing website. The first opportunity for students to submit an application will be August 1st or following spring semester of their freshman year as pre-nursing students (or depending on when the applicant will be ready to begin upper division). Submission of an application packet is required which includes: official transcripts from every college/university attended; a background check, urine drug screen, and immunizations by the application deadline.

At least 3 of the 5 required natural science courses must be completed with a grade of C or better, and one of those courses must be BIOH 201 (Human Anatomy and Physiology I) to apply to the nursing program. Those natural science pre-requisite courses are:

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| Upper division placement is dependent upon the grade point average in required lower division courses; students are also asked to indicate the campus of their choice.

A wait list of students with 3.0 or higher grade point averages in required lower division courses will be maintained in order to fill unexpected openings for placement at upper division campus sites. Students with grade point averages lower than 3.0 are not eligible to be placed. Students wishing to be considered for admission in later semesters must reapply.

Students need to carefully plan a course of study with advisors in order to complete all required lower division courses prior to upper division placement. Students who have not completed required lower division courses forfeit their upper division placement.

Transfer Students to the Traditional BSN program of study

The above criteria and procedures for progression through the nursing curriculum apply to transfer students as well as MSU-Bozeman students. Students who have been enrolled as nursing students at any other institution (have nursing courses on their transcripts) must provide a letter from their Dean or Director regarding their academic standing at their departure from that program.
In order to facilitate transcript evaluation, all transfer students must provide a copy of the original transcript(s) from all institutions of higher education they have attended to the College of Nursing Undergraduate Student Services Coordinator as well as to the MSU Admissions Office. Out-of-state transfer students must also provide a catalog or course descriptions from their former institution(s), if possible, to facilitate the course evaluation process. Course syllabi will be required if the course does not appear in the MSU transfer equivalency site.

Transfer students are strongly encouraged to work with a MSU-Bozeman College of Nursing Adviser well before application to the program of nursing.

Application for Accelerated Bachelor of Science Option

Applicants will be selected for the BSN accelerated option based on a calculated grade point average of 3.0 or higher in required prerequisite courses for the accelerated option; evidence of completion of a bachelor’s degree in a discipline other than nursing from a regionally accredited institution with at least a cum GPA of 3.0 or higher; signature on affidavit for “Abilities Required for Success in the BSN degree program” form. Prospective students may have no more than 2 required prerequisite courses (and no more than 9 credits) remaining in the fall semester of their application. All prerequisite courses must be completed with a grade of C or better by the end of the fall semester that precedes the May start date in the program. Submission of an application packet is required which includes: official transcripts from every college/university attended; a background check, urine drug screen, and immunizations.

All required prerequisite courses must be completed with a grade of C or better (C- grades are not acceptable) and no more than 2 of the required prerequisite courses may be repeated 1 time.

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- BIOH 211 Human Anatomy and Physiology II 4
- BIOM 250 Microbiology for Health Sciences: Infectious Diseases 3
- CCHMY 121IN Introduction to General Chemistry 4
- CCHMY 123 Introduction to Organic Chemistry and Biochemistry 4
- NUTR 221CS Basic Human Nutrition 3
- HDFS 101IS Indiv and Fam Dev: Lifespan 3
- PSYX 100IS Intro to Psychology 4
- SOCI 101IS Introduction to Sociology 3
- STAT 216Q Introduction to Statistics 3

Accelerated Program placement is dependent upon the grade point average in required pre-requisite courses; students are placed at one of four sites: Bozeman, Great Falls, Kalispell, Missoula.

Accelerated Program Application Deadline

Applications must be submitted completely and on time. Applications which are incomplete, or have been received after the deadline will not be processed. See the College of Nursing Web site for further information at http://www.montana.edu/nursing/undergraduate/acceleratedbsnapp.html

MSU Pre-Licensure Nursing Education and Standards of the Nursing Profession

The primary aim of the College of Nursing is the education of persons for professional nursing practice. Graduates of the program are recommended for admission to the National Licensing Examination for Registered Nurses (NCLEX-RN). As educators, faculty members have the responsibility to provide students with appropriate educational opportunities and with reasonable guidance and supervision. As professional practitioners, faculty members also have the obligation to patients to ensure that nursing students who care for them are competent. In the interest of patient safety, this responsibility also extends to the health agency administrator, to all licensed personnel providing care within that agency, and, in fact, to the nursing students themselves.

The 2015 ANA Code of Ethics for Nurses, Provision 3.3 describes Performance Standards and Review Mechanisms for the professional nurse:

Inherent in professional nursing is a process of education and formation. That process involves the ongoing acquisition and development of the knowledge, skills, dispositions, practice experiences, commitment, relational maturity, and personal integrity essential for professional practice. Nurse educators, whether in academics or direct care settings, must ensure that basic competence and commitment to professional standards exist prior to entry into practice (American Nurses Association, 2015, pg 11).

The student, upon admission to the nursing curriculum, assumes the obligations of performing and behaving according to the standards set by the College of Nursing. Mere satisfactory academic performance does not in and of itself constitute the basis for progression through the nursing major.

In keeping with the standards of the profession, the College of Nursing expects nursing students to demonstrate ethical behavior. Expected behaviors include, but are not limited to, abiding by guidelines for academic integrity; respecting the privacy rights of patients, students, and faculty members; placing priority on the health, safety, and welfare of patients; and avoiding prejudicial or discriminatory behavior in relationships with patients, students, and faculty members.

Some examples of misconduct are sharing confidential information, fabrication or falsification of information in the classroom or clinical area, any form of cheating, including plagiarism, and aiding or facilitating dishonesty or unethical behavior in others. Breaches in professional standards will result in disciplinary action, including the possibility of removal from the nursing curriculum. Students are responsible for reviewing the following publications which are available on each College of Nursing campus:

- Student Conduct & Instructional Guidelines & Grievances Procedures (MSU-Bozeman).
- The Essentials of Baccalaureate Education for Professional Nursing Practice (AACN, 2008).
- Code of Ethics for Nurses (ANA, 2015).

When a student fails to meet reasonable standards of performance or behavior or when a faculty member deems reasonable supervision is inadequate to ensure patient safety, the faculty member has the authority to remove a student from the clinical setting (see College of Nursing Policy C-6).

The criteria considered in denying the student access to patients are: demonstrated emotional instability, indifference or insensitivity to patient safety and comfort, lack of professional judgment, disregard for professional ethics and standards, any health condition which makes it impossible for the student to carry out her/his work without jeopardizing patient safety and comfort, or any other condition or circumstance which constitutes an unreasonable risk to the safety and well-being of the patient. A nursing student may be referred to appropriate resources for assistance with problems which are non-academic in nature but which might impair the student’s effectiveness as a professional nurse.
Denial of student access to a clinical agency will result in the student being dismissed from the nursing program. The student shall be fully informed of the decision and its consequences and shall be afforded the right to appeal to the College of Nursing Scholastic Committee (see Policy A-8).

**Unique Requirements of the Nursing Programs**

**Annual Compliance with Immunizations, CPR, Urine Drug Screen, Background Check, HIPAA/OSHA**

The College of Nursing utilizes CastleBranch®, an accredited member of the National Association of Professional Background Screeners (NAPBS) for compliance tracking.

- Information for utilizing CastleBranch®, for the following requirements will be supplied in the program application:
  - Background Check
  - Urine Drug Screen
  - Immunizations
  - CPR (we accept ONLY American Heart Association BLS for HealthCare Providers)
  - Health Insurance
  - HIPAA and OSHA training

- Details for completing this compliance tracking can be found within the application.

- Fees and schedules for this mandatory requirement are posted on the application web pages for each BSN track: ABSN (http://www.montana.edu/nursing/undergraduate/acceleratedbsnapp.html) and BSN (http://www.montana.edu/nursing/undergraduate/placement.html)

- All applicants to the MSU College of Nursing Program must submit documentation of compliance with immunizations, CPR, Urine Drug Screen, Background Check and HIPAA/OSHA training.

- Thereafter, students with placement will submit evidence of compliance annually.

**Transportation**

Access to an automobile is necessary, particularly for clinical work in the community, including home visits, as well as in rural areas. Public transportation is not adequate in the cities with upper division campuses. Students are responsible for providing their own transportation.

**Varied Schedules**

Students are expected to participate in clinical experiences in a variety of community and rural agencies and at variously scheduled times. Therefore, students must make arrangements to accommodate an irregular academic schedule that may include evening and weekend hours.

**Expenses**

Nursing students have additional expenses beyond those normally required in other curricula. They include but are not limited to, uniforms, immunizations, background checks, drug screening and current professional healthcare provider CPR certification (including infants, children, and adults) before beginning clinical coursework. Special purchases include, but are not limited to, stethoscope and other clinical equipment.

There is a **nursing program fee each semester** which covers such costs as specialized equipment, and distance delivery support when enrolled in clinical nursing courses. The **undergraduate nursing program fee is $420.00/semester.**

**Abilities and Skills**

College of Nursing (http://www.montana.edu/nursing/facstaff/policies.html) **Policy** (http://www.montana.edu/nursing/facstaff/policies.html) **A-19** ("Abilities Required for Success in the BSN degree Program") requires that students read the policy and complete a form indicating their agreement that they have the ability to perform certain skills and tasks to successfully complete the BSN degree program.

**Final Exams**

According to University policy, the examination period is instructional time, and it is expected that some instructional use is made of this period if a final examination is not given.

College of Nursing Final exams will be given in the last instructional week of the semester on Monday, Tuesday, and Wednesday.

1. By the fourth week of class, the CON shall distribute a final exam schedule to students; this will be posted on the **Exams and Finals Schedules site** (http://www.montana.edu/registrat/Schedules.html). The campus directors are responsible for distributing this schedule to the Associate Dean for Undergraduate students.

2. CON faculty are responsible for coordinating the Final exam schedule to avoid conflict in the timing of finals.

3. In the event of a conflict between scheduled examinations, the priority of scheduled versus make-up examination will be given to any course the student is enrolled in, which is not part of the CON curriculum. As an example, in the case of a student, who is pursuing a Hispanic Studies Minor and has a final Spanish exam which conflicts with a CON scheduled final, the CON faculty will accommodate a make-up exam for the student.

4. Make-up examinations for conflicts are to be given only to those students who, at the same hour:
   a. Have another Common Hour Examination
   b. Have a regularly scheduled class—either in or out of the CON curriculum
   c. Are engaged in an activity or event sanctioned in paragraph 310.01 of the Student Conduct Code. (Official student representatives with a regularly scheduled practice or meeting that conflicts with a Common Hour Exam see point 5 below.)
   d. Sustained a personal emergency that prevented participation in the scheduled examination.

5. Students are responsible for alerting faculty to potential conflicts in the schedule related to any courses they may be taking outside the CON curriculum by the 5th week of class.
   a. In addition, a student who has three or more final examinations in any one day or an exam schedule which exceeds 5 consecutive hours of examination should first contact the instructors of the courses to see if one exam can be rescheduled. If this rescheduling can’t be resolved, then the student should contact the campus director of his or her site at least one week before the beginning of final examination week to assist in resolving the conflict.

6. As per University policy, CON faculty must provide for make-up examinations or other equivalent means of evaluating the student who are absent from the scheduled examination for legitimate reasons.

**Computer Access and Skills**

**Access to and skills in using computer hardware and software**

Because many of the courses in the nursing program are Web-based or Web-enhanced, students must have access to and skills in using a computer and a printer. They must also have a reliable connection to the Internet with a current Internet browser.
Undergraduate Programs
• Nursing (p. 265)

Graduate Programs
• Master of Nursing (MN) (p. 392)
• Doctor of Nursing Practice (DNP) Degree (p. 393)
• Nursing Education certificate (non-degree option) (p. 401)

Nursing

Traditional BSN Program: 

Required Lower Division Pre-Requisite Courses*

The following courses must be completed prior to progression to upper division courses. Students are advised to consult appropriate sections of the MSU bulletin regarding required prerequisites for these courses.

CORE 2.0: Foundation Courses
University Seminar (US)
CLS 101US Knowledge and Community

College Writing (W)
WRIT 101W College Writing I

Quantitative Reasoning (Q)
STAT 216Q Introduction to Statistics

Contemporary Issues in Science (CS)
NUTR 221CS Basic Human Nutrition

CORE 2.0: Ways of Knowing
Social Science Inquiry (IS)
PSYX 100IS Intro to Psychology

SOCI 101IS Introduction to Sociology

Natural Science Inquiry (IN)
HDFS 101IS Indiv and Fam Dev: Lifespan

CHMY 121IN Introduction to General Chemistry

Other Required Courses
BIOH 201 Human Anatomy and Physiology I

BIOH 211 Human Anatomy and Physiology II

CHMY 123 Introduction to Organic Chemistry and Biochemistry

BIOM 250 Microbiology for Health Sciences: Infectious Diseases

The following core courses must be completed prior to graduation:

ARTS (A) Course of student’s choice

DIVERSITY (D) Course of student’s choice

HUMANITIES (H) Course of student’s choice

Note: Courses within the Nursing Curriculum may be offered online. All courses are web-enhanced, using the MSU learning platform.

Lower Division Nursing - the following courses must be completed prior to progression to upper division courses

NRSG 115 Nursing as a Profession

NRSG 220 Fundamentals of Nursing Recitation

NRSG 225 Foundational Nursing Principles of Clinical Nursing

NRSG 238 Health Assessment Across the Lifespan

NRSG 258 Principles of Pathophysiology

Required Upper Division Courses

The University requires that 42 credits be in courses numbered 300 and above. The College of Nursing requires that 55 credits be in courses numbered 300 and above.

Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRSG 336 - Pharmacotherapeutics</td>
<td>3</td>
</tr>
<tr>
<td>NRSG 341 - Psychosocial Nursing Concepts</td>
<td>3</td>
</tr>
<tr>
<td>NRSG 346 - Childbearing Family</td>
<td>5</td>
</tr>
<tr>
<td>NRSG 348 - Nursing Care of Child &amp; Family</td>
<td>5</td>
</tr>
<tr>
<td>NRSG 352 - Acute and Chronic Illness</td>
<td>5</td>
</tr>
<tr>
<td>NRSG 377 - Intro to Community Based Nursing</td>
<td>2</td>
</tr>
<tr>
<td>NRSG 387R - Research in Health Care</td>
<td>3</td>
</tr>
<tr>
<td>Year Total:</td>
<td>26</td>
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</tbody>
</table>

Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRSG 418 - Health Policy/Health Care Clinic</td>
<td>2</td>
</tr>
<tr>
<td>NRSG 437 - Psychiatric Nursing</td>
<td>6</td>
</tr>
<tr>
<td>NRSG 444 - Care Management</td>
<td>3</td>
</tr>
<tr>
<td>NRSG 454 - Urgent and Palliative Care</td>
<td>6</td>
</tr>
<tr>
<td>NRSG 477 - Pop Based Nursing Care in Comm</td>
<td>6</td>
</tr>
<tr>
<td>NRSG 487 - Nursing Leadership/Mgmt Dvlpmnt</td>
<td>6</td>
</tr>
<tr>
<td>Year Total:</td>
<td>29</td>
</tr>
</tbody>
</table>

Total Program Credits: 55

* NOTE: Required nursing curriculum courses must be completed with a grade of C or better and no more than one repeat of a course is permitted regardless of when or where taken. The College of Nursing does not accept C- as a passing grade in required courses. Courses may be offered in a web-enhanced or completely online mode of delivery.

Elective credits as required to meet the minimum of 120 required credits for graduation.

Accelerated BSN Program:

Required Lower Division Pre-Requisite Courses

The following courses must be completed prior to admission into the ABSN program. Students are advised to consult appropriate sections of the MSU bulletin regarding required prerequisites for these courses. The Accelerated BSN program students are required to have completed the same pre-requisite courses as the traditional students with the exception of WRIT 101, CLS 101, and the art, humanities, and diversity Core 2.0 requirements.

Once admitted to the ABSN option, students complete the same required lower division and upper division course work (see above) toward the BSN degree in approximately 15 months, as opposed to 29 months in the traditional program.

All required prerequisite courses must be completed with a grade of C or better (C- grades are not acceptable) and no more than 2 of the required prerequisite courses may be repeated 1 time. Those courses are:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOH 201</td>
<td>Human Anatomy and Physiology I</td>
<td>5</td>
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<tr>
<td>BIOH 211</td>
<td>Human Anatomy and Physiology II</td>
<td>4</td>
</tr>
<tr>
<td>BIOM 250</td>
<td>Microbiology for Health Sciences: Infectious Diseases</td>
<td>3</td>
</tr>
<tr>
<td>CHMY 121N</td>
<td>Introduction to General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHMY 123</td>
<td>Introduction to Organic Chemistry and Biochemistry</td>
<td>4</td>
</tr>
</tbody>
</table>
NUTR 221CS  Basic Human Nutrition  3
HDFS 101IS  Indiv and Fam Dev: Lifespan  3
PSYX 100IS  Intro to Psychology  4
SOCI 101IS  Introduction to Sociology  3
STAT 216Q  Introduction to Statistics  3

Gallatin College

Bob Hietala, Dean
Sarah Maki, Associate Dean

Programs Available

- Associate of Arts (p. 266)
- Associate of Science (p. 267)
- AAS in Aviation (p. 267)
- AAS in Culinary Arts (p. 269)
- AAS in Design Drafting Technology (p. 270)
- AAS in Interior Design (p. 271)
- AAS in Photonics and Laser Technology (p. 273)
- CAS in Bookkeeping (p. 268)
- CAS in CNC Machine Technology (p. 269)
- CAS in Health Information Coding (p. 271)
- CAS in Medical Assistant (p. 272)
- CAS in Network Technology (p. 272)
- CAS in Welding Technology (p. 274)
- CAS in Computer Network Technology (http://catalog.montana.edu/undergraduate/gallatin-college/general-education/network-technology)
- Professional Certificate in Business Management (p. 269)

Overview

Gallatin College MSU is Southwest Montana’s two-year college, offering associate degrees and one-year certificates. Gallatin College complements the four-year programs at Montana State University and ensures access to workforce development, general education for transfer, and developmental education. Gallatin College collaborates extensively with the local community to develop new programs and provide responsive options. Gallatin College strongly supports open access, affordability and responsiveness to local needs.

Mission

Gallatin College seeks to provide a comprehensive, accessible, responsive, student-centered learning environment that facilitates and supports the achievement of individuals’ professional and personal goals, and enhances the development of Montana’s citizens, communities and economy.

Developmental Education

The Developmental Education program offers individual courses that prepare students for college-level work in math, writing, and college studies. High quality instruction, small class sizes, and out-of-class support are hallmarks of the Developmental Education program.

Courses taught include:

- COLS 100  Effective Academic Practices  3
- COLS 101US  First Year Seminar  3
- COLS 103  College Learning Strategies  1
- WRIT 080  Building Basic Writing Skills  4
- WRIT 095  Developmental Writing  4
- WRIT 091  Sp: College Writing Co-Req  2
- M 065  Pre-Algebra  4
- M 066  Pre-Algebra Lab and Study  1
- M 085  Prealgebra  4
- M 088  Mathematical Literacy  4
- M 096  Survey of Algebra  4
- M 097  Survey of Algebra (Mastery Learning)  4
- M 091  Special Topics  1-4

General Education

Overview

Gallatin College MSU is Southwest Montana’s two-year college, offering associate degrees and one-year certificates. Gallatin College complements the four-year programs at Montana State University and ensures access to workforce development, general education for transfer, and developmental education. Gallatin College collaborates extensively with the local community to develop new programs and provide responsive options. Gallatin College strongly supports open access, affordability and responsiveness to local needs.

Mission

Gallatin College seeks to provide a comprehensive, accessible, responsive, student-centered learning environment that facilitates and supports the achievement of individuals’ professional and personal goals, and enhances the development of Montana’s citizens, communities and economy.

Associate of Arts Degree

The Associate of Arts (A.A.) degree provides a foundation of general education studies with a concentration of coursework in the arts, humanities, and social sciences. This degree program is designed for students who are undecided about their educational goals, prefer smaller class sizes, need academic skills improvement, or desire a more gradual entrance into the university.

Students may earn this degree as preparation to transfer to a Bachelor degree program at Montana State University or another university. Each student will follow a specific curriculum based on the student’s personal, long term, and educational goals as well as entering skills in math and writing.

To receive the A.A. degree, students must complete at least 60 credits including the following requirements:

- General Education Core requirements (30 credit hours)
  - University Seminar (US)
  - Writing (W)
  - Cultural Diversity (D)
  - Quantitative Reasoning (Q)
  - Contemporary Issues in Science (CS)
  - Natural Science (IN or RN)
  - Arts (IA or RA)
  - Humanities (IH or RH)
  - Social Science (IS or RS)
  - Research or Creative Experience
- Coursework in the Arts, Humanities, or Social Sciences beyond the Core (9 credit hours)
- General Education Electives (21 credit hours)
Gallatin College's relevant coursework, state-of-the-art classrooms, and their career opportunities, or who are interested in a career change. With meet the needs of students who want to improve their skills and advance Gallatin College one- and two-year Workforce Programs are designed to Workforce Programs A grade of C- or better is required for all courses counted toward the degree. Graduates with an Associate of Arts degree are prepared to: • Demonstrate the Montana State University Core 2.0 outcomes. • Think critically about concepts and applications from multiple disciplines. • Transfer and apply knowledge and skills learned into a Bachelor degree program. A grade of C- or better is required for all courses counted toward the degree. Associate of Science Degree Students may earn the A.S. degree as preparation to transfer to a Bachelor degree program at Montana State University or another university. The degree is suited for students who wish to pursue studies or a career in the sciences, mathematics, medical, or technology fields. Each student will follow a specific curriculum based on the student’s personal, long term, and educational goals, as well as entering skills in math and writing. To receive the A.S. degree students must complete at least 60 credits including the following requirements: • General Education Core requirements (30 credit hours) • University Seminar (US) • Writing (W) • Cultural Diversity (D) • Quantitative Reasoning (Q) • Contemporary Issues in Science (CS) • Natural Science (IN or RN) • Arts (IA or RA) • Humanities (IH or RH) • Social Science (IS or RS) • Research or Creative Experience • Coursework in Mathematics and Natural Sciences beyond the Core (9 credit hours) • General Education Electives (21 credit hours) Only certain Core courses are offered each semester. Please check the Gallatin College Class Schedule for current offerings. Graduates with an A.S. degree are prepared to: • Demonstrate the Montana State University Core 2.0 outcomes. • Think critically in evaluating information, solving problems, and making decisions. • Consider the application of the natural and physical sciences and mathematics in the context of today’s world. • Transfer and apply knowledge and skills into Bachelor degree programs. A grade of C- or better is required for all courses counted toward the degree. Workforce Programs Gallatin College one- and two-year Workforce Programs are designed to meet the needs of students who want to improve their skills and advance their career opportunities, or who are interested in a career change. With Gallatin College’s relevant coursework, state-of-the-art classrooms, and responsiveness to local business and industry needs, our graduates are highly prepared for careers in a variety of industries. Undergraduate Programs • Aviation (p. 267) • Bookkeeping (p. 268) • Business Management (p. 269) • CNC Machine Technology (p. 269) • Network Technology (p. 272) • Culinary Arts (p. 269) • Design Drafting Technology (p. 270) • Health Information Coding (p. 271) • Interior Design (p. 271) • Medical Assistant (p. 272) • Photonics & Laser Technology (p. 273) • Welding Technology (p. 274) Aviation Associate of Applied Science Degree Description When you complete the Associate of Applied Science in Aviation, you will have all the credentials required to pursue a career as a professional pilot. The program offers in-depth training in all stages of pilot certification: Private Pilot, Instrument Rating, and Commercial Pilot. The program also offers classroom training in Aircraft Systems, Advanced Navigation Systems, Aviation Safety, Flight Instructor/ Aircraft Theory, and Aviation Regulations and Professional Conduct. Job Opportunities Job opportunities range from occupations as a pilot for a national or regional carrier to less well-known, but in-demand, work as a pilot for cargo services, air taxis, media aircraft, corporate jets, and as certified flight instructors. In Montana, employment for pilots is projected to grow faster than most occupations through 2018. An AAS in Aviation with a bachelor’s degree in a related field will make you especially competitive in the entry-level job market. Graduates are Prepared to • Apply knowledge in aviation to adapt to emerging aviation trends. • Conduct themselves professionally and ethically. • Understand and analyze the role of aviation safety and human factors to the aviation industry. • Describe meteorology as it relates to aviation. • Independently fly and safely operate airplanes for which they are rated. • Demonstrate an understanding and the appropriate application of aeronautical principles, design characteristics, and operational limitations, for a variety of aircraft as it relates to the student’s career goals. • Communicate effectively using both written and verbal skills. • Demonstrate proficiency in math computation for aviation and modern society. • Demonstrate effective skills in the use of computers and aviation related technology. FAA medical certificates are issued by FAA designated Aviation Medical Examiners (AMEs), and are required by all pilots who operate aircraft. The names, addresses and phone numbers of AMEs in your area may be found at the FAA website (http://www.faa.gov/pilots/amelocator/) or you may contact the Gallatin College Director of Aviation for more information. A
Many students need preliminary math and writing courses before enrolling in the program requirements. These courses may increase the total number of program credits. Students should review their math and English placement before planning out their full program schedules.

**Aviation Track 1**

**Year 1**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVFT 121 - Aviation Fundamentals</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 122 - Private Pilot - Flight (42 Hours)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 130 - Meteorology for Aviation</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMX 115 - Introduction to Interpersonal Communication</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 105Q - Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts) (*or any Quantitative (Q) core math course)</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>AVFT 141 - Advanced Navigation Systems</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 142 - Instrument Flight (40 hours)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 143 - Instrument Ground</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 150 - Aviation Operations</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 263 - Aviation Regulations and Professional Conduct</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Total: 16 14

**Year 2**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVFT 171 - Aircraft Systems for Pilots</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 245 - Commercial Ground</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 252 - Commercial Flight 1 (60 Hours)</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMX 222 - Professional Communication</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 253 - Commercial Flight 2</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>AVFT 260 - Aviation Safety</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 261 - Flight Instructor Theory</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVFT 262 - Advanced Aircraft Theory</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Science or Contemporary Issues in Science with Lab</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Year Total: 14 16

Total Program Credits: 60 or more

* Indicates prerequisites needed.

** Placement in course(s) is determined by placement assessment.

*** Flight times are program averages.

A grade of “C-” or above is required for all courses for graduation.

**Aviation Track 2**

**Compliance and Liaison Advisory 223-15-01**

According to the VA Education Service Compliance and Liaison Staff (September 1, 2015), Institutions of Higher Learning (IHLs) “must provide the specific number of training hours required for the completion of any course involving such training, as well as the specific mandatory fees associated with any such course (to include a specific cost-per-hour rate), if the course is taken as part of a standard degree program.” Please see the Gallatin College Aviation program “Estimated Flight Training Costs (http://gallatin.montana.edu/programs/aviation.html)” for these details.

**Bookkeeping**

**Certificate of Applied Science Degree**

**Description**

The Bookkeeping program will prepare students for entry level accounting-related positions that are used by a variety of businesses. The Bookkeeping program is designed to provide students with the knowledge and skills necessary for employment in an accounting profession. Using the language of business, bookkeepers assemble and analyze, process, and communicate essential information about financial operations. Upon completion of the Bookkeeping degree, students will be prepared to work in public, private, or governmental agencies as accounting clerks, accounting technicians, bookkeepers, accounting support personnel, or payroll assistants.
Graduates with the professional certificate in Business Management will:

- cover the many important aspects of growing and leading a business.
- support current and future business owners and leaders.

The Professional Certificate in Business Management is a 25 credit program designed to be completed within two semesters. This CAS will prepare students to apply technical knowledge and skills to operate computer numerically controlled (CNC) machines such as lathes, mills, precision measuring tools, and related attachments and accessories, to perform machining functions such as cutting, drilling, shaping, and finishing products and component parts. This CAS includes instruction in CNC terminology, setup, programming, operations, troubleshooting, blueprint reading, machining, lathe and mill operations, technical mathematics, computer literacy, CAD/CAM systems, shop and safety practices, equipment capabilities, and regulations and laws.

A grade of C- or better is required for all courses for graduation.

This program begins in the FALL SEMESTER ONLY and enrollment in this program is LIMITED. Please contact Gallatin College for more information on start dates and enrollment availability.

**Business Management**

The Professional Certificate in Business Management is a 25 credit program that supports current and future business owners and leaders. This certificate covers the many important aspects of growing and leading a successful small business.

Graduates with the professional certificate in Business Management will:

- Develop a working knowledge of business fundamentals such as management principles, marketing, product/service development, sales, and basic accounting;
- Understand and be capable of building a business infrastructure for business operations, processes and financial decision making;
- Explore the risk and success factors in the marketplace;
- Understand how to access human, financial, and business resources;
- Identify and know how to meet market needs; and
- Create an environment that encourages interaction with other entrepreneurs and professionals.

**CNC Machine Technology**

**Certificate of Applied Science**

The CNC Machine Technology Certificate of Applied Science program is a 34 credit program designed to be completed in two semesters. This CAS will prepare students to apply technical knowledge and skills to operate computer numerically controlled (CNC) machines such as lathes, mills, precision measuring tools, and related attachments and accessories, to perform machining functions such as cutting, drilling, shaping, and finishing products and component parts. This CAS includes instruction in CNC terminology, setup, programming, operations, troubleshooting, blueprint reading, machining, lathe and mill operations, technical mathematics, computer literacy, CAD/CAM systems, shop and safety practices, equipment capabilities, and regulations and laws.

A grade of C- or better is required for all courses for graduation.

This program begins in the FALL SEMESTER ONLY and enrollment in this program is LIMITED. Please contact Gallatin College for more information on start dates and enrollment availability.

**Culinary Arts**

**Description**

Gallatin College’s Culinary Arts teaches students relevant coursework and offers experiential education in the Culinary Arts profession. This program prepares students for a variety of careers spanning from small restaurants to large food service facilities. Gallatin College’s Culinary Arts Associate of Applied Science (AAS) degree is a 65-credit offering. The coursework is well aligned with Montana’s food culture and strong tourism industry. This degree will lead to a variety of culinary and food service positions in our local food services industry.

Graduates are prepared to:

- Develop a passion for cooking, serving others, and genuine hospitality.
- Demonstrate the skills needed as a cook, Chef de Partie, Sous Chef, Executive Chef, or Pastry Chef.
- Take an entrepreneurial path to owning an independent restaurant, bake shop, food truck, or catering business.
- Join the American Culinary Federation as a Certified Culinary Arts professional.
• Transfer into Montana State University’s Hospitality Management Bachelor’s degree program.
• Work within the food service industry anywhere in the world in restaurants, hotels, lodges, breweries, food trucks, country clubs, cruise ships, institutions, assisted living facilities, catering companies, or in food manufacturing.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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</thead>
<tbody>
<tr>
<td>CULA 102 - Introduction to Culinary Arts</td>
<td>3</td>
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<tr>
<td>CULA 105 - Food Safety Sanitation</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 108 - Business Mathematics</td>
<td>3</td>
<td></td>
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<tr>
<td>or ACTG 101 - Accounting Procedures I</td>
<td></td>
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<tr>
<td>CULA 103 - Professional Chef I</td>
<td>3</td>
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<tr>
<td>COMX 115 - Introduction to Interpersonal Communication or WRIT 101W - College Writing I</td>
<td>3</td>
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<tr>
<td>NUTR 221CS - Basic Human Nutrition</td>
<td>3</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>CULA 161 - Meats and Vegetables</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>CULA 104 - Professional Chef II</td>
<td>4</td>
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<tr>
<td>CULA 157 - Pantry and Garde Manager</td>
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<tr>
<td>CULA 298 - Internship</td>
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<table>
<thead>
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<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUTR 226 - Food Fundamentals</td>
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<tr>
<td>CULA 2XX -</td>
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<td>CULA 2XX -</td>
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<tr>
<td>CULA 165 -</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>CULA 2XX -</td>
<td></td>
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<tr>
<td>CULA 248 -</td>
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<tr>
<td>SFBS 2XX -</td>
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<tr>
<td>CULA 250 - Hospitality Supervision and Customer Service</td>
<td>3</td>
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<tr>
<td>Year Total:</td>
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<td>6</td>
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<tr>
<td>Total Program Credits:</td>
<td></td>
<td></td>
<td></td>
<td>37</td>
</tr>
</tbody>
</table>

**Design Drafting**

**Associate of Applied Science Degree**

**Description**

In the Design Drafting Technology program, students acquire the skills necessary for entry-level drafting jobs in the design/drafting industry using computer-based systems to produce technical illustrations used in manufacturing, production, and construction. Sometimes called a CAD (Computer Aided Drafting) technician, students will create design concepts that are workable in the real world. Using the CAD software, students perform calculations, develop simulations, and manipulate and modify the displayed material. Although most drafters work at computer terminals much of the time, students will also learn traditional drafting which entails creating manual drawings at drafting tables.

**Graduates are prepared to**

- Create construction documents and shop drawings for architects, engineers and manufacturers.
- Visualize and measure 3D objects and buildings and recreate them in computer-aided design software (CAD).
- Render objects and buildings for presentation in programs including Adobe Photoshop, AutoCAD Architecture, SolidWorks, Revit, 3DS Max, and SketchUp.
- Create a complete set of residential plans using CAD software.
- Draw a site plan including topography using CAD software.
- Estimate construction material quantities and building costs.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMX 115 - Introduction to Interpersonal Communication</td>
<td>3</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CSTN 148 - Blueprints, Codes, and Estimating</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>CSTN 173 - Arch Construct and Material</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDSN 113 - Technical Drafting</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDSN 131 - Introduction to Drafting and Design</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 111 - Technical Mathematics</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMX 222 - Professional Communication</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDSN 135 - SolidWorks I</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDSN 166 - Revit I</td>
<td>3</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>DDSN 186 - Intermediate Drafting &amp; Design</td>
<td>3</td>
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<tr>
<td>MFTG 205 - Manufacturing Process</td>
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<td>Year Total:</td>
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<table>
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<th>Year 2</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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</thead>
<tbody>
<tr>
<td>DDSN 215 - Mechanical Detailing</td>
<td>3</td>
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<tr>
<td>or DDSN 265 - Architectural Drafting</td>
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</tr>
<tr>
<td>DDSN 235 - SolidWorks II</td>
<td>3</td>
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<tr>
<td>or DDSN 266 - Revit II</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>DDSN 236 - How and Why Machines Work or CSTN 248 - Plans Examining II - IBC - Commercial Codes, Blueprint Reading, and Estimating</td>
<td>3</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>IDSN 255 - Environmental Design Studio</td>
<td>4</td>
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</tr>
<tr>
<td>DDSN 275 - Computer Rendering</td>
<td>3</td>
<td></td>
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<tr>
<td>DDSN 280 - Small Business Planning &amp; Development</td>
<td>3</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>DDSN 298 - Internship</td>
<td>4</td>
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<tr>
<td>DDSN 299 - Capstone</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>ITS 280 - Computer Repair Maintenance</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take 1 of the following:</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDSN 245 - Civil Drafting</td>
<td>1</td>
<td></td>
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<tr>
<td>DDSN 276 - Presentation &amp; Animation</td>
<td>1</td>
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<tr>
<td>DDSN 277 - Statics &amp; Strength of Materials for Drafting</td>
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<td>16</td>
<td>17</td>
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<td>Year Total:</td>
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<td>60 or more</td>
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<tr>
<td>Total Program Credits:</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

1 Indicates prerequisites required
2 Placement in course(s) is determined by placement assessment
3 Requires Program Director approval for enrollment

Many students need preliminary math and writing courses before enrolling in the program requirements. These courses may increase the total number of program credits. Students should review their math and English placement before planning out their full program schedules.

A grade of “C-” or above is required for graduation in each course.
Students wishing to apply comparative course work for Degree and/or Prerequisite credit must have received a B or better in that course work and receive Program Director approval.

Math requirement options—Can be fulfilled by taking the following courses:

- M 108 Business Mathematics (Incorporated into DDSN 280) 3
- M 111 Technical Mathematics 3

Comparative AP Credit may also be used if approved by MSU and the Program Director.

Health Information Coding

Certificate of Applied Science Degree

The Certificate of Applied Science (CAS) in Health Information Coding provides students the ability to code and work in a variety of health care settings: hospitals, clinics, home health agencies, long-term care, insurance companies, consulting firms and software vendors. Graduates are likely to work on the administrative team of a health facility. This program closely follows the standards set forth by the American Health Information Management Associations (AHIMA) certification program. Upon completion of the required 35 hours of coursework, students take the certifying examination offered through the AHIMA. This industry specific certification demonstrates to the employer that this student has a particular aptitude in coding.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHMS 144</td>
<td>Medical Terminology</td>
</tr>
<tr>
<td>AH 140</td>
<td>Pharmacology</td>
</tr>
<tr>
<td>BIOH 112</td>
<td>Human Form &amp; Function I</td>
</tr>
<tr>
<td>AHMS 160</td>
<td>Beginning Procedural Coding</td>
</tr>
<tr>
<td>AHMS 162</td>
<td>Beginning Diagnostic Coding</td>
</tr>
<tr>
<td>BIOH 113</td>
<td>Human Form and Function II</td>
</tr>
<tr>
<td>AHMS 156</td>
<td>Medical Billing Fundamentals'</td>
</tr>
<tr>
<td>AHMS 158</td>
<td>Legal and Regulatory Aspects of Healthcare</td>
</tr>
<tr>
<td>AHMS 250</td>
<td>Advanced Medical Coding'</td>
</tr>
<tr>
<td>AHMS 298</td>
<td>Professional Practice Experience - Coding</td>
</tr>
<tr>
<td>COMX 222</td>
<td>Professional Communication</td>
</tr>
</tbody>
</table>

Total Program Credits: 32

* Indicates prerequisites needed

A grade of "C-" or above is required for all courses for graduation.

Interior Design

Associate of Applied Science Degree

The Interior Design program has been developed to prepare students with a wide variety of skills and competencies for entry into various areas of the design field, ranging from residential to commercial design. Gallatin College maintains a high level of expertise in our faculty drawing from those in the industry to provide current, relevant education for our students. After graduating and working in the field for over three years, students may be eligible to sit for the NCIDQ Exam, a national exam designed to demonstrate competency on a national level. Graduates of the Interior Design program find careers in all facets of design.

Description

The Interior Design program provides students with an avenue to join an elite industry with a large impact. Interior designers affect the function and efficiency of projects ranging from major industry to small residences. Trained interior designers are in demand in many fields as they provide for spaces that impact the look, feel and functionality of the built environments in which we live, work and play.

Manual and computer drafting, space planning and sketching along with a knowledge in construction and materials are some of the tools students use to bring their ideas to life. Students take classes that help them analyze spaces for appropriate use and function. Interior design students learn how their contribution as designers can address a wide range of social, economic and environmental issues facing our nation.

Job opportunities

Interior designers work in a variety of fields both residential and commercial. Gallatin College prepares students to enter the industry in a range of jobs, including residential design, kitchen and bath design, architectural design and various construction trade positions. Students may choose to work in the wholesale design industry with contractors and vendors, or with end users in the retail design market helping clients make appropriate selections. Some students may choose the commercial design field working on everything from restaurants to retail stores, schools to offices.

Graduates are Prepared to:

- Understand the theory and history of design and apply design principles and elements to their projects.
- Communicate in the language of interior design using listening, verbal, and written skills to interact with clients.
- Communicate graphically according to current architectural standards using both hand-drafting and AutoCAD techniques.
- Demonstrate research abilities and critical thinking in space planning, selection of finish materials, and application of codes for residential and commercial projects.
- Increase their body of knowledge in a wide variety of areas including construction and finish materials, color and lighting technologies, residential and commercial codes, sustainability, and professional practice.
- Employ creative skills to create client presentations using hand- and AutoCAD drafting, rendering, and professional sample boards and finish schedules.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
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<tbody>
<tr>
<td>IDSN 101</td>
<td>Intro to Interior Design***</td>
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<tr>
<td>or ARCH 121HA</td>
<td>Introduction to Design</td>
</tr>
<tr>
<td>IDSN 130</td>
<td>Interior Design Graphics***</td>
</tr>
<tr>
<td>or ARCH 151RA</td>
<td>Design Fundamentals I</td>
</tr>
<tr>
<td>DDSN 131</td>
<td>Introduction to Drafting and Design</td>
</tr>
<tr>
<td>WRIT 101W</td>
<td>College Writing I**</td>
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</tbody>
</table>

Year 1

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>Spring</td>
</tr>
<tr>
<td>Summer</td>
</tr>
</tbody>
</table>
Medical Assistant

Description
Students completing the Certificate of Applied Science-Medical Assistant will acquire the skills necessary for entry-level jobs in medical settings. Graduates are prepared to work in ambulatory medical settings such as physicians’ offices, clinics, and surgical centers; they function as members of the health care delivery team and perform administrative duties and basic clinical procedures. A grade of "C-" or above is required for all courses for graduation.

Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tbody>
<tr>
<td>AH 140</td>
<td>Pharmacology</td>
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<tr>
<td>AHMS 144</td>
<td>Medical Terminology</td>
<td>3</td>
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<tr>
<td>BIOH 112</td>
<td>Human Form &amp; Function I</td>
<td>3</td>
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<tr>
<td>AHMA 201</td>
<td>MA Clinical Procedures I</td>
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<tr>
<td>COMX 106</td>
<td>Communicating in a Dynamic Workplace</td>
<td>3</td>
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<tr>
<td>AHMA 203</td>
<td>MA Clinical Procedures II</td>
<td>4</td>
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<tr>
<td>AHMA 280</td>
<td>Med Assisting Exam Prep*</td>
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<tr>
<td>AHMS 100</td>
<td>Math Applications Health</td>
<td>3</td>
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<tr>
<td>AHMS 158</td>
<td>Legal and Regulatory Aspects of Healthcare</td>
<td>2</td>
<td></td>
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<tr>
<td>AHMS 220</td>
<td>Medical Office Procedures</td>
<td>3</td>
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<tr>
<td>BIOH 113</td>
<td>Human Form and Function II</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>AHMA 298</td>
<td>Medical Assisting Externship</td>
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<td>Total Program Credits:</td>
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<td>35</td>
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</tr>
</tbody>
</table>

* Indicates prerequisites needed.

This program begins in the FALL SEMESTER ONLY and enrollment in this program is LIMITED. Please contact Gallatin College for more information on start dates and enrollment availability.
test, the CompTIA Network + certification, the Cisco Certified Entry Networking Technician, and/or the Microsoft Technology Associate.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>ITS 164 - Networking Fundamentals (First 8 weeks)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ITS 280 - Computer Repair Maintenance (First 8 weeks)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>ITS 218 - Network Security (Second 8 weeks)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ITS 163 - Windows and Configuration (Second 8 weeks)</td>
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<tr>
<td>M 111 - Technical Mathematics</td>
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<tr>
<td>ITS 110 - Introduction to Networking and Cabling (First 8 weeks)</td>
<td>3</td>
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<tr>
<td>ITS 142 - CCNA 2: Discovery (First 8 weeks only)</td>
<td>4</td>
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</tr>
<tr>
<td>ITS 170 - Microsoft Windows Server (Second 8 weeks only)</td>
<td>4</td>
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</tr>
<tr>
<td>ITS 224 - Introduction to Linux (Second 8 weeks only)</td>
<td>4</td>
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</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
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<tr>
<td>Year Total:</td>
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<tr>
<td>Total Program Credits:</td>
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</tbody>
</table>

### Photonics and Laser Technology

#### Associate of Applied Science Degree

Students completing the AAS in Photonics and Laser Technology will learn the scientific principles of optics, fiber-optics, and lasers. Technicians will be instructed on the processes and equipment incorporating these devices in electronic and electro-optics systems. This training will prepare students to become technicians who work on products or devices in manufacturing, communications, defense, homeland security, medical, information technology, energy, environmental monitoring, lighting, displays, and entertainment. This Associate of Applied Science in Photonics and Laser Technology (AAS PLT) will prepare students for entry level employment as a photonics or photonics-related technician.

This curriculum will first present a foundation of electronics curriculum core, which is critical to the success of the student in the photonics/laser technology portion of the program and in general in the photonics/electro-optic industry. A large portion of the electronics curriculum is hands on and students will spend a portion of their first year in an electronics lab. Photonics and optics will be introduced in the 2nd semester of course work. Along with gaining a strong electronics background, students will spend more than 40 percent of their time in the lab training on a variety of industrial lasers and optical systems to prepare the student for easy transition into the photonics work force.

**Graduates are prepared to:**

- Work as a technician in the optics, laser, and photonics support field. Students will have demonstrated knowledge in laser systems, electronics, optics and electro-optics. In particular, graduates will be prepared for a variety of careers in design and manufacturing, materials processing, communications, medical applications, semiconductor fabrication, optical systems, electronics, military applications, sales, and education.
- Demonstrate a foundation in electronics that includes electronic components and circuitry knowledge base.
- Function in a professional manner in their field, and use, maintain and clean equipment and tools required in the field of optics, lasers, and photonics.

- Analyze, configure, test, measure, troubleshoot and assist with problems that arise in a professional optics, lasers, and photonics environment.
- Communicate technical ideas, procedures, and results with professionals in written, oral or graphic format.

Graduates will have knowledge of the following optics intensive components:

- Nature of light
- Optical Components
- Physics of Lasers and Laser Operation
- Materials Processing Systems
- Applied Mathematics
- Geometric optics
- Optical Devices and Principles of Operation
- Fibers and Fiber Optics
- Optical and Electro Optical Systems for Precision Measurements and Alignments
- Applied Physics
- Wave optics
- Optical Support and Positioning Equipment
- Optics of Imaging and Display
- Holography
- Applied Biology and Chemistry

Above program learning outcomes are derived with permission from OP-TEC’s National Photonics Skill Standards for Technicians document.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>M 121Q - College Algebra (or M 111, M151Q or M 171Q)</td>
<td>3</td>
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<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
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<tr>
<td>COMX 222 - Professional Communication</td>
<td>3</td>
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</tr>
<tr>
<td>PHSX 103IN - The Physics of How Things Work</td>
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</tr>
<tr>
<td>ETEC 101 - ETEC 101: AC/DC Electronics with Lab</td>
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<tr>
<td>M 151Q - Precalculus (or M 121Q or M 171Q)</td>
<td>3</td>
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<tr>
<td>DDSN 135 - SolidWorks I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ETEC 106 - AC Circuit Analysis</td>
<td>3</td>
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<tr>
<td>ETEC 113 - Circuits Lab</td>
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<tr>
<td>PLTT 101 - Fundamentals of Light and Lasers</td>
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<tr>
<td>Year 2</td>
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</tr>
<tr>
<td>Total Program Credits:</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>
Welding Technology

Certificate of Applied Science Degree

Students in the Welding Technology Certificate Program will gain the knowledge and the skills to make satisfactory welds in all positions using the following techniques: shielded metal arc welding, gas metal arc welding, gas tungsten arc welding, and flux cored arc welding. Students will also learn how to maintain tools and equipment and they will learn how to read and interpret blueprints. Upon completion of this program, students are eligible to apply to be listed in the AWS National Registry of Welders.

Job Opportunities

The world is growing and building at a much faster rate than workers can be trained. Welding Technology Certificate Program students’ skills will be in high demand in many different settings from the creative arts in a museum district to oil rigs in the Atlantic Ocean. Other places needing students’ new skills are: fabrication shops, aircraft contractors, boiler maintenance companies, specialty welding shops, as well as ship building and other transportation industries. According to the Montana Department of Labor, the 2007 median hourly wage was $15.86. A welding student’s salary may grow when an employer sees the completed one year training program and the AWS National Registry of Welders listing.

Graduates are Prepared to

- Meet safety requirements.
- Produce welds in all positions that meet industry standards using the following process(es):
  - Flux Cored Arc Welding (FCAW)
  - Gas Metal Arc Welding (GMAW)
  - Gas Tungsten Arc Welding (GTAW)
  - Shielded Metal Arc Welding (SMAW)
- Make cuts that meet industry standards in the following process(s):
  - Acetylene Cutting, Welding
  - Air Carbon Arc Cutting (CAC-C)
  - Plasma Arc Cutting (PAC)
- Understand the use of measuring instruments and their purpose
- Understand power sources and current types
- Interpret welding blueprints and weld symbols
- Use basic welding metallurgy
- Use oral and written communication skills in the workplace, including terminology in the welding industry

Welding Technology

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>WLDG 104</td>
<td>Technical Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>WLDG 110</td>
<td>Welding Theory I</td>
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</tr>
<tr>
<td>WLDG 111</td>
<td>Welding Theory I Practical</td>
<td>3</td>
</tr>
<tr>
<td>WLDG 121</td>
<td>Welding Theory II Practical</td>
<td>3</td>
</tr>
<tr>
<td>WLDG 117</td>
<td>Blueprint Reading and Welding Symbols</td>
<td>2</td>
</tr>
<tr>
<td>WLDG 205</td>
<td>Applied Metallurgy</td>
<td>2</td>
</tr>
<tr>
<td>WLDG 151</td>
<td>Shop Practices</td>
<td>3</td>
</tr>
<tr>
<td>WLDG 120</td>
<td>Welding Theory II</td>
<td>2</td>
</tr>
<tr>
<td>COMX 106</td>
<td>Communicating in a Dynamic Workplace</td>
<td>3</td>
</tr>
<tr>
<td>WLDG 122</td>
<td>Welding Theory III Practical</td>
<td>3</td>
</tr>
<tr>
<td>WLDG 130</td>
<td>Intro to Structural Welding</td>
<td>3</td>
</tr>
<tr>
<td>WLDG 145</td>
<td>Fabrication Basics</td>
<td>3</td>
</tr>
<tr>
<td>WLDG 185</td>
<td>Qualification Test Prep</td>
<td>2</td>
</tr>
</tbody>
</table>

Total Program Credits: 30

* Indicates prerequisites needed.

A grade of “C-” or above is required for all courses for graduation.

This program begins in the FALL SEMESTER ONLY and enrollment in this program is LIMITED. Please contact Gallatin College for more information on start dates and enrollment availability.

Honors College

The Honors College at Montana State University provides opportunities for students to study, conduct research, and exchange ideas in a challenging and supportive academic environment. In addition to learning from outstanding faculty members, Honors students can attend special Honors seminars, take interdisciplinary Honors courses, and engage in independent study and research opportunities.

For details about admission and graduation requirements, contact the Honors College Office in Quad F by calling 406-994-4110, sending an e-mail to honors@montana.edu or by checking www.montana.edu/honors.

An essential component of higher education is preparing students to better understand themselves, others, and the increasingly complex world around them. Undergraduate education in particular has the goal of helping students become, in time, their own best teachers. At Montana State University, the Honors College (http://www.montana.edu/honors) addresses this goal by providing academically motivated students with unique opportunities to undertake interdisciplinary course work and undergraduate research leading to an Honors Baccalaureate Degree. Such studies, in addition to courses within their chosen discipline, provide extraordinary preparation for professional and technical careers, or graduate and advanced studies.

Entering students have the opportunity to undertake innovative studies during their freshman year. “Texts and Critics: Knowledge and Imagination” is a two-semester seminar that address fundamental issues in the humanities, social sciences, natural sciences, and the fine arts through critical reading and analysis of seminal texts which serve as a foundation for advanced studies in major disciplinary fields. Instructed by faculty representing every college at the University, Texts and Critics earns University Seminar and Inquiry-Humanities core credits. In addition, the Honors College annually offers a variety of upper-division interdisciplinary seminars. These seminars employ Socratic methodology through which faculty and students engage in critical discussion of issues spanning a diverse range of academic interests. Such engagement also fosters the development of analytic and critical communication skills. Many of these seminars, typically taught by the most respected and inspirational professors on campus, carry university core credit in each of the major discipline categories.

Special Honors sections of departmental courses in Architecture, Chemistry, Computer Science, Physics, Math, Biology, Sociology, Psychology, Earth Science, Electrical Engineering, and Economics are also offered. Limited enrollment in seminars and classes permits lively discussion and interactive study among faculty and students.

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Special Honors sections of departmental courses in Architecture, Chemistry, Computer Science, Physics, Math, Biology, Sociology, Psychology, Earth Science, Electrical Engineering, and Economics are also offered. Limited enrollment in seminars and classes permits lively discussion and interactive study among faculty and students.

“Great Expeditions” is an Honors course that includes two-weeks of international travel following a semester of study pertinent to the expedition theme. After travel is completed, students present a public symposium highlighting the results of their journey.
“Mentoring Gifted Students,” a service-learning course, enables students to work with gifted and talented students in the public schools.

Additional opportunities for independent study are available through Honors contracts, which are offered primarily at the upper-division level. Contracts prepare students to accept the special challenges and benefits of an Honors thesis. Upper-class students may also qualify to undertake supervised tutorial study.

Honors students have been remarkably successful in earning other scholarships for further study, both in the United States and abroad. Special attention is given to preparation for professional and graduate schools. Extracurricular, outdoor, and social activities are an important feature of the daily life of the College.

Enrollment in Honors College courses is restricted to students officially admitted to Honors. Admission is normally limited to students in the upper ten percent of their high school class and who have high ACT or SAT scores, or to those already enrolled in the University who have demonstrated academic achievement and personal initiative.

To maintain good standing, students must have a cumulative GPA of 3.0 or higher and demonstrate significant and continuing progress toward their specific degree in addition to satisfying the particular standards of Honors course work or research. Graduation with an Honors Baccalaureate Degree requires the accumulation of a specific number of Honors credits as determined by the category of Honors degree the student pursues. All such credits may be acquired through successful completion of Honors courses, a minimum 3.5 cumulative grade-point average, and one-year (or its equivalent) of a second language. To graduate with Highest Distinction, a thesis and a minimum cumulative 3.7 GPA are required. Students are encouraged to discuss their interest with the Dean. For details about admission and graduation requirements, contact the Honors College Office in Quad F by calling 406-994-4110, sending an e-mail to honors@montana.edu or by visiting the Honors website at www.montana.edu/honors.

Undergraduate Programs
• Directed Interdisciplinary Studies (p. 275)

Directed Interdisciplinary Studies
Students may formally apply for admission to the DIS program no earlier than the second semester of their freshman year through the first semester of their junior year, and will be admitted on the strength of their written application, academic record, letters of recommendation and personal interview. Applications will be reviewed by the DIS Oversight Board, which will be comprised of representatives of all the academic colleges at Montana State University.

Applicants for admission to the DIS degree options must provide appropriately detailed answers to the questions listed below. Particular attention should be given to the DIS Project Proposal, and to the DIS Course Plan. If necessary, applicants may attach separate sheets providing documentation which might be useful to the DIS Oversight Board’s deliberations.

Applicants must also include an academic transcript with grades earned (3.5 minimum GPA) and two letters of reference attesting to the motivation of the applicant and their ability to work independently.

All applicants will be invited to discuss their proposals with the DIS Oversight Board during a formal interview, and applicants may resubmit amended proposals if they wish.

1. What are your reasons for wishing to undertake the Directed Interdisciplinary Studies Degree program? Comment briefly on your undergraduate education thus far, and give a brief account of why the DIS degree is particularly appropriate to your intellectual/academic goals.

2. Describe your anticipated and/or career goals after graduation from Montana State University.

3. Describe your anticipated DIS Project. It is understood that in consultation with your Faculty Advisory Committee (FAC), you may amend this initial proposal prior to the beginning of your final year of study as a DIS major.

4. Provide details of your anticipated DIS Course Plan.

A minimum of 120 semester credit hours will be required for graduation. No B.A. or B.S. DIS Degree will be awarded with less than 92 semester credit hours of DIS course work, (30 per academic discipline) nor less than 62 semester credit hours of DIS course work at the Upper Division level. At least 15 credits must be at the 400 level. Students must complete HONR 201 and HONR 202 (Texts and Critics: Knowledge and Imagination) or HONR 301 (Text and Critics for transfer students or students who enter the program late in their academic careers). Of particular use to the students in this curriculum will be existing Honors contracts including HONR 292 or HONR 492 Independent Study; HONR 450 Honors Tutorial; HONR 490R Honors Thesis and HONR 494 Honors Seminars.

The DIS Project must represent no fewer than 8 semester credit hours. Upon successful completion of their thesis defense, students will be required to present their Project in a public forum.

Students will not be eligible for the award of a DIS Degree unless they have also satisfied the Montana State University Core Curriculum requirements. For more detailed information regarding the DIS, please visit http://www.montana.edu/honors/dis.html.

University Programs
• Academic Advising Center (p. 275)
• McNair Scholars Program (p. 276)
• MSU Leadership Fellows Certificate (p. 276)
• National Student Exchange (p. 276)
• Pre-Law Advising (p. 276)
• Pre-Med Intake Major (p. 276)
• Pre-Veterinary Options (p. 276)
• Undergraduate Scholars Program (p. 276)
• University Studies Program (p. 277)
• First-Year Seminar (p. 277)

University Programs offers several important academic programs to students, regardless of major. Undergraduate research and creative activity, thematic research seminars, and major/career exploration are just a few of the many opportunities available. Special programs for academic enrichment include the Undergraduate Scholars Program and Leadership Fellows. University Programs also includes the MSU Advising Center and the National Student Exchange which are housed in University Studies.

Academic Advising Center

Academic Advising
University Studies is the home of the MSU Academic Advising Center (AAC). Advising professionals, who are well-acquainted with the curricula in all of MSU’s colleges, aid students in their exploration of courses, majors, and career objectives. Advisors work with students to match their individual interests and goals with college coursework. The advisors
construct personalized programs of academic study that incorporate both Core 2.0 requirements and other courses that will apply to a wide range of curricula. Advising is available by appointment or on a walk-in basis, 8:00-5:00, Monday through Friday.

The advisors and resources of the AAC are available to all undergraduate students. AAC advisors help students

1. Explore their academic strengths and interests
2. Review Core 2.0 requirements
3. Select a degree program suited to their personal and career goals
4. Identify ways to add value to their degree
5. Connect with resources available to MSU students

McNair Scholars Program
The Ronald E. McNair Post-Baccalaureate Achievement Program (McNair Scholars Program) is a nationally recognized school graduate preparatory program funded by the U.S. Department of Education that prepares eligible students who aspire to attain doctoral degrees through paid summer research/project internships and other academic activities. Students from all disciplines who have completed at least 60 credits, are first generation students, have low-income status, or are members of an underrepresented minority group are encouraged to apply.

The program supports scholars during their Junior and Senior years as they earn their undergraduate degrees, helps them enroll in graduate programs, and tracks their progress as they complete graduate degrees. Students accepted to the program are eligible for two consecutive years of summer research allowance, up to 6-credits of summer tuition waiver, 10-weeks of paid room/board, and a food allowance. McNair Scholars are paired with a faculty mentor in their field of interest who helps them present and publish their McNair research projects. Students receive graduate school application assistance, Graduate Record Exam (GRE) preparation, and specific instruction through a semester long seminar discussing all aspects of applying, preparing, and financing graduate school.

For more information about the McNair Scholars Program, visit our website at http://www.montana.edu/mcnair/, e-mail: mcnair@montana.edu, or call (406) 994-5072.

MSU Leadership Fellows Program
The MSU Leadership Fellows Program, administered by University Programs, challenges students to discover their true potential by developing ethical and critical thinking skills as they relate to leadership. Students completing the requirements will receive certificates of completion and have “Leadership Fellow” noted on their academic transcripts. For more information click here (p. 277).

National Student Exchange
Montana State University participates in the National Student Exchange (NSE), a consortium of over 190 state-supported universities and private institutions offering students the opportunity to study for up to one year at a university in another part of the United States and Canada.

By bringing together students from different areas of the country, NSE encourages participants to broaden their academic, social, and cultural awareness. Through a straightforward admissions process, students are able to enroll at a host institution under the same financial benefits as their home institution (MSU). Credits and grades are recorded at MSU-Bozeman as a part of the student’s regular transcript. For more information, follow this link to the NSE homepage: http://www.montana.edu/universitystudies/nse/index.html

Pre-Law Advising
Many students at MSU are interested in exploring possible careers in law. Every year MSU students are accepted at excellent law schools across the country. MSU offers a variety of resources and advising to students who wish to pursue a career in law after their undergraduate degree. These resources include:

- One-on-one law school advising
- Personal assistance with the application process, writing personal statements, law school selection, and planning for LSAT prep
- Law school information sessions and events scheduled several times during the academic year
- US 140 Introduction to Law and the Legal Profession – a one credit exploratory course

For more information about pre-law advising, please visit the Pre-Law website: http://www.montana.edu/universitystudies/advising/pre-law/index.html

Pre-Med Intake Major
MSU offers a Pre-Med Intake major for students interested in pursuing a career in the health professions, including medical, dental, pharmacy, and physical therapy. The Pre-Med intake major does not include nursing. Pre-Med is not a major from which students will graduate. It is a two-semester program designed to encourage students to explore the academic environment at MSU, to understand the breadth of career opportunities in the health professions, and to help students select courses from the science curriculum associated with professional school pre-requisites.

Pre-Med Intake Major students benefit from:

- Individualized advising with a dedicated Pre-Med advisor during the first-year
- Assistance with course and major selection
- Workshops on academics, professionalism, and the health professions application process
- The course “MEDS 140,” Introduction to Medicine Health (offered spring semesters)

For more information about the Pre-Med Intake Major, please Visit the College Of Letters and Science Pre-Med Intake Major. (p. 256)

Pre-Veterinary Options
MSU offers pre-veterinary coursework and advising for students interested in pursuing admission into any school or college of veterinary medicine. MSU’s pre-veterinary curriculum is not a major from which students will graduate, and ‘pre-vet’ is not a degree-granting option on the MSU campus. Rather, it is an advising program and a series of required undergraduate classes that prepare students for admission into schools of veterinary medicine. The Pre-Veterinary intake major is supported through the College of Agriculture, and we offer several resources to students who are interested in attending a veterinary medical program after their MSU baccalaureate careers. Pre-vet advisors are available to work with students as they prepare to apply for admission to schools of veterinary medicine.

Click here (p. 100) for details.

Undergraduate Scholars Program
The Undergraduate Scholars Program (USP) promotes and facilitates undergraduate research in collaboration with faculty mentors. Projects range from scientific research and humanistic scholarship to the creation of original artistic works. Projects may stem from ongoing faculty research or be developed from a student’s novel idea. USP funds student research
through grants and also provides training and logistical support. Students can earn academic credit for research projects.

The wide scope of USP research is showcased in recent projects including an investigation of underground coal beds, exploring the microscopic structure of biofilms, examining stereotypes in the nursing profession, bio-prospecting for novel organisms in Yellowstone National Park, a travel-inspired musical composition, diverse photography exhibits, and the creation of a life-sized educational pterosaur puppet. USP funds projects in all disciplines of study across the university.

For more information about the Undergraduate Scholars Program, visit the USP website at http://www.montana.edu/usp/, e-mail usp@montana.edu, or call (406) 994-3561.

**University Studies Program**

University Studies is the initial academic program for first-year students who want to explore their options before declaring a major field of study -- approximately 15% of entering students at MSU. Through its programs of individualized academic advising and first-year seminar, University Studies plays a key role in preparing MSU students for study in a chosen major. Undergraduate students may take up to 30 semester credits (typically 2 semesters) in University Studies before declaring a major, but students may declare at any time. Students who start in a declared major are also welcome to visit with the advisors in University Studies should they have questions about their initial choice of major, and University Studies offers individualized advising for students in-transition.

This program also serves students who plan to pursue specialized degrees at other institutions but wish to take courses at MSU for one or two years before transferring. Transfer students may enter University Studies to fulfill requirements and explore MSU degree programs before declaring a major. For more information about University Studies, please visit the University Studies website: http://www.montana.edu/wwwus/.

**First-Year Seminar**

First-Year Seminar, US 101US, is a 3-credit course, open to students of all majors, that fulfills the University Seminar requirement of CORE 2.0. The seminar is a focused, student-directed classroom experience that explores questions of place and identity through a range of texts in a discussion format.

Students explore their role as engaged citizens in their education and in society, questions of morality and justice, and their responsibilities to themselves and each other. The seminar focuses on helping students reach their academic and intellectual potential through a concentration on critical thinking, verbal and written communication, academic research, and intellectual exploration.

**MSU Leadership Fellows Certificate**

Montana State University’s **Leadership Fellows Certificate Program** (LFCP), a 16-credit program of study, is interdisciplinary in nature. With personal development as a focus, and based upon historical and theoretical foundations of leadership, students develop competencies needed for relational and engaged leadership in all their future endeavors.

Required coursework toward the certificate includes UC 121US Leadership Foundations*, 3 credits, and UC 302 Leadership Capstone, 1 credit. Designed to provide students with the essential tools needed to discover and develop their potential as positive change agents and empowered followers, these courses utilize critical reading and writing; require original undergraduate research; and encourage dialectical thinking through lecture and class discussion, experiential learning, and in-nature and arts-based modalities.

To obtain the Leadership Fellows Certificate, students must take 12 additional, selected electives. Six of the selected electives are chosen from the student’s major area(s) of study. This allows the student to investigate more deeply the ethical, contextual, and relational issues of leadership and followership within their particular program of study. The remaining six electives are chosen from an approved list of leadership-specific electives outside the student’s major area(s) of study, thereby providing the student with universal perspectives on leading and following.

Sooner or later, regardless of one’s chosen career, everything comes to how one leads and, for that matter, follows. The courses offered in MSU’s Leadership Fellows Certificate Program are universally applicable to, and relevant for, any student interested in effecting life-affirming change in the world.

To access the updated complete list of approved, leadership-specific electives and to learn more about the program, please see the Leadership Fellows website (http://www.montana.edu/leadershipfellows).

Other requirements:

1. Earn a grade of “C” (2.0) or better in each course used to satisfy the certificate
2. No "credit by exam" may be used

<table>
<thead>
<tr>
<th><strong>Course</strong></th>
<th><strong>Title</strong></th>
<th><strong>Credits</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>UC 202</td>
<td>Leadership Foundations</td>
<td>3</td>
</tr>
<tr>
<td>UC 302</td>
<td>Leadership Capstone</td>
<td>1</td>
</tr>
<tr>
<td>Leadership Electives</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

**Jake Jabs College of Business & Entrepreneurship**

**Administration**

Kregg Aytes, Ph.D., Dean
Myleen Leary, Ph.D., Associate Dean for Academic Affairs
Tia Brown, MBA, Director of Operations
Brenda Truman, MPA, Director of Student Services

**General Information**

Degree Programs (p. 278)
- Bachelor of Science in Business (p. 278)
- Master of Professional Accountancy (p. 412)
- Minors & Certificates (p. 284)

JJCBE Resources for Students (p. )
- Bracken Center (p. 279)
- Jabs Center for Entrepreneurship (p. 279)
- Alderson Program in Entrepreneurship (p. 279)
- Blackstone LaunchPad (p. 279)
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Academic Policies (p. 279)
- Admission to the Jake Jabs College of Business & Entrepreneurship (JJCBE (p. ))
- Minimum Grades & Grade Repeats (p. )
- Acceptance of Transfer Credits (p. 279) & (p. 279) Residency Requirements (p. 279)
The mission of the Jake Jabs College of Business & Entrepreneurship is to inspire innovation, creativity, and growth. We accomplish this through a personalized learning environment that challenges students to deeply engage in their education and take initiative for their own success in school and life. The College’s mission is embodied by Jabs Hall, the College’s home which opened in summer 2015. Jabs Hall offers students an energy-efficient building with cutting-edge classrooms, student work rooms, and many collaboration and social areas.

An extraordinary faculty offers transformational learning experiences that help students develop the initiative, skills, and creativity to be effective innovators in many different organizational contexts, including entrepreneurial ventures and large corporations. Distinguishing features of the program include exceptional faculty members in every classroom (no graduate student instructors), rigorous course work, an interactive, personalized learning environment, an emphasis on professional skills, and high-performing students.

The College is fully accredited by AACSB International—the Association to Advance Collegiate Schools of Business, the premium accrediting association for business programs. AACSB has awarded its mark of distinction to only five percent of all business programs worldwide. Not only does this accreditation certify that the JJCBE meets AACSB’s rigorous standards for business education, but it also signals to local, regional, and national employers that the College’s graduates are well-prepared for careers in business.

Learning Objectives

Throughout the business curriculum, students receive significant exposure to each of the College’s learning goals:

• **Knowledge of Business:** Students will have strong working knowledge of fundamental concepts in accounting, finance, management, marketing, information technology, strategy, and law.

• **Critical Thinking:** Students will learn to effectively and persuasively assimilate and evaluate information to solve business problems.

• **Quantitative Reasoning:** Students will be able to interpret, represent, and evaluate quantitative information and integrate such information into business decisions and recommendations.

• **Effective Written Communication:** Students will be able to develop and organize ideas, adopt an appropriate tone, employ correct grammar, sentence structure, and mechanics, use appropriate vocabulary, and correctly cite sources for facts, quotations and ideas.

• **Effective Oral Communication:** Students will be able to develop and organize ideas, successfully employ technology in support of a message, speak extemporaneously with minimal hesitations and fillers, adopt an appropriate tone, use appropriate vocabulary, employ correct grammar and sentence structure, and manage presentation pacing and timing effectively.

• **Ethical Decision Making and Social Responsibility:** Students will recognize the ethical and societal implications of proposed actions, employ decision-making tools to evaluate the ethical and societal effects of a variety of options, and make sound decisions in accordance with the analysis and evaluation of options.

• **Life-Long Learning:** Students will be immersed in an environment that encourages life-long learning through extensive opportunities to learn in team settings and to develop effective team skills, to develop research skills to advance learning, and to strengthen critical thinking skills.

**Degree Programs**

The Jake Jabs College of Business & Entrepreneurship (JJCBE) grants two degrees: a Bachelor of Science in Business, with options in Accounting (p. 280), Finance (p. 281), Management (p. 282) and Marketing (p. 283); and a Master of Professional Accountancy. Five minors (p. 284) in Accounting, Business Administration, Entrepreneurship & Small Business Management, Finance and International Business, and two certificates (p. 284) in Business and Entrepreneurship.

The JJCBE’s Master of Professional Accountancy degree is a demanding and highly reputed program that should be considered by students who are interested in pursuing CPA certification or advanced financial positions. Information about this program can be found in the College of Business (JJCBE) (p. 412) section of MSU’s Graduate Catalog.

The JJCBE undergraduate curriculum is made up three blocks: pre-business (foundation) courses, common body of knowledge (CBK) courses, and option (marketing, management, finance and accounting) courses. The pre-business courses must be completed with grades of C- or better and an MSU cumulative GPA of 2.50 or better in order for students to be admitted to the College (p. 279) and move on with their upper-division coursework.

**Pre-Business courses:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGEN 104US</td>
<td>Business &amp; Entrepreneurship Fundamentals Seminar</td>
<td>3</td>
</tr>
<tr>
<td>or BGEN 204</td>
<td>Business &amp; Entrepreneurship Fundamentals</td>
<td></td>
</tr>
<tr>
<td>BMGT 205</td>
<td>Prof Business Communication</td>
<td>3</td>
</tr>
<tr>
<td>BMIS 211</td>
<td>Intro to Bus Decision Support</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 201</td>
<td>Principles of Financial Accr</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 202</td>
<td>Principles of Managerial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>or ACTG 223</td>
<td>Principles of Accounting II</td>
<td></td>
</tr>
<tr>
<td>M 161Q</td>
<td>Survey of Calculus</td>
<td>4</td>
</tr>
<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 202</td>
<td>Principles of Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 204IS</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>STAT 216Q</td>
<td>Introduction to Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td>BMGT 240IS</td>
<td>Business Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>or STAT 217Q</td>
<td>Intermediate Statistical Concepts</td>
<td></td>
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</tbody>
</table>

*Students transferring into the JJCBE from another institution or transitioning from another MSU department, who have already earned credit for a University Seminar (US) course must take BGEN 204 instead of BGEN 104US.

**Accounting students take ACTG 201, 202 & 223; Finance students take ACTG 201 & 223; Management & Marketing students take ACTG 201 & 202.

**Common Body of Knowledge (CBK) courses:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMGT 335</td>
<td>Management and Organization</td>
<td>3</td>
</tr>
<tr>
<td>BGEN 302</td>
<td>Career Perspectives</td>
<td>1</td>
</tr>
<tr>
<td>or BGEN 303</td>
<td>Professional Coaching Clinic</td>
<td></td>
</tr>
<tr>
<td>BMIS 311</td>
<td>Management Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>BMGT 322</td>
<td>Operations Management</td>
<td>3</td>
</tr>
<tr>
<td>BMKT 325</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 322</td>
<td>Business Finance</td>
<td>3</td>
</tr>
<tr>
<td>BGEN 361</td>
<td>Principles of Business Law</td>
<td>3</td>
</tr>
<tr>
<td>BGEN 499</td>
<td>Senior Thesis/Capstone: Strategy Seminar</td>
<td>4</td>
</tr>
</tbody>
</table>
Option Courses:
The option courses, most of which are 400-level courses designed for seniors, enhance the depth of understanding in one area of business: Accounting (http://catalog.montana.edu/undergraduate/business/accounting), Finance (http://catalog.montana.edu/undergraduate/business/finance), Management (http://catalog.montana.edu/undergraduate/business/management) or Marketing (http://catalog.montana.edu/undergraduate/business/marketing).

JJCBE Student Resources
The Gary K. Bracken Center for Excellence in Undergraduate Business Education
The Bracken Center (http://www.montana.edu/business/bracken) is located within the Jake Jabs College of Business & Entrepreneurship (JJCBE) in Jabs Hall, where it offers students access to internship and career information, employer interviews, state-of-the-art conference rooms for student use, and the Bracken Business Communication Clinic (http://www.montana.edu/business/bracken/brcc) (BBCC). The BBCC is staffed by business communication professionals who coach students on oral presentations and written assignments, including basic grammar, punctuation, sentence structure and tenses, and business themes, content, and organization of material. The Bracken Center also provides assistance to faculty members to support their teaching and professional development activities. For more information: http://www.montana.edu/business/bracken/index.html

The Jabs Entrepreneurship Center
The mission of the Jabs Entrepreneurship Center (http://www.montana.edu/business/e-center) is to help Montana businesses flourish by connecting them to Montana State University students and resources. Through several courses each semester, students provide pro bono consulting to businesses and not-for-profit organizations. The Center also offers the Entrepreneur-in-Residence program, which brings in experienced entrepreneurs to spend a week with students and faculty, as well as the Family Business Day on the Road program, which offers business skills development to communities across Montana. The Center provides funding for student and faculty Entrepreneurship Fellows, as well as other opportunities in entrepreneurship. For more information: http://www.montana.edu/business/e-center/index.html

The Alderson Program in Entrepreneurship
The Alderson Program in Entrepreneurship (http://www.montana.edu/business/e-center/alderson.html) enables students to study entrepreneurship and to apply knowledge gained from their academic work to businesses. The Alderson Program has been recognized twice by Entrepreneur Magazine as one of the top 10 entrepreneur-empowerment programs in the U.S. For more information: http://www.montana.edu/business/e-center/alderson.html

Blackstone LaunchPad
In addition, MSU’s Blackstone LaunchPad (http://www.montana.edu/launchpad), a collaboration of the Blackstone Charitable Foundation, Montana State University, the University of Montana, and Headwaters RCD, provides guidance, resources, and mentoring to students from all majors as they develop their ideas into entrepreneurial opportunities. For more information: http://www.montana.edu/launchpad/

Advising & Student Services
The JJCBE’s Office of Student Services coordinates new and transfer student orientation, advises pre-business students (prior to admission to JJCBE), coordinates continuing student course registration, and admission to the JJCBE, and certifies degree requirements. Each JJCBE student is assigned a professional advisor in the Office of Student Services for their first two years; once admitted to the College they are transitioned to a faculty advisor to consult about the student’s career-related goals and objectives.

Academic Policies
Admission to the Jake Jabs College of Business & Entrepreneurship (JJCBE)
All business majors must be admitted to the JJCBE in order to enroll in upper-division option (300-400 level) ACTG, BGEN, BFIN, BMGT and BMKT courses and the senior capstone, BGEN 499.

Requirements for admission to the JJCBE include:
- Junior standing (completion of 60 semester credits)
- Completion of all pre-business courses with no grade less than a C-
- Minimum 2.50 cumulative MSU GPA

To be considered for admission, students must submit a completed admission application. Students who meet all requirements for admission and have a 2.50 or higher cumulative MSU GPA will be admitted to the College. Applications from students with a cumulative GPA less than 2.50 will not be considered. Applications for admission to the College are considered throughout the year. See the JJCBE Office for Student Services (business@montana.edu) for specific deadlines. Applications are available in the JJCBE Student Services Office located in Jabs Hall Room 124, and on the JJCBE website at: http://www.montana.edu/business/current-students/advising-faq.html. Notification of admission decisions will be made via the student’s official e-mail address as listed in MyInfo.

Course pre-requisites
Course pre-requisites are listed for each course in the catalog. Where there are specific pre-requisites for business students, please note that students pursuing a business major, minor, or certificate are considered business students and will be expected to meet those pre-requisites.

Minimum Grades
The Montana Board of Regents has established a common policy on minimum course grades across all campuses in the Montana University System. According to the policy, a grade of C- or better is required to satisfy requirements for prerequisite and required courses in majors, minors, and certificate programs and for all university core requirements. Further, a grade of C- or better is required in all courses that will be counted toward the 42 upper-division credits required in all degrees. Courses with a passing grade of D-, D, or D+ may only be counted toward the overall 120 credit requirement. To graduate with a Bachelor of Science degree in Business, a student must earn a C- or better in all prerequisites, university core, required and elective courses, and non-business/non-economics courses.

Repeat Grades
It is JJCBE policy that any upper-division required business or business option course(s) in which a student earns an unsatisfactory grade (D+, D, D-, or F) must be repeated in the JJCBE. A transfer course may not be used to fulfill a degree requirement in which a student earned an unsatisfactory grade in the JJCBE. If a student earns an unsatisfactory grade in an advisor approved or option elective course, s/he should contact the JJCBE Office of Student Services at business@montana.edu to discuss his/her possible remedies.

Acceptance of Transfer Credits and Residency Requirements
Residency Requirements
All students must comply with the JJCBE and the Montana State University residency requirements to be awarded a degree from Montana State University. The Montana State University residency requirement can be found at http://catalog.montana.edu/curriculum-enrollment-graduation/#Credits_for_Degree_Completion.

The JJCBE residency requirement is that of the upper-division credits required for business students, at least 28 credits must be taken in residence at the JJCBE. These 28 credits must include:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGEN 499</td>
<td>Senior Thesis/Capstone: Strategy Seminar</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Four upper-division required option courses, and</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Four of the following six required courses</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>- BMGT 335, BFIN 322, BMIS 311, BMGT 322,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BGEN 361, and BMKT 325</td>
<td></td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>28</td>
</tr>
</tbody>
</table>

Transferring to the JJCBE

University undergraduate programs in business administration normally concentrate on professional business courses in the last two years of a four-year program. The objective is to allow students the opportunity to build a foundation of work in the arts, sciences, and humanities prior to beginning professional course work. As a result of this approach, and because of the standards and requirements of AACSB, the international accrediting organization for colleges of business, most students transferring into the Jake Jabs College of Business & Entrepreneurship (JJCBE) from another university should do so no later than the end of their sophomore year.

Students taking their first two years of work at another institution should take only those business courses offered at the freshman or sophomore level at Montana State University. Lower-division business courses may not be used to satisfy upper-division course requirements of the JJCBE. If at all possible, students should complete courses which will transfer to Montana State University as the equivalent to the pre-business courses.

For additional guidance on transferring to Montana State University, see the Admissions (http://catalog.montana.edu/undergraduate-admissions) section of this catalog, explore the Admissions website at: http://www.montana.edu/admissions, and/or contact the JJCBE’s Office of Student Services at business@montana.edu.

Undergraduate Programs

- Accounting (p. 280)
- Finance (p. 281)
- Management (p. 282)
- Marketing (p. 283)
- Business Minors & Certificates (p. 284)

Graduate Degrees

- Master of Professional Accountancy (MPAc) (p. 412)

Accounting

Accountants are business professionals who work with people to identify, analyze, and solve business problems. Completing an Accounting option opens the door to a wide range of career opportunities. The Accounting option is designed to help students develop the necessary technical expertise and broad-based business knowledge required for long-term success in careers such as audit, assurance, tax consulting, corporate accounting/finance, not-for-profit/government, financial analysis/venture capital, and financial planning.

Students planning to pursue CPA certification or advanced financial positions should also complete the Master of Professional Accountancy Program. Students completing MSU’s undergraduate and graduate accounting programs are in high demand and often have multiple job offers at graduation.

Accounting Option

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td></td>
</tr>
<tr>
<td>BGEN 104US - Business &amp; Entrepreneurship Fundamentals Seminar</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 101IS - Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td>3</td>
</tr>
<tr>
<td>M 161Q - Survey of Calculus</td>
<td>4</td>
</tr>
<tr>
<td>ECNS 202 - Principles of Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td>3</td>
</tr>
<tr>
<td>Year Total:</td>
<td>15</td>
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</tbody>
</table>

Sophomore Year

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>Spring</td>
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</tbody>
</table>

Choose one of the following:

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>Spring</td>
</tr>
</tbody>
</table>

ACTG 201 - Principles of Financial Acct | 3
BMIS 211 - Intro to Bus Decision Support | 3
ECNS 204IS - Microeconomics | 3
STAT 216Q - Introduction to Statistics | 3
Non-business/non-economics and general electives, and University Core | 3
ACTG 202 - Principles of Managerial Accounting | 3
ACTG 223 - Principles of Accounting II | 3
BMGT 205 - Prof Business Communication | 3
Year Total: | 15 |

Junior Year

<table>
<thead>
<tr>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
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<td>Spring</td>
</tr>
</tbody>
</table>

Choose one of the following:

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>Spring</td>
</tr>
</tbody>
</table>

ACTG 327 - Intermediate Financial Accounting and Reporting I | 3
ACTG 321R - Acct Information Systems I | 3
BMGT 335 - Management and Organization | 3
BGEN 302 - Career Perspectives or BGEN 303 - Professional Coaching Clinic | 3
BMIS 311 - Management Information Systems | 3
Non-business/non-economics and general electives, and University Core | 3
ACTG 328 - Inter Fin Acct & Reporting II | 3
BF 322 - Business Finance | 3
BMGT 322 - Operations Management | 3
BMKT 325 - Principles of Marketing | 3
BGEN 361 - Principles of Business Law | 3
Year Total: | 16 |
### Senior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTG 401</td>
<td>Principles of Federal Taxation - Individuals</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ACTG 410</td>
<td>Cost Management Accounting I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Choose one of the following Accounting electives:</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ACTG 420</td>
<td>Cost Management Accounting II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACTG 421</td>
<td>Accounting Information Systems II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACTG 441</td>
<td>Financial Statement Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACTG 498</td>
<td>Internship (must be taken for at least 3 credits; counts as one Accounting elective)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>BGEN 499 - Senior Thesis/Capstone: Strategy Seminar</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>ACTG 411</td>
<td>Auditing I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ACTG 415</td>
<td>Government and Nonprofit Accounting I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
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</tr>
<tr>
<td>Year Total:</td>
<td></td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>

**Total Program Credits:** 120

* Students transferring into the Jake Jabs College of Business & Entrepreneurship (JJCBE), either from another institution or from another MSU department, who have already earned credit for a University Seminar (US) course must take BGEN 204 instead of BGEN 164US.*

All business majors must be formally admitted to the Jake Jabs College of Business & Entrepreneurship (JJCBE) in order to enroll in all upper-division (300-400 level) option courses (ACTG, BFIN, BMGT, BMKT, BGEN, BMIS) and BGEN 499 Senior Thesis/Capstone: Strategy Seminar.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above; 54 credits must be non-business/non-economics rubrics (although ECNS 101IS, ECNS 202, ECNS 204IS, BMGT 240IS may be included); University Core credit requirements must be satisfied.

Any students transferring to the JJCBE must meet the JJCBE residency requirement (p. 279).

### Finance Option

#### Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGEN 104US</td>
<td>Business &amp; Entrepreneurship Fundamentals Seminar</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>ECNS 202</td>
<td>Principles of Macroeconomics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>M 161Q</td>
<td>Survey of Calculus</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
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#### Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTG 201</td>
<td>Principles of Financial Acct</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMIS 211</td>
<td>Intro to Bus Decision Support</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>ACTG 223</td>
<td>Principles of Accounting II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMGT 205</td>
<td>Prof Business Communication</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ECNS 204IS</td>
<td>Microeconomics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 217Q</td>
<td>Intermediate Statistical Concepts</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>or BMGT 240IS</td>
<td>Business Research Methods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
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</tbody>
</table>

#### Junior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMGT 335</td>
<td>Management and Organization</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMIS 311</td>
<td>Management Information Systems</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BFIN 322</td>
<td>Business Finance</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BFIN 357</td>
<td>Financial Markets &amp; Institutions</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ACTG 327</td>
<td>Intermediate Financial Accounting and Reporting I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BGEN 302</td>
<td>Career Perspectives</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>or BGEN 303</td>
<td>Professional Coaching Clinic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMGT 322</td>
<td>Operations Management</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMKT 325</td>
<td>Principles of Marketing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BFIN 441</td>
<td>Advanced Analysis of Financial Statements</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td></td>
<td>15</td>
<td>16</td>
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</tbody>
</table>

#### Senior Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGEN 361</td>
<td>Principles of Business Law</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BFIN 420R</td>
<td>Investments I</td>
<td>3</td>
<td></td>
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<tr>
<td>BFIN 435</td>
<td>Corporate Finance</td>
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<td>Non-business/non-economics and general electives, and University Core</td>
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<tr>
<td>BFIN 460</td>
<td>Derivative Securities and Risk Management</td>
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</tr>
<tr>
<td>BGEN 499 - Senior Thesis/Capstone: Strategy Seminar</td>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

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**Finance**

Finance is the art and science of managing money. Financial management involves corporations raising and employing funds in order to maximize shareholders’ wealth. The investments field involves balancing the expected return and risk characteristics of securities in order to make optimal portfolio investment decisions. Financial institutions and markets serve as conduits through which the economy matches supply and demand of investable funds so that scarce resources are allocated efficiently. Career opportunities include credit, financial, and securities analysts, bank examiners, loan officers, comptrollers, treasurers, portfolio managers, financial services representatives, financial planners, and insurance underwriters.
Non-business/non-economics and general electives, and University Core
Choose two of the following:

- BFIN 421 - Real Estate and Investment Analysis (on demand)
- BFIN 452 - International Finance
- BFIN 456 - Financial Management for the Entrepreneur
- BFIN 458 - Commercial Bank Management (on demand)
- BFIN 461 - Portfolio Management
- BFIN 466 - Investments II (on demand)
- BFIN 498 - Internship (Must be taken for at least 3 credits, but counts as one Finance elective)
- ACTG 328 - Inter Fin Acct & Reporting II
- BMGT 405 - Supply Chain Analytics
- ECNS 301 - Intermediate Micro with Calc
- ECNS 303 - Intermediate Macro with Calc
- ECNS 403R - Intro to Econometrics
- ECNS 406 - Industrial Organization
- STAT 411 - Methods for Data Analysis I

*Students must meet pre-requisite requirements of individual courses.

Year Total: 12  16

Total Program Credits: 120

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Management Option

Freshman Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGEN 104US - Business &amp; Entrepreneurship Fundamentals Seminar</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ECNS 101IS - Economic Way of Thinking</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>M 161Q - Survey of Calculus</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>ECNS 202 - Principles of Macroeconomics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
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<td></td>
</tr>
<tr>
<td>Year Total:</td>
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<td>16</td>
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Sophomore Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTG 201 - Principles of Financial Acct</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMGT 205 - Prof Business Communication</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>ACTG 202 - Principles of Managerial Accounting</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMIS 211 - Intro to Bus Decision Support</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ECNS 204IS - Microeconomics</td>
<td>3</td>
<td></td>
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<tr>
<td>STAT 217Q - Intermediate Statistical Concepts or BMGT 240IS - Business Research Methods</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
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<tr>
<td>Year Total:</td>
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<td>15</td>
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Junior Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMGT 335 - Management and Organization</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMIS 311 - Management Information Systems</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMKT 325 - Principles of Marketing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BGEN 361 - Principles of Business Law</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
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<td></td>
</tr>
<tr>
<td>BGEN 302 - Career Perspectives or BGEN 303 - Professional Coaching Clinic</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BMGT 322 - Operations Management</td>
<td>3</td>
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<tr>
<td>BFIN 322 - Business Finance</td>
<td>3</td>
<td></td>
</tr>
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<td>BMGT 366 - Supervisory Management Skills</td>
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<td>BMGT 329 - Human Resource Management</td>
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<td>Non-business/non-economics and general electives, and University Core</td>
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<tr>
<td>Year Total:</td>
<td>15</td>
<td>16</td>
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Senior Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMGT 466 - Middle Management Skills</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMGT 475R - Management Experience</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Choose two of the following management electives: (other BMGT electives may be considered)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>BMGT 405 - Supply Chain Analytics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMGT 406 - Negotiation/Dispute Resolution</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Management

The Management option prepares women and men to think critically and to act decisively in the dynamic global marketplace. Management option graduates are ready to make immediate contributions to organizations in a variety of roles such as analysts, managers, and team members. An academically and professionally experienced management faculty whose priority is excellence in teaching, provides students with contemporary business management theory and practice. Emphasis is placed on the application of theory and knowledge in solving practical problems. The curriculum focuses on the development of personal capacity in leadership, critical thinking, problem solving, and ethical decision making at all organizational levels from first line supervision through middle management to executive levels.
Marketing Option

Freshman Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGEN 104US - Business &amp; Entrepreneurship Fundamentals Seminar</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ECNS 101IS - Economic Way of Thinking</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>ECNS 202 - Principles of Macroeconomics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>M 161Q - Survey of Calculus</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>15</td>
<td>16</td>
</tr>
</tbody>
</table>

Sophomore Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTG 201 - Principles of Financial Acct</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMGT 205 - Prof Business Communication</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>ACTG 202 - Principles of Managerial Accounting</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMIS 211 - Intro to Bus Decision Support</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ECNS 204IS - Microeconomics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 217Q - Intermediate Statistical Concepts or BMGT 240IS - Business Research Methods</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

Junior Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMGT 335 - Management and Organization</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BGEN 302 - Career Perspectives</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>or BGEN 303 - Professional Coaching Clinic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMIS 311 - Management Information Systems</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMKT 325 - Principles of Marketing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Non-business/non-economics and general electives, and University Core</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>BMGT 322 - Operations Management</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BFIN 322 - Business Finance</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BGEN 361 - Principles of Business Law</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMKT 342R - Marketing Research</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMKT 337 - Consumer Behavior</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>16</td>
<td>15</td>
</tr>
</tbody>
</table>

Senior Year

<table>
<thead>
<tr>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMKT 343 - Integrated Marketing Communication</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMKT 436 - Sales and Sales Management</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Choose two of the following Marketing electives:</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>BGEN 365 - International Practicum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMGT 405 - Supply Chain Analytics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMKT 406 - Advertising Campaign Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMKT 420 - Integrated Online Marketing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMKT 441 - International Marketing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMKT 444 - Retail Management</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Minors:

- Entrepreneurship and Small Business Management (p. 286)
- Finance (p. 286) (not available to business students in the Finance option)

Business Minor

The JJCBE offers five business minors, a Business Certificate, and an Entrepreneurship Certificate as described below. All minors and certificates are open to students pursuing majors outside of the JJCBE; however, the Accounting minor is not available to business students in the Accounting option and the Finance minor is not available to business students in the Finance option. The Business Administration minor, the Business Certificate, and the Entrepreneurship Certificate are not available to any business students. Students cannot pursue a Business Certificate and a Business minor nor an Entrepreneurship Certificate and an Entrepreneurship minor. In accordance with the Board of Regents’ policy, students must earn a C- or better in all courses in a minor or certificate.

Minors:
- Accounting (p. 284) (not available to business students in the Accounting option)
- Business Administration (p. 284) (not available to business-major students)
- Entrepreneurship and Small Business Management (p. 286)
- Finance (p. 286) (not available to business students in the Finance option)

Certificates:
- International Business (p. 286)
- Business Certificate (p. 285) (not available to business-major students)
- Entrepreneurship Certificate (p. 285)

Accounting Minor

The Accounting minor is open to all students, with the exception of students pursuing a business degree with an Accounting option. The coursework helps students understand the role that accounting plays in business decisions. Students who minor in accounting will learn how to prepare and analyze income statements, balance sheets, cost/managerial reports, and tax returns. Students must complete all of the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMIS 211</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 201</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 223</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 327</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 321R</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 328</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 401</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 410</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 411</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 415</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 420</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 421</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 441</td>
<td>3</td>
</tr>
<tr>
<td>BMIS 211</td>
<td>9</td>
</tr>
</tbody>
</table>

Total Credits: 24

* ACTG 328 is a prerequisite for these courses.
Four of the five upper-division courses must be taken in residence at MSU-Bozeman.

Business Administration Minor

The Business Administration minor is open to all non-business students. Students who obtain this minor will gain critical insights into business concepts. Students seeking a minor in Business Administration must complete the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTG 201</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 202</td>
<td>3</td>
</tr>
<tr>
<td>BMGT 335</td>
<td>3</td>
</tr>
<tr>
<td>BMKT 325</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 322</td>
<td>3</td>
</tr>
<tr>
<td>BGEN 361</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 202</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 204IS</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 24

* Students transferring into the Jake Jabs College of Business & Entrepreneurship (JJCBE), either from another institution or from another MSU department, who have already earned credit for a University Seminar (US) course must take BGEN 204 instead of BGEN 164US.
** Advisor Approved Elective: One course (3 credits), in addition to University Core, of any relevant upper-division course that are pre-approved by the student’s faculty advisor.

All business majors must be formally admitted to the Jake Jabs College of Business & Entrepreneurship (JJCBE) in order to enroll in all upper-division (300-400 level) option courses (ACTG, BFIN, BMGT, BMKT, BGEN, BMIS) and BGEN 499 Senior Thesis/Capstone: Strategy Seminar.

A minimum of 120 credits is required for graduation; 42 of these credits must be in courses numbered 300 and above; 54 credits must be non-business/non-economics rubrics (although ECNS 101IS, ECNS 202, ECNS 204IS, BMGT 240IS may be included); University Core credit requirements must be satisfied.

Any students transferring to the JJCBE must meet the JJCBE residency requirement (p. 279).
The Business Certificate consists of five required courses that introduce majors or to students pursuing a business administration minor.

The Business Certificate is for non-business majors who want an overview of business concepts in order to enhance their future career success, but do not want to pursue a full 30-credit business minor. The goal of the certificate is to enable non-business students to learn how to apply fundamental concepts in economics, accounting, finance, management and marketing to solve basic business problems. It is not available to business majors or to students pursuing a business administration minor.

The Business Certificate consists of five required courses that introduce students to basic concepts in economics, business, accounting, finance, management and marketing, plus one elective.

**Business Certificate**

**Select one (1) course from the following:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMKT 325</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BMGT 335</td>
<td>Management and Organization</td>
<td>3</td>
</tr>
<tr>
<td>BGEN 204</td>
<td>Business &amp; Entrepreneurship Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>or BGEN 104US</td>
<td>Business &amp; Entrepreneurship Fundamentals Seminar</td>
<td></td>
</tr>
<tr>
<td>BGEN 210</td>
<td>Accounting &amp; Finance Basics</td>
<td>3</td>
</tr>
<tr>
<td>or BFIN 322</td>
<td>Business Finance</td>
<td>3</td>
</tr>
<tr>
<td>or EGEN 325</td>
<td>Engineering Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>BMGT 355</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BMKT 355</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>STAT 216Q</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMGT 205</td>
<td>Prof Business Communication</td>
<td></td>
</tr>
<tr>
<td>WRIT 201</td>
<td>College Writing II</td>
<td></td>
</tr>
<tr>
<td>WRIT 221</td>
<td>Intermediate Tech Writing</td>
<td></td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

Three of the four upper-division courses must be taken in residence at MSU-Bozeman. Students may not earn both the Business Administration minor and the Business certificate.

Entrepreneurship Certificate

The Entrepreneurship Certificate provides non-business majors with an overview of the business startup process in order to prepare them to start their own businesses or non-profit organizations. Students completing the Entrepreneurship Certificate will be able to:

1. Demonstrate understanding of the business startup process
2. Apply fundamental concepts in accounting, finance, management and marketing to solve startup related problems
3. Create a business model for a new business venture

The Entrepreneurship Certificate consists of three required courses and two electives for a total of 15 credits. In accordance with the Board of Regents’ policy, students must earn a C- or better in all courses applied toward the certificate. Students may not earn both the Entrepreneurship Certificate and the Business Certificate. At least 12 of the credits earned toward the certificate must be taken in residence at MSU-Bozeman.

**Entrepreneurship Certificate**

<table>
<thead>
<tr>
<th>Year 1 and 2</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGEN 104US - Business &amp; Entrepreneurship Fundamentals Seminar</td>
<td>3</td>
</tr>
<tr>
<td>or BGEN 204 - Business &amp; Entrepreneurship Fundamentals Seminar</td>
<td></td>
</tr>
<tr>
<td>BGEN 210 - Accounting &amp; Finance Basics</td>
<td>3</td>
</tr>
<tr>
<td>Year Total:</td>
<td>6</td>
</tr>
</tbody>
</table>

**Year 3 and 4**

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMGT 448 - Entrepreneurship</td>
</tr>
<tr>
<td>Choose two courses from the following list (or another course approved by the Entrepreneurship Advisor):</td>
</tr>
<tr>
<td>BMGT 410 - Sustainable Business Practices</td>
</tr>
<tr>
<td>BMGT 458 - Adv Entrepreneurship Sem (on demand)</td>
</tr>
<tr>
<td>BMGT 461 - Small Business Management</td>
</tr>
<tr>
<td>BMGT 469 - Community Entrepreneurship &amp; Nonprofit Management</td>
</tr>
<tr>
<td>BMKT 420 - Integrated Online Marketing</td>
</tr>
<tr>
<td>BMKT 436 - Sales and Sales Management</td>
</tr>
<tr>
<td>BMKT 446 - Marketing for Entrepreneurs</td>
</tr>
<tr>
<td>BFIN 456 - Financial Management for the Entrepreneur</td>
</tr>
<tr>
<td>EIND 425 - Technology Entrepreneurship</td>
</tr>
<tr>
<td>GDSN 378 - Guerrilla Advertising</td>
</tr>
<tr>
<td>SFBS 429 - Small Business and Entrepreneurship in Food and Health</td>
</tr>
</tbody>
</table>

Courses other than BMGT courses have prerequisites in addition to those required for the Entrepreneurship Certificate. Students are responsible for fulfilling all prerequisites before attempting to enroll in a course.

At least two of the upper-division courses must be taken in residence at MSU-Bozeman.

Students may not earn both the Entrepreneurship & Small Business Management minor and the Entrepreneurship certificate.
Entrepreneurship and Small Business Management Minor

The Entrepreneurship and Small Business Management minor is open to all business and non-business students. This rigorous minor is designed to provide students with perspective and skills to pursue a successful entrepreneurial career through the Alderson Program in Entrepreneurship (http://www.montana.edu/cob/centernewwest/AldersonProgram.html) coursework. Program objectives include:

- To provide the knowledge, skills, and expertise necessary for successful entrepreneurial careers
- To provide a general overview of the field of business and management
- To provide entrepreneurial expertise and economic stimulus to the region and the state

Students seeking the Entrepreneurship and Small Business Management minor will take the following courses.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMGT 205</td>
<td>Prof Business Communication</td>
<td>3</td>
</tr>
<tr>
<td>BMKT 325</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BGEN 361</td>
<td>Principles of Business Law</td>
<td>3</td>
</tr>
<tr>
<td>BMGT 448</td>
<td>Entrepreneurship</td>
<td>3</td>
</tr>
<tr>
<td>BMGT 463</td>
<td>Entrepreneurial Experience</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 201</td>
<td>Principles of Financial Acct</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 202</td>
<td>Principles of Managerial Accounting</td>
<td></td>
</tr>
<tr>
<td>ACTG 220</td>
<td>Survey of Accounting</td>
<td></td>
</tr>
<tr>
<td>EIND 373</td>
<td>Production Inventory Cost Analysis</td>
<td></td>
</tr>
<tr>
<td>BMGT 335</td>
<td>Management and Organization</td>
<td>3</td>
</tr>
<tr>
<td>EIND 300</td>
<td>Engineering Management &amp; Ethics</td>
<td></td>
</tr>
<tr>
<td>BFIN 322</td>
<td>Business Finance</td>
<td></td>
</tr>
<tr>
<td>EGEN 325</td>
<td>Engineering Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>AGBE 345</td>
<td>Ag Finance and Credit Analysis</td>
<td></td>
</tr>
<tr>
<td>ACTG/BFIN 441</td>
<td>Financial Statement Analysis</td>
<td>6</td>
</tr>
<tr>
<td>BFIN 456</td>
<td>Financial Management for the Entrepreneur</td>
<td></td>
</tr>
<tr>
<td>BMGT 405</td>
<td>Supply Chain Analytics</td>
<td></td>
</tr>
<tr>
<td>BMGT 410</td>
<td>Sustainable Business Practices</td>
<td></td>
</tr>
<tr>
<td>BMGT 458</td>
<td>Adv Entrepreneurial Sem</td>
<td></td>
</tr>
<tr>
<td>BMGT 461</td>
<td>Small Business Management</td>
<td></td>
</tr>
<tr>
<td>BMGT 469</td>
<td>Community Entrepreneurship &amp; Nonprofit Management</td>
<td></td>
</tr>
<tr>
<td>BMKT 342R</td>
<td>Marketing Research</td>
<td></td>
</tr>
<tr>
<td>BMKT 420</td>
<td>Integrated Online Marketing</td>
<td></td>
</tr>
<tr>
<td>BMKT 436</td>
<td>Sales and Sales Management</td>
<td></td>
</tr>
<tr>
<td>BMKT 446</td>
<td>Marketing for Entrepreneurs</td>
<td></td>
</tr>
<tr>
<td>EIND 425</td>
<td>Technology Entrepreneurship</td>
<td></td>
</tr>
<tr>
<td>GDSN 378</td>
<td>Guerrilla Advertising</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 30

* JJCBE Management option students must take at least one course outside of BMGT.

Students must take at least 3 of the following courses in residence at MSU-Bozeman: BMGT 448, BMGT 463, and courses listed above as ‘electives.’ Students may not earn both the Entrepreneurship & Small Business Management minor and the Entrepreneurship certificate.

Finance Minor

The Finance minor is open to all students, with the exception of students pursuing a business degree with the Finance option. Program objectives include:

- To provide the tools for financial decision making, including time value of money techniques, asset valuation, and capital budgeting analysis
- To develop in students an analytical perspective in problem solving
- To provide flexibility to design one’s own program through choice of electives

Students seeking the Finance minor must complete the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 101</td>
<td>Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 204</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>BMIS 211</td>
<td>Intro to Bus Decision Support</td>
<td></td>
</tr>
<tr>
<td>ACTG 201</td>
<td>Principles of Financial Acct</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 202</td>
<td>Principles of Managerial Accounting</td>
<td></td>
</tr>
<tr>
<td>ACTG 220</td>
<td>Principles of Accounting II</td>
<td></td>
</tr>
<tr>
<td>STAT 216</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 322</td>
<td>Business Finance</td>
<td>3</td>
</tr>
<tr>
<td>BFIN 357</td>
<td>Financial Markets &amp; Institutions</td>
<td></td>
</tr>
<tr>
<td>ACTG/BFIN 441</td>
<td>Financial Statement Analysis</td>
<td>6</td>
</tr>
<tr>
<td>BFIN 417</td>
<td>American Financial Institutions</td>
<td></td>
</tr>
<tr>
<td>BFIN 420</td>
<td>Investments I</td>
<td></td>
</tr>
<tr>
<td>BFIN 421</td>
<td>Real Estate and Investment Analysis</td>
<td></td>
</tr>
<tr>
<td>BFIN 435</td>
<td>Corporate Finance</td>
<td></td>
</tr>
<tr>
<td>BFIN 452</td>
<td>International Finance</td>
<td></td>
</tr>
<tr>
<td>BFIN 456</td>
<td>Financial Management for the Entrepreneur</td>
<td></td>
</tr>
<tr>
<td>BFIN 458</td>
<td>Commercial Bank Management (on demand)</td>
<td></td>
</tr>
<tr>
<td>BFIN 460</td>
<td>Derivative Securities and Risk Management</td>
<td></td>
</tr>
<tr>
<td>BFIN 490</td>
<td>Undergrad Research</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 30

Students must meet prerequisite requirements of individual courses. Three of the four upper-division courses must be taken in residence at MSU-Bozeman.

International Business Minor

The International Business (IB) Minor consists of 30 credits, with 21 credits of required courses and 9 credits of elective courses with a geographic or subject matter focus. Foreign language study is not required but is strongly recommended. Students pursuing the minor are also encouraged to study abroad and/or engage in other intercultural experiences. Upon completion of the IB Minor, you should be able
to explain fundamental concepts associated with conducting business internationally, including in economics, management, finance, marketing and intercultural competence.

Students completing the International Business minor will complete the following courses, and are responsible for fulfilling the appropriate prerequisites for all courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGEN 210</td>
<td>Accounting &amp; Finance Basics **</td>
<td>3</td>
</tr>
<tr>
<td>BGEN 242D</td>
<td>Intro to Int’l Business</td>
<td>3</td>
</tr>
<tr>
<td><strong>Take one of the following four courses</strong></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ECNS 101IS</td>
<td>Economic Way of Thinking</td>
<td></td>
</tr>
<tr>
<td>ECNS 202</td>
<td>Principles of Macroeconomics</td>
<td></td>
</tr>
<tr>
<td>ECNS 204IS</td>
<td>Microeconomics</td>
<td></td>
</tr>
<tr>
<td>ECNS 251IS</td>
<td>Honors Economics</td>
<td></td>
</tr>
<tr>
<td><strong>Take two of the following three courses:</strong></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>BMKT 325</td>
<td>Principles of Marketing</td>
<td></td>
</tr>
<tr>
<td>BMGT 335</td>
<td>Management and Organization</td>
<td></td>
</tr>
<tr>
<td>BFIN 322</td>
<td>Business Finance</td>
<td></td>
</tr>
<tr>
<td><strong>Take two of the following three courses:</strong></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>BMKT 441</td>
<td>International Marketing</td>
<td></td>
</tr>
<tr>
<td>BMGT 464</td>
<td>International Management</td>
<td></td>
</tr>
<tr>
<td>BFIN 452</td>
<td>International Finance</td>
<td></td>
</tr>
<tr>
<td>Approved electives with a geographic or subject matter focus. ***</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

* Students must earn a C- or better in every course taken for the minor.

** Business majors may substitute ACTG 202 or 223, and BFIN 322 for BGEN 210

*** International Business Minor electives must revolve around a singular geographic or subject focus. These electives are selected in consultation with the JJCEBE International Business minor advisor from an approved list of lower- and upper-division elective courses, which can include up to nine credits of language study.
The Graduate School

Vision
The Graduate School strives to foster an environment that produces outstanding graduate scholars who contribute new ideas and knowledge using creative and innovative approaches to solve challenges in an evolving world.

Mission
The Graduate School enriches the graduate student experience by providing excellent service, timely oversight, and relentless advocacy for student success.

Welcome from the Dean of The Graduate School
Dr. Karlene Hoo, Dean of The Graduate School

The Graduate School welcomes you to Montana State University. We are delighted that you have chosen MSU. Graduate school is a place where you will gain expertise in your field and prepare to become the scientists, engineers, nurses, educators, agronomists, artists and architects of tomorrow.

When you become an MSU graduate student, you become an essential part of the university by conducting cutting edge research, assisting in instructional teaching, and making significant contributions to your field of study.

We invite you to explore the MSU website to learn more about our outstanding graduate programs, the exciting and challenging opportunities afforded graduate students, and the eclectic community of Bozeman, Montana. The Graduate School staff and I are committed to helping you succeed at all points throughout your education and welcome your questions and comments. We can be reached at 406-994-4145, gradschool@montana.edu.

Graduate Programs
For detailed information about The Graduate School at MSU, visit the webpage (http://www.montana.edu/gradschool). The master’s, doctoral, and certificate offerings are listed below, along with links to each academic department’s webpage. To find out more about a specific graduate program, please contact the department.

Department of Agricultural Economics and Economics (p. 291)
Home Page: http://www.montana.edu/econ/
  • Master of Science in Applied Economics (p. 292)

Division of Agriculture Education (p. 291)
Home Page: http://ageducation.montana.edu/
  • Master of Science in Agricultural Education (p. 395)

American Studies (p. 366)
Home Page: http://www.montana.edu/amst/index.html
  • Master of Arts in American Studies (p. 367)
  • Doctor of Philosophy in American Studies (p. 366)

Department of Animal and Range Sciences (p. 292)
Home Page: http://animalrange.montana.edu/degree-grad.html
  • Master of Science in Animal and Range Sciences (p. 293)
  • Master of Science in Land Rehabilitation (p. 300) (Interdisciplinary)
  • Doctor of Philosophy in Animal and Range Sciences (p. 294)

School of Architecture (p. 303)
Home Page: http://www.arch.montana.edu/pages/programs/programs.php
  • Master of Architecture (p. 305)

School of Art (p. 306)
Home Page: http://art.montana.edu
  • Master of Fine Arts (p. 307)
  • Master of Art in Art History (p. 306)

Jake Jabs College of Business & Entrepreneurship (JJCBE) (p. 412)
Home Page: http://www.montana.edu/cob/
  • Master of Professional Accountancy (p. 412)

Department of Cell Biology and Neuroscience (p. 368)
Home Page: http://www.montana.edu/cbn/
  • Master of Science in Biological Sciences (p. 369)
  • Master of Science in Neurosciences (p. 369)
  • Doctor of Philosophy in Biological Sciences (p. 369)
  • Doctor of Philosophy in Neurosciences (p. 369)

Department of Chemical and Biological Engineering (p. 345)
Home Page: http://www.chbe.montana.edu/
  • Master of Science in Chemical Engineering (p. 346)
  • Master of Science in Environmental Engineering (p. 347)
  • Master of Engineering In Chemical Engineering (p. 348)
  • Master of Engineering in Bioengineering (p. 349)
  • Doctor of Philosophy in Engineering (p. 351)
  • Doctor of Philosophy in Materials Science (p. 409)

Department of Chemistry and Biochemistry (p. 369)
Home Page: http://www.chemistry.montana.edu/graduate/
  • Master of Science in Chemistry (p. 371)
  • Master of Science in Biochemistry (p. 371)
  • Master of Science in Optics and Photonics Plan A (p. 361)
  • Master of Science in Optics and Photonics Plan B (p. 362)
  • Doctor of Philosophy in Chemistry (p. 371)
  • Doctor of Philosophy in Biochemistry (p. 371)
  • Doctor of Philosophy in Materials Science (p. 409)

Department of Civil Engineering (p. 349)
Home Page: http://www.coe.montana.edu/ce/
  • Master of Science in Civil Engineering (p. 349)
  • Master of Science in Environmental Engineering (p. 347)
  • Master of Science in Land Rehabilitation (p. 300)
  • Doctor of Philosophy in Engineering (p. 351) (Options in Environmental Engineering, Civil Engineering, Applied Mechanics)

Gianforte School of Computing (p. 356)
Home Page: http://www.cs.montana.edu/
• Master of Science in Computer Science (p. 359)
• Doctor of Philosophy in Computer Science (p. 359)

Department of Earth Sciences (p. 372)
Home Page: http://www.montana.edu/wwwes/programs/graduate.htm
• Master of Science in Earth Sciences (p. 373)
• Master of Science in Land Rehabilitation (p. 300) (Interdisciplinary)
• Doctor of Philosophy in Earth Sciences (p. 373)

Department of Ecology (p. 373)
Home Page: http://www.montana.edu/ecology/
• Master of Science in Biological Sciences (p. 374)
• Master of Science in Fish and Wildlife Management (p. 375)
• Doctor of Philosophy in Fish and Wildlife Biology (p. 375)
• Doctor of Philosophy in Biological Sciences (p. 375) (Interdisciplinary)

Department of Education (p. 309)
Home Page: http://www.montana.edu/wwweduc/grad/index.shtml
• Master of Education (MED)
  • Adult and Higher Education (p. 314)
  • Curriculum and Leadership (p. 317)
  • Educational Leadership (p. 323)
• Doctor of Education (Ph.D. & Ed.D)
  • Adult and Higher Education (p. 324)
  • Curriculum and Instruction (p. 327)
  • Educational Leadership (p. 329)
• Educational Specialist in Educational Leadership (p. 337)
• College Teaching Certificate (p. 312)
• School Library Media Graduate Endorsement (p. 313)
• Superintendent Certificate Program (http://www.montana.edu/education/grad/edlead/edlead_supt.html)

Department of Electrical and Computer Engineering (p. 360)
Home Page: http://www.coe.montana.edu/eel/research/eegrad1.htm
• Master of Science in Electrical Engineering, Plan A (p. 361) (Thesis)
• Master of Science in Electrical Engineering, Plan B (p. 361) (Professional Paper)
• Master of Engineering in Electrical Engineering (p. 361)
• Master of Science in Optics and Photonics Plan A (p. 361) (Thesis)
• Master of Science in Optics and Photonics Plan B (p. 362) (Professional Paper)
• Doctor of Philosophy in Engineering (p. 363) (Option in Electrical and Computer Engineering)
• Doctor of Philosophy in Materials Science (p. 409)

College of Engineering (p. 345)
Home Page: http://www.coe.montana.edu/

Department of English (p. 376)
Home Page: http://www.montana.edu/english/
• Master of Arts in English (p. 376)

School of Film and Photography (p. 307)
Home Page: http://naturefilm.montana.edu/
• Master of Fine Arts in Science and Natural History Filmmaking (p. 308)

Department of Health and Human Development (p. 338)
Home Page: http://www.montana.edu/hhd/
• Addiction Counseling Graduate Certificate (p. 344)
• Community Health (http://catalog.montana.edu/graduate/education-health-human-development/community-health)
• Counseling Program Options (p. 339)
• Exercise and Nutrition Sciences (p. 342)
• Family & Consumer Sciences (http://catalog.montana.edu/graduate/education-health-human-development/family-consumer-sciences-option)
• Family Financial Planning (p. 344)
• Sustainable Food Systems (http://catalog.montana.edu/graduate/education-health-human-development/sustainable-food-systems)

Department of History and Philosophy (p. 377)
Home Page: http://www.montana.edu/wwwwhi/
• Master of Arts in History (p. 377)
• Doctor of Philosophy in History (p. 377)

Department of Land Resources and Environmental Sciences (p. 298)
Home Page: http://landresources.montana.edu/
• Master of Science in Entomology (p. 299) (Coordinating department)
• Master of Science in Land Rehabilitation (p. 300) (Interdisciplinary)
• Master of Science in Land Resources and Environmental Sciences (p. 300)
• Doctor of Philosophy in Ecology and Environmental Sciences (p. 408)

Department of Mathematical Sciences (p. 378)
Home Page: http://www.math.montana.edu/graduate/programs.html
• Master of Science in Mathematics (p. 378)
• Master of Science in Mathematics (p. 398) (Mathematics Education option)
• Master of Science in Statistics (p. 379)
• Doctor of Philosophy in Mathematics (p. 380)
• Doctor of Philosophy in Mathematics (p. 381) (Mathematics Education option)
• Doctor of Philosophy in Statistics (p. 382)
• Applied Statistics Certificate (p. 378)

Department of Mechanical and Industrial Engineering (p. 363)
Home Page: http://www.coe.montana.edu/mie/
• Master of Science in Mechanical Engineering (p. 364)
• Master of Science in Industrial and Management Engineering (p. 364)
• Doctor of Philosophy in Engineering (p. 351) (Options in Industrial Engineering and Mechanical Engineering)
• Doctor of Philosophy in Materials Science (p. 409)

**Department of Microbiology and Immunology (p. 382)**
Home Page: [http://www.montana.edu/mbim/](http://www.montana.edu/mbim/)
- M.S. in Immunology and Infectious Diseases (p. 296)
- M.S. in Microbiology, Plan A (p. 296) (Thesis)
- M.S. in Microbiology, Plan B (p. 297) (Professional Paper)
- Doctor of Philosophy in Microbiology (p. 297)
- Doctor of Philosophy in Immunology and Infectious Diseases (p. 298)

**Molecular BioSciences Program**
Home Page: [http://mbprogram.montana.edu/index.asp](http://mbprogram.montana.edu/index.asp)

**Department of Native American Studies (p. 383)**
Home Page: [http://www.montana.edu/wwwnas/](http://www.montana.edu/wwwnas/)
- Master of Arts in Native American Studies (p. 384)
- Online Certificate in Native American Studies (p. 400)

**College of Nursing (p. 391)**
Home Page: [http://www.montana.edu/nursing/](http://www.montana.edu/nursing/)
- ADRN to MN: Associate to Masters in Nursing (MN) (http://montana.edu/nursing/graduate/teaching_methods.html)
- Master of Nursing (MN) (p. 392)
- Doctor of Nursing Practice (DNP) Degree (p. 393)
- Nursing Education Certificate (p. 401)

**Department of Physics (p. 386)**
Home Page: [www.physics.montana.edu](http://www.physics.montana.edu)
- Master of Science in Physics (p. 387)
- Doctor of Philosophy in Physics (p. 387)
- Doctor of Philosophy in Materials Science (p. 409)
- Master of Science in Optics and Photonics Plan A (p. 361)
- Master of Science in Optics and Photonics Plan B (p. 362)

**Department of Plant Sciences (p. 301)**
Home Page: [http://plantsciences.montana.edu/studentinfo/grad/student_grad.html](http://plantsciences.montana.edu/studentinfo/grad/student_grad.html)
- Master of Science in Plant Pathology (p. 302)
- Master of Science in Plant Science (p. 302)
- Doctor of Philosophy in Plant Science (p. 302)

**Department of Political Science (p. 388)**
Home Page: [http://www.montana.edu/wwwcat/programs/grad_mpa.htm](http://www.montana.edu/wwwcat/programs/grad_mpa.htm)
- Master of Public Administration (p. 388)

**Department of Psychology (p. 390)**
Home Page: [http://www.montana.edu/wwwpy/](http://www.montana.edu/wwwpy/)
- Doctor of Philosophy in Psychological Science (p. 390)

**Master of Science in Science Education**
Home Page: [http://www.montana.edu/mseel](http://www.montana.edu/mseel)
- Master of Science in Science Education (p. 399)

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### Interdisciplinary Programs

- Doctor of Philosophy in Ecology and Environmental Sciences (p. 408)
- Doctor of Philosophy in Individual Interdisciplinary
  ([http://www.montana.edu/gradschool/graduate-programs/individual_interdisciplinary_phd.html](http://www.montana.edu/gradschool/graduate-programs/individual_interdisciplinary_phd.html))
- Master of Science in Environmental Engineering (p. 347)
- Master of Science in Health Science (p. 404)
- Master of Science in Land Rehabilitation (p. 300) (Interdisciplinary)
- Master of Science in Science Education (p. 399)
- Molecular Biosciences Program (p. 407)
- Post Baccalaureate Pre-Medical Certificate (p. 408)
- WIMU Veterinary Medicine (p. 410)
- WWAMI Medical Education Program (p. 411)
- Doctor of Philosophy in Materials Science (p. 409)
- M.S. in Optics and Photonics Plan A (p. 361)
- M.S. is Optics and Photonics Plan B (p. 362)

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### Montana State Online

[http://ei.montana.edu/online/degrees/](http://ei.montana.edu/online/degrees/)

#### Graduate Programs

- Master of Science in Agricultural Education (p. 395)
- Master of Education in Curriculum and Instruction (p. 317)
- Master of Science in Health and Human Development-Family Financial Planning (p. 344)
- Master of Science in Land Resources and Environmental Sciences (p. 300)
- Mathematics Education Option (p. 398)
- Nursing MN (p. 392)
- Nursing DNP (p. 393)
- Master of Science in Science Education (p. 399)

#### Graduate Certificates

- Addiction Counseling ([http://catalog.montana.edu/graduate/extended-university/addiction-counseling](http://catalog.montana.edu/graduate/extended-university/addiction-counseling))
- Chemistry Teaching Certificate (p. 403)
- Earth Science Teaching Certificate (p. 403)
- Elementary School Science Teaching Certificate (p. 403)
- Life Science Teaching Certificate (p. 404)
- Native American Studies (p. 400)
- Nursing Education (p. 401)
- School Library Media (p. 313)
- Science Teaching (p. 402)
- Physics Teaching Certificate (p. 404)

### College of Agriculture

**Graduate Programs Available:**

### Agricultural Education Program (p. 291)
- M.S. in Agricultural Education (p. 291)

## Department of Agricultural Economics and Economics (p. 291)
- M.S. in Applied Economics (p. 291)
Department of Animal and Range Sciences (p. 292)
- M.S. in Animal and Range Sciences (p. 293)
- M.S. in Land Rehabilitation (Interdisciplinary) (p. 300)
- Ph.D. in Animal and Range Sciences (p. 294)

Department of Land Resources and Environmental Sciences (p. 298)
- M.S. in Entomology (Coordinating Department) (p. 299)
- M.S. in Land Rehabilitation (Coordinating Department) (p. 300)
- M.S. in Land Resources and Environmental Sciences (p. 300)
- M.S. in Land Resources and Environmental Sciences - Online Program (http://landresources.montana.edu/grad/gradonline.html)
- Ph.D. in Ecology and Environmental Sciences (Interdisciplinary) (p. 408)

Department of Microbiology and Immunology (p. 294)
- M.S. in Immunology and Infectious Diseases (p. 296)
- M.S. in Microbiology (Plan A) (p. 296)
- M.S. in Microbiology (Plan B) (p. 297)
- Ph.D. in Microbiology (p. 297)
- Ph.D. in Immunology and Infectious Diseases (p. 298)

Department of Plant Sciences and Plant Pathology (p. 301)
- M.S. in Plant Pathology (p. 302)
- M.S. in Plant Science (p. 302)
- Ph.D. in Plant Science (p. 302)

WIMU Regional Program in Veterinary Medicine (p. 410)

Agricultural Education Program

Division of Agricultural Education
230 Linfield Hall
PO Box 172830, Bozeman, MT 59717-2830
Tel: 406-994-2132, Fax: 406-994-6696, email: annie.mollock@montana.edu

Division of Agricultural Education Head: Dr. George Haynes

Associate Professor: Dr. Carl G. Igo
Associate Professor and Graduate Coordinator: Dr. Shannon Arnold
Assistant Professor: Dr. Dustin Perry

Admission
In order to apply for the Agricultural Education program, be sure you have completed the following and are prepared to report it during the application process:

- A bachelor’s degree in an appropriate field such as agricultural education, agricultural communications, or an agriculturally related area from an accredited university
- An acceptable grade point average in undergraduate studies (minimum GPA of 3.0)
- Graduate Record Examination score of 300 or above (combined verbal and quantitative; verbal section minimum 152). Score of 3.5 or higher on the GRE analytical writing section
- International students only: Minimum TOEFL score of 213 is required for all international applicants

Once all application materials are received they will be reviewed by the Agricultural Education graduate committee. Based on their review, a recommendation will be made to The Graduate School regarding admission. The Graduate School will inform the applicant of their final decision. If you do not meet these requirements, you may seek provisional admission. Provisional admission is not guaranteed to students who do not meet the requirements but is used in defined instances.

Degree Requirements
To earn a Masters of Science in Agricultural Education students must complete a minimum of 30 credits. Students deficient in preliminary coursework may be required by their graduate committee to take additional courses for which they will not receive graduate credit (courses numbered 400). All students’ coursework must include Research Method in Agricultural Education (AGED 506), Program Planning and Evaluation (AGED 507), Graduate Seminar (AGED 594), Philosophy of Teaching and Learning in Agricultural Education AGED 511

The masters program may be taken under either of two plans. One plan requires a thesis (Plan A) and other requires a professional paper or project (Plan B, online). All students are expected to submit their research to a journal or periodical for publication upon the completion of their degree program.

Financial Assistance
Teaching and Research Assistantships may be available for qualified students. Interested students should apply to: Division of Agricultural Education, 230 Linfield Hall, P.O Box 172830, MSU, Bozeman, MT 59717-2830. See the Graduate Assistantship section of The Graduate School website for detailed information on appointment criteria.

Deadlines
Deadlines for applying to the Ag Ed program are:

- July 1st for Fall semester, November 15th for Spring Semester**
- March 15th for Summer semester**

**International students should have application materials in two months prior to the dates mentioned above.

Graduate Programs
- M.S. in Agricultural Education (p. 395)

Department of Agricultural Economics and Economics

Department Head
Dr. Gregory Gilpin
P.O. Box 172920
306 Linfield Hall, Bozeman, MT 59717-2920
Tel: 406-994-3701 Fax: 406-994-4838
Email: agoconadvising@montana.edu

Our Master of Science degree in Applied Economics encourages students to develop and apply their skills in economic analysis and examine a wide array of economic and political issues. Learning takes place through coursework in economic theory, quantitative methods, and econometrics, through collaborative work with departmental faculty, and through an intensive research thesis that addresses an important economic issue selected by the student.

Admission
Core graduate courses are taught at a level that requires entering students to have successfully completed courses in intermediate microeconomic
and macroeconomic theory, calculus, matrix algebra, and statistics. Applicants who have not completed the prerequisite material, but who have apparent potential for graduate study, may be admitted to the program on a provisional basis. A math review course is offered prior to Fall semester each year for all incoming graduate students. Applicants must submit Graduate Record Examination (GRE) scores, official transcripts of all degree coursework, three letters of recommendation, and an application fee of $60. A personal statement is recommended but is not required. Foreign applicants must also include English proficiency test scores from: TOEFL [80], IELTS [level 6.5] or PTE [54]; this test is necessary for applicants who are not U.S. citizens and not from countries where English is the official language. To apply for the M.S. in Applied Economics, visit our website: www.montana.edu/gradschool/apply.html

Degree Requirements
A core of economic theory and quantitative methods courses (or equivalent) is required. Students are required to maintain a 3.0 grade point average overall in their core courses and the courses in their graduate program. Failure to meet these requirements, as well as receipt of more than one grade less than a “B-” in the core courses will be grounds for termination. See Program Requirements on the department website for course information.

Student Graduate Committee
Faculty members in our Department have expertise in a wide variety of fields. Some examples of graduate topics taught by our faculty are advanced economic theory, static and dynamic optimization models in economics, the dynamic effects of fiscal & monetary policy on the macroeconomy, theory and use of regression analysis, public policy, and research methodology. Our faculty takes an active interest in our students, and this one-on-one contact with faculty in our department is consistently given high praise among our students.

Financial Assistance
A number of research and teaching assistantships are available for graduate students and are awarded on a competitive basis. Late applications will be received by January 15. For further information, refer to the Graduate Assistantships sections on the department website.

Degree Offered
• M.S. in Applied Economics (p. 292)

M.S. in Applied Economics
Program Requirements
A core of economic theory and quantitative methods courses (or equivalent) is required. Students are required to maintain a 3.0 grade point average overall in their core courses and the courses in their graduate program. Failure to meet these requirements, as well as receipt of more than one grade less than a “B-” in the core courses will be grounds for termination. The core includes:

Required Core Courses
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGBE 467</td>
<td>Quantitative Method in Ag Econ</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 401</td>
<td>Microeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 501</td>
<td>Microeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 502</td>
<td>Macroeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 561</td>
<td>Econometrics I</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 562</td>
<td>Econometrics II</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>ECNS 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

ECNS 590 Master’s Thesis 10
In addition to theory and quantitative methods core courses, students will successfully complete ECNS 569 Research Methodology. Supplementary coursework and research may focus on agricultural economics, natural resource economics, or general applied economics. Through continued discussions with the advisor and other faculty, students will select additional courses and either a thesis topic (Plan A) or research paper topic (Plan B) to complete a program of study consistent with their interests.

Students may choose to study special problems on an individual basis. Students desiring “Individual Problem” credit as either ECNS 592 Independent Study, AGBE 592 Independent Study, or AGBE 591 Special Topics should consult with a faculty member and agree upon a plan of study before the beginning of the semester in which the credits are to be undertaken. The Graduate School must approve all such courses, and limits the number of credits applicable toward degree requirements as: maximum of 3 credits for Option A or 6 credits for Option B.

Under Plan A, required minimums are: 20 semester credits (including the core courses of graduate coursework), and 10 semester credits of thesis. For those who have satisfied coursework prerequisites, the required degree coursework should be completed in two semesters. The thesis must be acceptable to the student’s graduate committee and to The Graduate School, and it must demonstrate independent and original research.

Under Plan B, a thesis is not required. This option includes at least 30 semester credits of graduate coursework. Students who select Option B are required to include a Professional Paper and Project (ECNS 575); maximum of 4 credits in a semester and a maximum of 6 credits for the program) as part of their program. For those who have satisfied coursework prerequisites, the required degree coursework (other than the research paper) should be completed in two or three semesters. The paper must be original, of professional quality (meet style and format requirements set forth in The Graduate School Guide for Preparation of Thesis and Professional Papers), be acceptable to the student’s graduate committee, and receive final approval by the Department Head.

Two examinations complete degree requirements. Each student is required to pass a Microeconomics Theory Core Exam – a written exam administered by the Department’s Graduate Affairs Committee. The exam is offered early spring semester, and may be offered one additional time each year; it will consist of questions covering the fundamental concepts of microeconomic theory and their application. In addition to the Core Exam, each student is required to pass an oral examination in defense of their thesis (Option A) or research paper (Option B). The oral examination is administered by the student’s graduate committee and is open to all members of the faculty. Students are expected to present a typed draft, in final form, of the thesis or research paper to each member of their graduate committee at least seven days prior to the scheduled date of their examination. The examination for Option A students should not be scheduled until the student’s thesis committee agrees that the thesis is essentially in a form acceptable to the University Library (that is, copies of the typed draft should be readable and have a table of contents, list of tables and figures, chapter titles, section headings, bibliography, and consecutively numbered pages). The examination for Option B students should not be scheduled until the paper is in a form that satisfies style and format requirements.

Department of Animal and Range Sciences
P.O. Box 172900
Bozeman, MT 59717-2900
406-994-5582
Department Head
Dr. Patrick Hatfield
103 Animal Bioscience Building, Bozeman, MT 59717
406-994-3722 Email: animalrange@montana.edu

Graduate Coordinator
Dr. Jane Ann Boles
207 Animal Bioscience Building, Bozeman, MT 59717
406-994-7352 Email: jboles@montana.edu

Admission
A minimum of 3.0 GPA on a 4.0 scale is required by The Graduate School for admittance. The undergraduate work should have been in Animal Science, Range Science or a closely related field. A faculty member must agree to advise a student before they will be accepted into the Animal and Range Sciences department. Acceptance to the MSU Animal and Range Sciences department does not imply automatic acceptance to The Graduate School at MSU. Financial support for the form of research assistantships and/or tuition and fee waivers is limited and will be awarded on a competitive basis.

We do require that a student take the GRE (Graduate Record Examination) and that the scores be included as part of the application material (sent directly from the testing agency to MSU); unofficial scores will be used for initial evaluation by the department. If you have not taken the GRE exam, you should do so at your earliest convenience. A minimum GRE score of 150 verbal and 146 quantitative (450 verbal and 350 quantitative in previous GRE scoring system) are required for full admission. GRE scores cannot be over 5 years old at time of application. In addition to the above requirements international applicants must have a TOEFL (English proficiency) score of 550 (paper) or 213 (computer).

Additional required application materials: Official transcripts (sent directly to the Department from all higher education schools attended (universities, colleges, and/or community colleges) or via email: gradschool@montana.edu. Three reference letters (letters cannot be from the intended major professor or potential committee members) and a personal statement must be submitted through the online application. A complete domestic application package must be received by the department by the following dates and International applications are due one month prior:

- For admission Fall semester - June 1
- For admission Spring semester - November 1
- For admission Summer semester - March 1

Degrees Offered
- M.S. in Animal and Range Sciences (p. 293)
- M.S. in Land Rehabilitation (interdisciplinary) (p. 300)
- Ph.D. in Animal and Range Sciences (p. 294)

Master of Science Animal and Range Sciences

Animal Science Emphasis
Graduate students in the Animal Science emphasis receive broad-based training resulting in experiences that qualify them for many agricultural jobs. Areas of emphasis include nutrition, breeding and genetics, physiology, production systems, and meat science/muscle growth. Research problems may involve beef cattle, sheep and biochemical or other properties of agricultural products. Supporting course work may be taken from Animal Science, Range Science, Biology, Wildlife Management, Biochemistry, Statistics, Plant Sciences, Land Resources and Environmental Sciences, and Economics.

Research laboratories are available in the department and specialized equipment is also available through cooperation with other departments.

The department conducts cooperative research with the U.S. Livestock and Range Research Station at Miles City, Montana, and the U.S. Sheep Experiment Station at Dubois, Idaho. Facilities for the maintenance of beef cattle and sheep are available at the Red Bluff Research Ranch, 30 miles west of Bozeman, the Fort Ellis Research Center, near Bozeman, and the Northern Agricultural Research Center at Havre. The main station has facilities for sheep, horses and beef cattle (a cattle feedlot and nutrition laboratory). A wool laboratory is located on campus.

Range Science Emphasis
Research and training opportunities in the Range Science programs are diverse, and students with a wide variety of backgrounds, goals, and educational needs are accepted. Major areas of study are range ecology, habitat management, watershed management, grazing management, monitoring, riparian ecosystems, measurements, and plant-animal (livestock and wildlife) interactions. A graduate degree with the range science emphasis prepares students for careers in rangeland management, wildlife management, habitat management, natural resource conservation and restoration, research, land-use planning, and consultation. Research facilities include the Red Bluff Research Ranch, several research centers of the Montana Agricultural Experiment Station, U.S. Livestock and Range Research Station at Miles City, Montana, and the U.S. Sheep Experiment Station at Dubois, Idaho. Cooperative projects with ranchers and federal and state agencies are also conducted. Supporting courses at the graduate level include botany, wildlife biology and management, soils, animal science, earth science, plant science, statistics and biochemistry.

Biology Emphasis
Graduate students in the Biology emphasis receive training directed toward the basic biological functions as they relate to animal production, meat science/meat food safety or entomology. Research projects may involve beef cattle, sheep and biochemical or other properties of agricultural products. Supporting course work may be taken from Animal Science, Range Science, Biology, Wildlife Management, Biochemistry, Statistics and Plant Sciences.

Minimum Requirements for a M.S. in Animal & Range Sciences

- At least one upper level (400 or 500) course in statistics.
- Two semesters of ARNR 507 Research Methods.
- Students must declare either the Animal Science, Range Science or Biology Emphasis:
  - Course requirements for students in the Animal Science Emphasis:
    - At least two courses from the Graduate Animal Science block (must be 500 level course)
  - Course requirements for students in the Range Science Emphasis:
    - At least two courses from the Graduate Range Science block (must be 500 level course)
  - Course requirements for students in the Biology Emphasis:
    - At least two biology-related 500-level courses in their area of emphasis

AND
• At least one course from the Graduate Animal Science block or Range Science block

NOTE: students emphasizing meat science in the Biology Emphasis can substitute – Biochemistry of Macromolecules for one of the two 500-level courses.

Graduate Animal Science Block

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARNR 520</td>
<td>Nutrient Metabolism</td>
<td>3</td>
</tr>
<tr>
<td>ARNR 521</td>
<td>Adv Ruminant Nutrition</td>
<td>3</td>
</tr>
<tr>
<td>ARNR 523</td>
<td>Adv Physiology of Reproduction</td>
<td>3</td>
</tr>
<tr>
<td>ARNR 524</td>
<td>Adv Animal Breeding</td>
<td>3</td>
</tr>
<tr>
<td>ARNR 525</td>
<td>Muscle Growth &amp; Biology</td>
<td>3</td>
</tr>
</tbody>
</table>

Graduate Range Science Block

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARNR 508</td>
<td>Rangeland Ecological Theory and Application</td>
<td>3</td>
</tr>
<tr>
<td>ARNR 541</td>
<td>Range Ecophysiology</td>
<td>3</td>
</tr>
<tr>
<td>ARNR 543</td>
<td>Riparian Process &amp; Function</td>
<td>3</td>
</tr>
<tr>
<td>ARNR 544</td>
<td>Advanced Grazing Management and Ecology</td>
<td>3</td>
</tr>
<tr>
<td>ARNR 555</td>
<td>Rangeland Wildlife Ecology &amp; Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Students must meet the proficiency requirements for their emphasis area (see Proficiencies below).

Proficiency Requirements for Animal Science Emphasis

By the time a student completes a M.S. or Ph.D. in Animal & Range Sciences (Animal Science Emphasis), he/she must have successfully completed undergraduate or graduate coursework in three of the four areas listed below. Examples of MSU courses that fulfill these requirements are given. Students who have successfully completed an equivalent course may apply that course toward the proficiency requirements, subject to the approval of the student’s Graduate Committee. Undergraduate courses in these categories are not intended to comprise a substantial portion of a student’s graduate curriculum. These courses should be taken in addition to, not in lieu of, other courses in a graduate program. While some courses may apply toward requirements for the M.S. in Animal & Range Sciences and proficiency requirements, the student’s Graduate Committee must not allow the need to meet proficiency requirements detract from a student completing a rigorous graduate degree program.

• Breeding/Genetics (ANSC 322 Principles of Animal Breeding and Genetics or BIOB 375 General Genetics)
• Physiology/Reproduction (ANSC 321 Physiology of Animal Reproduction)
• Nutrition (ANSC 320 Animal Nutrition)
• Production/Management (ANSC 434R Beef Cattle Management)

Proficiency Requirements for Biological Science Emphasis

By the time a student finishes the M.S. degree in Animal & Range Sciences (Biological Science Emphasis), he/she must have successfully completed a minimum of 15 credit hours in the biological sciences with at least 9 credit hours in upper division course work which may include: biological sciences, chemistry, microbiology, food science, entomology, and ecology. Examples of MSU courses that fulfill these requirements are given. Students who have successfully completed an equivalent course may apply that course toward the proficiency requirements, subject to the approval of the student’s Graduate Committee. Undergraduate courses in these categories are not intended to comprise a substantial portion of a student’s graduate curriculum. These courses should be taken in addition to, not in lieu of, other courses in a graduate program. While some courses may

apply toward requirements for the M.S. in Animal & Range Sciences and proficiency requirements, the student’s Graduate Committee must not allow the need to meet proficiency requirements detract from a student completing a rigorous graduate degree program.

• Biology (BIOB 160 Principles of Living Systems, BIOB 170IN Principles of Biological Diversity, BIOB 260 Cellular and Molecular Biology)
• Ecology (BIOE 370 General Ecology (equiv to 270); BIOE 405 Behavioral and Evolutionary Ecology)
• Chemistry (CHMY 141 College Chemistry I, CHMY 143 College Chemistry II, CHMY 211 Elements of Organic Chemistry; CHMY 311 Fundamental Analytical Chem, CHMY 321 Organic Chemistry I)
• Biochemistry (BCH 380 Biochemistry)
• Entomology (BIOO 262IN Introduction to Entomology)
• Food Science / Meat Science (Introductory Food Science or upper division food science or food safety course)

Ph.D. in Animal & Range Sciences

Requirements

The Ph.D. program is based upon an area of specialization in research and intensive coursework that would normally require three years of full-time work beyond the M.S. degree.

In addition to departmental requirements candidates must fulfill the requirements of The Graduate School. The general requirements include:

• PhD students in Animal and Range Sciences will be required to take 3 credits of ARNR 507 Research Methods and a graduate (400-500 level) course in experimental design and two graduate statistical methods courses.
• The major professor and the student’s graduate committee will determine additional specific course requirements for completion of the Ph.D. degree.
• All PhD programs must comply with The Graduate School, including 60 credits hours (18 which must be dissertation credits) above the B.S. degree.
• Students must choose either the Animal Science option or the Range Science option; beyond this there are no specific minimum course requirements for the PhD program.
• Specific requirements are to be decided by the student’s graduate committee.

Department of Microbiology and Immunology

http://www.montana.edu/mbim/

Microbiology & Immunology offices:
PO Box 173520
Tel: 406-994-2902 Fax: 406-994-4926
Email: mbi@montana.edu

The Department of Microbiology and Immunology (M&I) conducts one of the premier infectious disease research programs in the Northwest, as demonstrated by the success of our faculty in competing nationally for extramural grant funding and publishing high-impact papers. Research funding comes from a range of sources such as the National Institutes of Health, US Department of Agriculture, National Science Foundation and the Montana Agricultural Experimental Station among others. Over
the past five years, M&I averaged over $6 million for annual research expenditures. M&I is also home to an NIH Center of Biomedical Research Excellence in Zoonotic and Emerging Infectious Diseases, which provides substantial core facilities and training opportunities for junior investigators. M&I is housed in a state-of-the-art facility with core laboratories for flow cytometry, cell biology, and molecular sciences, as well as pathogen containment facilities for small (BSL-3) and large animal research (ABSL-2). Instrumentation suites house equipment for DNA sequencing, genomic analysis, flow cytometry and cell sorting, and confocal microscopy.

We are uniquely situated in the close proximity to Yellowstone National Park. Our doorstep is one of the most exciting microbial ecosystems in North America, ripe with opportunities to discover new microbial life forms and contribute to major biotechnological advances. Many of our undergraduate and graduate students conduct research in the Park under the mentoring of our distinguished faculty.

Weekly seminars are offered by the department and the Frank N. Nelson Distinguished Lecture Series brings many accomplished scientists to Montana State University.

Admission

For detailed information, refer to the Admission Policies and Application Requirements sections. The M&I Core Committee will screen all applications and make recommendations to the Graduate Dean for acceptance to the M&I graduate program. Successful applicants are accepted into both the department and The Graduate School.

In addition to the documents required in the Application Requirements section, the Graduate Core Committee will consider the applicant’s research experience and the potential of the applicant to complete an appropriate program of study and an independent research project. The final disposition of each application will also take into account other factors, such as the availability of research positions (stipends).

The Graduate Core Committee, M&I faculty, and the M&I head will decide on the acceptability of all applicants. The Graduate Core Committee will serve as the “adviser” for all students accepted into the program during their first year of study.

Research

The research problem will be chosen in consultation with the student’s thesis or dissertation advisor. Research areas include microbiology, molecular biology and immunology, bacteriology, cell biology, mycology, parasitology, protozoology, physiology, genetics, biochemistry, ultrastructural cytology, virology, immunopathology, and a strong focus on biomedical research. Specialized equipment and facilities include large and small animal isolation units, a flow cytometry core facility, automated DNA sequencers, proteomics and genomics instrumentation, a microscopy core, numerous analytical equipment, multiple tissue-culture and histopathology laboratories.

Financial Assistance

Normally, all students accepted into the M&I graduate program are offered graduate stipends funded by State sources and research grants obtained by M&I faculty. Teaching assistantships are normally not available. Appointments are made on a 12-month basis. Beginning stipends are supported at a level of $22,000 per year plus tuition, health insurance, and other fees.

See the Graduate Assistantship sections on the department website for detailed information on appointment criteria.

Degrees Offered

- M.S. in Immunology and Infectious Diseases (p. 296)
- M.S. in Microbiology (Plan A) (p. 296)
- M.S. in Microbiology (Plan B) (p. 297)
- Ph.D. in Microbiology (p. 297)
- Ph.D. in Immunology and Infectious Diseases (p. 298)

The Immunology and Infectious Diseases Program uniquely combines expertise in the study of pathogen biology, host defense, cell biology and use of small and large animal models. Four areas broadly encompass the scope of immunology and infectious diseases research:

- Molecular and genetic studies of animal and pathogen biology
- Understanding molecular pathways of communication between pathogen and host
- Regulation of host immune responses in human and animal diseases
- Uncovering molecular mechanisms of pathogen virulence

### Immunology and Infectious Diseases Program Requirements

Graduate students are expected to have a basic understanding of biochemistry, molecular biology, immunology, and microbiology. The Master of Science degree requires a minimum of twenty (20) course credits and ten (10) credits of Master’s Thesis research beyond the baccalaureate degree as specified below. Students must maintain a 3.0 GPA.

1. A maximum of 3 credits of 400-level coursework may be applied to the M.S. degree.

#### Elective 400-level coursework Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 441</td>
<td>Biochemistry of Macromolecules</td>
<td>3</td>
</tr>
<tr>
<td>STAT 401</td>
<td>Applied Methods in Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

2. There are 18 credits of required 500-level coursework for the M.S. degree.

#### Required 500-level coursework Credits

<table>
<thead>
<tr>
<th>Course Codes</th>
<th>Course Titles</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 524</td>
<td>Ethical Practice of Science</td>
<td>3</td>
</tr>
<tr>
<td>IMID 501</td>
<td>Exper Immunology/Pathology</td>
<td>3</td>
</tr>
<tr>
<td>IMID 505</td>
<td>Eukaryotic Gene Regulation</td>
<td>3</td>
</tr>
<tr>
<td>IMID 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

3. A minimum of 6 credits of elective 500-level coursework is required for the M.S. degree.

#### Elective Coursework Credits (examples)

<table>
<thead>
<tr>
<th>Course Codes</th>
<th>Course Titles</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 524</td>
<td>Mass Spectrometry</td>
<td>3</td>
</tr>
<tr>
<td>BCH 543</td>
<td>Proteins</td>
<td>3</td>
</tr>
<tr>
<td>BCH 544</td>
<td>Molecular Biology</td>
<td>3</td>
</tr>
</tbody>
</table>

4. A minimum of 10 credits of IMID 590 (Master’s Thesis) is required for the M.S. degree.

#### Master’s Thesis Research Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Master’s Thesis Research</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMID 590</td>
<td>Master’s Thesis</td>
<td>10</td>
</tr>
</tbody>
</table>

Graduate students enrolled for the Ph.D. degree are required to take at least 25 credits of coursework and 35 credits of doctoral Thesis Research credits as specified below. Students must maintain a 3.0 GPA.

1. 9 credits of 400-level coursework may be applied to the Ph.D. degree.
Optional coursework Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 441</td>
<td>Biochemistry of Macromolecules</td>
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</tr>
<tr>
<td>STAT 401</td>
<td>Applied Methods in Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

2. There are 23 credits of required 500-level coursework for the Ph.D. degree.

Required coursework Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 524</td>
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</tr>
<tr>
<td>IMID 501</td>
<td>Exper Immunology/Pathology</td>
<td>3</td>
</tr>
<tr>
<td>IMID 505</td>
<td>Eukaryotic Gene Regulation</td>
<td>3</td>
</tr>
<tr>
<td>IMID 521</td>
<td>Laboratory Rotation I</td>
<td>2</td>
</tr>
<tr>
<td>IMID 522</td>
<td>Laboratory Rotation II</td>
<td>2</td>
</tr>
<tr>
<td>IMID 523</td>
<td>Laboratory Rotation III</td>
<td>2</td>
</tr>
<tr>
<td>IMID 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

2. There are 23 credits of required 500-level coursework for the Ph.D. degree.

Required coursework Credits

<table>
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<tr>
<th>Course Code</th>
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<tbody>
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<tr>
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<td>3</td>
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<td>IMID 521</td>
<td>Laboratory Rotation I</td>
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<tr>
<td>IMID 522</td>
<td>Laboratory Rotation II</td>
<td>2</td>
</tr>
<tr>
<td>IMID 523</td>
<td>Laboratory Rotation III</td>
<td>2</td>
</tr>
<tr>
<td>IMID 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

3. A minimum of 6 credits of elective 500-level coursework is required for the Ph.D. degree.

Elective coursework Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 524</td>
<td>Mass Spectrometry</td>
<td>3</td>
</tr>
<tr>
<td>BCH 543</td>
<td>Proteins</td>
<td>3</td>
</tr>
<tr>
<td>BCH 544</td>
<td>Molecular Biology</td>
<td>3</td>
</tr>
</tbody>
</table>

4. 35 credits of IMID 690 Doctoral Thesis is required for the Ph.D. degree

Doctoral Thesis Research Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMID 690</td>
<td>Doctoral Thesis</td>
<td>1-10</td>
</tr>
</tbody>
</table>

M.S. in Immunology and Infectious Diseases

The M.S. in Immunology and Infectious Diseases requires the below courses. The list represents only the minimum number of courses a student will take, as the student may be required to take preparatory courses if they are found to be deficient in specific areas (for example, Biochemistry or Immunology). These additional classes can count in the students Program of Study (no more than 9 credits can be 400-level). The students’ Ph.D. adviser may recommend additional coursework if it is relevant to the research within the Ph.D. program.

20 credits coursework
10 credits 590 thesis credits
30 credits total

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 524</td>
<td>Ethical Practice of Science</td>
<td>3</td>
</tr>
<tr>
<td>IMID 501</td>
<td>Exper Immunology/Pathology</td>
<td>3</td>
</tr>
<tr>
<td>IMID 505</td>
<td>Eukaryotic Gene Regulation</td>
<td>3</td>
</tr>
<tr>
<td>IMID 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>IMID 590</td>
<td>Master’s Thesis</td>
<td>10</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

M.S. in Microbiology (Plan A)

Course credits

- A minimum of 30 credits is required for graduation of which 20 must be for course work and not thesis credit.
- At least half of these 20 credits must be in the major subject area (MB).
- A minimum of 10 thesis credits must be successfully completed.
- Two-thirds of the minimum 30 credits must be at the 5XX-level. (Undergraduate courses at the 4XX-level are allowed but not 3XX-level).
- Credit in Seminar (MB 594), Independent Study (MB 592) and Internship (MB 598) courses in seminar (500), individual problem (570) and internship (576) courses may not exceed 1/3 of credits required.
- Course work more than 6 years old cannot be applied toward the program – see The Graduate School policy on transfer and age of credits (http://www.montana.edu/gradschool/policy).
- Transfer credits – see The Graduate School policy at Transferring Credits.

Pass-fail

No more than 3 credits taken on Pass/Fail basis may be applied to a M.S. program (aside from thesis credits). For more information on Pass/Fail courses, see The Graduate School policy on Pass/Fail.

Core Curriculum

All M.S. Plan A students are required to take two courses: MB520 - Microbial Physiology (fall semester) and BIOB524 - Ethical Practice of Science (spring semester).

All M.S. students are required to take at least one course in three of the six areas of the core curriculum. The six areas of the core curriculum and the courses which can be used to satisfy the requirement are:

<table>
<thead>
<tr>
<th>Area</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioinformatics</td>
<td>MB 537</td>
<td>Advance in Molecular Evol (Fall TBA)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MB 544</td>
<td>Advanced Bioinformatics (Spring even yrs)</td>
<td>4</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>BCH 543</td>
<td>Proteins (Fall odd yrs)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BCH 544</td>
<td>Molecular Biology (Spring odd yrs)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MB 527</td>
<td>Toxicology (Spring)</td>
<td>3</td>
</tr>
<tr>
<td>Immunology</td>
<td>MB 525</td>
<td>Advanced Immunology (Spring even yrs)</td>
<td>3</td>
</tr>
<tr>
<td>Microbial evolution &amp; ecology</td>
<td>MB 560</td>
<td>Infectious Disease Ecology &amp; Spillover (Fall)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MB 591</td>
<td>Special Topics (Precambrian Biosphere)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ERTH 505</td>
<td>Geomicrobiology (Spring even yrs)</td>
<td>3</td>
</tr>
<tr>
<td>Microbial genetics &amp; physiology</td>
<td>MB 528</td>
<td>Advanced Genetics (Spring odd yrs)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>IMID 505</td>
<td>Eukaryotic Gene Regulation (Spring odd yrs)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>EBIO 566</td>
<td>Fundamentals of Biofilm Engr (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>Microbial pathogenesis &amp; epidemiology</td>
<td>MB 505</td>
<td>Host-Associated Microbiomes (Fall)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>MB 530</td>
<td>Virology (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>Scientific Writing</td>
<td>MB591</td>
<td>Scientific Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

Courses required to fill each area of the core are likely to change as new courses are developed and approved by the Graduate Program Committee.
Current course descriptions are available in the MSU On-Line Catalog. Current course availability is found in the MSU On-Line Schedule of Classes.

- **MB 594 seminars**
  - All students are required to attend and participate in the Departmental Seminar (MB 594 section 01) each semester in residence. [Students who are also members of the Center for Biofilm Engineering will have the option of attending either the Departmental Seminar or the CBE Seminar during their first two years, but must attend at least two semesters of each during this time.]
  - Students are encouraged to register for these each semester, if possible, although there are limits to the number of MB 594 credits allowed in a Graduate Program (3 for M.S.)
  - Have the office staff register you online – there are conflicts when taking multiple MB 594 sections.

- **Thesis**
  - A thesis approved by the Graduate Committee, Department Head, and the Dean of The Graduate School is required.
  - A hardbound copy of Thesis must be provided to the Microbiology Department for inclusion in the Cotton-Morris library.

### M.S. in Microbiology (Plan B)

**Course credits**
- A minimum of 30 credits is required for graduation.
- At least half of these 30 credits must be in the major subject area (MB).
- Two-thirds of the minimum 30 credits must be at the 5XX-level. (Undergraduate courses at the 4XX-level are allowed but not 3XX-level).
- Credit in Seminar (MB 594), Modeling infectious disease dynamics (MB 592) and Internship (MB 598) courses may not exceed 1/3 of credits required.
- Credit for a Professional Paper (MB 575) may not exceed 6 credits.
- Course work more than 6 years old cannot be applied toward the program - see The Graduate School policy on transfer and age of credits required.
- Transfer credits – see The Graduate School policy at Transferring Credits (http://www.montana.edu/gradschool/policy).
- Transfer credits – see The Graduate School policy at Transferring Credits (http://www.montana.edu/gradschool/policy).

**Pass-fail**
No more than 3 credits taken on Pass/Fail basis may be applied to a M.S. program (aside from thesis credits). For more information on Pass/Fail courses, see The Graduate School policy on Pass/Fail.

### Core Curriculum

All M.S. Plan B students are required to take BIOB524 - Ethical Practice of Science (spring semester).

All M.S. students are required to take at least one course in **three** of the six areas of the core curriculum. The six areas of the core curriculum and the courses which can be used to satisfy the requirement are:

<table>
<thead>
<tr>
<th>Bioinformatics</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MB 537</td>
<td>Advance</td>
<td>Molecular Biology (Fall TBA)</td>
</tr>
<tr>
<td>MB 544</td>
<td>Advanced</td>
<td>Advanced Bioinformatics (Spring even yrs)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biochemistry</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 543</td>
<td>Proteins</td>
<td>(Fall odd yrs)</td>
</tr>
</tbody>
</table>

| BCH 544              | Molecular Biology | (Spring odd yrs) | 3 |
| MB 527               | Toxicology       | (Spring) | 3 |

### Immunology

| MB 525               | Advanced Immunology | (Spring even yrs) | 3 |

### Microbial evolution & ecology

| MB 560               | Infectious Disease Ecology & Spillover | (Fall) | 3 |
| MB 591               | Special Topics | (Precambrian Biosphere) | 3 |
| ERTH 505             | Geomicrobiology | (Spring even yrs) | 3 |

### Microbial genetics & physiology

| MB 528               | Advanced Genetics | (Spring alt odd) | 3 |
| IMID 505             | Eukaryotic Gene Regulation | (Spring alt odd) | 3 |

### Microbial pathogenesis & epidemiology

| MB 505               | Host-Associated Microbiomes | (Fall) | 4 |
| MB 530               | Virology | (Fall) | 3 |

### Scientific Writing

| MB 591               | Scientific Writing | 3 |

Courses required to fill each area of the core are likely to change as new courses are developed and approved by the Graduate Program Committee. Current course descriptions are available in the MSU On-Line Catalog. Current course availability is found in the MSU On-Line Schedule of Classes.

- **MB 594 seminars**
  - All students are required to attend and participate in the Departmental Seminar (MB 594 section 01) each semester in residence. [Students who are also members of the Center for Biofilm Engineering will have the option of attending either the Departmental Seminar or the CBE Seminar during their first two years, but must attend at least two semesters of each during this time.]
  - Students are encouraged to register for these each semester, if possible, although there are limits to the number of MB 594 credits allowed in a Graduate Program (3 for M.S.)
  - Have the office staff register you online – there are conflicts when taking multiple MB 594 sections.

### Ph.D. in Microbiology

**Course credits**
- A minimum of 60 post-baccalaureate credits are required for graduation. Students who already have an applicable Master’s degree may be able to apply up to 30 credits toward the 60 credits for the Ph.D. 

  *The 60 credit minimum was instated for students beginning Fall 2007 semester. Students who enrolled prior to this time may stay with the 30 credit minimum previously required.*

- A minimum of 18 Doctoral Thesis (MB 690) credits are required.
- 20 credits of coursework are recommended and at least half of those must be in the major subject area (MB).
- Two-thirds of the minimum 60 credits must be at the 5XX-level. (Undergraduate courses at the 4XX-level are allowed but not 3XX-level).
- Credit in MB 594 Seminar), MB 592 Modeling infectious disease dynamics(individual problem) and MB 598 Internship courses may not exceed 1/3 of credits required.
- Credit for a Professional Paper (MB 575) may not exceed 6 credits.
• Course work more than 10 years old cannot be applied toward the program.
• Transfer credits – see The Graduate School policy at Transferring Credits (http://www.montana.edu/gradschool/policy).

Pass-fail
No more than 3 credits taken on Pass/Fail basis may be applied to a Ph.D. program (aside from thesis credits). For more information on Pass/Fail courses, see The Graduate School policy on Pass/Fail (http://www.montana.edu/gradschool/policy/degreq_specialcourses.html#degreq_special_pass_fail).

Core Curriculum
All Ph.D. students are required to take two courses: MB520 - Microbial Physiology (fall semester) and BIOB524 - Ethical Practice of Science (spring semester).

In addition, all Ph.D. students are required to take at least one course in four of the six areas of the core curriculum. The six areas of the core curriculum and the courses which can be used to satisfy the requirement are:

Bioinformatics
MB 537 Advance in Molecular Evol (Fall TBA) 3
MB 544 Advanced Bioinformatics (Spring even yrs) 4

Biochemistry
BCH 545 Proteins (Fall odd yrs) 3
BCH 544 Molecular Biology (Spring odd yrs) 3
MB 527 Toxicology (Spring) 3

Immunology
MB 525 Advanced Immunology (Spring even yrs) 3

Microbial evolution & ecology
MB 560 Infectious Disease Ecology & Spillover (Fall) 3
MB 591 Special Topics (Precambrian Biosphere) 3
ERTH 505 Geomicrobiology (Spring even yrs) 3

Microbial genetics & physiology
MB 528 Advanced Genetics (Spring odd yrs) 3
IMID 505 Eukaryotic Gene Regulation (Spring odd yrs) 3
EBIO 566 Fundamentals of Biofilm Engr (Fall) 3

Microbial pathogenesis & epidemiology
MB 505 Host-Associated Microbiomes (Fall) 4
MB 530 Virology (Fall) 3

Scientific Writing
MB 591 - Scientific Proposal Writing 3

Courses required to fill each area of the core are likely to change as new courses are developed and approved by the Graduate Program Committee. Current course descriptions are available in the MSU On-Line Catalog. Current course availability is found in the MSU On-Line Schedule of Classes.

- MB 500 seminars
  • All students are required to attend and participate in the Departmental Seminar (MB 594 section 01) each semester in residence. [Students who are also members of the Center for Biofilm Engineering will have the option of attending either the Departmental Seminar or the CBE Seminar during their first two years, but must attend at least two semesters of each during this time.]

• Students are encouraged to register for these each semester, if possible, although there are limits to the number of MB 594 credits allowed in a Graduate Program (3 for M.S.)
• Have the office staff register you online – there are conflicts when taking multiple MB 594 sections.

- Laboratory Rotations. New students in the Ph.D. program are encouraged to participate in laboratory rotations. Students will be expected to work at least 12 hours per week in each rotation and will register for two semester credits of MB 592 Modeling infectious disease dynamics (Individual Problems) each semester.

- Minor/Supporting Area. A student has the option of including a minor (15 credits) or a supporting area (9 credits) in their degree program.

- Dissertation*. A dissertation approved by the Graduate Committee, Department Head, and the Dean of The Graduate School is required. This must be submitted as an electronic dissertation not later than 14 days before the end of the semester.

- A hardbound copy of the dissertation must be provided to the Microbiology Department for inclusion in the Cotner-Morris library.

*No more than five years may pass between successful completion of comprehensive exams and the time of completion of the Ph.D. degree. For more details on doctoral requirements, refer to The Graduate School policies (http://www.montana.edu/gradschool/policy).

Ph.D. in Immunology and Infectious Diseases
Below are a list of the minimum number of courses needed for the Ph.D. in Immunology and Infectious Diseases. Students may be required to take preparatory courses if they are found to be deficient in specific areas (For example, Biochemistry or Immunology). These additional courses can count in your Program of Study; however, no more than 9 credits can be preparatory courses if they are found to be deficient in specific areas (For example, Biochemistry or Immunology). These additional courses can count in your Program of Study; however, no more than 9 credits can be allowed in a Graduate Program (3 for M.S.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOP 524</td>
<td>Ethical Practice of Science</td>
<td>3</td>
</tr>
<tr>
<td>IMID 501</td>
<td>Exper Immunology/Pathology</td>
<td>3</td>
</tr>
<tr>
<td>IMID 505</td>
<td>Eukaryotic Gene Regulation</td>
<td>3</td>
</tr>
<tr>
<td>IMID 521</td>
<td>Laboratory Rotation I</td>
<td>2</td>
</tr>
<tr>
<td>IMID 522</td>
<td>Laboratory Rotation II</td>
<td>2</td>
</tr>
<tr>
<td>IMID 523</td>
<td>Laboratory Rotation III</td>
<td>2</td>
</tr>
<tr>
<td>IMID 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>IMID 690</td>
<td>Doctoral Thesis (Research Credits)</td>
<td>35</td>
</tr>
</tbody>
</table>

Total Credits: 60

Department of Land Resources and Environmental Sciences
Montana State University
334 Leon Johnson Hall
P.O. Box 173120
Bozeman, MT 59717-3120
406-994-7060 Email: lresinfo@montana.edu
Application Deadlines

U.S. and Canada

- Fall - May 15
- Spring - October 1
- Summer - February 1

International

- Fall - April 15
- Spring - September 1
- Summer - January 1

Departmental Facilities

LRES faculty members conduct cutting-edge investigations in state-of-art laboratory facilities, the modern Plant Growth Center, and in the many outstanding and diverse natural laboratories within and beyond the Greater Yellowstone Ecosystem. We utilize public and private lands across the state and region, as well as the MSU Agricultural Experiment Station facilities. Our faculty are participants and collaborators in many centers and institutes within and outside MSU. LRES faculty advisers work with national and international scientific collaborators, and are internationally recognized for their research and instructional excellence.

Environmental Sciences Analytical Laboratory

The department boasts a modern shared analytical facility that houses many state of art instruments for soil, water, air and plant analyses. The facility supports faculty and graduate student research programs, and provides outstanding hands-on experiences and instruction with diverse analytical measurement techniques.

Spatial Sciences Center

LRES faculty and staff are key members of the MSU Spatial Sciences Center. The Global Positioning System (GPS) Laboratory provides GPS base station data for determination of accurate location coordinates for field mapping projects. The Remote Sensing Laboratory offers a state-of-the-art facility with extensive abilities to analyze both digital and analog imagery. Equipment and support for both laboratories facilitate teaching, cooperative research, and land resource inventory and management activities.

Degrees Offered

- M.S. in Entomology (Interdisciplinary/Coordinating Department) (p. 299)
- M.S. in Land Rehabilitation (Interdisciplinary/Coordinating Department (p. 300)
- M.S. in Land Resources and Environmental Sciences (p. 300)
- M.S. in Land Resources and Environmental Sciences – Online (http://landresources.montana.edu/grad/gradonline.html)
- Ph.D. in Ecology and Environmental Sciences (Interdisciplinary) (p. 408)

M.S. in Entomology

The graduate program in Entomology at Montana State University leads to a Master of Science degree. Students in the program are required to take formal course work and conduct independent research guided by the student’s advisory committee. Each student, during the course of her/his graduate program, will also have the opportunity to participate in...
activities outside their degree program that will benefit them academically and professionally. Such activities include participating in teaching and outreach programs, taking part in the entomology seminar series, and attending and presenting research results at professional meetings. Each student is strongly encouraged to take advantage of these opportunities. A student’s individual program can be designed, with approval of the graduate advisor and graduate committee, to suit the student’s individual interests and career goals.

The entomology faculty at MSU conduct research in a variety of disciplines, including behavioral ecology, biodiversity studies, biological control of insects and weeds, biosystematics, chemical ecology, integrated pest management, pollination ecology, risk assessment, stored-product entomology, thermal biology, and veterinary entomology. Entomological research at MSU includes some of the most important pests in the western U.S., including alfalfa weevil, aphids, cutworms, grasshoppers, Hessian fly, lygus bugs, mosquito vectors of West Nile Virus, wheat-stem sawfly, wireworms, and others. Beneficial insects under study include various biological control agents and pollinators. Most faculty conduct both applied and basic research.

Admission

An entering student is expected to have a solid background in the basic sciences and a B.S. or B.A. in biological or related sciences. They are expected to present evidence of college level training and mastery in biology, chemistry and mathematics sufficient to provide a good background for further study at the advanced level. Students with deficiencies may be required to take background courses to make up these deficiencies before or after being approved for acceptance.

GRE exams are to be taken before applying for admittance and are part of the required application materials. Minimum scores of 150 verbal and 146 quantitative (Old scoring system: 450 verbal and 550 quantitative).

International Applicants: An English proficiency test is required for all applicants who are not U.S. citizens and are not from countries where English is the official language. This requirement is waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S. Minimum scores required are: TOEFL [80], IELTS [level 6.5] or PTE [54].

A GPA of 3.0 for the last two years, three letters of recommendation and a letter of application describing the applicant’s research interests and career goals in pursuing graduate training are minimum requirements for acceptance to the LRES graduate program.

All applications are evaluated by a departmental review committee and the Department Head for final recommendation to the Dean of The Graduate School. Successful applicants are accepted into both the Department and The Graduate School.

Entomology Curriculum

A minimum of 20 semester hours of course work and at least 10 thesis credit hours are required for the degree. Students deficient in preliminary course work may be required to take additional courses for which they will not receive graduate credit (course numbers <400). A minimum of 24 credits of course work (Including not more than 10 thesis credits) must be taken from Montana State University. Courses taken outside of Entomology must constitute a unified program approved by the student’s graduate committee.

Current research focuses on insect pests of agricultural importance, biological control of insects and weeds, integrated pest management, and basic studies in ecology, physiology, behavior, and evolution. Fieldwork is an integral part of most programs. Resources include a comprehensive insect collection, the regional Insect Quarantine Facility, and access to a state-of-the-art Plant Growth Center with glasshouse space, growth rooms, and growth chambers.

Required Courses (must be taken by all M.S. students)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOO 465</td>
<td>Insect Identification</td>
<td>4</td>
</tr>
<tr>
<td>ENTO 510</td>
<td>Insect Ecology</td>
<td>3</td>
</tr>
<tr>
<td>ENTO 520</td>
<td>Insect Physiology</td>
<td>3</td>
</tr>
<tr>
<td>ENTO 594</td>
<td>Seminar (1 credit each semester-3 credits total)</td>
<td>3</td>
</tr>
<tr>
<td>ENTO 590</td>
<td>Master’s Thesis</td>
<td>10</td>
</tr>
<tr>
<td>STAT 511</td>
<td>Methods of Data Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 512</td>
<td>Methods of Data Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>AGSC 401</td>
<td>Integrated Pest Management</td>
<td>3</td>
</tr>
<tr>
<td>ANSC 410</td>
<td>Veterinary Entomology and Parasitology</td>
<td></td>
</tr>
<tr>
<td>ENTO 525</td>
<td>Insect Morphology</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 32

M.S. in Land Rehabilitation

Course work in land rehabilitation is designed to serve students new to the rehabilitation field, as well as to experienced individuals or those already working in land rehabilitation or restoration ecology and who desire further education and training. Montana State University offers core courses in land rehabilitation and restoration ecology, and a very strong array of supporting courses in relevant disciplines. These courses are integrated with the core curriculum to add breadth and depth to the program and to make specialization possible in a given aspect of land rehabilitation. Site revegetation, soil remediation, restoration of riparian zones and stream channels, remediation of contaminated sites, and management of invasive plants are among the many potential areas of study. Emphasis is placed on developing a broad understanding of soil, plant and hydrological processes as foundation to effective applications. With the exception of required core courses, course sequences will be designed to correspond with the specific needs, interests and educational goals of the individual student. This program emphasizes soil, vegetation and water sciences, and graduates are expected to be well versed in these areas in addition to the student’s particular area of interest.

Core Curriculum

30 credits minimum (10 thesis, 20 course work) required for master’s degree. 2/3 of total credits must be 500 level. Candidates for the M.S. degree in Land Rehabilitation must complete a 8 credit core curriculum. Elective credits will reflect foundational courses as well as student’s special interests. A minimum of 20 credits of coursework must be taken from MSU.

Required Core Courses (8 credits) Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRES 563</td>
<td>Restoration Ecology</td>
<td>3</td>
</tr>
<tr>
<td>ENSC 460</td>
<td>Soil Remediation</td>
<td>3</td>
</tr>
<tr>
<td>LRES 562</td>
<td>Land Rehab Field Problem</td>
<td>2</td>
</tr>
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</table>

M.S. in Land Resources and Environmental Sciences

The M.S. program in Land Resources and Environmental Sciences is designed to provide outstanding graduate training opportunities across a substantial breadth of disciplinary interests. Research and coursework programs are specifically adapted to each graduate student. Research projects are directed toward improving our understanding of principles...
and processes important to land resources and environmental sciences, with opportunities for direct ties to management in many cases. Many projects address processes at multiple scales through well-integrated, multi-disciplinary efforts. Understanding is developed through targeted advanced coursework tailored to the student and to the research project. Research projects involve topics such as hydrology, watershed analysis, integrated management of invasive plant species, soil nutrient management, bioremediation, land reclamartion, restoration ecology, fluvial systems ecology and restoration, riparian ecology, microbial ecology of natural systems, chemical fate and transport, water quality, crop diversification, precision agriculture, environmental risk assessment, remote sensing applications, and climate variability.

Curriculum

30 credits minimum (10 thesis, 20 course work) required for master’s degree. 2/3 of total credits must be 500 level. Elective credits will reflect foundational courses as well as student’s special interests. 1 credit of LRES 594 Seminar is required.

Department of Plant Sciences and Plant Pathology

Montana State University
324 Leon Johnson Hall, Bozeman, MT 59717
406-994-4832 Email: ppgrad@montana.edu

Interim Department Head
Dr. Mike Giroux (http://plantsciences.montana.edu/facultyorstaff/faculty/sherwood)
203 Plant BioScience Building
Bozeman, MT 59717
406-994-7877 Email: mgiroux@montana.edu (sherwood@montana.edu)

The department offers advanced study leading to a Master of Science degree in plant sciences and plant pathology under either Plan A (thesis) or B (project or professional paper). In addition, a Ph.D. degree is offered in plant sciences with an option in either plant pathology or plant genetics. Supporting minors are also available in each of the degree fields. The department has major research strengths in the following areas: plant breeding and genetics, plant pathology, plant-microbe interactions, mycology, biocontrol, biotechnology, plant physiology, plant systematics, molecular evolution, and biochemistry.

Departmental Facilities

The department is housed in both Leon Johnson Hall and the Plant Science Facility located on the Bozeman campus. The research laboratories range in size from 600-720 sq. ft and are assigned to individual researchers. Individual laboratories are well equipped with the instruments and tools necessary to complete each research project. Researchers cooperate to purchase, share and maintain expensive pieces of specialized equipment or facilities such as the Electron Microscope Lab. Laboratories and offices are wired with high-speed computer lines for direct access to the Internet and the World Wide Web. The faculty has access to the Plant Growth Center Facility (a teaching and research facility available to the College of Agriculture staff). The current 60,000 square-foot facility houses 29 glasshouse rooms with 8,300 square feet of bench space – both temperature and lights are micro-computer controlled; 13 walk in growth rooms where all environmental variables are computer controlled; insect quarantine facilities with separate glasshouses and growth chambers; plant pathogen isolation facilities with 4 glasshouse rooms of 320 sq. ft; the Montana Potato Lab which is responsible for providing disease free seed stock to Montana potato producers. Other important accesses to the department are the Horticulture Farm, Post Research Farm, which is a 300 acre site dedicated to plant and soil research activities, and the MSU Herbarium located in Lewis Hall.

Admission

Graduate Record Examination General Test scores are required prior to consideration for admission. Students seeking admission to graduate status must hold a B5 degree and have a record of high scholarship in areas closely related to the plant sciences. Academic record is one indicator of such potential. A traditional standard is a B (3.00 on 4.00 scale) average or better for the last two years of undergraduate or graduate work. All applications are reviewed by a departmental committee for final recommendation to The Graduate School. Successful applicants are accepted by both the department and The Graduate School.

Admission decisions are individual, not class decisions, applicants may not be acceptable regardless of the institution from which credentials are submitted, if their preparation is not considered, in the judgment of the appropriate faculty and administration of this University, to be both adequate and appropriate. In addition, enrollment may be limited by the availability of faculty, staff and facilities. Therefore, it may not be possible to accommodate and admit all students who are otherwise qualified. Admission is permitted for only one graduate degree program at a time. Concurrent admission is not permitted for graduate degrees. Applicants should review the specific departmental requirements for admission.

Plant Sciences

Graduate students majoring in this field may obtain a Master of Science degree in plant science or a Ph.D. degree in plant science with a plant genetics option. Areas of concentration include plant breeding and genetics, plant molecular genetics and biotechnology, physiological genetics, plant systematics, and population genetics.

Plant Pathology

Graduate students majoring in this field may obtain a Master of Science degree in plant science or a Ph.D. degree in plant science with a plant pathology option. Areas of concentration include: biocontrol, mycology, plant-pathogen interactions, biochemistry and molecular genetics of plant disease and virology.

Financial Assistance

Assistantships are awarded on a competitive basis. See the Graduate Assistantship’s sections for detailed information on appointment criteria. Assistantships are requested through the student’s home department.

Required Courses

There are no set course requirements for Plant Sciences degree programs. Course requirements are set by the student’s graduate committee. However, all students are required to participate regularly in the PSPP seminar series, which includes presenting a research seminar once a year for each academic year enrolled in graduate school. In order to facilitate this seminar participation and presentation requirement, graduate students can enroll in PSPP 594 Seminar (1 credit), which is offered every Fall and Spring semester.

The PSPP Department requires a minimum of thirty (30) credits for a master’s degree, both thesis and non-thesis (Plan A, Plan B, Plan C). For a master’s degree with a thesis, the PSPP Department combines the required comprehensive examination and thesis defense such that they can be offered simultaneously. For additional master’s degree requirements, see The
Graduate School web page http://www.montana.edu/gradschool/policy/degreq_masters.html.

The PSPP Department requires a minimum of thirty (60) credits for a PhD degree, of which eighteen (18) to twenty-eight (28) must be dissertation credits. A maximum of thirty (30) credits from a previously earned master’s degree (from MSU or another accredited University) may be applied toward the sixty (60) credit minimum required for the doctoral degree. Doctoral students who have previously earned a master’s degree must take at least twelve (12) coursework credits and eighteen (18) to twenty-eight (28) dissertation credits beyond the master’s degree credits. For a PhD degree, the PSPP Department combines the required comprehensive examination and thesis defense such that they can be offered simultaneously. For additional PhD degree requirements, see The Graduate School web page http://www.montana.edu/gradschool/policy/degreq_doctoral.html.

**Degrees Offered**
- M.S. in Plant Pathology (p. 302)
- M.S. in Plant Sciences (p. 302)
- Ph.D. in Plant Sciences (p. 302)

### M.S. in Plant Pathology

For an MS in Plant Pathology, most research projects are problem oriented and pertain to major plant pathological problems in the state. Currently active research projects involve soil-borne diseases of cereals, genetic basis for disease resistance in field crops, cereal leaf spots, virus diseases of cereals and potatoes, bacterial diseases and the biochemistry and molecular genetics of plant disease. Additional current research projects pertain to the biocontrol of plant diseases and the biocontrol of weeds using plant pathogens and/or their toxins.

Department research projects employ modern molecular biological and biotechnological techniques as well as traditional plant pathological techniques.

**Financial Assistance**

Graduate research assistantships are available from several sources including state, farm commodity groups and federal grants. For information, contact the department.

### M.S. in Plant Sciences

The Department conducts research programs in: cereal quality; cropping systems/specialty crops; molecular and conventional approaches to plant improvement. Faculty have expertise in molecular genetics, plant breeding and genetics, cereal quality, cytogenetics, biochemistry, plant physiology and agronomy.

**Financial Assistance**

Graduate research assistantships are available from several sources including state, farm commodity groups and federal grants. For information, contact the department.

### Ph.D. in Plant Sciences

#### Plant Pathology Option

Many research projects are problem oriented and pertain to major plant pathological problems in the state. Currently active research projects involve soil-borne diseases of cereals, genetic basis for disease resistance in field crops, cereal leaf spots, virus diseases of cereals and potatoes, bacterial diseases and the biochemistry and molecular genetics of plant disease. Additional current research projects pertain to the biocontrol of plant diseases and the biocontrol of weeds using plant pathogens and/or their toxins.

Department research projects employ modern molecular biological and biotechnological techniques as well as traditional plant pathological techniques.

#### Plant Genetics Option

The Department offers advanced study leading to a Ph.D. degree in Plant Genetics with supporting minors. Thesis research problems are related to the diverse research projects of the faculty.

The Department conducts research programs in: cereal quality; cropping systems/specialty crops; molecular and conventional approaches to plant improvement. Faculty have expertise in molecular genetics, plant breeding and genetics, cereal quality, cytogenetics, biochemistry, plant physiology and agronomy.

**Financial Assistance**

Graduate research assistantships are available from several sources including state, farm commodity groups and federal grants. For information, contact the department.

### College of Arts and Architecture

#### School of Architecture (p. 303)

The School of Architecture offers a five and a half year professional program culminating in a Master of Architecture degree. The Master of Architecture is fully accredited by the National Architectural Accrediting Board (NAAB). Additionally the Masters of Architecture program meets the educational requirements needed for U.S. licensure with the National Council of Architectural Registration Boards (NCARB). The program has approximately 275 undergraduate students and 60 graduate students.

- Master of Architecture (p. 305)

#### School of Art (p. 306)

The School of Art offers a project based, non-media specific curriculum that focuses on individual artistic development and creative leadership. The program brings together talented individuals from a variety of different media building a community that fosters exploration, professionalism and creative success.

- M.F.A. in Art (p. 307)

The MA in Art History program welcomes inquiries and applications from students who have an academic background in art history or a broad spectrum of the humanities and social sciences. Candidates should have the motivation to learn to read a foreign language, to employ analytical structures, and to make timely progress through the two-year program.

- M.A. in Art History (p. 306)

#### School of Film and Photography (p. 307)

M.F.A. in Science and Natural History Filmmaking seeks candidates with at least an undergraduate major or minor degree concentration in natural, applied, or social sciences. These fields include but are not limited to biology, physics, chemistry, mathematics, astronomy, engineering, earth sciences, computer and technology science, environmental sciences, psychology, anthropology, archaeology, sociology, health sciences, and other related fields. Some research experience is preferred. Candidates are not expected to have education or experience in filmmaking although
to emphasize the development of a critical position with regard to the studios, architectural seminars, and non-architectural electives intended for study, students will choose from a variety of architectural studios, craft studios, architectural seminars, and non-architectural electives intended to emphasize the development of a critical position with regard to the environment and architecture. A comprehensive studio is required that demonstrates, through the development of an architectural project, the student’s ability to synthesize their aesthetic, technical and theoretical knowledge. The final design studio in the graduate program consists of a student-directed design project that demonstrates the student’s design and research capabilities and explores the student’s moral, ethical and aesthetic responsibility to society and the natural world.

Students receiving a Master of Architecture degree from the MSU School of Architecture must have completed a minimum of 168 combined graduate and undergraduate credits—of which a minimum of 42 graduate credits are to be completed at MSU. Students who completed a pre-professional undergraduate degree program at another institution, and completed less than 126 undergraduate credits, will be required to take additional credits at MSU in order to meet the combined graduate and undergraduate 168 credit requirement for graduation.

School of Architecture Philosophy

The School seeks to prepare students for a lifelong critical engagement in the arts and science of architecture. Located in "the last best place" of the Northern Rockies we are in an extraordinary position to engage questions regarding the relationship between the natural and built environments. As architects, we strive to play an essential and innovative role in enhancing the human condition. To that end, we teach and practice a moral, ethical and aesthetic responsibility to society and the natural world in the design of the built environment. The School of Architecture empowers students to critically engage the complexities of society and the natural environment by instilling the fundamental principles of design and inspiring a spirit of exploration and creative experimentation in shaping the built environment.

It is in our design studios, that this philosophy is most clearly demonstrated. Each studio is conceived to build upon the previous studio in a manner that develops a student’s mastery of the science of architecture while at the same time exposing the student to the rich diversity of our faculty’s philosophical beliefs. Within a structured sequence of increasingly complex problems, emphasis is placed on teaching both an iterative design process and the visualization skills necessary to demonstrate the resultant design proposals. The science of architecture is continuously evolving and will do so over the life of every architect. We are committed to preparing our students to enter the profession with the contemporary scientific knowledge and emerging technical expertise to further this evolution while at the same time ensuring that our graduates are grounded in the fundamental design thinking, investigatory and communication skills that have been central to architecture throughout its history. In addition to the science of architecture we are equally committed to ensuring that our graduates acquire a critical philosophy with which they can engage the design of the built environment.

Knowing how to build is a matter of science and technology but knowing what to build is a question of morality, ethics, and aesthetic responsibility. In this regard the faculty shares a commitment to the stewardship of our environment. This is particularly important in the Northern Rockies where our historic fabric of cities, rural communities and the natural landscape coexist in a tenuous balance. Focusing on the broad principles of creating a sustainable social, cultural, economic and physical environment we utilize the region, from its major cities to its national parks, as the canvas for our teaching, research and creative activities.

As a faculty we are committed to emphasizing the architect’s responsibility to create and maintain a sustainable environment formulated from a belief system of moral, ethical and aesthetic theories, but our philosophical beliefs with regard to how this is to be achieved are diverse. This is by intent. Each student, as she or he matriculates through the design studio sequence, is expected to develop an understanding of the various critical approaches advocated by their professors and ultimately reaches a position of their own. Thus our graduates become empowered to assume a leadership
role in the synthesis of the natural environment, human activity and the built environment from a critical, responsible and mature perspective. In doing so, our students discover the commitment of our faculty to both the future of our environment and that of their students. Because of this an extraordinary sense of community emerges within the School of Architecture at Montana State University. Students develop a sense of responsibility not only to the environment and architecture but also to their peers where all share a passion for design.

Program Requirements
The Master of Architecture professional degree is a Plan B program (professional paper or project plan) that requires forty-two (42) credits of graduate coursework. A student’s program of study includes three graduate design studios; Advanced Arch Studio (ARCH 551), Comprehensive Design Studio (ARCH 558), Masters Studio Project ARCH 560, required advanced theory and systems courses (Advanced Architectural Theory (ARCH 526), Adv Bldg Sys Integration (ARCH 535)), a required Professional Paper (ARCH 575) and graduate electives. The Plan B Program requires that students successfully complete a Masters Studio Project as their comprehensive examination.

Admission
Admission into the architecture graduate program is competitive. The school is able to admit approximately 60 graduate students per year, many of whom represent the best students from our own undergraduate B.A. in Environmental Design program. However, spaces are available for highly qualified students with undergraduate degrees from other universities. Placement may vary depending upon the student’s background; students with an undergraduate degree in a field other than architecture will be considered, and must, if accepted, complete a full course of study in design studio. Portfolio review is of primary importance to the School of Architecture’s application review committee. All applicants are required to submit a portfolio of their best work that is reviewed by the school’s faculty. For examples of student work and additional information visit the School of Architecture website at www.arch.montana.edu.

Admission Standards/Score
Admissions Numeric Evaluation Scale - Admissions Review is performed by a committee of five faculty members. An admission score is developed based upon the following percentages and are weighted accordingly (see scoring breakdown below). A perfect admissions score is a 12. A minimum score of a 7.6 on a 12 point scale is need for admission.

Scoring Breakdown

- **Cumulative GPA (40%)**: Min 3.0/Max 4.0 GPA based on a 4.0 system (4.0 = a letter grade of A)
- **Portfolio (40%)**: Min 6.5/Max 12 - Final Score is determined by averaging 5 reviewers portfolio scores.
- **Writing Component (10%)**: Min 0/Max 6- This score is the actual score received on written portion of the GRE.
- **Letters of Reference (10%)**: Min 0/Max 3 - Letter of Reference score is determined by averaging the overall recommendation criteria from each of the three letters of recommendation.

Highly Recommend= 3/ Recommend= 2/ Recommend with reservations= 1/ Do Not recommend= 0

Application Submission Requirements
1. On-line application for the MSU Graduate School which can be found at http://www.montana.edu/gradschool/.

2. During the online application process, you will be asked to submit an electronic portfolio of architectural work sufficient to demonstrate the one’s ability and achievement in architecture. Portfolio form and format are left to the discretion of the applicant, though the portfolio must be suitable for review by a committee. NOTE: If a hard copy of portfolio work is submitted, please also include a suitable mailing receptacle and sufficient postage for the return. The School of Architecture cannot guarantee its return; portfolio have been lost in transit.

3. You will be asked to submit three letters of reference during the online application process. Be sure you have contact information on the individuals you wish to ask; as your recommenders will be prompted through an email upon submission of your on-line application.

4. Official results of the Graduate Record Examination (send to campus code: 4488).

5. $60.00 non-refundable application fee.

6. Official transcript(s) from universities attended (MSU graduates do not need to submit MSU transcripts)

Deadline
- **January 15** - Deadline for application submission of portfolio, application forms, GRE scores to the School of Architecture for Fall admittance.

Expected Placement for Students with an Undergraduate Degree in an Architecture Related Field, Environmental Design, or Architectural Studies
If an applicant has an undergraduate 4-year degree in architectural studies or environmental design and are admitted to the Master of Architecture program, he/she will be placed at an appropriate point in the architecture curriculum and can expect to pursue a series of rigorous design studios, specialized courses in advanced architecture, a research paper/project and a student-directed design project in order to be granted the Master of Architecture degree. Students entering with excellent portfolios can expect to complete the Master of Architecture degree in three to four semesters.

Expected Placement for Students with an Undergraduate Degree in Other Fields
If an applicant has an undergraduate degree in another field and desires to study architecture at Montana State, he/she will be expected to complete the full eleven semesters of design studio. Advanced placement can be made depending on the quality of one’s portfolio, which may demonstrate equivalent achievement. The applicant will be placed as a “Second-Degree Student” until the prerequisites for graduate study have been completed. Upon successful completion of the required prerequisites, the applicant can be advanced to “graduate degree” status.

Required Courses

<table>
<thead>
<tr>
<th>Semester I</th>
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</thead>
<tbody>
<tr>
<td>ARCH 526</td>
<td>Advanced Architectural Theory</td>
</tr>
<tr>
<td>ARCH 535</td>
<td>Adv Bldg Sys Integration</td>
</tr>
<tr>
<td>ARCH 558</td>
<td>Comprehensive Design Studio</td>
</tr>
</tbody>
</table>
Notes:

1. Students must have completed a total of 45 non-architecture credits to receive their Master of Architecture degree. These credits can occur at the undergraduate or graduate level.

2. All graduate students will be required to receive a minimum grade of "B" (3.0) in any Design Studio (ARCH 558, ARCH 551, ARCH 560). Failure to receive a “B” will result in the student needing to retake that design studio. In addition a student must receive a minimum grade of “B” (3.0) in ARCH 575 Professional Paper/Project in order to be able to progress to ARCH 560.

3. M.Arch students are required to complete a minimum of 14 credits of graduate elective course work to fulfill degree requirements. The School of Architecture allows for 6 of these credits to be from outside of the department as long as those courses are shown to have a clear connection to architecture. These credits may be at the 400 or 500 level. A list of approved non-Architecture graduate electives will be provided to students each semester at the time of registration.

4. Per Graduate School policy, a student will have only two opportunities to pass a Masters Studio Project (ARCH 560) similar to a thesis student having only two opportunities to pass the closed door defense and the comprehensive examination.

5. Students may petition the Graduate Program Coordinator to take non-traditional studio classes for graduate elective credit.

All students shall continue to meet with the Graduate Program Coordinator or Administrative Support staff throughout their graduate year to track their progress toward completion of the Master program. The Program of Study will be developed with the advisor, approved by the committee and be submitted to the Graduate School by appropriate deadline. Final approval of the Program of Study rests with the Graduate School. Students may change courses or committee members on the Program of Study by completing a Program Change or Change of Committee form. All Graduate School transfer credit policies apply to M.Arch students.

The student is expected to be familiar with both School of Architecture and The Graduate School degree requirements. Refer to the For Master's Students section on The Graduates School website for additional information.

Financial Assistance

Applicants should contact the director of the school for information regarding the availability of assistantships. See the Graduate Assistantship section of the department website for detailed information on appointment criteria.

Degree Offered

- Master of Architecture (p. 305)

Master of Architecture

Throughout the graduate program, students choose from a variety of architectural studios, architectural electives and non-architecture electives intended to emphasize the development of a critical position with regard to the environment and architecture. A comprehensive studio is required to demonstrate, through the development of an architectural project, the student’s moral, ethical and aesthetic responsibility to society and the natural world.

The Master of Architecture professional degree is a Plan B program (professional paper or project plan) that requires forty-two (42) credits of graduate coursework. A student’s program of study includes three graduate design studios courses (Advanced Arch Studio (ARCH 551) ARCH 551)ARCH 551(ARCH 551), Comprehensive Design Studio (ARCH 558) ARCH 558(ARCH 558)ARCH 558(ARCH 558), and Master Studio Project ARCH 560, required advanced theory and systems courses Advanced Architectural Theory (ARCH 526) ARCH 526(ARCH 526) ARCH 526(ARCH 526)ARCH 526(ARCH 526) and Adv Bldg Sys Integration (ARCH 535) ARCH 535(ARCH 535) ARCH 535(ARCH 535) a required Professional Paper (ARCH 575) ARCH 575(ARCH 575) ARCH 575(ARCH 575)ARCH 575(ARCH 575) and graduate electives. The Plan B Program requires that students successfully complete a Masters Studio Project as their comprehensive examination.

Initial admission to the M.Arch program occurs only during the Fall term.

Graduate Design Studios

ARCH 551 Advanced Arch Studio (6 credits) are studios that are classified as experimental or theoretical design studios. These studios may be design/build in nature, place specific or theoretical and are intended to give a student an experience that is outside the traditional realm of Architecture. A field trip is associated with this studio.

ARCH 558 Comprehensive Design Studio (6 credits) is a studio that fulfills the NAAB requirements for comprehensive design and is also inclusive of all components of the field. This includes but is not limited to: structural systems, environmental controls, life safety, technical documentation, etc. This studio is designed to evaluate a student’s competency in areas of Architecture. The Comprehensive Design Studio is best described as a programmatically complex problem with an underlying agenda or theoretical component and should be considered the most challenging structured studio experience that a student will undertake within the School of Architecture. Requirements will be rigorous and demanding beyond the expectations of those studios in the undergraduate program. The design problem is developed by a faculty member and implemented and solved by the students.

ARCH 560 Masters Studio Project (3 credits) is a student-directed design studio project that provides students with the opportunity for advanced exploration of a wide-range of architectural issues and solutions. This studio serves to cover the Comprehensive Exam for the Master of Architecture degree program.

Advanced Theory, System Integration and Research Methods

All graduate students are required to take Advanced Architectural Theory (ARCH 526) ARCH 526(ARCH 526) ARCH 526(ARCH 526) and Adv Bldg Sys Integration (ARCH 535) ARCH 535(ARCH 535) ARCH 535(ARCH 535) in conjunction with

<table>
<thead>
<tr>
<th>Semester II</th>
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<tbody>
<tr>
<td>ARCH 551</td>
<td>Advanced Arch Studio</td>
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<tr>
<td>Graduate Electives</td>
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<td></td>
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<tr>
<td>ARCH 575</td>
<td>Professional Paper</td>
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<td>Total Credits</td>
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<table>
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<tr>
<td>ARCH 560</td>
<td>Masters Studio Project</td>
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<td>Total Credits</td>
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<td></td>
</tr>
</tbody>
</table>

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</tr>
<tr>
<td>3. M.Arch students are required to complete a minimum of 14 credits of graduate elective course work to fulfill degree requirements. The School of Architecture allows for 6 of these credits to be from outside of the department as long as those courses are shown to have a clear connection to architecture. These credits may be at the 400 or 500 level. A list of approved non-Architecture graduate electives will be provided to students each semester at the time of registration.</td>
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<tr>
<td>5. Students may petition the Graduate Program Coordinator to take non-traditional studio classes for graduate elective credit.</td>
</tr>
</tbody>
</table>
The MA degree candidates can concentrate in the areas of Ancient Greek & Roman Civilization; Medieval France, Germany & Britain; Renaissance Italy & Northern Europe; Baroque Italy & Northern Europe; Rococo & Neoclassical France & Britain; Modern France, Spain, Germany & Britain; Contemporary Europe & The United States; History of Printmaking; History of Photography.

**Degrees Offered**
- M.F.A. in Art (p. 307)
- M.A. in Art History (p. 306)

## M.A. in Art History

### Admission

The M.A. Program welcomes applications from all those interested in seeking an advanced degree in Art History. Approximately eight students are accepted each year to a thirty-two unit program that emphasizes focused study of cultural production from ancient times to the present and interdisciplinary connections with collateral departments in the Colleges of Arts & Architecture and Letters and Sciences. Art History faculty meet twice a year to read and assess applications, with a particular sensitivity to the students’ work and professional goals.

All materials must be received by March 15 (Fall deadline) and October 15 (Spring deadline) for full consideration. In addition to completing the application and paying the application fee, candidates for admission to the Art History M.A. Program must submit a letter of intent, one writing sample, official transcripts, GRE scores, and three letters of recommendation. International applicants must also include an official English proficiency exam score report and a completed and signed Financial Certificate.

The faculty consider the letter of intent and the writing sample to be among the most important parts of the application. The letter should describe your preparation for the program, academic interests, and professional goals. The most useful statements are those that present an intellectual portrait of the applicant, an account of the issues the applicant now finds engaging, and the program of study the candidate envisions for themselves at MSU. The writing sample should be a substantial essay, ideally a seminar paper or senior thesis, that demonstrates the candidate’s potential for advanced work in the discipline.

### Program Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTH 501</td>
<td>Pedagogy and Professionalism</td>
<td>2</td>
</tr>
<tr>
<td>ARTH 506</td>
<td>Methods and Critical Theory</td>
<td>3</td>
</tr>
<tr>
<td>Five Required Core Courses</td>
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<td>15</td>
</tr>
<tr>
<td>Two Elective Courses</td>
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</tr>
<tr>
<td>One Foreign Language Course</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ARTH 590</td>
<td>Master’s Thesis</td>
<td>3</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>32</td>
</tr>
</tbody>
</table>

All graduate students must take: Pedagogy and Professionalism (ARTH 501), Methods and Critical Theory (ARTH 506), and Master’s Thesis (ARTH 590).

In addition to the courses listed above, graduate students will select 5 courses, of which 3 must be 500-level graduate art history seminars, and 2 must be 400-level upper division undergraduate art history lectures in which the student will be required to complete supplementary readings, write advanced comparative analyses of articles, and complete a rigorous research project. Students will also select 2 elective courses at the 500-level taught in other departments in the humanities (e.g. History and Philosophy, English).

## Three semester graduate program.

### Year I - Fall Semester

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>ARCH 558</td>
<td>Comprehensive Design Studio</td>
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<tr>
<td>ARCH 535</td>
<td>Adv Bldg Sys Integration</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 526</td>
<td>Advanced Architectural Theory</td>
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<tr>
<td>Graduate Electives</td>
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</table>

### Year I - Spring Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARCH 551</td>
<td>Advanced Arch Studio</td>
<td>6</td>
</tr>
<tr>
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<td>Graduate Electives</td>
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</table>

### Year 2 - Fall Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Graduate Electives</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>ARCH 560</td>
<td>Masters Studio Project</td>
<td>6</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

## School of Art

213 Haynes Hall  
Bozeman, MT 59717-3680  
406-994-4501  
Email: art@montana.edu

The School of Art, fully accredited by the National Association of Schools of Arts and Design, was established in 1893 and its first graduate degree was conferred in 1932. We offer 2 Master degrees, a Master of Art (MA) in Art History and a Master of Fine Art (MFA) in Studio Arts. The MFA degree is designed for the professional artist including those who plan to teach art at the university level while the MA degree prepares students for graduate work leading to careers as academic instructors, museum curators or art critics and in allied fields such as art administration, historic preservation and gallery work.

The MFA degree offers courses at the graduate level in ceramics, metalsmithing, painting, drawing, sculpture and printmaking, but does not offer any graduate level courses in either photography or graphic design. The MA degree candidates can concentrate in the areas of Ancient Greek and gallery work.

Graduate Electives

The final component of the M.ARCH program is Graduate Electives. M.Arch students are required to complete a minimum of 14 credits of graduate elective course work to fulfill degree requirements. The School of Architecture allows for 6 of these credits to be from outside of the department as long as those courses are shown to have a clear connection to architecture. These credits may be at the 400 or 500 level. A list of approved non-Architecture graduate electives will be provided to students each semester at the time of registration. Nine of the credits can be credits that a student “petitioned” to use while an undergraduate. Electives vary from semester to semester. Six to ten electives will be offered each semester. Electives can be courses such as ARCH 533 Adv Environmental Controls, ARCH 564 Adv Arch Graphics, ARCH 525 Special Design Topic, etc.

### Three semester graduate program.

### Year 2 - Fall Semester

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<tr>
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<td>Adv Arch Graphics</td>
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All materials must be received by March 15 (Fall deadline) and October 15 (Spring deadline) for full consideration. In addition to completing the application and paying the application fee, candidates for admission to the Art History M.A. Program must submit a letter of intent, one writing sample, official transcripts, GRE scores, and three letters of recommendation. International applicants must also include an official English proficiency exam score report and a completed and signed Financial Certificate.

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After passing an exam in foreign language translation during the first semester, students must complete one additional semester of language translation appropriate to their area of concentration (offerings to be determined by the Department of Modern Languages).

Mastery of the discipline will be determined by a record of excellence in all courses taken within the graduate program and a well-written, well-argued thesis.

Financial Assistance
Limited numbers of graduate teaching assistantships are usually available within the School of Art and are awarded on a competitive basis to formally admitted graduate students. See the Graduate Assistantships sections for detailed information on appointment criteria. Assistantships are requested from the student’s home department.

M.F.A. in Art
The School of Art, accredited by the National Association of Schools of Art and Design, offers a Master of Fine Arts (MFA) degree. The MFA degree requires 60 credits of coursework including a minimum of 15 credits of thesis. The Master of Fine Arts is a project based non-media specific curriculum that focuses on individual artist development and creative leadership. The program brings together talented individuals from a variety of different media, building a community that fosters exploration, professionalism and creative success. Projects based in all traditional fine art media along with environmental art, new media and installation can be accommodated.

The program is housed at the Melvin Graduate Studios. The School of Art does not offer a MFA degree in either graphic design or photography, nor is the GRE required for entrance.

Admission
Students applying to the School of Art must submit a portfolio of 20 digital images, online application, official transcripts, artist statement, current resume and three letters of recommendation, along with an artist statement or statement of intent. Completed applications for the following academic year must be received by February 15.

Qualified students may be admitted to The Graduate School on a regular or provisional basis. Provisional acceptance is usually based on undergraduate deficiencies.

Program Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ARTZ 105RA</td>
<td>Visual Language - Drawing</td>
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<td>ARTZ 109RA</td>
<td>Visual Language: Comprehensive Foundation</td>
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<tr>
<td>ARTZ 110RA</td>
<td>Visual Language: Ideation and Creativity</td>
<td>3</td>
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Montana State University
University and Core electives 15
Year Total: 30

**Sophomore Year**

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<tr>
<th>Course</th>
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<tr>
<td>FILM 212 - Aesthetics Film Production II</td>
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</tr>
<tr>
<td>PHOT 213 - Intermediate Photography</td>
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</tr>
<tr>
<td>PHOT 255 - Intro to Color Photography</td>
<td>4</td>
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<td>Three of the following:</td>
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<tr>
<td>FILM 201D - Film History I: Origins to the 1960's</td>
<td></td>
</tr>
<tr>
<td>FILM 202D - Film History II: 1960s to the Present</td>
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<tr>
<td>PHOT 303 - Early History of Photography</td>
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<tr>
<td>PHOT 304 - Recent History of Photography</td>
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</tbody>
</table>

University and Core electives 10
Year Total: 30

**Junior and Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILM 301 - Issues in Lens-Based Media</td>
<td>2</td>
</tr>
<tr>
<td>PHOT electives</td>
<td>6</td>
</tr>
<tr>
<td>FILM electives</td>
<td>6</td>
</tr>
<tr>
<td>FILM/PHOT studies electives</td>
<td>6</td>
</tr>
<tr>
<td>Additional courses relevant to proposed course of study</td>
<td>20</td>
</tr>
<tr>
<td>University and Core electives</td>
<td>10</td>
</tr>
<tr>
<td>Capstone project</td>
<td>10</td>
</tr>
<tr>
<td>Year Total:</td>
<td>60</td>
</tr>
</tbody>
</table>

Total Program Credits: 84

---

**M.F.A. in Science and Natural History Filmmaking**

The Master of Fine Arts Program in Science and Natural History Filmmaking at Montana State University is the largest and best known of only three programs in the world dedicated to this unique and rewarding field of filmmaking. Students in the program have had their work broadcast on many major channels and programs such as The Discovery Channel, National Geographic, The Science Channel, CNN, Sixty Minutes II, Larry King, CBS Evening News, and NBC Nightly News.

Students have produced films for the National Park Service, the National Science Foundation, the Department of Agriculture, NOAA, NASA, National Geographic, Discovery, and such non-profit organizations as the Wildlife Conservation Society, the Sierra Club, the Audubon Society, the Nature Conservancy, the Field Museum and the Boston Museum of Science. Students’ work has also been featured in numerous festivals internationally.

Our students have won EMMYS, been awarded Fulbright scholarships, a Fred Rogers Scholarship from the National Academy of Television Arts and Sciences, Webby awards, and many other honors. The students have documented the work of explorers and scientists on every continent in the world. The graduate student podcast and website TERRA: THE NATURE OF OUR WORLD (http://www.lifeonterra.com) attracts and distributes some of the world’s leading science and conservation productions to more than 100,000 viewers a month and has won three Webby awards.

Our mission is to provide filmmaking knowledge to students with formal education and experience in science, engineering and technology so they may create accurate, innovative, and exciting programs that advance the public understanding of science.

Candidates for the MFA take courses that include film and video production, the history and theory of science and natural history film, cinematography, production management, editing, and writing. All students must also work at one or more production internships during their time as MFA students.

---

**Program Requirements**

The curriculum consists of a minimum of sixty semester credit hours of study, written thesis, and thesis film taken over a minimum of three years. To graduate, a student should complete the course of study in good academic standing and produce and defend a written thesis and thesis film.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILM 504 - Fundamentals of Filmmaking</td>
<td>3</td>
</tr>
<tr>
<td>FILM 505 - Crit Approach Nat Hst Filmmaking</td>
<td>3</td>
</tr>
<tr>
<td>FILM 506 - Crit Approach Sci Filmmaking (Delete course)</td>
<td>3</td>
</tr>
<tr>
<td>FILM 510 - Fundamentals of Filmmaking</td>
<td>3</td>
</tr>
<tr>
<td>FILM 513 - Advanced Cinematography</td>
<td>3</td>
</tr>
<tr>
<td>FILM 515 - Science and Natural History Film Prod.</td>
<td>3</td>
</tr>
<tr>
<td>FILM 517 - Production Management</td>
<td>3</td>
</tr>
<tr>
<td>FILM 518 - Writing for Documentary and Non-Fiction Film</td>
<td>3</td>
</tr>
<tr>
<td>FILM 519 - Post Production Workflow</td>
<td>3</td>
</tr>
<tr>
<td>FILM 521 - Interactive Documentary</td>
<td>3</td>
</tr>
<tr>
<td>FILM 523 - Second Year Film Prep</td>
<td>2</td>
</tr>
<tr>
<td>FILM 524 - Research Methods (Delete Course)</td>
<td>3</td>
</tr>
<tr>
<td>FILM 525 - Second Year Film Prod</td>
<td>3</td>
</tr>
<tr>
<td>FILM 526 - Alternative Nonfiction</td>
<td>3</td>
</tr>
<tr>
<td>FILM 533 - Adv Prob TV and Internet Prod (Change title to Web-Based Documentary)</td>
<td>1-3</td>
</tr>
<tr>
<td>FILM 550 - Film and Documentary Theory</td>
<td>3</td>
</tr>
<tr>
<td>FILM 560 - Post Production Meets Info Design (Change title to Post Production Workflow)</td>
<td>3</td>
</tr>
<tr>
<td>FILM 581 - Special Professional Proj</td>
<td>1-3</td>
</tr>
<tr>
<td>FILM 590 - Master’s Thesis</td>
<td>1-15</td>
</tr>
<tr>
<td>FILM 592 - Independent Study</td>
<td>1-3</td>
</tr>
<tr>
<td>FILM 598 - Professional Internship (Graduate Internships are 1-6 credits)</td>
<td>1-6</td>
</tr>
</tbody>
</table>

- FILM 592 Independent Study - 1-3 Credits, Max. 3 credits May be repeated
- FILM 598 Professional Internship - 1-12 Credits, max 12 Credits, credits, May be repeated
- FILM 591 Special Topics - 1-4 cr., Max. 12 credits, May be repeated
- FILM 581 Special Professional Proj - 1-3 Credits, Max 6 credits, May be repeated
- FILM 590 Master’s Thesis - 1-15, May be Repeated

---

**College of Education, Health and Human Development**

**Alison Harmon, Dean**

250 Reid Hall, Bozeman, MT 59717
The Department of Education offers graduate programs in the following areas:

**Department of Education (p. 309)**
- College Teaching Certificate (p. 312)
- Library Media Certificate (p. 313)
- School Superintendent Certificate Program (p. 314)
- MEd
  - Adult and Higher Education (p. 314)
  - Curriculum and Instruction (p. 317)
  - Educational Leadership (p. 323)
- EdD
  - Adult and Higher Education (p. 324)
  - Curriculum and Instruction (p. 327)
  - Educational Leadership (p. 329)
- EdS
  - Educational Leadership (p. 337)
- PhD
  - Adult and Higher Education (p. 330)
  - Curriculum and Instruction (p. 333)
  - Educational Leadership (p. 335)

**Department of Health and Human Development (p. 338)**
- Addiction Counseling Certificate (p. 344)
- Community Health (p. 341)
- Counseling (p. 339)
- Exercise and Nutrition Sciences (p. 342)
- Family & Consumer Sciences (http://catalog.montana.edu/graduate/education-health-human-development/health-human-development/family-consumer-sciences-option)
- Family Financial Planning (p. 343)
- School Counseling (p. 339)
- Sustainable Food Systems (http://catalog.montana.edu/graduate/education-health-human-development/health-human-development/sustainable-food-systems)

**Department of Education**
Department of Education Graduate Programs Website: http://www.montana.edu/education/grad/ahe/index.html

**Department Head**
Dr. Tricia Seifert
213 Reid Hall
406-994-3120 Email: tricia.seifert@montana.edu (tricia.seifert@montana.edu)
(jdowney@montana.edu)

**Graduate Program Assistant**
Micki MacGregor
215 Reid Hall
406-994-6786 Email: edgrad@montana.edu

The Department of Education’s graduate offerings are divided into three units: Adult & Higher Education, Curriculum & Instruction, and Educational Leadership. Master’s (MEd) and Doctoral (EdD and PhD) programs are offered in all three areas. In addition, the Adult & Higher Education program offers the College Teaching Certificate, the Curriculum and Instruction program offers the Library Media Certificate, and an Education Specialist (EdS) degree is available in Educational Leadership only. Additional degree requirements are listed in each program’s section.

For information on graduate programs, please contact the appropriate Program Leader:

- **Adult & Higher Education:** Dr. Carrie Myers, 406-994-4203 or Email cbmyers@montana.edu (bryce.hughes@montana.edu)
- **Curriculum & Instruction:** Dr. Nicholas Lux, 406-994-6581 or Email nicholas.lux@montana.edu (edgrad@montana.edu)
- **Educational Leadership:** Dr. Tena Versland, 406-994-6799 or Email tena.versland@montana.edu

**Adult and Higher Education**
http://www.montana.edu/education/grad/ahe/index.html

The Adult and Higher Education (A&HE) program offers three degrees: Master’s of Education, Doctor of Education, and a Doctor of Philosophy in Education. The A&HE graduate program prepares students to work in and/or research both formal and informal educational opportunities beyond traditional Pre-K-12 settings. Students in the program would be specifically focused on (a) college teaching and college students and their development, (b) higher education leadership, administration, and organization, (c) postsecondary institutional and program evaluation, assessment, and accreditation, and (d) comparative international and diverse postsecondary (e.g., Tribal Colleges) institutional contexts. Special attention is directed at underrepresented student groups and diverse learners within these foci areas.

There are three specialization options for the Master’s in Education (MEd) degree: Adult Education, Student Affairs, and Higher Education.

Graduates of the EdD and PhD programs in Education receive equally rigorous scholarly training. Both degrees require coursework that develops knowledge of the interdisciplinary nature of education, skills and expertise in the range of methodologies needed to conduct high-quality and rigorous educational research, and values becoming of an ethical and scholarly researcher or practitioner.

Although these two programs share much in common, each program has a distinct focus. Graduates of the PhD program will prepare to advance the field of education through the creation and dissemination of new knowledge by specializing in research. Graduates of the EdD will prepare to work as leaders and innovators in educational settings, where they will generate and apply research-based solutions to specific problems of practice.

There are two specialization options for the Doctor of Education (EdD) degree: Higher Education Administration and Higher Education Academics. The EdD in Higher Education Administration specialization is intended for individuals who will contribute to the administrative leadership within a range of diverse postsecondary settings. The EdD Higher Education Academics specialization is intended for individuals who will teach and provide academic leadership in the area of college teaching and learning within a diverse range of postsecondary settings.

The Doctor of Philosophy in Education (PhD), Adult & Higher Education degree is designed for graduate students seeking faculty or research positions in higher education or positions within research organizations that require educational research in highly specialized disciplines. Progress through the degree provides students with opportunities to develop specialized disciplinary content and research knowledge along with scholarly experiences that provides the foundational knowledge and skills required for success as faculty in higher education and in research organizations. Special emphasis in these major research areas addresses topics specific to Montana including working with rural communities and Native Americans on state and other educational issues.
Graduates of this PhD program in education will be well-positioned to directly and positively affect the data driven culture related to improving the K-20 educational systems.

The Adult & Higher Education Program also offers a Certificate in College Teaching (CTC) to develop and promote exemplary teaching among graduate students, aspiring faculty, and current faculty wanting to enhance their teaching skills. The goal of the certificate is to make individuals more competitive in the job market as instructors and faculty members at a range of colleges and universities.

**Curriculum and Instruction**

http://www.montana.edu/education/grad/ci/index.html

The program in Curriculum & Instruction (C&I) offers a Master of Education, a Doctor of Education, and a Doctor of Philosophy in Education.

The **Master of Education (MEd) degree** is designed to meet the needs of elementary and secondary classroom teachers, subject matter specialists, and educational scholars and researchers. The MEd degree has three options: the Professional Educator, Educational Researcher, and Technology Education.

Graduates of the EdD and PhD programs in Education receive equally rigorous scholarly training. Both degrees require coursework that develops knowledge of the interdisciplinary nature of education, skills and expertise in the range of methodologies needed to conduct high-quality and rigorous educational research, and values becoming of an ethical and scholarly researcher or practitioner.

Although these two programs share much in common, each program has a distinct focus. Graduates of the PhD program will prepare to advance the field of education through the creation and dissemination of new knowledge by specializing in research. Graduates of the EdD will prepare to work as leaders and innovators in educational settings, where they will generate and apply research-based solutions to specific problems of practice.

The **Doctor of Education (EdD) degree** provides graduates the opportunity to develop the rich knowledge base needed to address problems of practice affecting the greater education community. The program offers multiple opportunities to impact diverse educational settings.

The **Doctor of Philosophy in Education (PhD)**, with emphasis in Curriculum and Instruction degree is designed to prepare graduate students to conduct educational research in highly specialized disciplines. Progress through the degree provides students with opportunities to develop specialized disciplinary content and research knowledge along with scholarly experiences that will provide the foundational knowledge and skills required for success as faculty in higher education and in research organizations. The program addresses topics specific to Montana including working with rural communities and Native Americans on state and other educational issues. Graduates of this PhD program in education will be well-positioned to directly and positively affect the data driven culture related to improving the educational systems of Montana and beyond.

The Department also offers the **Library Media Certificate (LMC) program**. This totally online program consists of 21 semester credits (7 courses). The program is for teachers who want to add an endorsement in K-12 Library Media to an existing teaching license.

**Educational Leadership**

http://www.montana.edu/education/grad/edlead/index.html

The program in Educational Leadership offers a Master of Education, Education Specialist, Doctor of Education, and Doctor of Philosophy in Education.

The **Master of Education (MEd) degree** is designed to meet the needs of those who desire positions in school leadership: Curriculum Director, principal and superintendent certification. The MEd degree allows candidates to gain licensure in Montana as a K-12 Principal. Once candidates complete the MEd degree and earn principal certification they may take additional coursework to obtain superintendent licensure. This can be accomplished through earning an Education Specialist (EdS) degree or completing the Superintendent Certificate (SUPC) program.

Graduates of the EdD and PhD programs in Education receive equally rigorous scholarly training. Both degrees require coursework that develops knowledge of the interdisciplinary nature of education, skills and expertise in the range of methodologies needed to conduct high-quality and rigorous educational research, and values becoming of an ethical and scholarly researcher or practitioner.

Although these two programs share much in common, each program has a distinct focus. Graduates of the PhD program will prepare to advance the field of education through the creation and dissemination of new knowledge by specializing in research. Graduates of the EdD will prepare to work as leaders and innovators in educational settings, where they will generate and apply research-based solutions to specific problems of practice.

The **Doctor of Education (EdD) degree** prepares the scholar-practitioner where students are engaged researching problems encountered in practice related to K-20 educational organizations and educational leadership. Graduates will develop the rich knowledge base in educational theory and practice and leadership theory needed to conduct practical educational research and engage in service to the greater education community. The program offers multiple opportunities to engage in research grounded in cutting-edge educational issues and collaborative activities in diverse educational settings, including faculty from other disciplines.

The **Doctor of Philosophy in Education (PhD)**, Educational Leadership degree is designed for graduate students seeking faculty or administrative positions in higher education or positions within research organizations that require educational research skills in highly specialized disciplines. The program addresses topics specific to Montana including working with rural communities and Native Americans on state and other educational issues. Graduates of the PhD program in education will be well-positioned to directly and positively affect the data driven culture related to improving the K-20 educational systems.

The Educational Leadership Program also offers a Montana School Superintendent Certificate program (SUPC) to prepare candidates to complete all state requirements for licensure as a School Superintendent in Montana. The certificate is designed to be completed through an intensive summer program followed by a semester long internship.

The **Board of Public Education/Office of Public Instruction (BPE/OPI) Internship** is designed for candidates who do not possess licensure as a K-12 Principal or Superintendent and who have been hired into a school leadership position requiring principal or superintendent licensure. The BPE/OPI Internship allows the candidate to gain a Class V (provisional) license to properly hold a school leadership position while completing coursework to earn full licensure. To be eligible, a candidate must be already hired into a school leadership position, and must sign an agreement between their school board trustees and MSU’s Educational Leadership Program. The agreement stipulates that MSU will supervise the candidate while he/she finishes coursework toward full licensure. There is an extra fee that the candidate or district pays to MSU for the supervision.
Programs and Degrees Offered

Post Baccalaureate Teacher Licensure (http://catalog.montana.edu/graduate/education-health-human-development/education/teacherlicensure)

Licensed Teacher Added Recommendation (http://catalog.montana.edu/graduate/education-health-human-development/education/addedrecommendation)

Certificates

- College Teaching Certificate (p. 312)
- Library Media Certificate (p. 313)
- School Superintendent Certificate (p. 314)

MEd

- Adult and Higher Education (p. 314)
- Curriculum and Instruction (p. 317)
- Educational Leadership (p. 323)

EdD

- Adult and Higher Education (p. 324)
- Curriculum and Instruction (p. 327)
- Educational Leadership (p. 329)

EdS

- Educational Leadership (p. 337)

PhD

- Adult and Higher Education (p. 330)
- Curriculum and Instruction (p. 333)
- Educational Leadership (p. 335)

K-12 Principal Licensure

The Educational Leadership program at Montana State University is nationally accredited by the Council for the Accreditation of Educator Preparation (CAEP), as well as by the Montana Board of Public Education. The focus of the program is to prepare K-12 School Principals to effectively serve Montana communities and rural communities throughout the Northern Plains and Northern Rocky Mountain region of the United States. Those students completing the degree requirements for the MEd will also have met the academic requirements necessary for a Montana Class III Administrative license with a K-12 Principal Endorsement.

Administrative Licensure Programs

- Board of Public Education/OPI Internship (p. 311)
- Out of State School Administrative License (p. 311)
- Principal Licensure (p. 323)

Board of Public Education/OPI Internship

The Board of Public Education/Office of Public Instruction BPE/OPI Internship is designed for candidates who do not possess licensure as a K-12 Principal or Superintendent and who have been hired into a school leadership position requiring principal or superintendent licensure. The BPE/OPI Internship allows the candidate to gain a Class V (provisional) license to properly hold a school leadership position while completing coursework to earn full licensure. To be eligible, a candidate must be already hired into a school leadership position, and must sign an agreement between their school board trustees and MSU’s Educational Leadership Program. The agreement stipulates that MSU will supervise the candidate while he/she finishes coursework toward full licensure. There is an extra fee that the candidate or district pays to MSU for the supervision.

Educational Leadership Faculty

Dr. Tena Versland, Program Leader
406-994-6799 Email: tена.versland@montana.edu

Dr. Bill Ruff
406-994-4182 Email: wruff@montana.edu

Dr. David Henderson
406-994-6424 Email: david.henderson3@montana.edu

Contact Information

Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

Out of State School Administrative License

Out-of-State School Administrators Seeking Administrative Licensure in Montana

Principal Endorsement

Educators with less than five years experience, who have completed their principal preparation coursework in other states and are seeking Administrative Licensure with a Principal Endorsement in Montana must complete a course in Montana School Law. An additional recommendation is that principals be licensed K-12 in Montana, and completion of EDLD 565 Instructional Leadership is required to do so. The following courses are recommended for K-12 MT Licensure:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDLD 565</td>
<td>K-12 Instructional Leadership</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 655</td>
<td>MT Legal &amp; Policy Studies</td>
<td>3</td>
</tr>
<tr>
<td>or</td>
<td>EDLD 532</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>School Law</td>
<td></td>
</tr>
</tbody>
</table>

Although EDLD 532 Montana School Law or EDLD 655 Montana Legal and Policy Studies will meet this requirement, the recommended course is EDLD 655 Montana Legal and Policy Studies. EDLD 655 delves more substantively into Montana case law without duplicating the U.S. Constitutional Law content present in most school law courses offered in principal preparation programs.

School Superintendent Endorsement

Educators who have completed their School Superintendent preparation coursework and licensure in other states and are seeking Administrative Licensure with a School Superintendent Endorsement in Montana must complete both a course in Montana School Law and a course in Montana School Finance. The following courses are required and are typically offered every summer:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDLD 655</td>
<td>MT Legal &amp; Policy Studies</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 650</td>
<td>MT Finance &amp; Facilities</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 645</td>
<td>Personnel and Collective Bargaining in MT</td>
<td>3</td>
</tr>
</tbody>
</table>
### How to Apply

Contact the Educational Leadership faculty to discuss requirements for licensure.

Complete the Graduate School application available online at the Graduate School website.

http://www.montana.edu/gradschool/admissions/apply.html

---

### Educational Leadership Faculty

**Dr. Tena Versland, Program Leader**  
406-994-6799 Email: tena.versland@montana.edu

**Dr. Bill Ruff**  
406-994-4182 Email: wruff@montana.edu

**Dr. David Henderson**  
406-994-6424 Email: david.henderson3@montana.edu

---

### Contact Information

Micki MacGregor, Graduate Program Assistant  
PO Box 172880, Reid Hall 215  
Department of Education, Montana State University  
Bozeman, MT 59717-2880  
Phone: 406-994-6786 Email: edgrad@montana.edu

---

### College Teaching Certificate

#### Objectives

The Adult and Higher Education Program offers a Certificate in College Teaching to develop and promote exemplary teaching among graduate students, aspiring faculty, and current faculty wanting to enhance their teaching skills. The goal of the certificate is to make individuals more competitive in the job market as instructors and faculty members at colleges and universities. A total of 12 credits of coursework are required to earn the certificate. Participants may enroll in the program either Fall or Spring.

---

### Program Flow

A total of 12 credits of course work are required to earn the College Teaching Certificate. Taking three credits a semester, participants will be able to earn the certificate in two years. Taking six credits a semester, participants will be able to earn the certificate in one year. Participants may enroll in the program for Fall or Spring semesters.

---

### Program of Study

**Required Courses - 6 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDLD 635</td>
<td>College Teaching</td>
</tr>
<tr>
<td>EDLD 574</td>
<td>Field Experience in Educational Leadership (Section-006, College Teaching Practicum)</td>
</tr>
</tbody>
</table>

Field Experience is the experiential component for the certificate program and is taken after the majority of the coursework is completed.

**Electives - choose 6 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDLD 509</td>
<td>Issues and Trends in Higher Education</td>
</tr>
<tr>
<td>EDLD 616</td>
<td>Organization and Administration of Higher Education</td>
</tr>
<tr>
<td>EDLD 628</td>
<td>College Students</td>
</tr>
<tr>
<td>EDLD 529</td>
<td>Post Secondary Distance Delivered Education</td>
</tr>
<tr>
<td>EDLD 531</td>
<td>Theoretical Foundations of Student Services</td>
</tr>
</tbody>
</table>

Total Credits: 12

---

### Application for Certificate in College Teaching

The minimum requirement for admission to the certificate program is a master's degree or current enrollment in a master's or doctoral degree program as well as knowledge of a self-identified discipline or area of specialization. In the personal statement, candidates should describe their qualifications to teach the content of their discipline or area of specialization at the college level and their teaching goals.

Complete the online application through the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html)

Applicants are to submit the following documentation during the application process:

1. **Official Transcripts** – current students at MSU may submit copies of transcripts.
2. **Three letters of reference** – one of these must address the discipline/specialization qualifications of the applicant to teach at the college level.  
   a. NOTE: If the applicant is a current graduate student at MSU, then only one reference is required.
3. **Current Curriculum Vitae**
4. **Personal statement** – please address the following:  
   a. Brief background  
   b. Goal for completing the Certificate – What are the applicants teaching goals?  
   c. Discipline/content knowledge – What qualifications does the applicant have to teach the content of the discipline or area of specialization at the college level?  
   d. List of current teaching responsibilities or experiences  
   e. Initial ideas on a possible course(s) the applicant would like to “teach” as part of the practicum experience. Also, include names of any mentors who might serve as a master teacher for the practicum experience.  
   f. Has the applicant taken or are currently enrolled in any courses that might count towards the Certificate? If yes, list these and when taken.

Note: Additional information may be requested by the Admissions Committee upon receipt of application.
Application Deadlines

The following are the preferred application deadline dates by which all of the application materials must be submitted via the online application system.

Fall Semester: April 1st  
Spring Semester: November 1st  
Summer Semester: April 1st  

The following is the absolute deadline date for the fall semester. If an applicant is unable to submit all application materials via the online application system by the preferred dates listed above, he or she can submit the materials by the date listed below, as there will be a second review for the fall semester.

Fall Semester: August 15th

Contact Information

Micki MacGregor, Graduate Program Assistant  
Department of Education  
PO Box 172880, Reid Hall 215  
Department of Education, Montana State University  
Bozeman, MT 59717-2880  
Phone: 406-994-6786 edgrad@montana.edu

Library Media Certificate

Program Objectives

This program is geared toward licensed teachers who want to obtain the school library media endorsement. This certification program/endorsement can only be added to an existing teaching license. We have received official approval from accreditation officials in Alaska, Colorado, Idaho, Montana, Oregon, South Dakota, North Dakota, Washington, and Wyoming. Many other states accept our program as well. Contact your state’s Department of Education to ensure that the program is accepted. Our education programs are accredited by the Montana Board of Public Education. We participate in the National Association of State Directors of Teacher Education and Certification’s (NASDTEC) Interstate Contract.

Additionally, the Library Media program offers an option to earn a Master’s degree (MEd) in Curriculum & Instruction after completion of all Library Media coursework. The Master’s portion involves completion of 9 additional credits past the 21 required by the Library Media Certificate program, and these courses are also offered online. A student must apply to the full MEd program either initially or before 9 credits of Library Media coursework have been completed. See Master of Education in Curriculum & Instruction - Professional Educator Option (p. 321).

Program Flow

Following admission, the student should register for the course(s) offered in the upcoming semester. Two to three courses are typically offered each semester.

This is a fully online program. Therefore, students must have reliable Internet access. Students also need:

1. Basic understanding of word processing and email applications  
2. Familiarity with spreadsheet and database applications and software  
3. Basic knowledge of the Web, search engines, and experience using different browsers and online databases  
4. Experience with software downloads and multimedia plug-ins

Program of Study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 522</td>
<td>Info Resources &amp; Services</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 545</td>
<td>Organization of Information in School Library Media Centers</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 546</td>
<td>School Library Media Specialist</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 547</td>
<td>Info Inquiry &amp; Ed Change</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 548</td>
<td>Management of Information &amp; Resources</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 549</td>
<td>Applications of Literature for Children and Young Adults</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 598</td>
<td>Internship</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 591</td>
<td>Special Topics</td>
<td>1-4</td>
</tr>
</tbody>
</table>

Total Credits 21

Contact Information

Dr. Ann Ewbank, Program Leader  
Phone: 406-994-5788  
Email: ann.ewbank@montana.edu

Application Process for the Library Media Certificate Program

Prior to applying for the Library Media Certificate program applicants must hold a teaching license and have gained at least one year teaching experience.

1. Complete the online application through the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html)  
2. Provide official transcripts from all higher education institutions attended to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717.

   • Note: Admission to the program requires a cumulative GPA of 3.0 for the last two years of undergraduate coursework.

Application Deadlines

The following are the preferred application deadline dates by which all of the application materials must be submitted via the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html):

- Fall Semester: April 1st  
- Spring Semester: November 1st  
- Summer Semester: April 1st

The following are the absolute application deadline dates. If an applicant is unable to submit all application materials via the online application system by the preferred dates listed above, he or she can submit the materials by the date listed below, as there will be a second review.

- Fall Semester: July 15th

Contact Information

Micki MacGregor, Graduate Program Assistant  
PO Box 172880, Reid Hall 215  
Department of Education, Montana State University  
Bozeman, MT 59717-2880
School Superintendent Certificate Program

Objectives
The Educational Leadership Program at Montana State University offers the Montana School Superintendent Certificate Program to prepare candidates to complete all state requirements for licensure as a School Superintendent in Montana. The Montana School Superintendent Certificate Program is a 15-credit certificate with coursework designed to be completed through an intensive summer program with a semester long internship following the coursework.

Program Flow
Students must first apply to the Montana School Superintendent Certificate Program via the MSU Graduate School. The early admission deadline is February 1st with final deadline of April 1st. Once accepted to the program, students must enroll and begin summer session classes by mid-May. Classes begin with online coursework and culminate with a two-week on campus experience during the last two weeks in June.

Program of Study
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDLD 620</td>
<td>The School Superintendent</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 645</td>
<td>Personnel and Collective Bargaining in MT</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 650</td>
<td>MT Finance &amp; Facilities</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 655</td>
<td>MT Legal &amp; Policy Studies</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 574</td>
<td>Field Experience in Educational Leadership</td>
<td>3</td>
</tr>
</tbody>
</table>

* Course with 3 credits is completed in a Montana school district of the candidate’s choosing under the supervision of a properly licensed superintendent.

* Students who possess more than seven (7) years of principal experience in Montana or seven (7) years of experience as a central office administrator in Montana may petition the program to waive the field experience requirement.

Total Credits: 15

Educational Leadership Faculty
Dr. Tena Versland, Program Leader and Chair of School Superintendent Certificate Program
406-994-6799 Email: tena.versland@montana.edu

Dr. Bill Ruff
406-994-4182 Email: wruff@montana.edu

Dr. David Henderson
406-994-6424 Email: david.henderson3@montana.edu

Application for Montana School Superintendent Certificate in Educational Leadership
The minimum requirement for admission to the certificate program is a master’s degree or current enrollment in a master’s program.

Complete the online application through the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html) (and pay a non-refundable $60 application fee). During the online application process you will be asked to submit the following materials.

1. Official Academic Transcripts from each university attended. Transcripts must verify all bachelor’s and master’s degree coursework (as well as a confirmation of both degrees submitted directly to the Department of Education Graduate Programs Office either electronically to: edgrad@montana.edu (margaret.secrest@montana.edu) or by mail to: 215 Reid Hall, P.O. Box 172880, Montana State University, 59717.

2. Current Curriculum Vitae/Resume. Include three references
3. Personal statement - please address the following
   a. Brief background (describe qualifications, previous educational experience, teaching experience, leadership experience)
   b. Goal for completing the Certificate - What are the applicant’s leadership goals?

* NOTE: Additional information may be requested by the Admissions Committee upon receipt of application.

How to Apply
To discuss requirements for licensure and applying for the School Superintendent Certificate Program contact:

Dr. Tena Versland, Chair of School Superintendent Certificate Program
406-994-6799 Email: tena.versland@montana.edu

Complete the Graduate School application available online at the Graduate School website.
http://www.montana.edu/gradschool/admissions/apply.html

Application Deadlines
April 1st is the deadline by which all of the application materials for the School Superintendent Certificate must be submitted via the online application system. By submitting materials by the deadline, accepted students may be eligible for early registration. In order for a graduate degree application to be reviewed for admission, all required application documents must be submitted prior to the department’s posted deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

- Fall Semester: April 1st
- Summer Cohort Session: April 1st

Contact Information
Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

Master of Education in Adult & Higher Education

Objectives
There are three specialization options for the Master’s in Education (MEd): Adult Education, Student Affairs, and Higher Education.
Adult Education (p. 316)
- Community education
- Religious education
- Workplace training and development

Higher Education (p. 316)
- Entry-level general administrative positions in higher education
- Program Development
- Institutional Development and Leadership

Student Affairs (p. 317)
- Residence Life
- Career Services
- Leadership Development
- Student Support Services

Program Flow
After acceptance, the student will be assigned a temporary advisor and should then meet with his/her assigned advisor. During the second semester of enrollment, the student will identify a graduate committee chair and committee members, establish and submit their program of study to the Graduate School, and clarify plans for the comprehensive examination or master's thesis. Near the completion of course work, the student will write the comprehensive examination. Students writing a thesis will not be required to write a comprehensive examination.

Committees
Each masters student’s committee must consist of three members. The chair and one other member must be from the Adult & Higher Education faculty. The third committee member must have academic credentials in the area of the student’s program of study and be approved by the Head of the Department of Education and Dean of The Graduate School.

Chairs
The student should carefully select his/her chair after thorough conversations with members of the Adult & Higher Education faculty. The graduate committee chair will give strong leadership and approval regarding the balance of the committee’s potential membership. The committee, as a whole, is subject to the approval of the Head of the Department of Education. The chair will facilitate program approval, comprehensive exam planning and clarification. Chairs and members of a student’s committee are subject to change. In addition, revision to the program of study can be made during the course of study with the chair’s approval.

Comprehensive Examinations
Near the end of completing course work, MEd students will complete a written comprehensive exam or a Master’s Thesis. Students are expected to demonstrate mastery of the program of study and the ability to interact with the research in that area. The substantive content of the written exam questions will be determined by the chair in consultation with the committee. Students may be required to meet with the committee to provide oral clarification of their written responses.

If completing a masters thesis in lieu of a comprehensive exam, you will need to discuss thesis credit requirements with your graduate committee chair by the second semester.

Contact Information
Dr. Tricia Seifert
tricia.seifert@montana.edu

Dr. Carrie Myers, Program Leader
cbmyers@montana.edu

Dr. Sweeney Windchief
sweeney.windchief@montana.edu

Dr. Bryce Hughes
bryce.hughes@montana.edu

MEd in Adult & Higher Education Options:
- Adult Education Option (p. 316)
- Higher Education Option (p. 316)
- Student Affairs Option (p. 317)

Application Process for the MEd in Adult & Higher Education

Click Here to access the online application (http://www.montana.edu/wwwdg/apply.html)

During the online application process you will be asked to submit the following materials.

1. Completed Graduate School Application
2. GPA calculation sheet – The form is provided during the application process.
3. Resume/Curriculum Vitae
4. Documentation of verbal and quantitative skills needed for the degree – The general test of the Graduate Record Examination (GRE) or Miller Analogies Test (MAT) is required. Official scores can be sent to Montana State University (code 4488). There is no minimum score requirement. Applications are reviewed holistically and take into account all elements.
5. Academic Transcripts – Provide official transcripts verifying all Bachelor's degree course work submitted directly to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717. Transcripts will be evaluated for rigor and academic fit.
6. Personal essay – The suggested length is 2-3 pages, double-spaced. Briefly describe your background, prior professional and leadership experience, why you are interested in our program, and how you plan to use your degree.
7. Three (3) professional references – The letters should be from individuals qualified to assess your ability and potential as a graduate student and/or be able to attest to your work ethic and professionalism. References from relatives are not acceptable.
8. For International Applicants ONLY
   TOEFL (https://www.ets.org/toefl) or ACE level 7 – Applicants who are not U.S. citizens and not from countries where English is the official language are required to take the Test of English as a Foreign Language and score a minimum 213 (paper version- 550, 80 for the iBT). This requirement may be waived if the
applicant has earned an undergraduate or graduate degree from an institution in the U.S.

9. For International Applicants ONLY
   International Student Financial Certificate (http://www.montana.edu/international/admissions/graduatefinancialcertificate.pdf)

Application Deadlines

Below are the deadlines by which all of the application materials for the MEd in Adult & Higher Education must be submitted via the online application system. By submitting materials by the deadline, accepted students may be eligible for early registration. In order for a graduate degree application to be reviewed for admission, all required application documents must be submitted prior to the department’s posted deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

Fall Semester: April 1st
Spring Semester: April 1st
Summer Semester: April 1st

*An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships require students to work on campus 19 hours per week. Applications must be complete for an early review.

We hope that you are interested in our program! We strongly suggest that you contact one of our faculty by e-mail or phone for further information and before applying. We would like to get to know you as early as possible. E-mail addresses of our faculty are listed on the Overview page.

Contact Information

Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

Adult Education Option

Objectives

The M.Ed. Adult Education specialization emphasizes fundamental skills and understandings of adult learners and is intended for individuals who will work within programs of adult education in contexts other than higher education institutions. This program of study is designed to develop skills in working with adult learners within formal and informal contexts such as community education, nonprofit settings, religious education, corporate training, and workforce development. (30 credits).

Program of Study

<table>
<thead>
<tr>
<th>Program of Study</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Education Core - 12 credit hours</td>
<td>12</td>
</tr>
<tr>
<td>EDLD 501 Foundations of Adult Education</td>
<td></td>
</tr>
<tr>
<td>EDU 614 Planning Program Assessment</td>
<td></td>
</tr>
<tr>
<td>EDLD 513 Resource and Program Management</td>
<td></td>
</tr>
<tr>
<td>EDLD 616 Organization and Administration of Higher Education</td>
<td></td>
</tr>
<tr>
<td>Statistics and Research - 6 credit hours</td>
<td>6</td>
</tr>
<tr>
<td>EDCI 501 Educational Statistics I</td>
<td></td>
</tr>
<tr>
<td>EDCI 506 Applied Educational Research</td>
<td></td>
</tr>
<tr>
<td>Electives - 12 credit hours</td>
<td>12</td>
</tr>
</tbody>
</table>

Approved electives may be selected from other Education programs or departments that strengthen the student’s program of study. These courses need to be selected in consultation with the chair.

Total Credits 30

Internship

Students with no professional experience working in an adult education program are encouraged to enroll in a three-credit higher education Internship (EDLD 598) to gain practical field experience.

Higher Education Option

Objectives

The MEd Higher Education specialization emphasizes the structure and function of higher education and is intended for individuals interested in working within student and academic affairs. Graduates with this specialization will be prepared to work within a range of post-secondary settings such as registrar, institutional research & assessment, library, marketing, and entry level programming and administration. (30 credits)

Program of Study

<table>
<thead>
<tr>
<th>Program of Study</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Education Core - 12 credit hours</td>
<td>12</td>
</tr>
<tr>
<td>EDLD 605 Higher Education History and Philosophy</td>
<td></td>
</tr>
<tr>
<td>EDLD 616 Organization and Administration of Higher Education</td>
<td></td>
</tr>
<tr>
<td>EDLD 628 College Students</td>
<td></td>
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<tr>
<td>EDU 637 Institutional Research and Assessment</td>
<td></td>
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<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>EDCI 501 Educational Statistics I</td>
<td></td>
</tr>
<tr>
<td>EDCI 506 Applied Educational Research</td>
<td></td>
</tr>
<tr>
<td>Higher Education Specialized Courses - 12 credit hours from the following</td>
<td>12</td>
</tr>
<tr>
<td>EDLD 509 Issues and Trends in Higher Education</td>
<td></td>
</tr>
<tr>
<td>EDLD 512 Finance and Administration in Higher Education</td>
<td></td>
</tr>
<tr>
<td>EDLD 513 Resource and Program Management</td>
<td></td>
</tr>
<tr>
<td>EDLD 529 Post Secondary Distance Delivered Education</td>
<td></td>
</tr>
<tr>
<td>EDLD 635 College Teaching</td>
<td></td>
</tr>
<tr>
<td>EDLD 531 Theoretical Foundations of Student Services</td>
<td></td>
</tr>
<tr>
<td>EDLD 533 Law and Policy in Higher Education</td>
<td></td>
</tr>
<tr>
<td>EDLD 535 Student Services</td>
<td></td>
</tr>
</tbody>
</table>

Approved electives may be selected from other Education programs or departments that strengthen the student’s program of study.

Statistics and Research - 6 credits 6

EDCI 501 Educational Statistics I
EDCI 506 Applied Educational Research

Total Credits 30

Internship

Students with no professional experience working in higher education are encouraged to enroll in a three-credit higher education Internship (EDLD 598) to gain practical field experience.
Student Affairs Option

Objectives
The MEd Student Affairs specialization emphasizes student development & advising and is intended for individuals who will work within college student affairs' programs in higher education. This program plan is designed to provide the graduates with the fundamental skills and understandings necessary to work within diverse post-secondary settings such as residence life, career services, athletics, and student government. (30 credits)

Program of Study

Student Affairs Required - 18 credit hours
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDLD 616</td>
<td>Organization and Administration of Higher Education</td>
<td>3</td>
</tr>
<tr>
<td>EDU 614</td>
<td>Planning Program Assessment</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 628</td>
<td>College Students</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 531</td>
<td>Theoretical Foundations of Student Services</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 533</td>
<td>Law and Policy in Higher Education</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 535</td>
<td>Student Services</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Statistics and Research - 6 credit hours</td>
<td>6</td>
</tr>
<tr>
<td>EDCI 501</td>
<td>Educational Statistics I</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 506</td>
<td>Applied Educational Research</td>
<td>3</td>
</tr>
<tr>
<td>Electives - 6 credit hours</td>
<td>Approved electives may be selected from other Education programs or departments that strengthen the student's program of study. These courses need to be selected in consultation with the chair.</td>
<td>6</td>
</tr>
</tbody>
</table>

Total Credits 30

Internship
Students with no professional experience working in college student affairs are encouraged to enroll in a three-credit higher education Internship, EDLD 598 Internship to gain practical field experience.

Master of Education in Curriculum & Instruction

Program Objectives
At the Master’s level, the Curriculum and Instruction program offers three options. The Professional Educator and Technology Education options are fully online and the Educational Researcher option is blended-online and onsite.

Professional Educator (p. 321)
Students in the Professional Educator online program will share strengths, develop new instructional strategies, study theory and best practice, as well as examine current issues in education and consider implications for teaching practice. Students who complete the Professional Educator option of the Curriculum & Instruction Master’s degree are expected to demonstrate the knowledge, skills, and dispositions of a master teacher. For the Professional Educator option, all courses are offered in a 100% online format.

There are four specializations available within the Professional Educator option:

- Secondary (6-12) Teachers
- K-12 Music Teachers
- Library Media Certificate Core

Technology Education (p. 322)
Students who complete the online Technology Education option of the Curriculum & Instruction Master’s degree are expected to demonstrate the knowledge, skills, and dispositions of a master teacher.

Educational Researcher (p. 322)
Students who complete the blended-online and onsite Educational Researcher option of the Curriculum & Instruction Master’s degree are expected to demonstrate the knowledge, skills, and dispositions of a professional researcher. Most courses in the Educational Researcher option can be taken online.

Program Flow
The graduate faculty are committed to offering multiple avenues for students to fulfill their goals and expectations for advanced study in teaching, learning, and curriculum design. The program provides academic preparation for educators who seek higher education in order to become master teachers, scholars, researchers, or curriculum coordinators in schools, districts, and other educational agencies. The program is structured to allow full-time working professionals to continue their jobs while working toward an advanced degree.

Committees
Students in the Professional Educator and Technology Education options of the Curriculum and Instruction Master’s program will be assigned an advisor. The advisor will guide the student’s course selection and progress toward degree completion including the submission of the student’s Graduate Program of Study form.

Students in the Educational Researcher option will be guided by a graduate committee. A minimum of three committee members will be included on the student’s Program of Study at the discretion of the advisor/chair.

The Master’s Capstone ~ Comprehensive Examinations

Capstone for the Professional Educator, Technology Education, and Library Media Certificate Core Options
As MEd students in the Professional Educator and Technology Education Options approach the end of their coursework (approximately 21 credits completed), they will contact their advisor/chair to discuss the content, format, and time frame for their Master’s Capstone.

The Master’s Capstone for the Professional Educator, Technology Education, and Library Media Certificate Core Options is composed of two elements:

1. The Written Comprehensive Exam entails the completion of EDCI 575 Professional Paper/Project. The content and design of the Professional Paper/Project will be determined by consultation between the advisor/chair and the student. The Professional Paper/Project will be designed to most appropriately meet the professional growth and learning needs of the individual student. Students are required to use APA format. The completed Professional Paper/Project will be evaluated for written competency (quality, thoroughness, depth, and professionalism) as well as the student’s mastery of: pertinent literature,
academic and theoretical underpinnings, development of professional skills, and the ability to conduct effective educational research.

2. The Oral Comprehensive Exam entails formal presentation of the findings from the Professional Paper/Project. The student will give a one (1) hour oral presentation of the Professional Paper/Project. Students can be queried about their research as well as all areas of program content during the oral presentation. The presentation will be evaluated for oral competency and mastery of knowledge of pertinent literature, academic and theoretical grounding, development of professional skills, and the ability to conduct effective educational research.

**Capstone for the Educational Researcher Option**
The Master’s Capstone for the Educational Researcher Option is composed of a Written Comprehensive Exam and an Oral Comprehensive Exam. These are the major final academic examinations during a Master’s degree study that assure the student has attained sufficient mastery of a program of study. Through this Capstone experience, students will demonstrate mastery in: knowledge of pertinent literature, academic and theoretical underpinnings, development of professional skills, and the ability to conduct effective educational research.

1. **Written Comprehensive Exam**
   As MEd students in the Educational Researcher Option approach the end of their first year of study, they will contact their Committee Chair to discuss the format, content, and time frame of their Master’s Thesis. The content of the Master’s Thesis will be an original research project determined by consultation between the chair and the student and must be approved by the student’s Master’s Committee. Students are required to complete the Master’s Thesis using APA format. The completed Master’s Thesis will be submitted to the student’s Committee for evaluation. Committee members will have approximately two weeks to read and evaluate the content and written competency (quality, thoroughness, and completeness of the research) of the Thesis.

2. **Oral Comprehensive Exam**
   At the end of the two-week period, the student will give a 1-2 hour oral presentation and defense of the Thesis to the Master’s Committee. Students can be queried about all areas of program content during the oral presentation and Thesis defense. The presentation will be evaluated for research content and oral competency.

**Application Process**

Applicants are required to submit the following documentation during the online application process through The Graduate School (http://www.montana.edu/wwwdg/apply.html) (A nonrefundable $60 application fee must accompany the online application):

1. Resume/Curriculum Vitae
2. GPA calculation sheet for undergraduate degree — The form is provided during the application process.
3. Academic Transcripts — Provide official transcripts from all higher education institutions attended to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717. Admission to the program requires a cumulative GPA of 3.0 for the last two years of undergraduate coursework. Applicants who earned a degree from MSU do not need to submit MSU transcripts.
4. Three (3) Personal Essays — Each essay should be a maximum of 2 pages in length, typed, double spaced, and must respond to the following:
   a. Essay 1: Describe your career goals for the future and how you see the completion of a Master’s degree in Curriculum & Instruction as helping you achieve your goals.
   b. Essay 2: Describe your personal strengths as an educator and identify the ways in which you believe you could use your strengths to contribute to the cohort of students with whom you will be studying.
   c. Essay 3: Describe the areas in which you want and need to grow as a professional educator/researcher.

5. Three (3) Professional References — During the application process you will be asked to submit contact information for each recommender. One of the recommenders should be from your current direct supervisor. Applicants who do not have a letter from a present supervisor must provide a written explanation identifying the specific reason(s) why they were unable to secure a letter of recommendation from their present supervisor.

6. Official GRE scores — These scores are required ONLY for those applying to the Educational Researcher option. The general test of the Graduate Record Examination (GRE) or Miller Analogies Test (MAT) is required. Official scores can be sent to Montana State University (code 4488). There is no minimum score requirement. Applications are reviewed holistically and take into account all elements.

7. For International Applicants ONLY - International applicants must submit an English proficiency exam (TOEFL (https://www.ets.org/toefl) or ACE level 7 - Applicants who are not U.S. citizens and not from countries where English is the official language are required to take the Test of English as a Foreign Language and score a minimum 213 (paper version- 550, 80 for the iBT). This requirement may be waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S.) and a International Student Financial Certificate (http://www.montana.edu/international/admissions/graduatefinancialcertificate.pdf).

**Application Deadlines**

Below are the deadlines by which all of the application materials for the M.Ed. program in Curriculum and Instruction must be submitted via the online application system. By submitting materials by the deadline, accepted students may be eligible for early registration. In order for a graduate degree application to be reviewed for admission, all required application documents must be submitted prior to the department’s posted deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

- Fall Semester: April 1st
- Spring Semester: November 1st
- Summer Semester: April 1st

*An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships...
require students to work on campus 19 hours per week. Applications must be complete for an early review.

Admission to Curriculum & Instruction Programs
Complete applications will be reviewed and rated by members of the Graduate Admissions Committee who then convene to make final admission decisions. Once applicants are accepted, their applications will be forwarded to The Graduate School for final administrative processing. Please note that the application review process will begin on the application deadline dates and not before.

Contact Information
Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

Master of Education in Curriculum & Instruction
Program Objectives
At the Master’s level, the Curriculum and Instruction program offers three options. The Professional Educator and Technology Education options are fully online and the Educational Researcher option is blended-online and onsite.

Professional Educator (p. 321)
Students in the Professional Educator online program will share strengths, develop new instructional strategies, study theory and best practice, as well as examine current issues in education and consider implications for teaching practice. Students who complete the Professional Educator option of the Curriculum & Instruction Master's degree are expected to demonstrate the knowledge, skills, and dispositions of a master teacher. For the Professional Educator option, all courses are offered in a 100% online format.

There are four specializations available within the Professional Educator option:
- Elementary (K-8) Teachers
- Secondary (6-12) Teachers
- K-12 Music Teachers
- Library Media Certificate Core

Technology Education (p. 322)
Students who complete the online Technology Education option of the Curriculum & Instruction Master's degree are expected to demonstrate the knowledge, skills, and dispositions of a master teacher.

Educational Researcher (p. 322)
Students who complete the blended-online and onsite Educational Researcher option of the Curriculum & Instruction Master's degree are expected to demonstrate the knowledge, skills, and dispositions of a professional researcher. Most courses in the Educational Researcher option can be taken online.

Program Flow
The graduate faculty are committed to offering multiple avenues for students to fulfill their goals and expectations for advanced study in teaching, learning, and curriculum design. The program provides academic preparation for educators who seek higher education in order to become master teachers, scholars, researchers, or curriculum coordinators in schools, districts, and other educational agencies. The program is structured to allow full-time working professionals to continue their jobs while working toward an advanced degree.

Committees
Students in the Professional Educator and Technology Education options of the Curriculum and Instruction Master's program will be assigned an advisor. The advisor will guide the student’s course selection and progress toward degree completion including the submission of the student’s Graduate Program of Study form.

Students in the Educational Researcher option will be guided by a graduate committee. A minimum of three committee members will be included on the student’s Program of Study at the discretion of the advisor/chair.

The Master’s Capstone ~ Comprehensive Examinations
Capstone for the Professional Educator, Technology Education, and Library Media Certificate Core Options
As MEd students in the Professional Educator and Technology Education Options approach the end of their coursework (approximately 21 credits completed), they will contact their advisor/chair to discuss the content, format, and time frame for their Master’s Capstone.

The Master’s Capstone for the Professional Educator, Technology Education, and Library Media Certificate Core Options is composed of two elements:

1. The Written Comprehensive Exam entails the completion of EDCI 575 Professional Paper/Project. The content and design of the Professional Paper/Project will be determined by consultation between the advisor/chair and the student. The Professional Paper/Project will be designed to most appropriately meet the professional growth and learning needs of the individual student. Students are required to use APA format. The completed Professional Paper/Project will be evaluated for written competency (quality, thoroughness, depth, and professionalism) as well as the student’s mastery of: pertinent literature, academic and theoretical underpinnings, development of professional skills, and the ability to conduct effective educational research.

2. The Oral Comprehensive Exam entails formal presentation of the findings from the Professional Paper/Project. The student will give a one (1) hour oral presentation of the Professional Paper/Project. Students can be queried about their research as well as all areas of program content during the oral presentation. The presentation will be evaluated for oral competency and mastery of: knowledge of pertinent literature, academic and theoretical grounding, development of professional skills, and the ability to conduct effective educational research.

Capstone for the Educational Researcher Option
The Master’s Capstone for the Educational Researcher Option is composed of a Written Comprehensive Exam and an Oral Comprehensive Exam. These are the major final academic examinations during a Master’s degree study that assure the student has attained sufficient mastery of a program of study. Through this Capstone experience, students will demonstrate mastery in: knowledge of pertinent literature, academic and
theoretical grounding, development of professional skills, and the ability to conduct effective educational research.

1. **Written Comprehensive Exam**
   As MEd students in the Educational Researcher Option approach the end of their first year of study, they will contact their Committee Chair to discuss the format, content, and time frame of their Master’s Thesis. The content of the Master’s Thesis will be an original research project determined by consultation between the chair and the student and must be approved by the student’s Master’s Committee. Students are required to complete the Master’s Thesis using APA format. The completed Master’s Thesis will be submitted to the student’s Committee for evaluation. Committee members will have approximately two weeks to read and evaluate the content and written competency (quality, thoroughness, and completeness of the research) of the Thesis.

2. **Oral Comprehensive Exam**
   At the end of the two-week period, the student will give a 1-2 hour oral presentation and defense of the Thesis to the Master’s Committee. Students can be queried about all areas of program content during the oral presentation and Thesis defense. The presentation will be evaluated for research content and oral competency.

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**Contact Information**

**Dr. Nicholas Lux, Program Leader**
Email: nicholas.lux@montana.edu

**Office of Graduate Programs in Education**
Phone: 406-994-6786  Email: edgrad@montana.edu

**Options**
- Professional Educator Option (p. 321)
- Technology Education Option (p. 322)
- Educational Researcher Option (p. 322)

**Application Process**

Applicants are required to submit the following documentation during the online application process through The Graduate School (http://www.montana.edu/wwwdg/apply.html) (A nonrefundable $60 application fee must accompany the online application):

1. **Resume/Curriculum Vitae**
2. **GPA calculation sheet for undergraduate degree** – The form is provided during the application process.
3. **Academic Transcripts** – Provide official transcripts from all higher education institutions attended to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717. Admission to the program requires a cumulative GPA of 3.0 for the last two years of undergraduate coursework. Applicants who earned a degree from MSU do not need to submit MSU transcripts.
4. **Three (3) Personal Essays** – Each essay should be a maximum of 2 pages in length, typed, double spaced, and must respond to the following:
   a. Essay 1: Describe your career goals for the future and how you see the completion of a Master’s degree in Curriculum & Instruction as helping you achieve your goals.
   b. Essay 2: Describe your personal strengths as an educator and identify the ways in which you believe you could use your strengths to contribute to the cohort of students with whom you will be studying.
   c. Essay 3: Describe the areas in which you want and need to grow as a professional educator/researcher.
5. **Three (3) Professional References – During the application process you will be asked to submit contact information for each recommender.** One of the recommenders should be from your current or most recent direct supervisor. Applicants who do not have a letter from a present supervisor must provide a written explanation identifying the specific reason(s) why they were unable to secure a letter of recommendation from their present supervisor.
6. **Official GRE scores** – These scores are required ONLY for those applying to the Educational Researcher option. The general test of the Graduate Record Examination (GRE) or Miller Analogies Test (MAT) is required. Official scores can be sent to Montana State University (code 4488). There is no minimum score requirement. Applications are reviewed holistically and take into account all elements.
7. **For International Applicants ONLY** - International applicants must submit an English proficiency exam (TOEFL (https://www.ets.org/toefl) or ACE level 7 - Applicants who are not U.S. citizens and not from countries where English is the official language are required to take the Test of English as a Foreign Language and score a minimum 213 (paper version- 550, 80 for the iBT). This requirement may be waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S.) and a International Student Financial Certificate (http://www.montana.edu/international/admissions/graduatefinancialcertificate.pdf).

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**Application Deadlines**

Below are the deadlines by which all of the application materials for the M.Ed. program in Curriculum and Instruction must be submitted via the online application system. By submitting materials by the deadline, accepted students may be eligible for early registration. In order for a graduate degree application to be reviewed for admission, all required application documents must be submitted prior to the department’s posted deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

- Fall Semester: April 1st
- Spring Semester: November 1st
- Summer Semester: April 1st

*An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships require students to work on campus 19 hours per week. Applications must be complete for an early review.*

**Admission to Curriculum & Instruction Programs**

Complete applications will be reviewed and rated by members of the Graduate Admissions Committee who then convene to make final admission decisions. Once applicants are accepted, their applications will be forwarded to The Graduate School for final administrative processing. Please note that the application review process will begin on the application deadline dates and not before.

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**Contact Information**

Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786  Email: edgrad@montana.edu
Professional Educator Option

Objectives

Students who complete the Professional Educator option of the Curriculum & Instruction Master's degree are expected to demonstrate the knowledge, skills, and dispositions of a Master Teacher.

Four options are available:

- Elementary (K-8) Teachers
- Secondary (6-12) Teachers
- K-12 Music Teachers
- Library Media Certificate Core

Graduates will exhibit:

1. Deep understanding of student development, diversity, and learning processes;
2. Content mastery of the subjects they teach and how to teach those subjects to students;
3. Skill in managing, monitoring, and assessing student learning;
4. Systematic reflection regarding their professional practice and experience; and
5. Commitment to membership in a community of learners.

Program of Study for Elementary (K-8) Teachers

Signature Content - 12 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 504</td>
<td>Assessment and Evaluation in Education</td>
</tr>
<tr>
<td>EDCI 506</td>
<td>Applied Educational Research</td>
</tr>
<tr>
<td>EDCI 514</td>
<td>Mentoring New Teachers</td>
</tr>
<tr>
<td>EDCI 531</td>
<td>Contemporary Issues in Education</td>
</tr>
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Core Content - 15 credits; choose from the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>EDCI 512</td>
<td>Writing and Its Improvement</td>
</tr>
<tr>
<td>EDCI 520</td>
<td>Visual Arts and Learning</td>
</tr>
<tr>
<td>EDCI 525</td>
<td>Improvement of Instruction in Science</td>
</tr>
<tr>
<td>EDCI 530</td>
<td>Improvement of Math Instruction</td>
</tr>
<tr>
<td>EDCI 532</td>
<td>General School Curriculum</td>
</tr>
<tr>
<td>EDCI 533</td>
<td>Middle Years School</td>
</tr>
<tr>
<td>EDCI 534</td>
<td>Literacy Assessment and Instruction</td>
</tr>
<tr>
<td>EDCI 536</td>
<td>Construction of Curriculum</td>
</tr>
<tr>
<td>EDCI 540</td>
<td>American Indian Studies for Ed</td>
</tr>
<tr>
<td>EDCI 551</td>
<td>Education Technology: Teaching, Learning,</td>
</tr>
<tr>
<td></td>
<td>and Leadership</td>
</tr>
<tr>
<td>EDCI 604</td>
<td>Advanced Educational Psychology</td>
</tr>
</tbody>
</table>

Or Electives relevant to licensure area and approved by graduate advisor

Master's Capstone - 3 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 575</td>
<td>Professional Paper/Project</td>
</tr>
</tbody>
</table>

Total Credits 30

Program of Study for Secondary (6-12) Teachers

Signature Content - 12 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 504</td>
<td>Assessment and Evaluation in Education</td>
</tr>
<tr>
<td>EDCI 506</td>
<td>Applied Educational Research</td>
</tr>
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</table>

Core Content - 15 credits; choose from the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>EDU 610</td>
<td>Qualitative Educational Research</td>
</tr>
<tr>
<td>EDCI 604</td>
<td>Advanced Educational Psychology</td>
</tr>
<tr>
<td>EDCI 532</td>
<td>General School Curriculum</td>
</tr>
<tr>
<td>EDCI 540</td>
<td>American Indian Studies for Ed</td>
</tr>
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</table>

Or Electives relevant to licensure area and approved by graduate advisor

Master's Capstone - 3 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 575</td>
<td>Professional Paper/Project</td>
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</table>

Total Credits 30

Program of Study for K-12 Music Teachers

Signature Content - 12 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>EDCI 504</td>
<td>Assessment and Evaluation in Education</td>
</tr>
<tr>
<td>EDCI 506</td>
<td>Applied Educational Research</td>
</tr>
<tr>
<td>EDCI 514</td>
<td>Mentoring New Teachers</td>
</tr>
<tr>
<td>EDCI 531</td>
<td>Contemporary Issues in Education</td>
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</table>

Core Content - 9 credits

<table>
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<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>MUSI 504</td>
<td>Studies in Hist and Analysis</td>
</tr>
<tr>
<td>MUSE 530</td>
<td>Music, Society, Education</td>
</tr>
<tr>
<td>MUSE 532</td>
<td>Music Ed: Res and Practice</td>
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Music Education Electives - 6 credits; choose from the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>MUSI 540</td>
<td>Advanced Conducting</td>
</tr>
<tr>
<td>MUSE 542</td>
<td>Graduate Vocal Pedagogy</td>
</tr>
<tr>
<td>MUST 544</td>
<td>Comp App Mus Ed</td>
</tr>
<tr>
<td>MUSE 545</td>
<td>General Music Practicum</td>
</tr>
<tr>
<td>MUSI 595</td>
<td>Applied Music</td>
</tr>
</tbody>
</table>

Master's Capstone - 3 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 575</td>
<td>Professional Paper/Project</td>
</tr>
</tbody>
</table>

Total Credits 30

Program of Study for Library Media Certificate Core

A student must apply to the full MEd program either initially or before 9 credits of Library Media coursework have been completed.

Signature Content - 21 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 522</td>
<td>Info Resources &amp; Services</td>
</tr>
<tr>
<td>EDCI 545</td>
<td>Organization of Information in School</td>
</tr>
<tr>
<td>EDCI 546</td>
<td>School Library Media Specialist</td>
</tr>
<tr>
<td>EDCI 547</td>
<td>Info Inquiry &amp; Ed Change</td>
</tr>
<tr>
<td>EDCI 548</td>
<td>Management of Information &amp; Resources</td>
</tr>
<tr>
<td>EDCI 549</td>
<td>Applications of Literature for Children and Young Adults</td>
</tr>
<tr>
<td>EDCI 598</td>
<td>Internship</td>
</tr>
<tr>
<td>EDCI 591</td>
<td>Special Topics</td>
</tr>
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</table>

Master's Content and Capstone - 9 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 531</td>
<td>Contemporary Issues in Education</td>
</tr>
</tbody>
</table>
**Educational Researcher Option**

**Objectives**
Students who complete the Educational Researcher option of the Curriculum & Instruction Master's degree are expected to demonstrate the knowledge, skills, and dispositions of a professional researcher.

**Program of Study**

<table>
<thead>
<tr>
<th>Signature Content - 9 credits; choose from the following</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 501 Educational Statistics I</td>
<td></td>
</tr>
<tr>
<td>EDU 602 Educational Statistics II</td>
<td></td>
</tr>
<tr>
<td>EDCI 506 Applied Educational Research</td>
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</tr>
<tr>
<td>EDU 610 Qualitative Educational Research</td>
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<tr>
<td>EDU 607 Quantitative Educational Research</td>
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</table>

<table>
<thead>
<tr>
<th>Core Content - 12 credits</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four courses appropriate to student’s area of specialization and approved by graduate advisor</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Thesis - 9 credits</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 590 Master’s Thesis</td>
<td></td>
</tr>
</tbody>
</table>

**Master's Thesis**
Students pursuing the Educational Researcher option of the Curriculum & Instruction Master’s degree will complete a Master’s Thesis. See the Graduate School’s Defense of Thesis (http://www.montana.edu/gradschool/policy/degreq_masters.html#degreq_mast_def) website.

**Written Comprehensive Exam - Thesis**
As MEd students in the Educational Researcher option approach the end of their first year of study, they will contact their committee chair to discuss the format, content, and time frame of their Master’s Thesis. The content of the Master’s Thesis will be an original research project determined by consultation between the chair and the student and must be approved by the student’s Master’s Committee. Students are required to complete the Master’s Thesis using APA format.

The completed Master’s Thesis will be submitted to the student’s committee for evaluation. Committee members will have approximately two weeks to read and evaluate the written and competency (quality, thoroughness, and completeness of the research) of the thesis.

**Oral Comprehensive Exam - Thesis Defense**
When the committee members have read and evaluated the thesis, the student will give an oral presentation and thesis defense to the Master’s Committee. Students can be queried about all areas of program content during the oral presentation and thesis defense. The presentation will be evaluated for research content and oral competency.

The committee chair will facilitate the meeting and the order of questioning. Committee members can ask follow-up and clarifying questions in all areas. At the completion of the questioning and in the absence of the student, the entire committee will discuss their evaluation of the oral presentation and thesis defense. The chair will lead the committee to a determination regarding the passing or failing of both the written and oral components of the thesis.

The thesis defense is graded with either a passing or failing grade - determined by a majority committee vote. The student will officially pass the written and oral components of the thesis by demonstrating evidence of knowledge of pertinent literature, academic and theoretical grounding, development of professional skills, and the ability to conduct effective educational research.

A “fail” occurs when a majority of the committee determines that a student has not demonstrated sufficient evidence of knowledge of pertinent literature, academic and theoretical grounding, development of professional skills, or the ability to conduct effective educational research. A failure on either portion of the thesis is considered to be a failed exam. A failed defense may be repeated once. At least two months must elapse before the second defense takes place.

Failure to pass a second thesis defense results in termination of graduate study and dismissal from the academic program. Students who are dismissed from the program due to a failed thesis are ineligible to reapply to the same degree program at any time.

**Technology Education Option**

**Objectives**
Students who complete the Technology Education option of the Curriculum & Instruction Master’s degree are expected to demonstrate the knowledge, skills, and dispositions of a Master Teacher.

Graduates will exhibit:

1. Skill in managing, monitoring, and assessing student learning;
2. Systematic reflection regarding their professional practice and experience; and
3. Commitment to membership in a community of learners.

**Program of Study**

<table>
<thead>
<tr>
<th>Core Content - 12 credits</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 504 Assessment and Evaluation in Education</td>
<td></td>
</tr>
<tr>
<td>EDCI 506 Applied Educational Research</td>
<td></td>
</tr>
<tr>
<td>EDCI 514 Mentoring New Teachers</td>
<td></td>
</tr>
<tr>
<td>EDCI 531 Contemporary Issues in Education</td>
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</table>

<table>
<thead>
<tr>
<th>Signature Content - 15 credits; choose from the following</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE 501 History and Philosophy of Technology Education</td>
<td></td>
</tr>
<tr>
<td>TE 530 3D Modeling &amp; Animation</td>
<td></td>
</tr>
<tr>
<td>TE 594 Seminar</td>
<td></td>
</tr>
<tr>
<td>EDCI 532 General School Curriculum</td>
<td></td>
</tr>
<tr>
<td>EDCI 555 Technology, Instructional Design, and Learner Success</td>
<td></td>
</tr>
<tr>
<td>EDCI 571 In-Service Education</td>
<td></td>
</tr>
<tr>
<td>Electives relevant to licensure area and approved by graduate advisor</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Master's Capstone - 3 credits</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 575 Professional Paper/Project</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits**

30
Master of Education in Educational Leadership (K-12 Principal Licensure)

Objectives
The Educational Leadership program at Montana State University is nationally accredited by the Council for the Accreditation of Educator Preparation (CAEP) as well as by the Montana Board of Public Education. The focus of the program is to prepare K-12 school principals to effectively serve Montana communities and rural communities throughout the Northern Plains and Northern Rocky Mountain region of the United States. Those students completing the degree requirements for the MEd will also have met the academic requirements necessary for a Montana Class III Administrative license with a K-12 Principal Endorsement. This is a full Master’s program with a MEd granted upon graduation.

This program of study has been developed to prepare effective K-12 principals. Using a blended delivery model, it seeks to meet the needs of students who desire convenience and face-to-face interaction. Courses will be delivered using a blended model that features online instruction with a few face-to-face sessions. During the summer, students will meet on the Bozeman campus for two full weeks of face-to-face instruction. The face-to-face instruction will usually take place during the latter weeks of June or early July.

Program Flow
The ideal time to begin the Educational Leadership masters program is in the summer. Students are expected to take coursework in the sequence outlined in the course offerings found below. Developing a learning community is a critical aspect of principal preparation. To enhance the development of a learning community among the students and to facilitate learning by offering an integrated curriculum, students will be placed into a cohort based on year of acceptance into the program and will matriculate together. The application deadline for the Summer Cohort is April 1st.

K-12 Principal Cohort typical Program of Study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDLD 507</td>
<td>Foundations of Educational Leadership</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 508</td>
<td>Supervision of Instruction</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 515</td>
<td>Planned Change</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 520</td>
<td>Schools &amp; Diverse Communities</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 526</td>
<td>Evaluating School Programs</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 532</td>
<td>School Law</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 534</td>
<td>Data Driven Decisions</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 555</td>
<td>School Finance</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 565</td>
<td>K-12 Instructional Leadership</td>
<td>3</td>
</tr>
<tr>
<td>EDLD 574</td>
<td>Field Experience in Educational Leadership (I &amp; II)</td>
<td>6</td>
</tr>
<tr>
<td>EDLD 566</td>
<td>Administration and Supervision of Special Education Programs</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 36

Committees
Each master’s student’s committee must consist of three members. The chair and one other member must be from the Educational Leadership faculty. The third committee member must have academic credentials in the area of the student’s program of study and be approved by the Head of the Department of Education and Dean of the Graduate School.

Chairs
The student should carefully select his/her chair after thorough conversations with the approved Educational Leadership faculty members. The chair will serve as the student’s primary advisor. The committee, as a whole, is subject to the approval of the Head of the Department of Education. Chairs and members of a student’s committee are subject to change. In addition, revision to the program of study can be made during the course of study with the chair’s approval.

Application Materials for the MEd in Educational Leadership
The application deadline for the Summer Cohort is April 1st. *Prior to applying for an Educational Leadership program, applicants must hold a Class I teaching license, should have at least three years teaching experience, and possess a 3.0 undergraduate GPA.

Complete the online application through the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html) (and pay a non-refundable $60 application fee). During the online application process you will be asked to submit the following materials.

1. GPA calculation form: The form is provided during the application process. NOTE: We require a GPA of 3.00 for the last two (2) years of undergraduate course work.

2. Resume/Curriculum Vitae

3. Three (3) letters of recommendation: Candidates must meet the following criteria for one of the three letters of recommendation.
   a. At least one of the three letters must be from the candidate’s PRESENT direct supervisor. That means a school district administrator who (a) is currently administratively certified by Montana Office of Public Instruction or other equivalent state agency; AND (b) currently acts as direct supervisor for the candidate, and has done so for a minimum period of one semester.
   b. At least one of the letters of recommendation must be from a PREVIOUS direct supervisor. That means a school district administrator who is (a) currently administratively certified by Montana Office of Public Instruction or other equivalent state agency; AND (b) has, at some point preceding the date of this application, acted as direct supervisor for the candidate for a minimum period of one semester. Any applicant who does not have a letter from a present direct supervisor must indicate in the self-nomination letter (see below) the specific reason(s) why they were unable to secure a letter of recommendation from their present supervisor.

4. Self-Nomination Letter: The self-nomination letter should be 2-3 pages, double-spaced, and focus on the following:
a. Your development and growth as a teacher, including professional development
b. Your contributions to the school and district
c. Your development as a leader. Specific examples are needed that clarify how you have grown as a leader and your leadership activities
d. Your specific goals, including a timeline for assuming a school leadership position
e. Your motivation to become a school leader and an explanation of how you came to this decision, and
f. Personal qualities you possess that are desirable in a leader

5. Academic Transcripts: Official transcripts verifying all Bachelor’s Degree course work should be sent to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717. Electronic transcripts are also acceptable as long as they arrive directly from the applicants’ certifying university. Please have electronic transcripts sent to edgrad@montana.edu. Transcripts from a degree awarded through MSU are not needed.

6. For International Applicants ONLY -
   • TOEFL (https://www.ets.org/toefl) or ACE level 7 - Applicants who are not U.S. citizens and not from countries where English is the official language are required to take the Test of English as a Foreign Language and score a minimum 213 (paper version), 550, 80 for the iBT. This requirement may be waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S.
   • International Student Financial Certificate (http://www.montana.edu/international/admissions/graduatefinancialcertificate.pdf)

Application Deadlines
April 1st is the deadline by which all of the application materials for the Master’s Program in Educational Leadership must be submitted via the online application system. By submitting materials by the deadline, accepted students may be eligible for early registration. In order for a graduate degree application to be reviewed for admission, all required application documents must be submitted prior to the department’s posted deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

   • Fall Semester: April 1st
   • Summer Cohort Session: April 1st

*An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships require students to work on campus 19 hours per week. Applications must be complete for an early review.

Contact Information
Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

Doctor of Education in Adult & Higher Education
Objectives
At the Doctor of Education level, the Adult & Higher Education program offers two specializations:

Higher Education Academics
The EdD Higher Education Academics specialization is intended for individuals who will teach and/or provide academic leadership and support in the area of college teaching and learning within a diverse range of post-secondary settings. Individuals pursuing this option may hold a Master’s degree within higher education or another discipline in which they will teach or provide academic leadership.

High Education Administration
The EdD in Higher Education Administration specialization is intended for individuals who will contribute to the administrative leadership and support within a range of diverse post-secondary settings. The primary objective of the degree is to produce informed scholarly practitioners for mid- to upper-level management or administrative positions. These individuals typically manage or direct either academic or student affairs operational functions.

Program Flow
After acceptance, the student will be assigned a temporary advisor and should then meet with his/her assigned advisor. During the first semester, students will complete the Doctoral Seminar (EDU 600). Coursework will be based on the student’s previous academic work and advisor/committee approval. By the third semester of enrollment, the student will identify a graduate committee chair and committee members, establish and submit their program of study to the Graduate School, and clarify plans for the comprehensive examination.

Near the end of completing course requirements, the student will write the comprehensive exam and will later meet with the committee for the oral defense of the comprehensive exam. If deemed necessary by the committee, the student may be required to take additional coursework to make up identified deficiencies. Toward the end of the program, the student will take 3-credit hours of Dissertation Seminar (EDU 650) to begin preparation of the proposal. During the proposal preparation, the student will work closely with his/her advisor and members of the committee to prepare the dissertation proposal. During the proposal preparation, the student will work closely with his/her chair and the readers of the committee with progress being made each semester. The student then presents/defends their proposal, which includes the study introduction, literature review, and research methodology. The student conducts the research and writes the dissertation, with progress being made each semester toward completion. When the committee chair determines the student is ready, the student defends the dissertation.

Committees
Each doctoral student’s committee must consist of at least four approved members. The chair and one other approved member must be from the Adult & Higher Education faculty. Two other approved members will be selected based upon their ability to contribute to the student’s studies leading up to and through the dissertation research. These two committee members must have academic credentials in the area of the student’s program of study and be approved by the Head of the Department of Education and Dean of The Graduate School. For information regarding graduate representatives, please refer to the Graduate School policy.
Chairs

The student should carefully select his/her graduate committee chair after thorough conversations with the approved Adult & Higher Education faculty members that he/she believes might have an interest in their doctoral research agenda and/or the ability to work with them toward generating a defensible dissertation. The chair will give strong leadership and approval regarding the balance of the committee’s potential membership. The committee, as a whole, is subject to the approval of the Head of the Department of Education. The chair will facilitate program approval, comprehensive exam planning and clarification, proposal hearing, and dissertation defense. The chair and two other committee members will be the primary “readers” of the dissertation as it is being written. The importance of selecting the right chair cannot be overstated. However, chairs and members of a student’s committee are subject to change. In addition, revision to the program of study can be made during the course of study with the chair’s approval.

Comprehensive Examinations

Comprehensive examinations are required for completion of all graduate degrees at Montana State University. Students are expected to demonstrate mastery of the program of study and the ability to interact with the research in that area. Students should refer to The Graduate School’s web page at: http://www.montana.edu/gradschool/policy/degreq_doctoral.html. The comprehensive exams must be completed by the posted Graduate School deadlines.

Near the end of completing coursework and before the dissertation proposal defense, EdD students will complete a written and oral comprehensive exam. The exam is completed in writing and then orally defended in front of the entire Graduate Committee. Through the comprehensive exam, students will be expected to demonstrate:

- a competency in the breadth of knowledge covered in their coursework
- the ability to integrate concepts from courses into a holistic viewpoint
- the ability to apply material to anticipated real life situations based on the theoretical principles and concepts covered in classes
- the ability to critically read, analyze, and critique research
- a readiness to move forward to create their own research

Generally, there will be four primary question areas:

- Specialization area
- Foundation of Higher Education
- Research
  - Read, analyze, and critique a research article
  - Design a project - will be expected to demonstrate a mastery of aspects of both qualitative and quantitative projects (such as sampling, validity, reliability, and data analysis)

However, these areas may be revised according to individual programs.

Additional Doctor of Education Requirements

The Doctor of Education degree must meet the minimum requirements in the For Doctoral Students section on The Graduate School’s website. Additional requirements for the EdD degree beyond these minimums are available through the Department of Education. All EdD degree candidates are expected to be familiar with both The Graduate School’s degree requirements listed here: http://www.montana.edu/gradschool/policy/degreq_doctoral.html and Department of Education degree requirements listed on each of the three program’s websites.

Contact Information

EdD in Higher Education Options:
- EdD Higher Education Academics (Teaching) (p. 326)
- EdD Higher Education Administration (p. 326)

Application Process for the Doctor of Education in Adult & Higher Education

Applicants are required to complete the online application and submit the following documentation via the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html)

1. Completed Graduate School Application
2. GPA calculation sheet (The form is provided during the application process).
3. Resume/Curriculum vitae
4. Documentation of verbal and quantitative skills needed for the degree: The general test of the Graduate Record Examination (GRE) or Miller Analogies Test (MAT) is required. Official scores can be sent to Montana State University (code 4488). There is no minimum score requirement. Applications are reviewed holistically and take into account all elements.
5. Academic Transcripts: Applicants must provide official transcripts verifying all Bachelors degree and Masters degree course work. Unofficial transcripts may be uploaded during the application process. Official transcripts must be sent from the Institution directly to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, 59717. Electronic transcripts are also acceptable as long as they arrive directly from the applicants certifying university. Please have electronic transcripts sent to edgrad@montana.edu. Transcripts will be evaluated for rigor and academic fit.
6. Personal essay: Suggested length is 2-3 pages, double-spaced. The student should briefly describe the following:
   a. Background
   b. Prior professional and leadership experience
   c. Why the interest in the EdD program
   d. How the applicant plans to use the degree
7. Three (3) professional references: The letters should be from individuals qualified to assess the following:
   a. Applicant’s ability and potential as a graduate student
   b. Attest to the applicants work ethic and professionalism
   c. References from relatives are not acceptable.
8. For International Applicants ONLY: In addition to the above, international applicants will be required to submit the following:
   a. TOEFL (https://www.ets.org/toefl) or ACE level 7 – Applicants who are not U.S. citizens and not from countries where English is the official language are required to take the Test of English as a Foreign Language and score a minimum 213 (paper version-550, 80 for the iBT). This requirement may be waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S. For more information see this link: http://www.montana.edu/gradschool/policy/admissions_intl.html
   b. International applicants must fill out an International Student Financial Certificate.
Application Deadlines
Below is the deadline by which all of the application materials for the EdD in Adult & Higher Education must be submitted via the online application system. Students matriculate into the EdD program in the fall semester only. Applications to the EdD programs are reviewed once per year at the April 1 deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

- Fall Semester: April 1st

*An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships require students to work on campus 19 hours per week. Applications must be complete for an early review.

Contact Information
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Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

EdD Higher Education Academics (Teaching) Option

Objectives
This EdD Higher Education Academics specialization educates informed practitioners who want to teach or provide academic leadership and support at the post-secondary level. Students will work with their advisor on designing a program of study that meets their educational and professional objectives.

Program of Study

Core Courses (12 Credit Hours)

- EDLD 605 Higher Education History and Philosophy
- EDLD 616 Organization and Administration of Higher Education
- EDLD 628 College Students
- EDU 637 Institutional Research and Assessment

or

- EDU 614 Planning Program Assessment

Other Required Core Courses (6 Credit Hours)

- EDU 600 Doctoral Seminar
- EDU 650 Dissertation Seminar

Electives (18 Credit Hours)

- EDLD 509 Issues and Trends in Higher Education
- EDLD 512 Finance and Administration in Higher Education
- EDLD 513 Research and Program Management
- EDU 612 Critical Race Theory
- NASX 523 Am Indians/Minority in High Ed
- EDLD 529 Post Secondary Distance Delivered Education
- EDLD 635 College Teaching
- EDLD 531 Theoretical Foundations of Student Services
- EDLD 533 Law and Policy in Higher Education
- EDLD 535 Student Services

Approved electives may be selected from other Education programs or departments that strengthen the student’s program of study. These courses need to be selected in consultation with the chair.

Statistics and Research Courses (9 Credit Hours beyond the masters)

- EDU 602 Educational Statistics II
- EDU 610 Qualitative Educational Research
- EDU 607 Quantitative Educational Research

* EDCI 506, EDCI 501 or equivalent are prerequisite courses

Dissertation (15 Credit Hours)

- EDU 690 Doctoral Thesis

Higher Education Administration Option

Objectives
This EdD Higher Education Administration specialization educates informed scholarly practitioners for mid-to-upper level management or administrative positions within a range of diverse post-secondary settings. Students will work with their advisor on designing a program of study that meets their educational and professional objectives. Coursework is divided into two categories: required and electives, and research and statistics. Doctoral students must conduct research and write an original theory-based dissertation. Courses are offered generally on evenings and weekends. Many courses are offered as blended courses with a combination of face-to-face and distance delivery.

Program of Study

Core Courses (12 Credit Hours)

- EDLD 605 Higher Education History and Philosophy
- EDLD 616 Organization and Administration of Higher Education
- EDLD 628 College Students

or

- EDU 614 Planning Program Assessment

Other Required Core Courses (6 Credit Hours)

- EDU 600 Doctoral Seminar
- EDU 650 Dissertation Seminar

Electives (18 Credit Hours)

- EDLD 509 Issues and Trends in Higher Education
- EDLD 512 Finance and Administration in Higher Education
- EDLD 513 Resource and Program Management
- EDU 612 Critical Race Theory
- NASX 523 Am Indians/Minority in High Ed
- EDLD 529 Post Secondary Distance Delivered Education
- EDLD 635 College Teaching
- EDLD 531 Theoretical Foundations of Student Services
- EDLD 533 Law and Policy in Higher Education
- EDLD 535 Student Services

Total Credits

60
Approved electives may be selected from other Education programs or departments that strengthen the student’s program of study. These courses need to be selected in consultation with the chair.

Statistics and Research Courses (9 Credit Hours beyond the masters)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 602</td>
<td>Educational Statistics II</td>
</tr>
<tr>
<td>EDU 610</td>
<td>Qualitative Educational Research</td>
</tr>
<tr>
<td>EDU 607</td>
<td>Quantitative Educational Research</td>
</tr>
</tbody>
</table>
* EDCI 506, EDCI 502 or equivalent are prerequisite courses.

Dissertation (15 Credit Hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 690</td>
<td>Doctoral Thesis</td>
</tr>
</tbody>
</table>

Total Credits

Doctor of Education in Curriculum & Instruction

Program Objectives
The Doctor of Education (EdD) degree provides graduates the opportunity to develop the rich knowledge base needed to address problems of practice affecting the greater education community. The program offers multiple opportunities to impact diverse educational settings.

The faculty is committed to offering multiple avenues for students to reach their goals and expectations for advanced study in curriculum and instruction.

Program Flow
After being admitted the student will be assigned a temporary advisor and should then meet with his/her assigned advisor. Actual courses taken during the initial stage will be based on the student’s previous academic work and advisor/committee approval.

The EdD program emphasizes the study of disciplinary content knowledge and related theories guided by a scholar-practitioner approach that can be used to devise applied research studies designed to solve practical problems encountered in K-12 school systems. The program is structured to be completed in 3 to 4 years with tuition support for a limited number of residential EdD students.

Program of Study

<table>
<thead>
<tr>
<th>Research - 12 credits; take the following required courses and add one other research course</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 602</td>
<td>Educational Statistics II</td>
</tr>
<tr>
<td>EDU 607</td>
<td>Quantitative Educational Research</td>
</tr>
<tr>
<td>EDU 610</td>
<td>Qualitative Educational Research</td>
</tr>
</tbody>
</table>

Research Electives are appropriate to area of specialization & approved by Graduate Advisor.

View this link: http://www.montana.edu/education/Documents/grad/grad_research_rotation.pdf for a Graduate Research Methods 3-year rotation for both required and elective courses. EDCI 506 if equivalent is a prerequisite course and does not satisfy research component of the degree.

Curriculum & Instruction Core - 9 credits; choose from the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 532</td>
<td>General School Curriculum</td>
</tr>
</tbody>
</table>

EDCI 536  Construction of Curriculum
EDCI 541  History & Philosophy of Education
EDCI 544  Philosophical Issues in Education
EDCI 604  Advanced Educational Psychology
*Substitute courses may be approved by graduate advisor.

Internships/Apprenticeships - 3 credits; choose one or more of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 598</td>
<td>Internship (Teaching)</td>
</tr>
<tr>
<td>EDCI 598</td>
<td>Internship (Supervision)</td>
</tr>
<tr>
<td>EDCI 598</td>
<td>Internship (Research)</td>
</tr>
<tr>
<td>EDCI 592</td>
<td>Independent Study</td>
</tr>
</tbody>
</table>
*Substitute courses may be approved by graduate advisor.

Social Justice - 3 credits; choose from the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 612</td>
<td>Critical Race Theory</td>
</tr>
<tr>
<td>EDLD 643</td>
<td>Leading Social Justice</td>
</tr>
</tbody>
</table>
*Substitute courses may be approved by graduate advisor.

Required Core Content Courses - 6 credit

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 600</td>
<td>Doctoral Seminar</td>
</tr>
<tr>
<td>EDU 650</td>
<td>Dissertation Seminar</td>
</tr>
</tbody>
</table>

Concentration - 15 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>Courses selected appropriate to area of specialization &amp; approved by Graduate Advisor</td>
<td></td>
</tr>
</tbody>
</table>

Dissertation - 15 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 690</td>
<td>Doctoral Thesis</td>
</tr>
</tbody>
</table>

Total Credits

Committees
Each doctoral student’s committee must consist of at least four approved members. The chair and one other approved member must be from the Curriculum & Instruction faculty. Two other approved members will be selected based upon their ability to contribute to the student’s studies leading up to and through the dissertation research. These two committee members must have academic credentials in the area of the student’s program of study and be approved by the Head of the Department of Education and Dean of The Graduate School. For information regarding graduate representatives, please refer to the Graduate School policy.

Chairs
The student should carefully select a chair after thorough conversations with those Curriculum & Instruction faculty members that he/she believes might have an interest in his/her doctoral research agenda and/or the ability to work with him/her toward generating a defensible dissertation. The chair will give leadership and approval regarding the balance of the committee’s potential membership. The committee, as a whole, is subject to the approval of the Head of the Department of Education. The chair will facilitate program approval, comprehensive exam planning and clarification, proposal hearing, and dissertation defense. Chairs and members of a student’s committee are subject to change. Revision to the program of study can be made during the course of study with the chair’s approval.

Comprehensive Examinations
As EdD students in Curriculum & Instruction approach the end of their coursework (30 credits completed), and prior to the Dissertation Proposal Meeting, they will contact their committee chair to discuss the content and format of the required written and oral comprehensive examinations. The
Written Comprehensive Examination will be composed of one question from each of three primary areas:

- Educational Foundations (e.g., synthesis of theoretical and empirical literature regarding various aspects of teaching and learning),
- Educational Research (demonstration of mastery of aspects of both qualitative and quantitative projects such as sampling, validity, reliability, data analysis), and
- The student’s major area of study (e.g., methods of science education for pre-service teachers). Students who are completing a minor (e.g., History) will answer one additional question in their minor area.

The committee chair will discuss the process with committee members and based upon the members’ area of expertise, designate one member to compose an appropriate question for each of the suggested areas. The members will submit their questions to the chair who will compile them and give them to the student. The Written Comprehensive Examination will be structured as a written take-home exam that is to be completed over the subsequent 17 day period. Students are required to complete the exam using APA format.

The completed written examination will be submitted to the committee chair and copies will be distributed to the entire doctoral committee for evaluation. Committee members will have two weeks to read and evaluate the content and written competency of the student’s responses. At the end of the two week period, the committee will meet for a two-hour Oral Comprehensive Examination. The chair will facilitate the meeting and determine the order of questioning. At the completion of the questioning and in the absence of the student, the entire committee will discuss their evaluation of the outcome of the examination. The chair will work with the committee to make a determination regarding passing or failing both the written and comprehensive components of the examination.

The comprehensive exams must be completed by the posted Graduate School deadlines.

Additional Doctor of Education Requirements

The Doctor of Education degree must meet the minimum requirements in the For Doctoral Students section of the Graduate School’s website. Additional requirements for the EdD degree beyond these minimums are available through the Department of Education. All EdD degree candidates are expected to be familiar with both The Graduate School’s degree requirements listed here: http://www.montana.edu/gradschool/policy/degreq_doctoral.html and the Department of Education degree requirements listed on the department website.

Contact Information

Dr. Nicholas Lux, Program Leader
Email: mailto:nicholas.lux@montana.edu (nicholas.lux@montana.edu)

Office of Graduate Programs in Education
Phone: 406-994-6786 Email: edgrad@montana.edu

Application Process for the Doctorate of Education in Curriculum and Instruction

Applicants are required to complete the online application and submit the following documentation via the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html).

1. Completed Graduate School Application
2. GPA calculation sheet for Masters Degree (provided during the application process)

3. Resume/Curriculum Vitae

4. Documentation of verbal and quantitative skills needed for the degree: The general test of the Graduate Record Examination (GRE) or Miller Analogies Test (MAT) is required. Official scores can be sent to Montana State University (code 4488). There is no minimum score requirement. Applications are reviewed holistically and take into account all elements.

5. Academic Transcripts: Applicants must provide Official transcripts verifying all Bachelor’s degree and Master’s degree coursework. Unofficial transcripts may be uploaded during the online application process. Official transcripts must be sent from the Institution directly to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717. Electronic transcripts are also acceptable as long as they arrive directly from the applicants’ certifying university. Please have electronic transcripts sent to edgrad@montana.edu.

6. Personal Essay: The essay should be a maximum of 4 pages in length, typed, double spaced, and respond to the following:
   a. Describe your development as an educator, your future career goals, and how you see the completion of a Doctoral Degree in Curriculum & Instruction as helping you achieve your goals.
   b. Describe your personal strengths and interests as an educator and identify the ways in which you believe you could use your strengths to contribute to the cohort of students with whom you will be studying.
   c. Indicate whether you would be studying as a resident close to the MSU campus or via distance education.
   d. Indicate the area of curriculum, instruction, or teacher education in which you would like to conduct research.

7. Three (3) Professional References

8. For International Applicants ONLY: In addition to the above, International applicants will be required to submit the following:
   a. English proficiency scores: TOEFL or ACE level 7: Applicants who are not U.S. citizens and not from countries where English is the official language are required to take the Test of English as a Foreign Language and a score a minimum 213 (paper version – 550, 60 for the iBT). This requirement may be waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S. For more information on the International application process, see this link: http://www.montana.edu/gradschool/policy/admissions_intl.html
   b. International Applicants must complete an International Student Financial Certificate (http://www.montana.edu/international/admissions/gradfinancialcertificate.pdf)

Application Deadlines

Below is the deadline by which all of the application materials for the EdD program in Curriculum and Instruction must be submitted via the online application system. Students matriculate into the EdD program in the fall semester only. Applications to the EdD programs are reviewed once per year at the April 1 deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

- Fall Semester: April 1st

*An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships require students to work on campus 19 hours per week. Applications must be complete for an early review.
Admission Process
Complete applications will be reviewed by members of the Graduate Admissions Committee who then convene to make final admission decisions. Once a decision has been made the application will be forwarded to The Graduate School for final administrative processing. Please note that the application review process will begin on the application deadline dates and not before.

Contact Information
Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

Doctor of Education in Educational Leadership

Program Objectives
Those students completing the degree requirements for the EdS or EdD will have met the academic requirements necessary for a Montana Class III Administrative license with a Superintendent endorsement. (Additionally, a non-degree Superintendent Preparation program is available for those students who already hold a Master’s degree and Principal Licensure. Please see Superintendent Licensure (http://catalog.montana.edu/education-health-human-development/education/administrative-licensure/superintendent-licensure/).

Program Flow
The Educational Leadership program courses are offered using blended delivery methods. Blended courses use a combination of distance delivery and face-to-face meetings. Many EdD program courses are blended such that the class meets for face-to-face instruction one weekend a month and online during the weeks in between meetings.

After admission to the EdD program, the applicant will be assigned a temporary advisor and should then meet with his/her assigned advisor. Actual courses taken during the initial stage will be based on the student’s previous academic work and advisor/committee approval.

Program of Study

Doctoral Core (suggested) (18 Credit Hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>EDU 604</td>
<td>Advanced Educational Psychology</td>
</tr>
<tr>
<td>EDLD 610</td>
<td>Leadership and Organizational Theory</td>
</tr>
<tr>
<td>EDLD 630</td>
<td>Supervision &amp; Instructional Leadership</td>
</tr>
<tr>
<td>EDLD 643</td>
<td>Leading Social Justice</td>
</tr>
<tr>
<td>EDLD 657</td>
<td>Education Policy &amp; Politics</td>
</tr>
<tr>
<td>EDLD 591</td>
<td>Special Topics</td>
</tr>
</tbody>
</table>

 Superintendent Certification Required Courses (12 Credit Hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDLD 620</td>
<td>The School Superintendent</td>
</tr>
<tr>
<td>EDLD 645</td>
<td>Personnel and Collective Bargaining in MT</td>
</tr>
<tr>
<td>EDLD 650</td>
<td>MT Finance &amp; Facilities</td>
</tr>
<tr>
<td>EDLD 655</td>
<td>MT Legal &amp; Policy Studies</td>
</tr>
</tbody>
</table>

Research Required Core (9 Credit Hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 602</td>
<td>Educational Statistics II</td>
</tr>
<tr>
<td>EDU 610</td>
<td>Qualitative Educational Research</td>
</tr>
</tbody>
</table>

Dissertation Credits (15 Credit Hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 607</td>
<td>Quantitative Educational Research</td>
</tr>
<tr>
<td>EDU 690</td>
<td>Doctoral Thesis</td>
</tr>
</tbody>
</table>

Total Credits: 54

Committees
Each doctoral student’s committee must consist of at least four approved members. The chair and one other approved member must be from the Educational Leadership faculty. Two other approved members will be selected based upon their ability to contribute to the student’s studies leading up to and through the dissertation research. These two committee members must have academic credentials in the area of the student’s program of study and be approved by the Head of the Department of Education and Dean of the Graduate School. For information regarding graduate representatives, please refer to the Graduate School policy.

Chairs
The student should carefully select a chair after thorough conversations with the Educational Leadership faculty members that he/she believes might have an interest in his/her doctoral research and/or the ability to work with him/her towards generating a defensible dissertation. The committee as a whole is subject to approval by the Head of the Department of Education. The chair will advise students in selecting committee members and in understanding the dissertation process. The chair and at least one committee member will be the primary readers of the dissertation as it is being written. The importance of selecting the right chair cannot be overstated. However, chairs and members of the student’s committee are subject to change. In addition, revision to the program of study can be made during the course of study with the committee’s approval.

Comprehensive Examinations
Comprehensive examinations are required for completion of all EdD degrees in Educational Leadership. Students are expected to demonstrate mastery of the program of study and the ability to interact with the research in that area. Students should refer to The Graduate School’s Policies and Procedures (http://www.montana.edu/gradschool/policy/degreq_doctoral.html#degreq_doc_gen) web page.

After completion of at least two thirds of the required coursework, EdD students will complete a written comprehensive exam. The exam is completed in writing and then orally defended in front of the entire Graduate Committee. Through the comprehensive exam, students will be expected to demonstrate: 1) the ability to integrate concepts from courses into a holistic viewpoint; 2) the ability to apply material to anticipated real-life situations based on the theoretical principles and concepts covered in classes; 3) the ability to critically read, analyze, and critique research; and 4) a readiness to move forward to create their own research.

Generally, there are two primary question areas: 1) Identification of a topic with the potential to contribute to the literature in Educational Leadership, and a critical evaluation of the research on that topic; and 2) Design a research project on the topic of interest. Students will be expected to demonstrate a mastery of aspects of both qualitative and quantitative projects (such as sampling, validity, reliability, data analysis).

Additional Doctor of Education Requirements
The Doctor of Education degree must meet the minimum requirements in the For Doctoral Students section of the Graduate School’s website with the following exception: only fourteen (14) credits of dissertation
are required. Additional requirements for the EdD degree beyond these minimums are available through the Department of Education. All EdD degree candidates are expected to be familiar with both The Graduate School’s degree requirements (http://www.montana.edu/gradschool/policy/degreq_doctoral.html#degreq_doctoral) and Department of Education degree requirements listed on the program’s website.

**Contact Information**

Dr. Tena Versland, Program Leader  
406-994-6799 Email: tena.versland@montana.edu

Dr. Bill Ruff  
406-994-4182 Email: wruff@montana.edu

Dr. David Henderson  
406-994-6424 Email: david.henderson3@montana.edu

**Application Materials for the EdD in Educational Leadership**

- Prior to applying for an Educational Leadership EdD program, applicants must have a Master’s degree in education or a related topic, have gained at least three years teaching experience as a certified or licensed teacher, and possess a 3.0 undergraduate GPA. Those applicants who do not hold an administrative license will be required to take principal preparation coursework as prerequisites to many doctoral courses.

Complete the online application through the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html).

Applicants are to submit the following documentation during the application process:

1. **Completed Graduate School Application**
2. **GPA calculation form:** The form is provided during the application process. **NOTE:** We require a GPA of 3.00 for the last two (2) years of undergraduate course work.
3. **Resume/Curriculum Vitae**
4. **Documentation of verbal and quantitative skills needed for the degree:** The general test of the Graduate Record Examination (GRE) or Miller Analogies Test (MAT) is required. Official scores can be sent to Montana State University (code 4488). There is no minimum score requirement. Applications are reviewed holistically and take into account all elements.
5. **Personal Essay:** Suggested length is 2-3 typed, double-spaced pages. The applicant should briefly describe the following:
   a. Education and other educational professional experiences
   b. Research interests and experience including alignment with faculty interests and expertise and an example of research experiences using educational theory, research methods, and application.
   c. Professional goals
6. **Three (3) letters of recommendation:** (NOTE: At least one of the three letters must be from the candidate’s PRESENT direct supervisor in his/her educational field.) The letters should be from individuals qualified to assess the following:
   a. Knowledge in chosen field
   b. Motivation and perseverance toward goals
   c. Ability to work independently
   d. Ability to express thoughts in speech and writing
   e. Ability/potential for college teaching
   f. Ability to plan and conduct research
7. **Academic Transcripts:** Applicants must provide Official transcripts verifying all Bachelor’s degree and Master’s degree coursework. Unofficial transcripts may be uploaded during the online application process. Official transcripts must be sent from the Institution directly to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717. Electronic transcripts are also acceptable as long as they arrive directly from the applicants’ certifying university. Please have electronic transcripts sent to edgrad@montana.edu.
8. **For International Applicants ONLY:** In addition to the above, international applicants will be required to submit the following:
   a. **TOEFL** (https://www.ets.org/toefl) or **ACE level 7** - Applicants who are not U.S. citizens and not from countries where English is the official language are required to take the Test of English as a Foreign Language and a score a minimum 213 (paper version – 550, 60 for the iBT). This requirement may be waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S. For more information on the International application process, see this link: [http://www.montana.edu/gradschool/policy/admissions_intl.html](http://www.montana.edu/gradschool/policy/admissions_intl.html)
   b. **International Student Financial Certificate**

**Application Deadlines**

Below is the deadline by which all of the application materials for the EdD in Educational Leadership must be submitted via the online application system. Students matriculate into the EdD program in the fall semester only. Applications to the EdD programs are reviewed once per year at the April 1 deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

- **Fall Semester:** April 1st

An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships require students to work on campus 19 hours per week. Applications must be complete for an early review.

**Contact Information**

Micki MacGregor, Graduate Program Assistant  
PO Box 172880, Reid Hall 215  
Department of Education, Montana State University  
Bozeman, MT 59717-2880  
Phone: 406-994-6786 Email: edgrad@montana.edu

**Doctor of Philosophy in Education, Adult & Higher Education**

**Objectives**

The PhD in Education with the Adult & Higher Education specialization educates individuals who wish to become faculty members and/or who wish to conduct research to inform post-secondary policy and practice. Students will work with their advisor on designing a program of study that meets their educational and professional objectives.

Coursework is divided into two categories: required and electives, and research and statistics. Doctoral students must conduct research and write an original theory-based dissertation. Courses are generally offered on evenings and weekends. Many courses are offered in a blended format with a combination of face-to-face and distance delivery.
Program Flow
After acceptance, the student will be assigned a temporary advisor and should then meet with his/her assigned advisor. During the first semester, students will complete the Doctoral Seminar (EDU 600). Coursework will be based on the student’s previous academic work and advisor/committee approval. By the third semester of enrollment, the student will identify a graduate committee chair and committee members, establish and submit their program of study to the Graduate School, and clarify plans for the comprehensive examination.

Near the end of completing course requirements, the student will write the comprehensive exam and will later meet with the committee for the oral defense of the comprehensive exam. If deemed necessary by the committee, the student may be required to take additional coursework to make up identified deficiencies. Toward the end of the program, the student will take 3 hours of a Dissertation Seminar (EDU 650) to begin preparation of the proposal. During the proposal preparation, the student will work closely with his/her chair and the readers of the committee with progress being made each semester. The student then presents/defends their proposal, which includes the study introduction, literature review, and research methodology. The student conducts the research and writes the dissertation with progress being made each semester towards completion. When the chair determines the student is ready, the student defends the dissertation.

Program of Study

<table>
<thead>
<tr>
<th>Core Content - choose 9 credits</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 604 Advanced Educational Psychology</td>
<td></td>
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<tr>
<td>EDLD 610 Leadership and Organizational Theory</td>
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<tr>
<td>EDLD 635 College Teaching</td>
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<td>EDLD 643 Leading Social Justice</td>
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<tr>
<th>Required Core Content Courses - 6 credits</th>
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<tr>
<td>EDU 600 Doctoral Seminar</td>
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<tr>
<td>EDU 650 Dissertation Seminar</td>
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<tr>
<th>Adult &amp; Higher Education Required Core Content - 12 credits</th>
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<tr>
<td>EDLD 616 Organization and Administration of Higher Education</td>
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<tr>
<td>EDLD 628 College Students</td>
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</tr>
<tr>
<td>EDU 637 Institutional Research and Assessment</td>
<td>or</td>
</tr>
<tr>
<td>EDU 614 Planning Program Assessment</td>
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<thead>
<tr>
<th>Electives - 3 credits</th>
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</thead>
<tbody>
<tr>
<td>Approved electives may be selected from other Education programs or departments that strengthen the student’s program of study. These courses need to be selected in consultation with the chair.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Required Research Courses - 9 credits</th>
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</table>

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<td>EDU 613 Indigenous Methodologies in Educational Research</td>
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</tbody>
</table>

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<tr>
<th>Electives also may be taken that are appropriate to the research area of specialization and approved by the graduate advisor</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Dissertation - 18 credits</td>
<td>18</td>
</tr>
<tr>
<td>EDU 690 Doctoral Thesis</td>
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</tr>
</tbody>
</table>

Total Credits 66

Residency Requirement
The PhD requires one year of on-campus full-time residency. The residency requirement consists of two consecutive semesters of full-time enrollment (6-9 credits per semester) in PhD coursework.

Committees
Each doctoral student’s committee must consist of at least four approved members. The chair and one other approved member must be from the Adult & Higher Education faculty. Two other approved members will be selected based upon their ability to contribute to the student’s studies leading up to and through the dissertation research. These two committee members must have academic credentials in the area of the student’s program of study and be approved by the Head of the Department of Education and Dean of The Graduate School. For information regarding graduate representatives, please refer to the Graduate School policy.

Chairs
The student should carefully select his/her graduate committee chair after thorough conversations with those Adult & Higher Education faculty members that he/she believes might have an interest in his/her doctoral research agenda and/or the ability to work with him/her toward generating a defensible dissertation. The chair will give leadership and approval regarding the balance of the committee’s potential membership. The committee, as a whole, is subject to the approval of the Head of the Department of Education. The chair will facilitate program approval, comprehensive exam planning and clarification, proposal hearing, and dissertation defense. Chairs and members of a student’s committee are subject to change. Revision to the program of study can be made during the course of study with the chair’s approval.

Comprehensive Examinations

Comprehensive examinations are required for completion of all graduate degrees at Montana State University. Students are expected to demonstrate mastery of the program of study and the ability to interact with the research in that area. Students should refer to The Graduate School’s web page at: http://www.montana.edu/gradschool/policy/degreq_doctoral.html.

The comprehensive exam must be completed by the posted Graduate School deadlines.

Near the end of completing coursework and before the dissertation proposal defense, PhD students will complete a written and oral comprehensive exam. The exam is completed in writing and then orally defended in front of the entire Graduate Committee.

Through the comprehensive exam, students will be expected to demonstrate:

- a competency in the breadth of knowledge covered in their coursework
- the ability to integrate concepts from courses into a holistic viewpoint
- the ability to apply material to anticipated real life situations based on the theoretical principles and concepts covered in classes
- the ability to critically read, analyze, and critique research
• a readiness to move forward to create their own research

Generally, there will be four primary question areas:

• Specialization area
• Foundation of Higher Education
• Research
  • Read, analyze, and critique a research article
  • Design a project - will be expected to demonstrate a mastery of aspects of both qualitative and quantitative projects (such as sampling, validity, reliability, and data analysis)

However, these areas may be revised according to individual programs.

Additional Requirements

The Doctor of Education degree must meet the minimum requirements in the For Doctoral Students section of the Graduate School’s website. Additional requirements for the PhD degree beyond these minimums are available through the Department of Education. All PhD degree candidates are expected to be familiar with both The Graduate School’s degree requirements listed here: http://www.montana.edu/gradschool/policy/degreq_general.html and the Department of Education degree requirements listed on the department website.

How to Apply

Application requirements can be accessed through the Department of Education’s Doctor of Philosophy in Adult & Higher Education Application Process (http://www.montana.edu/education/grad/ahe/applications.html) web page. Apply online through The Graduate School (http://www.montana.edu/gradschool/admissions/apply.html).

Contact Information

Dr. Tricia Seifert
tricia.seifert@montana.edu

Dr. Carrie Myers, Program Leader
cbmyers@montana.edu

Dr. Sweeney Windchief
sweeney.windchief@montana.edu

Dr. Bryce Hughes
bryce.hughes@montana.edu

Application Process for the PhD in Education, Adult & Higher Education

Applicants are required to complete the online application and submit the following documentation via the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html).

1. Completed Graduate School Application

2. GPA calculation sheet (The form is provided during the application process)

3. Resume/Curriculum Vitae

4. Documentation of verbal and quantitative skills needed for the degree: The general test of the Graduate Record Examination (GRE) is required. Official scores can be sent to Montana State University (code 4488). There is no minimum score requirement. Applications are reviewed holistically and take into account all elements.

5. Academic Transcripts: Applicants must provide Official transcripts verifying all Bachelor’s degree and Master’s degree coursework. Unofficial transcripts may be uploaded during the online application process. Official transcripts must be sent from the Institution directly to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717. Electronic transcripts are also acceptable as long as they arrive directly from the applicants’ certifying university. Please have electronic transcripts sent to edgrad@montana.edu. Transcripts will be evaluated for rigor and academic fit.

6. Personal Essay: Suggested length is 2-3 typed, double-spaced pages. The applicant should briefly describe the following:

• Education and other educational professional experiences
• Research interests and experience including alignment with faculty interests and expertise and an example of research experiences using educational theory, research methods, and application.
• Professional goals

7. Three (3) Professional References: The letters should be from individuals qualified to assess the following:

• Knowledge in chosen field
• Motivation and perseverance toward goals
• Ability to work independently
• Ability to express thoughts in speech and writing
• Ability/potential for college teaching
• Ability to plan and conduct research

8. For International Applicants ONLY: In addition to the above, international applicants will be required to submit the following:

• English proficiency scores: TOEFL [80], IELTS [level 6.5], or PTE [54], are necessary for applicants who are not U.S. citizens and not from countries where English is the official language. This requirement is waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S. For more information on the International application process, see this link: http://www.montana.edu/gradschool/policy/admissions_intl.html

• Evidence of Financial Support: International Student Financial Certificate (http://www.montana.edu/international/admissions/graduatefinancialcertificate.pdf)
• Proof of funds (if self-funded)
• Copy of applicant’s passport
• Degree certificates as well as an English translation for all non-English academic transcripts and credentials. Photocopies can be used to initiate the application process; however, official transcripts/credentials are still required upon admission.

*Note: Applicants may be contacted for an interview by the program specific applicant review committee.

Application Deadlines

Below is the deadline by which all of the application materials for the PhD in Education must be submitted via the online application system. Students matriculate into the PhD program in the fall semester only. Applications to the PhD programs are reviewed once per year at the April 1 deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

• Fall Semester: April 1st
"An early review deadline of February 1st has been set for those applicants wishing to be considered for Graduate Assistantships. Graduate Assistantships require students to work on campus 19 hours per week. Applications must be complete for an early review.

Admission Process
Complete applications will be reviewed by members of the Graduate Admissions Committee who then convene to make final admission decisions. Once a decision has been made the application will be forwarded to The Graduate School for final administrative processing. Please note that the application review process will begin on the application deadline dates and not before.

Contact Information
Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

Doctor of Philosophy in Education, Curriculum & Instruction
Objectives
The Doctor of Philosophy in Education (PhD), with emphasis in Curriculum and Instruction degree is designed to prepare graduate students to conduct educational research in highly specialized disciplines. Progress through the degree provides students with opportunities to develop specialized disciplinary content and research knowledge along with scholarly experiences that will provide the foundational knowledge and skills required for success as faculty in higher education and in research organizations.

The program addresses topics specific to Montana including working with rural communities and Native Americans on state and other educational issues. Graduates of this PhD program in education will be well-positioned to directly and positively affect the data driven culture related to improving the educational systems of Montana and beyond.

Program Flow
After being admitted to the PhD program, the student will be assigned a temporary advisor and should then meet with his/her assigned advisor. Actual courses taken during the initial stage will be based on the student’s previous academic work and advisor/committee approval.

The program is designed to be specifically tailored to each doctoral student’s related research interest while providing cutting edge knowledge and skills in research and theory.

Program of Study
Core Content (13 Credit Hours)

<table>
<thead>
<tr>
<th>Required Core Content Courses (6 Credit Hours)</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td>EDU 600 Doctoral Seminar</td>
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<tr>
<td>EDU 650 Dissertation Seminar</td>
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<tr>
<td>Or approved substitutions</td>
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Choose: (9 Credit Hours from the following)

<table>
<thead>
<tr>
<th>Required (9 Credit Hours)</th>
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<tbody>
<tr>
<td>EDU 602 Educational Statistics II</td>
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<td>EDU 607 Quantitative Educational Research</td>
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<td>EDU 610 Qualitative Educational Research</td>
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</table>

Advanced Research Electives (Choose 9 Credit Hours)

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<th>Required (9 Credit Hours)</th>
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</thead>
<tbody>
<tr>
<td>EDU 606 Mixed Methods Research Design in Education</td>
</tr>
<tr>
<td>EDU 611 Advanced Qualitative Research</td>
</tr>
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</tr>
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</tr>
<tr>
<td>EDU 614 Planning Program Assessment</td>
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</tbody>
</table>

Electives also may be taken that are appropriate to the research area of specialization and approved by the graduate advisor.

Dissertation (18 Credit Hours)

<table>
<thead>
<tr>
<th>EDU 690 Doctoral Thesis</th>
<th>18</th>
</tr>
</thead>
</table>

Total Credits

| 66 |

Residency Requirement
The PhD requires one year of on campus full-time residency. The residency requirement consists of two consecutive semesters of full-time enrollment (6-9 credits per semester) in PhD coursework.

Committees
Each doctoral student’s committee must consist of at least four approved members. The chair and one other approved member must be from the Curriculum & Instruction faculty. Two other approved members will be selected based upon their ability to contribute to the student’s studies leading up to and through the dissertation research. These two committee members must have academic credentials in the area of the student’s program of study and be approved by the Head of the Department of Education and Dean of The Graduate School. For information regarding graduate representatives, please refer to the Graduate School policy.

Chairs
The student should carefully select a chair after thorough conversations with those Curriculum & Instruction faculty members that he/she believes might have an interest in his/her doctoral research agenda and/or the ability to work with him/her toward generating a defensible dissertation. The chair will give leadership and approval regarding the balance of the committee’s
potential membership. The committee, as a whole, is subject to the approval of the Head of the Department of Education. The chair will facilitate program approval, comprehensive exam planning and clarification, proposal hearing, and dissertation defense. Chairs and members of a student’s committee are subject to change. Revision to the program of study can be made during the course of study with the chair’s approval.

Comprehensive Examinations
As PhD students in Curriculum & Instruction approach the end of their coursework (46 credits completed), and prior to the Dissertation proposal meeting, they will contact their committee chair to discuss the content and format of the required written and oral comprehensive examinations. The comprehensive exams must be completed by the posted Graduate School deadlines.

Additional Requirements
The PhD degree must meet the minimum requirements in the For Doctoral Students section of the Graduate School’s website. Additional requirements for the PhD degree beyond these minimums are available through the Department of Education. All PhD degree candidates are expected to be familiar with both The Graduate School’s degree requirements listed here: http://www.montana.edu/gradschool/policy/degreq_doctoral.html and the Department of Education degree requirements listed on the department website.

How to Apply
Application requirements can be accessed through the Department of Education’s Doctor of Philosophy in Curriculum & Instruction Application Process (http://www.montana.edu/education/grad/ci/applications.html) web page. Apply online through The Graduate School (http://www.montana.edu/gradschool/admissions/apply.html).

Contact Information
Dr. Nicholas Lux, Program Leader
Email: nicholas.lux@montana.edu

Office of Graduate Programs in Education
Phone: 406-994-6786 Email: edgrad@montana.edu

Application Process for the PhD in Education, Curriculum & Instruction
Applicants are required to complete the online application and submit the following documentation via the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html)

1. Completed Graduate School Application
2. GPA calculation sheet (The form is provided during the application process)
3. Resume/Curriculum Vitae
4. Documentation of verbal and quantitative skills needed for the degree: The general test of the Graduate Record Examination (GRE) is required. Official scores can be sent to Montana State University (code 4488). There is no minimum score requirement. Applications are reviewed holistically and take into account all elements.
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6. Personal Essay: Suggested length is 2-3 typed, double-spaced pages. The applicant should briefly describe the following:
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   - Proof of funds (if self-funded)
   - Copy of applicant’s passport
   - Degree certificates as well as an English translation for all non-English academic transcripts and credentials. Photocopies can be used to initiate the application process; however, official transcripts/credentials are still required upon admission.
   *Note: Applicants may be contacted for an interview by the program specific applicant review committee.

Application Deadlines
Below is the deadline by which all of the application materials for the PhD in Education must be submitted via the online application system. Students matriculate into the PhD program in the fall semester only. Applications to the PhD programs are reviewed once per year at the April 1st deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

   - Fall Semester: April 1st

*An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships
Program of Study

Core Content - choose 9 credits

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>EDLD 605</td>
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<tr>
<td>EDLD 635</td>
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<tr>
<td>EDLD 610</td>
<td>Leadership and Organizational Theory</td>
</tr>
<tr>
<td>EDLD 643</td>
<td>Leading Social Justice</td>
</tr>
<tr>
<td>EDU 600</td>
<td>Doctoral Seminar</td>
</tr>
</tbody>
</table>

Admission Process

Complete applications will be reviewed by members of the Graduate Admissions Committee who then convene to make final admission decisions. Once a decision has been made the application will be forwarded to The Graduate School for final administrative processing. Please note that the application review process will begin on the application deadline dates and not before.

Contact Information

Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

Doctor of Philosophy in Education,
Educational Leadership

Objectives

The Doctor of Philosophy in Education (PhD) with an emphasis in Educational Leadership is designed for graduate students seeking faculty or administrative positions in higher education or positions within research organizations that require education research skills in highly specialized disciplines. The program addresses topics specific to Montana including working with rural communities and Native Americans on state and other educational issues. Graduates of this PhD program in education will be well-positioned to directly and positively affect the data driven culture related to improving the educational systems of Montana and beyond.

Program Flow

After being admitted to the PhD program, the student will be assigned a temporary adviser and should then meet with his/her assigned adviser. Actual courses taken during the initial stage will be based on the student’s previous academic work and adviser/committee approval.

The program is designed to be specifically tailored to each doctoral student’s related research interest while providing cutting edge knowledge and skills in research and theory. The program is structured to be completed in 4 to 5 years with full-time tuition support for qualified students provided by the Department of Education.

Program of Study

Core Content - choose 9 credits

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<td>Doctoral Seminar</td>
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Required Core Content Courses - 6 credits

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<th>Course</th>
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</tr>
</thead>
<tbody>
<tr>
<td>EDU 600</td>
<td>Dissertation Seminar</td>
</tr>
</tbody>
</table>

Educational Leadership Concentration - 15 credits

Electives appropriate to area of specialization & approved by Graduate Advisor. Examples of General Curriculum courses to choose from should be discussed with advisor.

Required Research Courses - 9 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 602</td>
<td>Educational Statistics II</td>
</tr>
<tr>
<td>EDU 610</td>
<td>Qualitative Educational Research</td>
</tr>
<tr>
<td>EDU 607</td>
<td>Quantitative Educational Research</td>
</tr>
</tbody>
</table>

Advanced Research Electives - choose 9 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 614</td>
<td>Planning Program Assessment</td>
</tr>
<tr>
<td>EDU 606</td>
<td>Mixed Methods Research Design in Education</td>
</tr>
<tr>
<td>EDU 612</td>
<td>Critical Race Theory</td>
</tr>
<tr>
<td>EDU 637</td>
<td>Institutional Research and Assessment</td>
</tr>
<tr>
<td>EDU 606</td>
<td>Mixed Methods Research Design in Education</td>
</tr>
<tr>
<td>EDU 608</td>
<td>Advanced Quantitative Research</td>
</tr>
<tr>
<td>EDU 611</td>
<td>Advanced Qualitative Research</td>
</tr>
<tr>
<td>EDU 613</td>
<td>Indigenous Methodologies in Educational Research</td>
</tr>
</tbody>
</table>

Electives also may be taken that are appropriate to the research area of specialization and approved by the graduate advisor.

Dissertation - 18 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 690</td>
<td>Doctoral Thesis</td>
</tr>
</tbody>
</table>

Total Credits 66

Residency Requirement

The PhD requires one year of on campus, full-time residency. The residency requirement consists of two consecutive semesters of full-time enrollment (6-9 credits per semester) in PhD coursework.

Committees

Each doctoral student’s committee must consist of at least four approved members. The chair and one other approved member must be from the Educational Leadership faculty. Two other approved members will be selected based upon their ability to contribute to the student’s studies leading up to and through the dissertation research. These two committee members must have academic credentials in the area of the student’s program of study and be approved by the Head of the Department of Education and Dean of The Graduate School. For information regarding graduate representatives, please refer to the Graduate School policy.

Chair

The student should carefully select a chair after thorough conversations with those Educational Leadership faculty members that he/she believes might have an interest in his/her doctoral research agenda and/or the ability to work with him/her toward generating a defendable dissertation. The chair will give leadership and approval regarding the balance of the committee’s potential membership. The committee, as a whole, is subject to the approval of the Head of the Department of Education. The chair will facilitate program approval, comprehensive exam planning and clarification, proposal hearing, and dissertation defense. Chairs and members of a student’s committee are subject to change. Revision to the program of study can be made during the course of study with the chair’s approval.
Comprehensive Examinations
As PhD students in Educational Leadership approach the end of their coursework (48 credits completed), and prior to the Dissertation proposal meeting, they will contact their committee chair to discuss the content and format of the required written and oral comprehensive examinations. The comprehensive exams must be completed by the posted Graduate School deadlines.

Additional Requirements
The Doctor of Education degree must meet the minimum requirements in the For Doctoral Students section of the Graduate School’s website. Additional requirements for the PhD degree beyond these minimums are available through the Department of Education. All PhD degree candidates are expected to be familiar with both The Graduate School’s degree requirements listed here: http://www.montana.edu/gradschool/policy/degreq_doctoral.html and Department of Education degree requirements listed on the department website.

How to Apply
Application requirements can be accessed through the Department of Education’s Doctor of Philosophy in Educational Leadership Application Process (http://www.montana.edu/education/grad/edlead/applications.html) web page. Application deadline is April 1st. Apply online through The Graduate School (http://www.montana.edu/gradschool/admissions/apply.html).

Application Process for the PhD in Education, Educational Leadership
Applicants are required to complete the online application and submit the following documentation via the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html)

1. Completed Graduate School Application
2. GPA calculation sheet (The form is provided during the application process)
3. Resume/Curriculum Vitae
4. Documentation of verbal and quantitative skills needed for the degree: The general test of the Graduate Record Examination (GRE) is required. Official scores can be sent to Montana State University (code 4488). There is no minimum score requirement. Applications are reviewed holistically and take into account all elements.
5. Academic Transcripts: Applicants must provide Official transcripts verifying all Bachelor’s degree and Master’s degree coursework. Unofficial transcripts may be uploaded during the online application process. Official transcripts must be sent from the Institution directly to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717. Electronic transcripts are also acceptable as long as they arrive directly from the applicants’ certifying university. Please have electronic transcripts sent to margaret.secrest@montana.edu. Transcripts will be evaluated for rigor and academic fit.
6. Personal Essay: Suggested length is 2-3 typed, double-spaced pages. The applicant should briefly describe the following:
   - Education and other educational professional experiences
   - Research interests and experience including alignment with faculty interests and expertise and an example of research experiences using educational theory, research methods, and application.
   - Professional goals
7. Three (3) Professional References: The letters should be from individuals qualified to assess the following: (Note: At least one of the three letters must be from the candidate’s PRESENT direct supervisor in his/her educational field.)
   - Knowledge in chosen field
   - Motivation and perseverance toward goals
   - Ability to work independently
   - Ability to express thoughts in speech and writing
   - Ability/potential for college teaching
   - Ability to plan and conduct research
8. For International Applicants ONLY: In addition to the above, International applicants will be required to submit the following:
   - English proficiency scores: TOEFL [80], IELTS [level 6.5], or PTE [54], are necessary for applicants who are not U.S. citizens and not from countries where English is the official language. This requirement is waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S. For more information on the International application process, see this link: http://www.montana.edu/gradschool/policy/admissions_intl.html
   - Proof of funds (if self-funded)
   - Copy of applicant’s passport
   - Degree certificates as well as an English translation for all non-English academic transcripts and credentials. Photocopies can be used to initiate the application process; however, official transcripts/credentials are still required upon admission.
   *Note: Applicants may be contacted for an interview by the program specific applicant review committee.

Application Deadlines
Below is the deadline by which all of the application materials for the PhD in Education must be submitted via the online application system. Students matriculate into the PhD program in the fall semester only. Applications to the PhD programs are reviewed once per year at the April 1st deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

- Fall Semester: April 1st

*An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships
require students to work on campus 19 hours per week. Applications must be complete for an early review.

Admission Process

Complete applications will be reviewed by members of the Graduate Admissions Committee who then convene to make final admission decisions. Once a decision has been made the application will be forwarded to The Graduate School for final administrative processing. Please note that the application review process will begin on the application deadline dates and not before.

Contact Information

Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

Education Specialist in Educational Leadership

Objectives

The Education Specialist Degree (EdS) is a practitioner’s degree. Many states require this degree for Superintendent Licensure, however, Montana does not. This degree is particularly valuable for students who see themselves as school system leaders in medium sized to larger school systems. Admission into the Educational Leadership program is required.

Program Flow

The purpose of the EdS Degree is to provide skills and knowledge required for District Superintendent and central office leadership. In addition to improving skill and knowledge, it is the goal of the program to create strong networks among students to support effective practices. To that end, classes are generally offered in a blended format which combines face-to-face delivery and distance delivery. An appropriate balance of theory and practice is a strong consideration in planning for the content of the classes.

An appropriate balance of theory and practice is a strong consideration in planning for the content of the classes. Typically the Superintendent Core (EDLD 620, EDLD 645, EDLD 650, EDLD 655) is offered every summer beginning online in mid-May and on campus for two weeks in June.

Program of Study

<table>
<thead>
<tr>
<th>Specialist Core</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDLD 610</td>
<td>Leadership and Organizational Theory</td>
</tr>
<tr>
<td>EDLD 620</td>
<td>The School Superintendent</td>
</tr>
<tr>
<td>EDLD 630</td>
<td>Supervision &amp; Instructional Leadership</td>
</tr>
<tr>
<td>EDLD 645</td>
<td>Personnel and Collective Bargaining in MT</td>
</tr>
<tr>
<td>EDLD 650</td>
<td>MT Finance &amp; Facilities</td>
</tr>
<tr>
<td>EDLD 655</td>
<td>MT Legal &amp; Policy Studies</td>
</tr>
<tr>
<td>EDLD 657</td>
<td>Education Policy &amp; Politics</td>
</tr>
<tr>
<td>EDLD 643</td>
<td>Leading Social Justice</td>
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<table>
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<tr>
<th>Field Experience</th>
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</table>
| EDLD 574         | Field Experience in Educational Leadership (Field Experience may be waived based on experience and goals)

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<tbody>
<tr>
<td>EDLD 575</td>
<td>Professional Paper &amp; Project</td>
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</table>

Total Credits 30

Committees

Candidates will have a three member committee. Candidates should work closely with their committee chair to prepare and submit a program of study immediately upon admission to the program. The chair and one other member must be from the Educational Leadership faculty. The third committee member must have academic credentials in the area of the student’s program of study and be approved by the Head of the Department of Education and Dean of The Graduate School.

Chairs

The student should carefully select his/her chair after thorough conversations with the approved Educational Leadership faculty members. The chair will serve as the student’s primary advisor. The committee, as a whole, is subject to the approval of the Head of the Department of Education. Chairs and members of a student’s committee are subject to change. In addition, revision to the program of study can be made during the course of study with the chair’s approval.

Comprehensive Examination/Professional Paper

The EdS student will develop a professional paper as his/her summative experience. The professional paper will address a specific issue and contextualized problem of practice using appropriate theory and research-based best practices. Specifically the professional paper will: 1) frame the problem; 2) review pertinent research literature; 3) identify appropriate methods used to demonstrate the extent of the problem and the efficacy of the solution employed; and 4) provide recommendations grounded in research to solve the problem.

Additional Education Specialist Requirements

The Education Specialist degree must meet the minimum requirements under the For Doctoral Students section on found in the departmental website with the following two exceptions: 1) no dissertation is required, and 2) courses over seven years old may not be included on the graduate program of study.

While many courses for the Education Specialist degree are the same as those for the Doctor of Education degree, it must be clearly understood that admission to one program does not imply admission to the other. Transfer from Doctoral to Education Specialist status will be possible only if the applicant: 1) is in good standing with The Graduate School, and 2) has not failed the doctoral comprehensive exam.

Contact Information

Dr. Tena Versland, Program Leader
406-994-6799 Email: tenu.versland@montana.edu

Dr. Bill Ruff
406-994-4182 Email: wruff@montana.edu

Dr. David Henderson
Application Materials for the EdS in Educational Leadership

Prior to applying to the Educational Leadership program, applicants must hold a Montana Class III Admin License or equivalent, with experience as a principal.

Complete the online application through the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html)

During the online application process you will be asked to submit the following materials.

1. **GPA calculation form:** The form is provided during the application process. **NOTE:** We require a GPA of 3.00 for the last two (2) years of undergraduate course work.

2. **Resume/Curriculum Vitae**

3. **Three (3) letters of recommendation:** Candidates must meet the following criteria for one of the three letters of recommendation.
   a. At least one of the three letters must be from the candidate’s **PRESENT** direct supervisor. That means a school district administrator who (a) is currently administratively certified by Montana Office of Public Instruction or other equivalent state agency; AND (b) currently acts as direct supervisor for the candidate, and has done so for a minimum period of one semester. **If for any reason you cannot secure a letter from your present supervisor, then:**
      i. At least one of the letters of recommendation must be from a **PREVIOUS** direct supervisor. That means a school district administrator who is (a) currently certified by the Montana Office of Public Instruction or other equivalent state agency; AND (b) has, at some point preceding the date of this application, acted as direct supervisor for the candidate for a minimum period of one semester. Any applicant who does not have a letter from a present direct supervisor must indicate in the self-nomination letter (see below) the specific reason(s) why they were unable to secure a letter of recommendation from their present supervisor.

4. **Self-Nomination Letter:** The self-nomination letter should be 2 pages, double-spaced, and focus on the following:
   a. Your development and growth as an educator, including professional development;
   b. Your contributions to the school and district;
   c. Your development as a leader. Specific examples are needed that clarify how you have grown as a leader and your leadership activities; and
   d. Your specific goals, and why the EdS would be of benefit to you/your school.

5. **Academic Transcripts:** Official transcripts verifying all Bachelor’s Degree course work should be sent to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717. Electronic transcripts are also acceptable as long as they arrive directly from the applicants’ certifying university. Please have electronic transcripts sent to edgrad@montana.edu. Transcripts will be evaluated for rigor and academic fit.

6. **For International Applicants ONLY:**
   • TOEFL (https://www.ets.org/toefl) (http://www.ets.org/toefl) or ACE level 7 - Applicants who are not U.S. citizens and not from countries where English is the official language are required to take the Test of English as a Foreign Language and score a minimum 213 (paper version- 550, 80 for the iBT). This requirement may be waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S.

**International Student Financial Certificate**

**Application Deadlines**

Below is the deadline by which all of the application materials for the Education Specialist Programs in Education must be submitted via the online application system. By submitting materials by the deadline, accepted students may be eligible for early registration. In order for a graduate degree application to be reviewed for admission, all required application documents must be submitted prior to the department’s posted deadline. Applications received after the deadline may be reviewed for acceptance on a case-by-case basis.

- **Fall Semester:** April 1st
- **Summer Semester:** April 1st

*An early review deadline of February 1st has been set for those applicants wanting to be considered for Graduate Assistantships. Graduate Assistantships require students to work on campus 19 hours per week. Applications must be complete for an early review.*

**Contact Information**

Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

**Department of Health and Human Development**

Department Head
Dr. Deborah C. Haynes
219A Herrick Hall
406 994-3242

Department Main Office
219 Herrick Hall
Bozeman, MT 59717-3540

Graduate programs in the Department of Health and Human Development lead to a Master of Science degree with options in community health, counseling (marriage and family; mental health), exercise and nutrition sciences (exercise physiology and nutrition; sport and coaching sciences), family and consumer sciences (early childhood education/child development; human development and family science), and sustainable food systems. The Master of Education degree is given to those completing the school counseling degree.

General descriptions of the graduate options are included below. More detailed information regarding curricula and requirements may be obtained from the respective graduate coordinators listed below. Information may also be obtained on the Department of Health and Human Development website at montana.edu/hhd.

A minimum of 30 credits is required for the Master of Science degree in exercise and nutrition sciences, family and consumer sciences, and the sustainable food systems programs. A minimum of 36 credits is required in community health. Both thesis and non-thesis plans are available. Because of professional licensure requirements, a minimum of 60 credits is required.
Assistantships may be available with individual faculty members who hold an appointment in addition to the academic year appointment. Research assistantships can include a summer appointment. Counseling assistantships can include a summer appointment. The Department of Health and Human Development offers a Master of Science degree in counseling with options in marriage, couples, and family counseling or mental health counseling, and a Master of Education degree in school counseling. All three programs are accredited by the Council for Accreditation of Counseling and Related Educational Programs (CACREP). The marriage, couples, and family counseling programs are 60 credits and require a minimum of two years of study. The school counseling option is 48 credits. All programs are designed to meet Montana licensure requirements for professional counselors. Students must obtain a minimum of 1,500 hours supervised counseling experience and training in core counseling areas. Completed applications must be filed by February 15 as students are expected to begin their graduate program the following summer session. Applications are screened only once each year following the February 15 deadline. A maximum of 25 students shall be admitted into the counseling areas each year.

Graduate Coordinators
- Dr. Dr. John Seifert, 103E Romney, 406-994-7154, john.seifert@montana.edu - Exercise and Nutrition Sciences and Sustainable Food Systems
- Dr. Jennifer Franklin, 315 Reid, 406-994-3285, kathryn.franklin1@montana.edu - Addictions Counseling Certificate Program
- Dr. Deborah Haynes, 219A Herrick Hall, 406-994-5013, dhaynes@montana.edu - Family Financial Planning
- Dr. Rebecca Koltz, 220 Herrick Hall, 406-994-3299, rebecca.koltz@montana.edu - School Counseling
- Dr. Mark Nelson, 121 Herrick Hall, 406-994-3810, markn@montana.edu - School Counseling
- Dr. John Seifert, 103E Romney, 406-994-7154, john.seifert@montana.edu - Exercise and Nutrition Sciences
- Dr. Craig Stewart, 121A Marga Hosaeus Fitness Center, 406-994-6315, cstewart@montana.edu - Sport and Coaching Sciences
- Dr. J. Mitchell Vaterlaus, 122 Herrick Hall, 406-994-3229, j.vaterlaus@montana.edu - Community Health, Family and Consumer Sciences

Program Leaders
- Dr. Carmen Byker Shanks, 344 Reid Hall, 406-994-1952, cbykershanks@montana.edu - Sustainable Food Systems
- Dr. Anna Elliott, 210E Romney, 406-994-3245, anna.elliott@montana.edu - Mental Health Counseling
- Dr. Katey Franklin, 315 Reid, 406-994-3285, kathryn.franklin1@montana.edu - Addictions Counseling Certificate Program
- Dr. Deborah Haynes, 219A Herrick Hall, 406-994-5013, dhaynes@montana.edu - Family Financial Planning
- Dr. Rebecca Koltz, 220 Herrick Hall, 406-994-3299, rebecca.koltz@montana.edu - Marriage and Family Counseling
- Dr. Dr. John Seifert, 103E Romney, 406-994-7154, john.seifert@montana.edu - Exercise and Nutrition Sciences
- Dr. Craig Stewart, 121A Marga Hosaeus Fitness Center, 406-994-6315, cstewart@montana.edu - Sport and Coaching Sciences
- Dr. J. Mitchell Vaterlaus, 122 Herrick Hall, 406-994-3229, j.vaterlaus@montana.edu - Community Health, Family and Consumer Sciences

Admission
In addition to the requirements listed in the application requirements and admission policies sections, admission requirements for specific options can be obtained from the department website at montana.edu/hhd or by calling 406-994-3242.

Provisional admission as a graduate student is possible if there is a deficiency in one or more of these areas. Students accepted provisionally will be required to:

1. successfully complete the undergraduate prerequisites for graduate-level classes,
2. successfully complete the specific undergraduate or graduate classes needed for acceptance, and/or
3. take a required course load and earn a specific grade point average while on a provisional status.

Financial Assistance
Teaching assistantships may be available within the Department of Health and Human Development. Assistantships are typically nine-month appointments. Counseling assistantships can include a summer appointment in addition to the academic year appointment. Research assistantships may be available with individual faculty members who have funded grants or contracts. Stipends vary depending on the type of appointment, the requirements of the job, the experience of the applicant, and available funding. See the Graduate Assistantships sections of the department website for detailed information on appointment criteria. Assistantships are requested from the student’s home department.

Graduate Programs
Master of Science in:
- Community Health (p. 341)
- Counseling (options in Marriage, Couples, & Family or Mental Health) (p. 339)
- Exercise and Nutrition Sciences (options in Exercise Physiology & Nutrition or Sport & Coaching Sciences (p. 342)
- Family & Consumer Sciences (p. 342)
- Family Financial Planning (p. 343)
- Sustainable Food Systems (http://catalog.montana.edu/graduate/education-health-human-development/health-human-development/sustainable-food-systems)

M.Ed. in School Counseling (p. 339)

Graduate certificate program in Addiction Counseling (p. 344)

Counseling Program Options
The Department of Health and Human Development offers a Master of Science degree in counseling with options in marriage, couples, & family counseling or mental health counseling, and a Master of Education degree in school counseling. All three programs are accredited by the Council for Accreditation of Counseling and Related Educational Programs (CACREP). The marriage, couples, & family and mental health counseling programs are 60 credits and require a minimum of two years of study. The school counseling option is 48 credits. All programs are designed to meet Montana licensure requirements for professional counselors. Students must obtain up to 1,500 hours supervised counseling experience and training in core counseling areas. Completed applications must be filed by February 15 as students are expected to begin their graduate program the following summer session. Applications are screened only once each year following the February 15 deadline. A maximum of 25 students shall be admitted into the counseling areas each year.

Marriage, Couples, & Family Counseling / Mental Health Counseling
Marriage, couples, & family and mental health counseling students at Montana State University graduate with a master’s degree in counseling. The program is accredited by CACREP (council for the accreditation of counseling and related educational programs). Upon graduation, students must apply for a licensed professional counselor candidate’s license from the State of Montana Board of Behavioral Health. The candidate’s license is a training license while students accrue the required post-masters counseling hours to obtain their full LCPC (licensed clinical professional counselor). This license allows the graduate to practice independently.

School Counseling Licensure Process
School counseling students at Montana State University graduate with a master of education degree in school counseling. The school counseling program is accredited by the Montana Office of Public Instruction and therefore when students graduate they are eligible to apply for a class 6 license or a school counseling endorsement on their pre-existing class 2 (standard teaching) license. Upon review of degree completion, licensure applicants are granted an appropriate license to practice as a school counselor in grade levels d-12 throughout the state.
Interested students may obtain more descriptions by visiting the department website at montana.edu/hhd or by calling 406 994-3241.

**Marriage, Couples, and Family Counseling**

The 60-credit marriage, couples, and family counseling option prepares counselors to address mental health and relationship problems with individuals, couples, families, and children from a family systems perspective. Students are taught a conceptual framework for assessment and intervention which focuses on the multiple systems and family context of individual development. Emphasis is on a positive, competency-based view of individual and family strengths. This approach examines the larger environments in which individuals and families interact and the plethora of influences (i.e., social, cultural, and economic) that affect human growth and development. Interpersonal issues between family members and the family and outer environmental systems are highlighted.

In addition to family systems theory, students are well grounded in individual and group counseling theories. Collaboration between marriage and family counselors and other mental health care providers is emphasized.

The marriage and family counseling option meets educational licensure requirements for a Licensed Clinical Professional Counselor in the State of Montana. After licensure, graduates of the marriage, couples, and family counseling option are prepared to work in a variety of counseling contexts where they see children, adolescents, individuals, couples, and families. In this program track students are prepared to work with individuals, as well as with couples and families. This extended focus beyond individual counseling provides a well-rounded training experience.

| Summer |  |
|--------|  |
| HDCO 502 | Cnsl Ethic Prof Orient | 2 |
| HDCO 508 | Counseling Theories I | 3 |
| HDCO 558 | Career Counseling | 2 |

**Fall**

|  |
| HDCO 503 | Prof Issues in Counseling | 3 |
| HDCO 510 | Counseling Theories II | 3 |
| HDCO 521 | Counseling Skills Lab | 1 |
| HDCO 522 | Group Counseling | 3 |

**Spring**

|  |
| HDCO 523 | Theory and Practice of Addiction | 2 |
| HDCO 525 | Counsel Child & Adolescents | 3 |
| HDCO 550 | Counseling Research and Evaluation | 2 |
| HDCO 564 | Diagnosis and Mental Health | 3 |
| HDCO 571 | Prof Counsel Practicum | 3 |

**Summer**

|  |
| HDCO 524 | Crisis Counseling: Theory and Practice | 3 |
| HDCO 551 | Appraisal | 3 |
| HDCO 598 | Internship | 2 |

**Fall**

|  |
| HDCO 554 | Develop Theory Across Lifespan | 3 |
| HDCO 563 | Multicultural Awareness | 3 |
| HDCO 565 | Couples Counseling | 3 |
| HDCO 598 | Internship | 2 |

**Spring**

|  |
| HDCO 569 | Advanced Family Counseling | 3 |
| HDCO 598 | Internship | 2 |

**Electives**

|  |
| HDCO 598 | Internship | 2 |

**Partial List of Electives**

|  |
| CTHH 430 | Mental Health & Social Issues in Aging | 3 |
| CTHH 435 | Human Response To Stress | 3 |
| HDCO 526 | Adventure Counseling | 3 |
| HDCO 530 | Mind-Body Well-Being Self-Care | 3 |
| HDCO 556 | Sexuality Counseling | 3 |
| HDCO 568 | Mental Health Methods | 3 |

**Mental Health Counseling**

The 60-credit mental health counseling option prepares counselors to apply principles of human development, counseling theory, learning theory, group dynamics, and the etiology of mental illness and dysfunctional behavior in their work at a variety of mental health facilities.

The mental health counseling area of study provides students with 700 hours of supervised experience in appraisal, individual, group counseling, and consultation in primarily clinic and community agencies. The goals of the mental health counseling program are the following: to enhance students’ personal and professional development as counselors; to increase their ability to understand the characteristics and concerns of various client populations and their environments; and to develop their knowledge and skills in use of theory based counseling model.

The mental health counseling option meets educational licensure requirements for a Licensed Clinical Professional Counselor in the State of Montana. After licensure, graduates of the mental health program work in a variety of mental health counseling contexts where they see adults.

| Summer |  |
|--------|  |
| HDCO 502 | Cnsl Ethic Prof Orient | 2 |
| HDCO 508 | Counseling Theories I | 3 |
| HDCO 558 | Career Counseling | 2 |

**Fall**

|  |
| HDCO 503 | Prof Issues in Counseling | 3 |
| HDCO 510 | Counseling Theories II | 3 |
| HDCO 521 | Counseling Skills Lab | 1 |
| HDCO 522 | Group Counseling | 3 |

**Spring**

|  |
| HDCO 523 | Theory and Practice of Addiction | 2 |
| HDCO 525 | Counsel Child & Adolescents | 3 |
| HDCO 550 | Counseling Research and Evaluation | 2 |
| HDCO 564 | Diagnosis and Mental Health | 3 |
| HDCO 571 | Prof Counsel Practicum | 3 |

**Summer**

|  |
| HDCO 524 | Crisis Counseling: Theory and Practice | 3 |
| HDCO 551 | Appraisal | 3 |
| HDCO 598 | Internship | 2 |

**Fall**

|  |
| HDCO 554 | Develop Theory Across Lifespan | 3 |
| HDCO 563 | Multicultural Awareness | 3 |
| HDCO 598 | Internship | 2 |
| Electives | 3 |

**Spring**

|  |
| HDCO 523 | Theory and Practice of Addiction | 2 |
| HDCO 598 | Internship | 2 |
School Counseling

The Master of Education in School Counseling is a 48-credit program designed to prepare students to work in public or private schools as professional counselors. Upon completion, students are eligible to apply for certification as a school counselor with the Montana Office of Public Instruction. School counselors in Montana can be certified with a class 6 (specialist) certificate (for those without a Montana teaching certificate), or certified with a Guidance and Counseling endorsement on a Montana teaching certificate.

School counseling students take a common core of counseling and human development courses. This core of course work provides all students with the knowledge and skills necessary to be a professional counselor and follows the standards developed by CACREP. In addition, students in the school counseling option also study aspects of counseling germane to the school setting. The program focuses on a comprehensive and developmental programming designed to promote health, human development and well-being. Interested students may obtain descriptions by visiting the department website at montana.edu/hhd. Depending on the students’ goals, undergraduate degree, and course work, additional courses may be added or deleted to supplement the curriculum.

<table>
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Partial List of Electives

- **CHTH 430** Mental Health & Social Issues in Aging 3
- **CHTH 435** Human Response To Stress 3
- **HDCO 525** Counsel Child & Adolescents 3
- **HDCO 526** Adventure Counseling 3
- **HDCO 556** Sexuality Counseling 3
- **HDCO 565** Couples Counseling 3
- **HDCO 569** Advanced Family Counseling 3

Community Health

The community health program offers a skills-based program which integrates theory and critical thinking to assess the needs of individuals, families, and communities. Students learn to plan, implement and evaluate programming designed to promote health, human development and well-being. Interested students may obtain descriptions by visiting the department website at montana.edu/hhd. Depending on the students’ goals, undergraduate degree, and course work, additional courses may be added or deleted to supplement the curriculum.

Year 1

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>CHTH 502 - Theories and Models in Health</td>
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<td>or Statistical Approaches to Studying Children, Families and Communities</td>
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<td>CHTH 503 - Community-Based Participatory Research or CHTH 598 - Internship</td>
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<tr>
<td>CHTH 548 - Program Planning and Evaluation</td>
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<td>HDCO 554 - Develop Theory Across Lifespan</td>
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<td>HHD 512 - Research Methods in HHD</td>
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Year 2

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<td>Electives tailored to program</td>
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<td>CHTH 575 - Professional Paper and Project or CHTH 590 - Master’s Thesis</td>
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Electives (other electives may be approved by advisor)

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<td>CHTH 428 - Health Disparities</td>
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<td>CHTH 435 - Human Response To Stress</td>
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<td>CHTH 440 - Principles Of Epidemiology</td>
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<td>CHTH 445 - Program Planning for CH</td>
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<td>CHTH 598 - Internship</td>
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<td>HDPS 464 - Gndr, Rce, Clss, and Fam Diver</td>
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<td>HDPS 465R - Family Law &amp; Public Policy</td>
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<td>HEE 506 - Exercise and Chronic Disease</td>
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<td>HTH 455 - The Ethic of Care</td>
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<tr>
<td>NASX 524 - Contemporary Issues in American Indian Studies</td>
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<td>PSCI 436 - Politics of Food &amp; Hunger</td>
<td>3</td>
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<td>PSCI 559 - Program Evaluation</td>
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</table>
Exercise and Nutrition Sciences Option

The Department of Health and Human Development offers a Master of Science degree in exercise and nutrition sciences with two options:

- Exercise Physiology and Nutrition
- Sport and Coaching Sciences

Prerequisites
Ideally, entering graduate students will have completed a bachelor’s degree in exercise science, nutrition, or a closely related field (e.g., biology, pre-medical, physical therapy) with appropriate background course work (e.g., chemistry, biology, anatomy, physiology) to enter the exercise and nutritional sciences program.

For those entering into sport and coaching sciences, students will have a bachelor’s degree in health enhancement or physical education, athletic training, and or appropriate practical experience. For example, athletic coaches and administrators at any level of sport—competitive, developmental, or recreational—athletic trainers, health enhancement or education teachers, or those in the private sector who are involved or interested in the application of sport and teaching sciences are welcome.

Admissions
Admissions decisions are based on:

1. Undergraduate preparation (GPA and strength of prerequisite course work)
2. GRE combined score from verbal and quantitative tests
3. Goodness of fit and how consistent interests and goals of student align with research and outreach goals of faculty (to be addressed in personal essay)
4. Relevant professional experience
5. Strength of letters of recommendation

The exercise and nutrition sciences option allows students to focus on understanding the determinants of physical activity and energy expenditure, adaptations to exercise that impact human work performance and disease risk, biomechanics, neurophysiology, and exercise metabolism and nutrition. Although not required, a graduate student may simultaneously complete course work needed to become a Registered Dietitian/Nutritionist. A graduate student may earn a verification statement (http://www.montana.edu/hhd/undergrad/foodandnutrition/dietetics/verification.html) by completing required classes in the MSU dietetics program. The verification statement is required in order to apply to an accredited dietetic internship.

The sport and coaching sciences option is designed to meet the need in advanced coaching and sport science abilities at the local, state, national and international levels. Course work includes knowledge pertinent to coaches of all sports at developmental, competitive, and high performance levels as well as sport administrators in both public and private sectors.

Required Courses for Exercise Physiology and Nutrition

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Exercise and Nutrition Sciences Option

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<td>Fall</td>
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<td>KIN 515</td>
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<td>or KIN 545</td>
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<td>or KIN 590</td>
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<td>NUTR 511</td>
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<td>or KIN 525</td>
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Total Credits: 30

Required Courses for Sport and Coaching Sciences

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<td>or KIN 545</td>
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<td>or KIN 590</td>
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<td>Electives</td>
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Total Credits: 30

Family & Consumer Sciences

Family and Consumer Sciences

The master’s degree in Family and Consumer Sciences creates opportunities for students to develop a deeper and applied understanding of family and human development theory, research methods, and program planning and evaluation. If so desired, the program specifically provides an emphasis option in Early Childhood Education/Child Development. The master’s degree is designed to accommodate students who wish to attend graduate school full-time (blended—face-to-face and online courses) and working professionals who require more flexibility (all online).

Required Courses

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<th>Course</th>
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or KIN 525    | 3-6     |

or EDCI 501  | 3-10    |

Family and Consumer Sciences
Electives
Distance education options

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<td>Caregiving &amp; Aging Families</td>
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<td>Mental Health &amp; Social Issues in Aging</td>
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<td>Human Response To Stress</td>
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<td>HDFP 459</td>
<td>Reaching the Hurt Child</td>
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<td>HDFP 461</td>
<td>Principles Wellbeing in Aging</td>
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<td>HDFP 465R</td>
<td>Family Law &amp; Public Policy</td>
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<td>HDFP 572</td>
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On-campus options

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<th>Course</th>
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<td>CTHH 428</td>
<td>Health Disparities</td>
<td>3</td>
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<td>CTHH 435</td>
<td>Human Response To Stress</td>
<td>3</td>
</tr>
<tr>
<td>CTHH 503</td>
<td>Community-Based Participatory Research</td>
<td>3</td>
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<td>EDEC 430</td>
<td>Social and Emotional Development in the Young Child</td>
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<td>EDEC 450</td>
<td>Literacy in the EC Classroom</td>
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<td>HDFP 457</td>
<td>Curric Dev in FCS Education</td>
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<td>HDFP 457</td>
<td>Family Life Education</td>
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<td>HDFP 460</td>
<td>Parenting</td>
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<tr>
<td>HDFP 465R</td>
<td>Family Law &amp; Public Policy</td>
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The program is registered with the Certified Financial Planner® Board of Standards and meets the education criteria for individuals who wish to fulfill the education component for obtaining CFP® certification. Students may also take the six core courses to fulfill this CFP® education requirement, rather than the full master's program. As a participating university in this consortium, Montana State University offers two of the twelve required courses, in addition to a three-credit practicum experience and a three-credit professional paper. The program is designed to be a part-time program for fully or partially employed students.

Applicants apply at their home institution and take approximately two to three 3-credit courses via distance delivery from each of the participating universities, at a uniform tuition rate determined by the consortium. More information is available at www.montana.edu/montanagpidea/faq.htm

Two plans for program completion are available: the professional paper plan and the course work-only plan.

Professional Paper/Project Plan

This option is appropriate for students who want to conduct their own original research or to participate in a project of interest. This option is particularly appropriate for students who wish to continue to get a Ph.D. A maximum of six (6) professional paper/project credits can be taken.

If the student is using faculty time or university facilities to work on their professional paper/project, the student must be registered for HDFP 575 credits. The HDFP 575 credits can be graded or taken pass/fail, as negotiated between the student and the professional paper/project faculty adviser.

Course Work-Only Plan

This plan is for family financial planning students who intend to only work as a financial planning practitioner and have no intention of continuing on for a Ph.D. A minimum of 36 credits of course work is required and a practicum is highly recommended for this course work-only option.

Financial Assistance

The program does qualify for financial aid. However, it is a self-supporting program and as such is not eligible for faculty and staff fee waivers through the MUS system.

Required Courses in Family Financial Planning:

(subject to change - check with program contact)

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<tr>
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<td>Retirement Planning, Employee Benefits, and Families</td>
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<td>Financial Plan Case Studies</td>
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Total Credits 36

Electives

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<td>HDFP 555</td>
<td>Financial Counseling</td>
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<tr>
<td>HDFP 560</td>
<td>Professional Practices in Family Financial Planning</td>
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Family Financial Planning

Dr. Deborah Haynes
Department of Health and Human Development
219A Herrick Hall, Bozeman, MT 59717-3540
406-994-5013 Email: dhaynes@montana.edu

The family financial planning master’s degree is a 36-credit distance degree program that is offered through a consortium of eight mid-western and western land-grant universities through Great Plains Interactive Distance Education Alliance (http://www.gpidea.org) (GP-IDEA). The participating land grant universities are:

- Iowa State University
- Kansas State University
- University of Missouri–Columbia
- University of Nebraska–Lincoln
- Oklahoma State University
- North Dakota State University
- South Dakota State University
- Montana State University

- South Dakota State University
- North Dakota State University
- Oklahoma State University
- University of Nebraska–Lincoln
- University of Missouri–Columbia
- Kansas State University
- Iowa State University

The program does qualify for financial aid. However, it is a self-supporting program and as such is not eligible for faculty and staff fee waivers through the MUS system.
Family Financial Planning

Dr. Deborah Haynes
Department of Health and Human Development
219A Herrick Hall, Bozeman, MT 59717-3540
406-994-5013 Email: dhaynes@montana.edu

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- Kansas State University
- University of Missouri–Columbia
- University of Nebraska–Columbia
- Oklahoma State University
- North Dakota State University
- South Dakota State University
- Montana State University

The program is registered with the Certified Financial Planner® Board of Standards and meets the education criteria for individuals who wish to fulfill the education component for obtaining CFP® certification. Students may also take the six core courses to fulfill this CFP® education requirement, rather than the full master's program. As a participating university in this consortium, Montana State University offers two of the twelve required courses, in addition to a three-credit practicum experience and a three-credit professional paper. The program is designed to be a part-time program for fully or partially employed students.

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Course Work-Only Plan

This plan is for family financial planning students who intend to only work as a financial planning practitioner and have no intention of continuing on for a Ph.D. A minimum of 36 credits of course work is required and a practicum is highly recommended for this course work-only option.

Financial Assistance

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Required Courses in Family Financial Planning:
(subject to change - check with program contact)

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<td>Retirement Planning, Employee Benefits, and Families</td>
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Electives

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<td>HDFP 560</td>
<td>Professional Practices in Family Financial Planning</td>
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<td>HDFP 575</td>
<td>Professional Paper</td>
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<td>HDFP 576</td>
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Addiction Counseling

Overview

The addiction counseling certificate program is an online academic preparation program that prepares students to become eligible for licensure in Montana. This program offers all academic graduate course work needed to pursue internship/licensure with the State of Montana. Significantly, this is a graduate certificate program – not a master’s degree program. Students must have a bachelor’s degree in a relevant field with a GPA of 3.0 to apply; however, motivated students with a GPA less than 3.0 are highly encouraged to contact the program leader or program manager to discuss the application process.

Students must earn a minimum of 12 credits in addiction-specific course work in order to earn the addiction counseling certificate from MSU. State licensure requirements are different, and students will be advised to take additional MSU addiction-specific course work to meet the State of Montana requirements.

Prerequisite course work for the State of Montana licensure depends upon your educational background. The MSU addiction counseling certificate program provides individual academic advisement and tailors a program of study based on individual student academic backgrounds.

Requirements

Complete 12 credits from the course list to receive the MSU addiction counseling certificate. State licensure may require all 30 credits depending on student’s prior academic course work.
## Curriculum

<table>
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<th>Course Code</th>
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<td>AC 501</td>
<td>Chemical Dependency Counseling (Spring)</td>
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<tr>
<td>AC 502</td>
<td>Psychopharmacology and Addictions (Spring)</td>
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<tr>
<td>AC 503</td>
<td>Assessment, Treatment Planning and Ethics of Addiction Counseling (Fall)</td>
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<tr>
<td>AC 504</td>
<td>Alcohol and Drug Studies (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>AC 505</td>
<td>Cross Cultural &amp; Ethical Considerations in Addictions Counseling (Summer)</td>
<td>3</td>
</tr>
<tr>
<td>AC 506</td>
<td>Group Counseling in Addiction Settings (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>AC 507</td>
<td>Group Counseling in Addiction Settings II (Spring)</td>
<td>3</td>
</tr>
<tr>
<td>AC 508</td>
<td>Counseling Theories in Addiction Settings (Summer)</td>
<td>3</td>
</tr>
<tr>
<td>AC 509</td>
<td>Assess Treat Plan Addiction II (Spring)</td>
<td>3</td>
</tr>
<tr>
<td>AC 510</td>
<td>Chem Dependency Counseling II (Fall)</td>
<td>3</td>
</tr>
</tbody>
</table>

## Continuing Education Opportunity

Gambling and Gaming Disorders: Assessment and Treatment (open enrollment), 30 hours

## For More Information

### About the Program

Contact Katey Franklin, Program Director, at kathryn.franklin1@montana.edu or (406) 994-5993.

### About the Application Process

Contact Hilary Becker, Program Manager, at hilary.becker@montana.edu or (406) 994-2379.

## Explore Further

- Other Montana State Online Degree and Certificate Programs (http://eu.montana.edu/online/degrees)
- Frequently Asked Questions (http://eu.montana.edu/online/faq) concerning online courses
- MSU Department of Health and Human Development (http://www.montana.edu/wwwhhd)
- Is online learning right for you? Find out with our interactive quiz (http://eu.montana.edu/online/quiz).

## College of Engineering

### Graduate Programs Available

#### Department of Chemical and Biological Engineering (p. 345)
- M.S. in Chemical Engineering (p. 346)
- M.S. in Environmental Engineering (p. 347)
- M.Eng. in Chemical Engineering (p. 348)
- M.Eng. in (p. 348) Bioengineering (p. 349)
- Ph.D. in Engineering (p. 351)
- Ph.D. in Materials Science and Engineering (p. 409)

#### Department of Civil Engineering (p. 349)
- M.S. in Civil Engineering (p. 349)
- M.S. in Environmental Engineering (p. 347)

#### Gianforte School of Computing (p. 356)
- M.S. in Computer Science (p. 359)
- Ph.D. in Computer Science (p. 359)

#### Department of Electrical and Computer Engineering (p. 360)
- M.Eng. in Electrical Engineering (p. 361)
- M.S. in Electrical Engineering, Plan A (thesis) (p. 361)
- M.S. in Electrical Engineering, Plan B (professional paper) (p. 361)
- M.S. in Optics and Photonics Plan A (thesis) (p. 361)
- M.S. in Optics and Photonics, Plan B (professional paper) (p. 362)
- Ph.D. in Electrical Engineering (p. 363)
- Ph.D. in Materials Science (p. 409)

#### Department of Mechanical and Industrial Engineering (p. 363)
- M.S. in Industrial and Management Engineering (p. 364)
- M.S. in Mechanical Engineering (p. 364)
- M.Eng. in Mechanical Engineering (p. 364)
- Ph.D. in Engineering -- Industrial & Management Engineering option (p. 351)
- Ph.D. in Engineering -- Mechanical Engineering option (p. 351)
- Ph.D. in Materials Science (p. 409)

Research and Extension Centers (http://www.coe.montana.edu/research_centers.html)

### Dean

Brett Gunnink, Ph.D., P.E.
214 Roberts Hall
406-994-2272 Email:bgunnink@ce.montana.edu

### Associate Dean for Research, Faculty & Administration

Anne K. Camper, Ph.D.
214 Roberts Hall
406-994-2272 Email: anne_c@erc.montana.edu

### Associate Dean for Student Success

Christine M. Foreman, Ph.D.
214 Roberts Hall
406-994-2272 Email: cforeman@montana.edu

### Department of Chemical and Biological Engineering

#### Department Head/Assoc. Professor:

Jeff Heys, Ph.D.
Email: jeffrey.heys@coe.montana.edu

Montana State University
310 Cobleigh Hall
PO Box 173920, Bozeman , MT 59717-3920
406-994-2221 Department Email: chbe@montana.edu

Home Page: www.chbe.montana.edu

The department offers graduate programs leading to the Master of Science in Chemical Engineering degree and a Master of Science degree in
Environmental Engineering. The department participates in the Doctor of Philosophy degree in Engineering through the College of Engineering, with options available in Chemical Engineering and Environmental Engineering.

**Admission (M.S. and Ph.D.)**

Students may enter the Master of Science or Doctoral programs with a bachelor’s degree in Chemical Engineering or other engineering or science discipline. Non-chemical engineering students wishing to pursue a master’s program may require limited remedial coursework. Students may be admitted directly to the doctoral program without a master’s degree.

The Department of Chemical and Biological Engineering has the following minimum requirements for admission to the graduate program:

- 3.0 GPA in undergraduate program (based on A=4.0)
- GRE Scores (145 verbal, 153 quantitative)
- International Applicants: TOEFL (internet exam - 75) or IELTS score of 6.5 or higher - required for non-native speakers of English

Note: Typical scores for admitted graduate students are well above these minima.

For further information, refer to Admission Policies and Application Requirements section of the department webpage.

**Deadlines**

Deadline for consideration for Assistantships

- Fall Semester: February 1
- Spring Semester: August 1

Domestic Applicants

- Fall Semester: July 1
- Spring Semester: November 1
- Summer Semester: March 15

International Applicants

- Fall Semester: May 1
- Spring Semester: September 15
- Summer Semester: January 15

**Research**

This degree involves research in transport phenomena in complex systems, materials, biofilms, biochemical transformation, biotechnology, remediation of hazardous wastes, and environmental engineering. Research topics include extremophilic bioprocessing, in situ biocatalyzed heavy metal biotransformations in natural and engineered biological systems, biomaterials, biorheology, colloidal system dynamics, durability of materials, surface interactions, membrane materials, composite materials, separations, metabolic engineering, metabolic systems analysis, biofuels processing.

Some departmental research is conducted in collaboration with the Center for Biofilm Engineering, the Thermal Biology Institute and MSU’s Surface Science Program. Research also includes materials science and engineering for energy applications including: high temperature corrosion and corrosion protection, advanced physical vapor deposition (PVD) technologies, and sustainable energy.

**Financial Assistance**

Research and teaching assistantships and scholarships are available on either a 9-month or a 12-month basis; only MS and Ph.D. candidates are eligible.

**Degree Offered**

- M.S. in Chemical Engineering (p. 346)
- M.S. in Environmental Engineering (p. 347)
- Master of Engineering In Chemical Engineering (p. 348)
- Master of Engineering in Bioengineering (p. 349)
- Ph.D. in Engineering (p. 351)
- Ph.D. in Materials Science (p. 409)

**Program Requirements (M.S. and Ph.D.)**

The Master of Science program requires 30 credits total (including a minimum of 10 credits of ECHM 590 Master’s Thesis for Plan-A option).

The chemical engineering program for students from other disciplines requires appropriate background remedial coursework in addition to the previously listed requirements.

The Ph.D. program requires specific coursework, depending on the option, 60 total credits (including a minimum of 18 thesis credits).

Doctoral candidates will register for dissertation research in one of the five departments offering the above options. Course requirements for the Engineering Ph.D. include completion of 2 credits of ENGR 610 Resch & Mthds in Engineering, two courses in Mathematical systems, a minimum of eighteen (18) credits of doctoral dissertation, and other courses chosen to support the proposed doctoral program that are approved by the candidate’s committee. All doctoral candidates will be required to pass three examinations: a Ph.D. Qualifying Examination taken during the first year of the student’s doctoral program, a Ph.D. Comprehensive Examination taken within two years of qualifying for the doctoral program, and a Ph.D. Dissertation Defense. Students are expected to be familiar with the individual program degree requirements as well as those of The Graduate School.

**M.S. in Chemical Engineering**

**Degree Options**

- M.S. in Chemical Engineering - Thesis Option (Plan A) (p. 347)
- M.S. in Chemical Engineering - Non-thesis Option (Plan B) (p. 346)

**M.S. in Chemical Engineering - Non-Thesis Option (Plan B)**

**General Requirements**

- 30 credits total
- ECHM 575 Research or Prof Paper/Project is required
- 21 credits or more required for degree must be at 5xx level
- 3xx level courses are not allowed
- 4xx level courses may be used
- Courses with grades below C- cannot be used to satisfy graduation requirements
- Three credits (min.) registration required during term of graduation (1 credit with in absentia graduation request on file)

**Course Requirements**

The following courses are required of each MS student:
Each student’s graduate advisor and committee are to work with the student to prepare a Program of Study listing the courses the student is required to take.

### Examinations

For Non-Thesis Option (Plan B) Students:

- Presentation of professional paper

### M.S. in Chemical Engineering - Thesis Option (Plan A)

#### General Requirements

- 30 credits total (including thesis credits)
- 10 credits (minimum) of ECHM 590 Master’s Thesis
- 21 or more credits required for degree must be at 5xx level
- 3xx level courses are not allowed
- 4xx level courses may be used
- Courses with grades below C- cannot be used to satisfy degree requirements
- Three credits (min.) registration required during term of:
  - Comprehensive Examination and Thesis defense
  - Graduation (1 credit with in absentee graduation request on file)

#### Course Requirements

The following courses are required of each MS student

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHM 594</td>
<td>Seminar (can be taken twice)</td>
<td>1</td>
</tr>
<tr>
<td>ECHM 503</td>
<td>Thermodynamics (F)</td>
<td>3</td>
</tr>
<tr>
<td>ECHM 533</td>
<td>Transport Phenomena (Sp)</td>
<td>3</td>
</tr>
<tr>
<td>ECHM 575</td>
<td>Research or Prof Paper/Project</td>
<td>1-4</td>
</tr>
</tbody>
</table>

Plus, a course in each of the following areas:

- Reaction Engineering
  - ECHM 510 Reaction Engineering/Modeling (Sp alt. Years) 3
  - or EBIO 566 Fundamentals of Biofilm Engr

- Advanced Mathematics
  - EGEN 505 Advanced Engineering Analysis 3
  - or EGEN 506 Numerical Sol to Engr Problems

### Examination

For Thesis Option (Plan A) students, the thesis defense and comprehensive examination are combined.

### Environmental Engineering

#### Contact

Civil Engineering Department (http://www.coe.montana.edu/ce)
Email: cedep@ce.montana.edu

Chemical and Biological Engineering Department (http://www.chbe.montana.edu)
Email: che_b@coe.montana.edu or

The Environmental Engineering program is an integrated effort of the Departments of Civil and Chemical and Biological Engineering. The vision of the program is to educate students who will develop solutions to environmental and industrial needs for physical/chemical/biological treatment, environmental restoration, and waste management using a cross-disciplinary approach.

The degree of Master of Science in Environmental Engineering is awarded through either the Civil or Chemical and Biological Engineering departments, depending on the student’s background, academic program and research work. Areas of specialty within the program include water quality management, design of water and waste water facilities, chemical/microbial process analysis and design. Environmental Engineering is also one of the options for the Doctor of Philosophy in Engineering.

### Admission

Students entering the Environmental Engineering program must meet the admission requirements for either Civil or Chemical and Biological Engineering. Generally, students with undergraduate degrees in Civil or Chemical and Biological Engineering will apply to the departments of their undergraduate discipline. Students with degrees in disciplines other than engineering may be admitted to the program through either department, but may be required to complete remedial coursework. Successful applicants are accepted into both the department and The Graduate School. For further information, refer to the Admission Policies and Application Requirements sections.

### Research Opportunities

Research is considered a vital part of the Environmental Engineering program. Many of the students do their research work through the Center for Biofilm Engineering, although avenues through Civil or Chemical and Biological Engineering are also available. Research is used as the basis for a thesis or professional paper, one of which is required for graduation. Current research within the program focuses on both the fundamentals and application of chemical and biological processes relating to water quality management, water and wastewater treatment processes, the remediation of contaminated soils, and groundwater and biofilm processes of industrial relevance.

### Financial Assistance

A number of teaching and research assistantships are available in both the Civil and Chemical and Biological Engineering Departments. Additionally, research assistantships are available in the Center for Biofilm Engineering. Students should apply directly to the appropriate department and/or to the Center for Biofilm Engineering for financial assistance. See the Graduate Assistantships sections for more information.
Degree Options
• M.S. in Environmental Engineering - Thesis Option (Plan A) (p. 348)
• M.S. in Environmental Engineering - Non-Thesis Option (Plan B) (p. 350)

M.S. in Environmental Engineering - Thesis Option (Plan A)
This summary is intended to assist students in planning their program of study and presents commonly needed information in this regard. General University degree requirements are fully enumerated in the Graduate School Policies and Procedures. The information presented here is a combination of the general requirements of the Graduate School and specific departmental requirements.

General Requirements
The Degree of M.S. Environmental Engineering is awarded through either the Civil or Chemical and Biological Engineering Departments, depending on the student’s background and professional focus. Degree candidates correspondingly must meet the requirements of the appropriate Department as enumerated below, as well as the requirements of the Graduate School. Each student’s graduate adviser and committee will work with the student to prepare a Program of Study listing the courses the student will take. This program must be submitted to The Graduate School before the end of the second semester of study.

Common requirements for both departments include:
• Minimum 30 credits total (including thesis credits)
• Minimum 20 credits coursework (4xx or 5xx-level)
• Minimum 10 credits: Master’s Thesis (ECHM 590) or Master’s Thesis (EENV 590)
• Maximum of 9 credits taken at the 4xx level may be included in the program of study
• Courses graded below C- cannot be used to satisfy degree requirements
• Three credits (minimum) registration required during term of:
  • Comprehensive examination and thesis defense
  • Graduation (or 1 credit with in absentia request on file)

Additional specific requirements by department are listed below.

Civil Engineering Department Specific Requirements
Curriculum requirements for the M.S. degree in Environmental Engineering in the Civil Engineering Department are highly individualized and established in consultation with and approved by the student’s graduate committee. The courses listed below are often considered when establishing the program of study for a particular student. There are also many other courses offered at MSU that may support a student’s academic goals. The Civil Engineering Department also requires all students to take one credit of graduate seminar - ECIV 594 - during their final semester, which is in addition to the 30 credit minimum.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECIV 529</td>
<td>Groundwater Contamination</td>
<td>3</td>
</tr>
<tr>
<td>EENV 540</td>
<td>Water Chemistry for Envr Engr</td>
<td>3</td>
</tr>
<tr>
<td>EENV 561</td>
<td>Environ Eng Reactor Theory</td>
<td>2</td>
</tr>
<tr>
<td>EENV 562</td>
<td>Water Treatment Process/Design</td>
<td>3</td>
</tr>
<tr>
<td>EENV 563</td>
<td>Wastewater Treat Proc/Design</td>
<td>3</td>
</tr>
<tr>
<td>EENV 565</td>
<td>Chem Sens/Instr Envir Biotech</td>
<td>2</td>
</tr>
<tr>
<td>EENV 590</td>
<td>Master’s Thesis (Required)</td>
<td>10</td>
</tr>
</tbody>
</table>

EENV 591: Special Topics 1-3
EENV 592: Independent Study 1-3
EENV 598: Internship 2
ECIV 529: Groundwater Contamination 3
ECIV 594: Seminar (Required) 1
EBIO 566: Fundamentals of Biofilm Engr 3
ECHM 503: Thermodynamics 3
ECHM 510: Reaction Engineering/Modeling 3
ECHM 533: Transport Phenomena 3

Chemical and Biological Engineering Department Specific Requirements
Master of Science in Environmental Engineering degree requirements through the Chemical and Biological Engineering Department are:

Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHM 594</td>
<td>Seminar (may be taken twice for credit)</td>
<td>1</td>
</tr>
<tr>
<td>ECHM 503</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ECHM 533</td>
<td>Transport Phenomena</td>
<td>3</td>
</tr>
<tr>
<td>EENV 561</td>
<td>Environ Eng Reactor Theory</td>
<td>2</td>
</tr>
<tr>
<td>or</td>
<td>ECHM 510: Reaction Engineering/Modeling</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td>EBIO 566: Fundamentals of Biofilm Engr</td>
<td></td>
</tr>
<tr>
<td>EENV 562</td>
<td>Water Treatment Process/Design</td>
<td>3</td>
</tr>
<tr>
<td>or</td>
<td>EENV 563: Wastewater Treat Proc/Design</td>
<td></td>
</tr>
<tr>
<td>EENV 590</td>
<td>Master’s Thesis</td>
<td>1-10</td>
</tr>
</tbody>
</table>

Additional Recommended Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECIV 529</td>
<td>Groundwater Contamination</td>
<td>3</td>
</tr>
<tr>
<td>EENV 534</td>
<td>Environ Eng Investigation</td>
<td>3</td>
</tr>
</tbody>
</table>

* Substitution for this course requirement may be approved by the committee after carefully considering the professional goals of the student.

Each student’s graduate adviser and committee are to work with the student to prepare a Program of Study listing the courses the student will take. This program must be submitted to The Graduate School before the end of the second semester of study.

Master of Engineering in Chemical Engineering

General Requirements

• 30 credits total
• at least 21 of the total credits required for degree must be at 5xx level
• 3xx level courses are not allowed
• 4xx level courses may be used
• Courses with grades below C- cannot be used to satisfy graduate requirements
• Three credits (min.) registration required during term of graduation
• Max of 6 credits of individual problems courses (570)

Course Requirements

The following courses are required of each ME student:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHM 594</td>
<td>Seminar (can be taken twice)</td>
<td>1</td>
</tr>
<tr>
<td>ECHM 503</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ECHM 533</td>
<td>Transport Phenomena</td>
<td>3</td>
</tr>
</tbody>
</table>
Plus, a course in each of the following areas:

**Reaction Engineering**
- ECHM 510 Reaction Engineering/Modeling 3
- or EBIQ 566 Fundamentals of Biofilm Engr

**Advanced Mathematics**
- EGEN 505 Advanced Engineering Analysis 3
- or EGEN 506 Numerical Sol to Engr Problems

**Master of Engineering in Bioengineering**

**General Requirements**
- 30 credits total
- At least 21 of the total credits required for degree must be at 5xx level
- 3xx level courses are not allowed
- 4xx level courses may be used
- Courses with grades below C- cannot be used to satisfy graduation requirements
- Three credits (min.) registration required during term of graduation
- Max of 6 credits of individual problems courses (570)

**Course Requirements**
The following courses are required for each ME student:

- ECHM 594 Seminar (can be taken twice) 1
- ECHM 533 Transport Phenomena 3

Plus, a course in each of the following areas:

**Reaction Engineering**
- EBQ 566 Fundamentals of Biofilm Engr 3
- or ECHM 510 Reaction Engineering/Modeling

**Advanced Mathematics**
- EGEN 505 Advanced Engineering Analysis 3
- or EGEN 506 Numerical Sol to Engr Problems

**Course in Environmental Engineering Processes**
- EENV 562 Water Treatment Process/Design 3
- or EENV 563 Wastewater Treat Proc/Design

**Department of Civil Engineering**

Po Box 173900
Bozeman, MT 59717-3900
406-994-2111 Email: cedep@montana.edu (cedep@ce.montana.edu)

Home Page: www.montana.edu/ce

The department offers graduate study leading to Master of Science degrees in Civil Engineering or Environmental Engineering. The department also participates in the Doctor of Philosophy in Engineering degree program through the College of Engineering, specifically in the Civil Engineering, Applied Mechanics and Environmental Engineering options.

For the M.S. and Ph.D. degrees, major study is offered in various combinations of the subject areas of transportation engineering, geotechnical engineering, fluid mechanics, hydraulic and hydrologic engineering, structural engineering, engineering mechanics, and environmental engineering.

**Admission**
A bachelor’s degree in a similar engineering field is normally required for admission to the graduate programs in the department, although graduates in the physical and life sciences may be accepted. In certain cases, students may be required to make up subject area deficiencies before being admitted to the graduate program.

For more detailed information, interested students are referred to the Admission Policies and Application Requirements sections of the departmental website. Successful applicants are accepted into both the department and The Graduate School.

**Research Facilities**
The research facilities of the department include well-equipped laboratories for bituminous materials, concrete, hydraulics and fluid mechanics, structures, stress analysis, computer analysis, photogrammetry, geotechnical engineering, and environmental engineering. Civil Engineering students also frequently utilize the research facilities of the Center for Biofilm Engineering (CBE), the Western Transportation Institute (WTI) and the Subzero Science and Engineering Laboratory (SSEL).

**Financial Assistance**
Teaching and research assistantships are available in the department. Teaching assistantships involve assisting professors with the conduct of classes including preparation and grading. Research assistantships provide the opportunity for work on a research project under the direction of a faculty member. Results of the research done on an assistantship may form the basis for the graduate student’s professional paper, thesis or dissertation. For more information on appointment criteria for assistantships, see the Graduate Assistantships sections of the departmental website.

**Graduate Programs**
- M.S. in Civil Engineering (p. 349)
- M.S. in Environmental Engineering (p. 347)
- M.S. in Land Rehabilitation (p. 300)
- Ph.D. in Engineering (p. 351) (Options: Applied Mechanics, Environmental Engineering, Civil Engineering)

**MS in Civil Engineering**
Students may pursue the M.S. degree in any of the Civil Engineering Department programs under either Plan A or Plan B. Plan A (thesis) requires completion of a minimum of thirty-one (31) credits of work, including a thesis. Plan B (Professional Paper) requires completion of a minimum of thirty-one (31) credits of work, including a maximum of six (6) credits of Research or Prof Paper/Project (ECIV 575) / Research or Prof Paper/Project (EENV 575). One (1) credit of Seminar (ECIV 594) is required for both Plans A and B.

A research experience, acceptable to the student’s graduate committee, is required of all M.S. students. The Plan A student prepares a thesis that is submitted to the student’s graduate committee and defended at the oral comprehensive examination. A Plan B student prepares a professional paper that is submitted to the student’s adviser and presented at an ECIV 594 seminar.

Candidates for the M.S. degree must pass a comprehensive examination near the completion of their graduate program. Students are expected to be familiar with the degree requirements of both the department and The Graduate School. Refer to the For Master’s Students section.

Curriculum requirements are highly individualized and established in consultation with and approved by the student’s graduate committee.
M.S. in Environmental Engineering

Degree Options

• M.S. in Environmental Engineering - Thesis Option (Plan A) (p. 348)
• M.S. in Environmental Engineering - Non-Thesis Option (Plan B) (p. 350)

M.S. in Environmental Engineering - Non-Thesis Option (Plan B)

General Requirements

The Degree of M.S., Environmental Engineering is awarded through either the Civil or Chemical and Biological Engineering Departments, depending on the student’s background and professional focus. Degree candidates correspondingly must meet the requirements of the appropriate Department as enumerated below, as well as the requirements of the Graduate School. Each student’s graduate adviser and committee will work with the student to prepare a Program of Study listing the courses the student will take. This program must be submitted to The Graduate School before the end of the second semester of study.

Common requirements for both Departments include:

• Minimum 30 credits total (4xx or 5xx-level)
• Maximum of 9 credits taken at the 4xx level may be included in the program of study
• Courses graded below C- cannot be used to satisfy degree requirements
• Defense of professional paper
• Three credits (minimum) registration required during term of:
  • Comprehensive examination
  • Graduation (or 1 credit with in absentia request on file)

Additional specific requirements by department are listed below.

Civil Engineering Department Specific Requirements

Curriculum requirements for the M.S. degree in Environmental Engineering in the Civil Engineering Department are highly individualized and established in consultation with and approved by the student’s graduate committee. The courses listed below are often considered when establishing the program of study for a particular student. There are also many other courses offered at MSU that may support a student’s academic goals. The Civil Engineering Department also requires all students to take one credit of graduate seminar - ECIV 594 - during their final semester, which is in addition to the 30 credit minimum.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EENV 534</td>
<td>Environ Eng Investigation</td>
<td>3</td>
</tr>
<tr>
<td>EENV 540</td>
<td>Water Chemistry for Envir Engr</td>
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</tr>
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<td>Wastewater Treat Proc/Design</td>
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<td>EENV 565</td>
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<td>EENV 575</td>
<td>Research or Prof Paper/Project</td>
<td>1-4</td>
</tr>
<tr>
<td>EENV 591</td>
<td>Special Topics</td>
<td>1-3</td>
</tr>
<tr>
<td>EENV 592</td>
<td>Independent Study</td>
<td>1-3</td>
</tr>
<tr>
<td>EENV 598</td>
<td>Internship</td>
<td>2</td>
</tr>
<tr>
<td>ECIV 529</td>
<td>Groundwater Contamination</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 594</td>
<td>Seminar (Required)</td>
<td>1</td>
</tr>
</tbody>
</table>

EBIO 566   Fundamentals of Biofilm Engr 3
ECHM 503   Thermodynamics 3
ECHM 510   Reaction Engineering/Modeling 3
ECHM 533   Transport Phenomena 3

Chemical and Biological Engineering Department Specific Requirements

Master of Science in Environmental Engineering degree requirements through the Chemical and Biological Engineering Department are:

Course Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHM 594</td>
<td>Seminar (may be taken twice for credit)</td>
<td>1</td>
</tr>
<tr>
<td>ECHM 503</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ECHM 533</td>
<td>Transport Phenomena</td>
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</tr>
<tr>
<td>ECHM 556</td>
<td>Fundamentals of Biofilm Engr *</td>
<td>3</td>
</tr>
<tr>
<td>EENV 561</td>
<td>Environ Eng Reactor Theory</td>
<td>2</td>
</tr>
<tr>
<td>or ECHM 510</td>
<td>Reaction Engineering/Modeling</td>
<td></td>
</tr>
<tr>
<td>EENV 562</td>
<td>Water Treatment Process/Design</td>
<td>3</td>
</tr>
<tr>
<td>EENV 563</td>
<td>Wastewater Treat Proc/Design</td>
<td>3</td>
</tr>
<tr>
<td>EENV 575</td>
<td>Research or Prof Paper/Project</td>
<td>1-4</td>
</tr>
<tr>
<td>&amp; EENV 534</td>
<td>Environ Eng Investigation</td>
<td></td>
</tr>
<tr>
<td>or EENV 575</td>
<td>and Research or Prof Paper/Project</td>
<td></td>
</tr>
<tr>
<td>ECIV 529</td>
<td>Groundwater Contamination *</td>
<td>3</td>
</tr>
</tbody>
</table>

* Substitutions for these course requirements may be approved by the committee after carefully considering the background and professional goals of the student.

Each student’s graduate adviser and committee are to work with the student to prepare a program of study listing the courses the student will take. This program must be submitted to The Graduate School before the end of the second semester of study. Note: If the student is attempting to graduate in two semesters, the program of study and application for degree must be submitted by the third week of the second semester.

M.S. in Environmental Engineering - Thesis Option (Plan A)

This summary is intended to assist students in planning their program of study and presents commonly needed information in this regard. General University degree requirements are fully enumerated in the Graduate School Policies and Procedures. The information presented here is a combination of the general requirements of the Graduate School and specific departmental requirements.

General Requirements

The Degree of M.S., Environmental Engineering is awarded through either the Civil or Chemical and Biological Engineering Departments, depending on the student’s background and professional focus. Degree candidates correspondingly must meet the requirements of the appropriate Department as enumerated below, as well as the requirements of the Graduate School. Each student’s graduate adviser and committee will work with the student to prepare a Program of Study listing the courses the student will take. This program must be submitted to The Graduate School before the end of the second semester of study.

Common requirements for both Departments include:

• Minimum 30 credits total (including thesis credits)
• Minimum 20 credits coursework (4xx or 5xx-level)
• Minimum 10 credits: Master’s Thesis (ECHM 590) or Master’s Thesis (EBIO 590) or Master’s Thesis (EENV 590)
• Maximum of 9 credits taken at the 4xx level may be included in the program of study
• Courses graded below C- cannot be used to satisfy degree requirements
• Three credits (minimum) registration required during term of:
  • Comprehensive examination and thesis defense
  • Graduation (or 1 credit with in absentia request on file)

Additional specific requirements by department are listed below.

Civil Engineering Department Specific Requirements
Curriculum requirements for the M. S. degree in Environmental Engineering in the Civil Engineering Department are highly individualized and established in consultation with and approved by the student’s graduate committee. The courses listed below are often considered when establishing the program of study for a particular student. There are also many other courses offered at MSU that may support a student’s academic goals. The Civil Engineering Department also requires all students to take one credit of graduate seminar - ECIV 594 - during their final semester, which is in addition to the 30 credit minimum.

- ECIV 529 Groundwater Contamination 3
- EENV 540 Water Chemistry for Envir Engr 3
- EENV 561 Environ Eng Reactor Theory 2
- EENV 562 Water Treatment Process/Design 3
- EENV 563 Wastewater Treat Proc/Design 3
- EENV 565 Chem Sens/Instr Envir Biotech 2
- EENV 590 Master’s Thesis (Required) 10
- EENV 591 Special Topics 1-3
- EENV 592 Independent Study 1-3
- EENV 598 Internship 2
- ECIV 529 Groundwater Contamination 3
- ECIV 594 Seminar (Required) 1
- EBIO 566 Fundamentals of Biofilm Engr 3
- ECHM 503 Thermodynamics 3
- ECHM 510 Reaction Engineering/Modeling 3
- ECHM 533 Transport Phenomena 3

Chemical and Biological Engineering Department Specific Requirements
Master of Science in Environmental Engineering degree requirements through the Chemical and Biological Engineering Department are:

Requirements

- ECHM 594 Seminar (may be taken twice for credit) 1
- ECHM 503 Thermodynamics 3
- ECHM 533 Transport Phenomena 3
- EENV 561 Environ Eng Reactor Theory 2
  or ECHM 510 Reaction Engineering/Modeling
  or EBIO 566 Fundamentals of Biofilm Engr
- EENV 562 Water Treatment Process/Design * 3
  or EENV 563 Wastewater Treat Proc/Design
- EENV 590 Master’s Thesis 1-10

Additonal Recommended Courses

- ECIV 529 Groundwater Contamination 3

* Substitution for this course requirement may be approved by the committee after carefully considering the professional goals of the student.

Each student’s graduate adviser and committee are to work with the student to prepare a Program of Study listing the courses the student will take. This program must be submitted to The Graduate School before the end of the second semester of study.

M.S. in Land Rehabilitation
Course work in land rehabilitation is designed to serve students new to the rehabilitation field, as well as to experienced individuals or those already working in land rehabilitation or restoration ecology and who desire further education and training. Montana State University offers core courses in land rehabilitation and restoration ecology, and a very strong array of supporting courses in relevant disciplines. These courses are integrated with the core curriculum to add breadth and depth to the program and to make specialization possible in a given aspect of land rehabilitation. Site revegetation, soil remediation, restoration of riparian zones and stream channels, remediation of contaminated sites, and management of invasive plants are among the many potential areas of study. Emphasis is placed on developing a broad understanding of soil, plant and hydrological processes as foundation to effective applications. With the exception of required core courses, course sequences will be designed to correspond with the specific needs, interests and educational goals of the individual student. This program emphasizes soil, vegetation and water sciences, and graduates are expected to be well versed in these areas in addition to the student’s particular area of interest.

Core Curriculum
30 credits minimum (10 thesis, 20 course work) required for master’s degree. 2/3 of total credits must be 500 level. Candidates for the M.S. degree in Land Rehabilitation must complete a 8 credit core curriculum. Elective credits will reflect foundational courses as well as student’s special interests. A minimum of 20 credits of coursework must be taken from MSU.

Required Core Courses (8 credits) Credits
- LRES 563 Restoration Ecology 3
- ENSC 460 Soil Remediation 3
- LRES 562 Land Rehab Field Problem 2

Engineering Ph.D.
Dean
Brett Gunnink
Associate Dean for Faculty & Administration
Anne K. Camper
Associate Dean for Student Success
Christine M. Foreman

The Doctor of Philosophy in Engineering degree is offered through the College of Engineering. The most current information on requirements for the degree can be found at: www.coe.montana.edu/graduate_programs.html

Candidates will be admitted to both the College of Engineering and The Graudate School under one of seven options:
**Applied Mechanics**

This option involves research in areas central to engineering mechanics including solid mechanics, fluid mechanics, thermal mechanics, geomechanics, and structures.

Coordinating Departments: Chemical and Biological Engineering, Civil Engineering, and Mechanical and Industrial Engineering. Typical Research Areas: solid mechanics, fluid mechanics, biomechanics, thermal sciences, structural mechanics.

**Chemical Engineering**

This option involves research in transport phenomena in complex systems, biofilms, biological materials, and the chemical and biochemical transformation of materials.

Coordinating Department: Chemical and Biological Engineering. Typical Research Areas: extremophilic bioprocessing, in situ biocatalyzed heavy metal biotransformations in natural and engineered biological systems, biomaterials, bioinformatics, colloidal system dynamics, metabolic engineering, metabolic systems analysis, biofuels processing, composite materials, durability of materials, surface interactions, catalysis, membrane materials, separations.

**Civil Engineering**

This option involves research in geotechnical engineering, structural engineering, transportation engineering, environmental engineering, water resources engineering, and construction management.

Coordinating Departments: Civil Engineering and Mechanical and Industrial Engineering. Typical Research Areas: geosynthetics, seismic response of structures and foundations, innovative structural materials, intelligent transportation systems, transportation operations, transportation planning, recycled pavements and base materials, road ecology and constructed wetlands.

**Environmental Engineering**

This option involves research in all areas of the environment including soil, water, and air, with emphasis on microbial interactions with natural and engineered systems.

Coordinating Departments: Chemical and Biological Engineering and Civil Engineering. Typical Research Areas: bioremediation, wetlands, water treatment, wastewater treatment, solid and hazardous waste treatment, biofilm engineering.

**Industrial Engineering**

This option involves research related to areas of Industrial Engineering.

Coordinating Department: Mechanical and Industrial Engineering. Typical Research Areas: transportation safety, human factors, service systems engineering, virtual reality, health care, ergonomics, leadership and change management, usability engineering, engineering education, and concurrent engineering.

**Mechanical Engineering**

This option involves research in advance structures and materials, fluid dynamics, and energy systems.


**Application and Admission**

1. Applications can be submitted online through The Graduate School (http://www.montana.edu/gradschool/apply.html) (all information below will be asked during the online application process and a non-refundable $60 application fee will be required prior to submitting your application)

   Minimum College Requirements for Full Admission:
   - At least a 3.0 undergraduate GPA.
   - GRE scores of Verbal >=152 (53%), Quantitative >=153 (56%) and Analytical Writing >=3.5.
   - Favorable letters of recommendation from three references.
   - Graduate GPA (if applicable) of 3.2 or better.
   - International Students: TOEFL scores of 580 (237 for computer test version) or greater or a minimum International English Language Testing System (IELTS) band score of 7.
   - A personal statement of of up to 2 pages describing the applicant’s research interests, prior research activities (if applicable), and career goals. If the applicant has no direct research experience, they should describe the experiences and activities they have that they believe have prepared them to undertake research.
   - A two page CV or résumé describing the applicant’s prior background.

2. Department/s attach summary admission form and circulate application to option coordinator and potential advisers for faculty recommendation.

3. Department Head reviews application in conjunction with faculty recommendation, and exercises one of the following options.
   - Full admission - Forward to The Graduate School.
   - Provisional admission - Determine conditions that candidate will be accepted and notes actions to be taken, then forwards to The Graduate School
   - Reject admission because of academic qualifications.
   - Reject admission based on lack of fit with COE research programs or the lack of a potential adviser.

4. Associate Dean responsible for graduate studies in the College of Engineering reviews applications, returns to department for submission to The Graduate School.

5. The Graduate School reviews application to ensure GS standards are met with the following possible options.
   - Accept
   - Reject
   - Return to Department Head and Associate Dean with recommendation for further consideration.

6. Applicant is informed with a letter of acceptance or rejection by The Graduate School.

Acceptance into the program is not always a guarantee of funding (tuition or stipend). Students should establish a dialogue with their chosen department to determine the availability of funding.

If there are course deficiencies that are identified in the student’s educational background, these must be completed prior to full admission (matriculation).

For those entering without having an adviser/major professor previously identified, students should secure an adviser as early as possible, but no later than the end of the third semester of registration in the Ph.D. program. During the selection process, there should be discussions with the student.
that include an understanding of funding available to the student and the
term of commitment.

**Degrees Offered**
- Ph.D. in Computer Science (p. 359)
- Ph.D. (p. 363) in Electrical & Computer Engineering (p. 363)
- Ph.D. in Engineering with options in:
  - Applied Mechanics (p. 354)
  - Chemical Engineering (p. 354)
  - Civil Engineering (p. 354)
  - Environmental Engineering (p. 355)
  - Industrial Engineering (p. 355)
  - Mechanical Engineering (p. 356)

**Program Requirements**
To satisfy the requirements for the Ph.D. in Engineering, the student will take a minimum of 60 credits beyond the bachelor’s degree according to the table below. Different options within the Ph.D. in Engineering and individual graduate student committees may require additional coursework beyond the minimum requirements (see Declared Option Coursework section later in this document).

For students entering with a Masters degree, up to 24 graded credits may be applied (see below). However, the Seminar (ENGR 694) and Rich & Mhds in Engineering (ENGR 610) requirements and a minimum of 13 additional graded course credits must still be taken at Montana State University. Depending on option requirements, students may have the option (with approval of the committee) of using some of their M.S. credits toward the advanced mathematics and numerical methods requirements.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 610 Rich &amp; Mhds in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 694 Seminar</td>
<td>2</td>
</tr>
<tr>
<td>Advanced Mathematics - see declared option coursework *</td>
<td>3</td>
</tr>
<tr>
<td>Numerical Methods - see declared option coursework *</td>
<td>3</td>
</tr>
<tr>
<td>Other Graded Courses - see declared option coursework</td>
<td>24</td>
</tr>
<tr>
<td>Dissertation</td>
<td>18</td>
</tr>
<tr>
<td>Additional Dissertation or Course credits</td>
<td>7</td>
</tr>
</tbody>
</table>
* Course content must be above and beyond that typically required for an undergraduate degree in the student’s Ph.D. option area.
** ENGR 694 should be taken the semester prior to scheduling the comprehensive exams as this seminar class helps the student to prepare the written proposal for their comprehensive.

Total Credits 60

Credits applied from a prior Masters degree must:
- be graded course credits (e.g., not M.S. thesis or independent study credits),
- have a grade of B or higher (or equivalent), and
- be approved by the student’s graduate committee.

Students are expected to attend the COE Seminar Series presentations.

**Note for Students Entering Without a Prior Degree in Engineering**
If a student enters the Ph.D. program without a prior degree in engineering from an accredited program and is interested in pursuing registration as a professional engineer, they should consult with their department head and major professor to determine what coursework and other experiences may be needed to ensure they are on a pathway to seek licensure. These requirements vary with discipline and the state where licensure is sought.

**Examination Requirements**
General information about forms required for completion of examinations can be found on The Graduate School (http://www.montana.edu/gradschool/current-grad.html)’s website.

Ph.D. candidates within the College of Engineering at Montana State University must pass a qualifying examination, a comprehensive examination, and a defense of dissertation. The general rules governing these follow. Options may have more specific requirements; see the specifics under option requirements below.

**Ph.D. Qualifying Examination**
The purpose of the qualifying examination is to determine whether the student has sufficiently mastered the core topics within their chosen area of study. It will be a written examination on undergraduate engineering topics determined by the student’s chosen Ph.D. option area and administered by that option’s committee.

Each Ph.D. Option Committee will offer a qualifying examination annually to students in that option. The qualifying examination will be completed within three semesters but typically within two semesters of full admission (matriculation) into the Ph.D. program. Failure to take the examination in that time period may result in suspension of Ph.D. candidate status, including stipend. The committee will document the results of the examination in a letter to the student, and in the student’s file.

**Ph.D. Comprehensive Examination**
The purpose of the Ph.D. comprehensive examination is to determine whether the student is ready for independent research in their chosen area of study. The comprehensive examination is administered by the student’s graduate committee (including the Graduate Representative assigned by The Graduate School), and must be completed within two years after passing the qualifying examination. It is also recommended that the student has taken 2/3 of their graded coursework. In addition, students should have completed ENGR 694 prior to taking the exam; the course is designed to help the student has sufficiently mastered the core topics within their chosen area of study.

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The comprehensive examination will be administered by the student’s graduate committee in advance of the oral presentation, by a date agreed to by the option’s committee.

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The comprehensive examination will be administered by the student’s graduate committee in advance of the oral presentation, by a date agreed to by the option’s committee.

The Ph.D. comprehensive examination is comprised of:
- A written proposal for the student’s Ph.D. dissertation, and
- An oral presentation of the proposal and oral examination.

The candidate will prepare a written proposal associated with the research topic for the Ph.D. dissertation, in a format designated by the Ph.D. Option. The successful proposal will include a significant literature review, preliminary research to date, and the research proposed to complete the Ph.D. The written proposal will be presented to the student’s graduate committee in advance of the oral presentation, by a date agreed to by the student and graduate committee.

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The student’s graduate committee will inform the student of the results of the comprehensive examination immediately following the oral examination and committee deliberation, and will document the results on the appropriate form filed with The Graduate School. A student not passing the comprehensive will have one opportunity to retake the comprehensive after a span of six months has passed. Failure to pass the examination on the second attempt is grounds for dismissal from the Ph.D. program.

There may be additional requirements for these exams specified in the option requirements.

Dissertation Defense
The dissertation defense will consist of two parts: an open seminar of the research results and a closed session with the student’s committee and the graduate representative. Written notification of the results within one week of the defense must be delivered to The Graduate School and the student. Committee members must approve the dissertation, along with the Department Head, and Vice Provost for Graduate Education. Deadline for the dissertation approval is 14 working days before the end of the term for a given semester.

If failure occurs at the first attempt, a second defense must be held. At least six months must elapse before the second examination takes place, with the time period not to exceed nine months. Failure of the second exam will result in suspension from the program.

Graduation Application
An application to graduate is prepared by the student, approved by the major professor, and submitted to The Graduate School through the student’s academic department. Applications are due to The Graduate School September 20th for a Fall Semester graduation, February 5th for a Spring Semester graduation and June 10th for Summer semester graduation.

The student’s graduate committee will inform the student of the results of the comprehensive examination immediately following the oral examination and committee deliberation, and will document the results on the appropriate form filed with The Graduate School. A student not passing the comprehensive will have one opportunity to retake the comprehensive after a span of six months has passed. Failure to pass the examination on the second attempt is grounds for dismissal from the Ph.D. program.

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There may be additional requirements for these exams specified in the option requirements.
Degree in meeting the Ph.D. credit requirements, at the discretion of the student’s Ph.D. committee.

Qualifying Examination: The diversity of backgrounds of students pursuing this option requires that the qualifying examination subject material and to some extent format be responsive to these backgrounds. The exam will be administered during an 8-hour period of mutual agreement between the adviser, student and PhD option coordinator. The student will be given a packet of up to 10 questions on undergraduate Civil Engineering topics appropriate to the sub-discipline of the proposed research and related topics. Each problem will be designed to be solved in about an hour, and the student must submit 6 solutions. Problem solutions will be graded by the faculty member who presented that topic. Students will be provided an opportunity to examine their results, however, in order to protect the questions from dissemination they will not be permanently returned. A grade for the qualifying examination of Pass (P), Fail (F) or RemEDIATE (R) will be given for each candidate. In cases where remediation in certain topic areas is required, the Ph.D. adviser will develop a problem solving based plan with the Ph.D. candidate to prepare for a retest on the identified topic areas. The retest must occur prior to completion of the following semester and will be overseen by the Ph.D. adviser. Students may apply for a Ph.D. qualifying examination waiver (for instance if they have completed the Master of Science written comprehensive examination at Montana State University in the same sub-discipline as is the focus of their proposed Ph.D. studies).

Comprehensive Examination: The proposal should be in the NSF format, in compliance with the current year’s grant proposal guidelines (gpg) at www.nsf.gov (http://www.nsf.gov) unless otherwise agreed to by the student’s committee. A public oral seminar of 30 to 40 minutes plus 10 minutes of public questions, on the research to date and proposed research to complete the Ph.D., will be given by the Ph.D. candidate. This will be followed by a closed-session oral examination of up to 2 hours administered by the student’s Ph.D. committee. A written exam on graduate level environmental engineering topics may be required of graduate students who have a GPA in graduate coursework of less than 3.5.

Environmental Engineering

Of the credits in the Option coursework noted above, 12 credits from the following subset of courses are required, with no more than 6 credits at the 400 level. Equivalent courses from prior MS degrees may be used to satisfy this requirement.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EENV 441</td>
<td>Natural Treatment Systems</td>
<td>3</td>
</tr>
<tr>
<td>EENV 443</td>
<td>Air Pollution Control</td>
<td>3</td>
</tr>
<tr>
<td>EENV 445</td>
<td>Hazardous Waste Treatment</td>
<td>3</td>
</tr>
<tr>
<td>EENV 447</td>
<td>Hazardous Waste Management</td>
<td>3</td>
</tr>
<tr>
<td>EENV 534</td>
<td>Environ Eng Investigation</td>
<td>3</td>
</tr>
<tr>
<td>EENV 540</td>
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<td>Fundamentals of Biofilm Engr</td>
<td>3</td>
</tr>
</tbody>
</table>

The remaining credits are to be established by the student and the major professor in consultation with the student’s graduate committee.

Qualifying Examination: The diversity of backgrounds of students pursuing this option requires that the qualifying examination subject material and to some extent format be responsive to these backgrounds.

The exam will be administered during a 6-hour period of mutual agreement between the adviser, student and PhD option coordinator. The student will be given a packet of questions that cover environmental engineering and related topics, each designed to be solved in approximately an hour. The student must submit 4 solutions out of 7 topic areas. The qualifying exam may be on undergraduate Environmental Engineering topics including: Water Quality Parameters, Water Chemistry, Drinking Water Treatment, Wastewater Treatment, Reactors/Kinetics/Stoichiometry, Hydraulics, Porous Media Flow & Groundwater Contamination, Air Pollution Control & Air Quality, Solid & Hazardous Waste Management, Fluid Mechanics, Transport Phenomena, Thermodynamics. The exam will be open book, open notes format. Each question the student chooses to answer will be graded by the Faculty member that submitted the question. The results will be analyzed by a Committee composed of the Environmental Engineering Faculty and a grade of Pass (P), Fail (F) or Remediate (R) will be given to the candidate for each topic. In cases where remediation in certain topic areas is required, the Ph.D. adviser will develop a problem solving based plan with the Ph.D. student to prepare for a retest on the identified topic areas. The retest must occur within six months and will be overseen by the Ph.D. adviser. Students may apply for a Ph.D. qualifying examination waiver (for instance if they have completed the Master of Science written comprehensive examination at Montana State University in Environmental Engineering).

Comprehensive Examination: The proposal should be in the NSF format, in compliance with the current year’s grant proposal guidelines (gpg) at www.nsf.gov unless otherwise agreed to by the student’s committee. A public oral seminar of 30 to 40 minutes plus 10 minutes of public questions, on the research to date and proposed research to complete the Ph.D., will be given by the Ph.D. candidate. This will be followed by a closed-session oral examination of up to 2 hours administered by the student’s Ph.D. committee. A written exam on graduate level environmental engineering topics may be required of graduate students who have a GPA in graduate coursework of less than 3.5.

Industrial Engineering

The requirements for the IE Option of the Ph.D. in Engineering degree are summarized below:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 610</td>
<td>Resch &amp; Mthds in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 694</td>
<td>Seminar</td>
<td>2</td>
</tr>
<tr>
<td>Advanced Mathematics: EGEN 505, EIND 554, or EIND 557</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Numerical Methods: EGEN 506, EIND 558, or EIND 509</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EIND 5XX Courses</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>EIND 4XX*, Other 4XX/5XX*, EIND 592</td>
<td>12-16</td>
<td></td>
</tr>
<tr>
<td>Dissertation: EIND 690</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>TOTAL CREDITS</td>
<td></td>
<td>60 Minimum</td>
</tr>
</tbody>
</table>

*The total number of 400-level course credits taken must comply with Graduate School policies.

EIND 490, EIND 492, EIND 499, EIND 575 and EIND 590 cannot be used towards the PhD course requirements. EIND 592 may be counted as an EIND 4XX level course. Double counting is not allowed; that is, each course can be applied only to fulfill one requirement. Other courses may qualify pending approval in writing from the student’s graduate committee.

Qualifying Examination: The exam will be administered on the second Tuesday in February of the Spring semester. Students will be examined on the following three Industrial Engineering topics: engineering probability...
& statistics (e.g. EIND 354), work design & analysis (e.g. EIND 313), and engineering economy (e.g. EGEN 325). Additionally, students will choose from one of the following Industrial Engineering topics: principles of operations research (e.g. EIND 364), ergonomics and human factors engineering (e.g. EIND 413), or engineering management & ethics (EIND 300). The exam will be 5 hours duration in an open book, open notes format. Each problem set will be graded by the faculty member who most recently taught the course. The results will be analyzed by the Industrial Engineering Ph.D. Option Coordinator, and each candidate will receive a grade of Pass (P), Fail (F) or Remediate (R). Students will not be given the test back in order to protect the questions from dissemination. In cases where remediation in certain topic areas is required, the Ph.D. advisor will develop a problem-solving-based plan with the Ph.D. candidate to prepare for a retest on the identified topic areas. The retest must occur prior to the next fall semester and will be overseen by the Ph.D. Advisor.

Comprehensive Examination: The public research seminar will include 40 minutes for the student’s presentation and 10 minutes for questions from the audience. This will be followed immediately by a closed-session oral examination of 45-90 minutes by the student’s Ph.D. committee and additional remediation may be required at this point.

Mechanical Engineering
The advanced mathematics and numerical methods classes are specified:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGEN 505</td>
<td>Advanced Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 506</td>
<td>Numerical Sol to Engr Problems</td>
<td>3</td>
</tr>
</tbody>
</table>

Requirements include:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM 525</td>
<td>Continuum Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Thermo-fluids Mechanics</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Solid Mechanics</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

The remaining credits to be established by the student and the major professor in consultation with the graduate committee.

Qualifying Examination: The exam will be administered on the second Tuesday in February of the Spring semester. The undergraduate Mechanical Engineering topics will include: Thermodynamics, Heat (energy) transfer, Fluid Mechanics, Structural Mechanics, Materials, Dynamics and Vibrations, and Mathematics. Students will solve problems in 4 of the 7 topic areas. The exam will be 5 hours duration in an open book, open notes format. Each problem set will be graded by the faculty member that submitted the set. The results will be analyzed by the Mechanical Engineering graduate studies committee, and each candidate will receive a grade of Pass (P), Fail (F) or Remediate (R). Students will not be given the test back in order to protect the questions from dissemination. In cases where remediation in certain topic areas is required, the Ph.D. advisor will develop a problem-solving-based plan with the Ph.D. candidate to prepare for a retest on the identified topic areas. The retest must occur prior to the next fall semester and will be overseen by the Ph.D. advisor.

Comprehensive Examination: The public research seminar will include 40 minutes for the student’s presentation and 10 minutes for questions from the audience. This will be followed immediately by a closed-session oral examination of 45-90 minutes by the student’s Ph.D. committee and additional remediation may be required at this point.

Gianforte School of Computing
357 Barnard Hall
Bozeman, MT 59717
406-994-4780

www.gsoc.montana.edu
soc-info@montana.edu

Director
John Paxton (http://www.cs.montana.edu/faculty/john-paxton.html)

Research Experience
Thesis option master’s degree students gain research experience through their theses and are expected to submit the results of their thesis work to at least one journal or conference. Ph.D. students gain research experience through their doctoral work, journal or conference submissions, and attending conferences.

Research Facilities
Graduate research and coursework can be performed on systems owned and operated by the School of Computing. On-campus work is typically performed in laboratories or graduate student offices. A typical machine is a dual boot (Linux / Windows) PC. Intel-based Macs running OSX are also available. Outside the department, the MSU Information Technology Center provides additional computing infrastructure.

The School of Computing is housed in MSU’s high technology Barnard Hall.

Financial Assistance
A number of research and teaching assistantships are available for qualified graduate students. These appointments are normally for 19 hours per week during the academic year. Some appointments may also be available during the summer. Assistantships will only be offered to formally admitted graduate students. See the appropriate CS M.S. degree or Ph.D. degree website for more information.

Graduate Programs
• M.S. in Computer Science (p. 359)
• Ph.D. in Computer Science (p. 359)

M.S. Degree Program
A Bachelor’s degree in Computer Science is recommended. Students with non-computer science degrees at the Bachelor’s level or above are also encouraged to apply; such students will generally be required to take appropriate courses while enrolled at MSU to make up computer science and related subject matter deficiencies prior to full acceptance into the computer science Master’s program. Factors that the department uses in its admissions process include GRE scores, TOEFL scores (for non-native English speakers), reference letters, GPA and previous coursework. For more information, please refer to www.cs.montana.edu/future-students-masters-program.html.

Details about applying can be found at www.montana.edu/gradschool/admissions/apply.html.

Ph.D. Degree Program
The degree is generally intended for students who have a B.S. or M.S. degree in Computer Science and who want to pursue a research and/or college-level teaching career. The program requires coursework, research, exams and the writing of a dissertation.

Admission to the doctoral program follows the requirements of The Graduate School. Factors that the department uses in its admissions process include GRE scores, TOEFL scores (for non-native English speakers), reference letters, GPA and previous coursework. For more information, please refer to www.cs.montana.edu/future-students-phd.html.
Details about applying can be found at www.montana.edu/gradschool/admissions/apply.html. The Computer Science Department encourages applicants to use the online application procedure.

**Computer Science Bachelor of Arts**

**Freshman Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 107 - Joy and Beauty of Computing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 216Q - Introduction to Statistics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>WRIT 101W - College Writing I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>University CORE</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Broadening Coursework</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CSCI 127 - Joy and Beauty of Data</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>STAT 217Q - Intermediate Statistical Concepts</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>University Seminar CORE</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>University CORE</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Broadening Coursework</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td>15</td>
<td>16</td>
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</table>

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 132 - Basic Data Structures and Algorithms</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>M 165Q - Calculus for Technology I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>University CORE</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Broadening Coursework</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>CSCI 232 - Data Structures and Algorithms</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CSCI 246 - Discrete Structures</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>WRIT 221 - Intermediate Tech Writing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Broadening Coursework</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td>16</td>
<td>16</td>
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</table>

**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESOF 322 - Software Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Broadening Coursework CS Electives</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>University CORE</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Broadening Coursework</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Broadening Coursework CS Electives</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>University CORE</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Broadening Coursework</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS Electives</td>
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<td></td>
</tr>
<tr>
<td>Broadening Coursework</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ESOF 423 - Software Engineering Applications</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CSCI 481 - Program Assessment</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CS Electives</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Broadening Coursework</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Year Total:</strong></td>
<td>14</td>
<td>13</td>
</tr>
</tbody>
</table>

**Total Program Credits:**

120

**Broadening Coursework:**

The Computer Science B.A. must be paired with one of following tracks:

- Track 1: completion of an approved complimentary major,
- Track 2: completion of an approved complimentary minor AND the first year of a modern language. (101 & 102D in ARAB, CHIN, FRCH, GRMN, JPNS or SPNS), or
- Track 3: completion of a faculty-approved Plan which must include the first year of a modern language. (101 & 102D in ARAB, CHIN, FRCH, GRMN, JPNS or SPNS)

**Track One: Approved Complimentary Majors**

**College of Arts and Architecture**

- Art (B.A. and B.F.A.)
- Environmental Design
- Film and Photography
- Music
- Music Technology
- Music Education

**College of Education, Health**

- Elementary Education K-8
- Secondary Education
- Technology Education
- Community Health
- Early Childhood Education and Child Services
- Food and Nutrition
- Health and Human Performance
- Health Enhancement (Health and Physical Education)
- Hospitality Management
- Human Development and Family Science
- Sustainable Food & Bioenergy Systems

**Jake Jabs College of Business and Entrepreneurship**

- Accounting
- Finance
- Management
- Marketing

**College of Letters and Science**

- American Studies
- Asian Studies
- Anthropology
- Economics
- English
- History
- Liberal Studies
- Modern Languages and Literature
- Philosophy
- Political Science
- Psychology
- Sociology
## Track Two: Approved Complimentary Minors

In addition to any of the minors listed below, the first year of a modern language (101 & 102D in ARAB, CHIN, FRCH, GRMN, JPNS or SPNS) must be completed.

### College of Arts and Architecture

- Art History Minor (http://catalog.montana.edu/undergraduate/artsarchitecture/art/art-history-minor-nonteaching): 27 credits
- Music Minor (http://catalog.montana.edu/undergraduate/artsarchitecture/music/music-minor-nonteaching): 28 credits
- Photography Minor (http://catalog.montana.edu/undergraduate/artsarchitecture/film-photography/photography-minor-nonteaching): 28 credits

### College of Education, Health and Human Development


### College of Letters and Science

- Anthropology Minor (http://catalog.montana.edu/undergraduate/letters-science/anthropology/anthropology-minor-nonteaching): 21 credits plus advisor-approved Anthropology coursework to reach 27 credits
- China Studies Minor (http://catalog.montana.edu/undergraduate/letters-science/modern-languages-literatures/china-studies-minor-nonteaching): 28 credits
- English Literature Minor (http://catalog.montana.edu/undergraduate/letters-science/english/english-literature-minor): 21 credits plus advisor-approved BA coursework to reach 27 credits.
- French Minor (http://catalog.montana.edu/undergraduate/letters-science/modern-languages-literatures/french-minor-nonteaching): 27 credits
- German Minor (http://catalog.montana.edu/undergraduate/letters-science/modern-languages-literatures/german-minor-nonteaching): 27 credits
- Hispanic Studies Minor (http://catalog.montana.edu/undergraduate/letters-science/modern-languages-literatures/hispanic-studies-minor-nonteaching): 27 credits
- History Minor (http://catalog.montana.edu/undergraduate/letters-science/history/history-minor-nonteaching): 22-25 credits plus advisor-approved BA coursework to reach 27 credits.
- Native American Studies Minor (http://catalog.montana.edu/undergraduate/letters-science/native-american-studies/native-american-studies-minor-nonteaching): 21 credits plus advisor-approved BA coursework to reach 27 credits.
- Philosophy Minor (http://catalog.montana.edu/undergraduate/letters-science/philosophy/philosophy-minor-nonteaching): 21 credits plus advisor-approved BA coursework to reach 27 credits.
- Psychology Minor (http://catalog.montana.edu/undergraduate/letters-science/psychology/psychology-minor-nonteaching): 23 credits plus (PSYX 490 or PSYX 495, 3 credits) plus (PSYX 499, 3 credits): 29 credits

### Jake Jabs College of Business and Entrepreneurship

- Accounting Minor (http://catalog.montana.edu/undergraduate/business/business-minors/accounting-minor): 24 credits plus a fourth 3-credit accounting elective to reach 27 credits
- Business Administration Minor (http://catalog.montana.edu/undergraduate/business/business-minors/business-administration-minor): 30 credits
- Finance Minor (http://catalog.montana.edu/undergraduate/business/business-minors/finance-minor): 30 credits
- International Business Minor (http://catalog.montana.edu/undergraduate/business/business-minors/international-business-minor): 30 credits

### Track Three: Faculty Approved Plan

#### College of Agriculture

**Agricultural Business Plan: 33 credits**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECNS 1011S</td>
<td>Economic Way of Thinking</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 202</td>
<td>Principles of Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 2041S</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 301</td>
<td>Intermediate Micro with Calc</td>
<td>3</td>
</tr>
<tr>
<td>ACTG 201</td>
<td>Principles of Financial Acct</td>
<td>3</td>
</tr>
<tr>
<td>AGBE 321</td>
<td>Economics of Ag Marketing</td>
<td>3</td>
</tr>
<tr>
<td>AGBE 341</td>
<td>Farm and Ranch Management</td>
<td>3</td>
</tr>
<tr>
<td>AGBE 345</td>
<td>Ag Finance and Credit Analysis</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Targeted Economics Elective Courses - Choose Two (6 credits)</td>
<td></td>
</tr>
<tr>
<td>AGBE 421</td>
<td>Advanced Ag Marketing</td>
<td>3</td>
</tr>
<tr>
<td>AGBE 445</td>
<td>Agribusiness Management</td>
<td>3</td>
</tr>
<tr>
<td>AGBE 451RS</td>
<td>Economics of Ag Policy</td>
<td>3</td>
</tr>
</tbody>
</table>
### Political Science Plan: 27 credits

**Required Courses**
- PSCI 201: Scope and Methods of Political Science
- PSCI 210S: Introduction to American Government
- PSCI 230D: Introduction to International Relations
- PSCI 240: Introduction to Public Administration
- PSCI 250: Introduction to Political Theory

**Upper Division Elective Courses** (12 credits)
- Earn 12 credits from any upper-level PSCI courses

Total Credits: 27

**Notes:** Supporting courses include STAT 216Q and M 161Q or M 171Q. Students in the Computer Science B.A. program will be allowed to substitute M 165Q for the M 161Q/M 171Q calculus requirements. ECNS 251IS Honors Economics (4 credits) may be substituted for the Three-course sequence: ECNS 251IS ECNS 202, and ECNS 204IS. Students completing this plan would also receive credits required for the minor.

### Applied Economics Plan: 27 Credits

**Required Courses** (18 Credits)
- ECNS 101IS: Economic Way of Thinking
- ECNS 202: Principles of Macroeconomics
- ECNS 204IS: Microeconomics
- ECNS 301: Intermediate Micro with Calc
- ECNS 303: Intermediate Macro with Calc
- ECNS 403R: Intro to Econometrics

**Targeted Elective Courses** - Choose Three (9 Credits)
- AGBE 321: Economics of Ag Marketing
- AGBE 345: Ag Finance and Credit Analysis
- AGBE 421: Advanced Ag Marketing
- AGBE 445: Agribusiness Management
- AGBE 451RS: Economics of Ag Policy
- ECNS 309: Managerial Economics
- ECNS 312: Labor Economics
- ECNS 313: Money and Banking
- ECNS 314: International Economics
- ECNS 317: Economic Development
- ECNS 320: Public Finance
- ECNS 332: Econ of Natural Resources
- ECNS 345: Econ Org, Finance & Credit
- ECNS 432R: Benefit-Cost Analysis

**Notes:** Supporting courses include STAT 216Q and M 161Q or M 171Q. Students in the Computer Science B.A. program will be allowed to substitute M 165Q for the M 161Q/M 171Q calculus requirements. ECNS 251IS Honors Economics (4 credits) may be substituted for the Three-course sequence: ECNS 251IS ECNS 202, and ECNS 204IS. Students completing this plan would also receive credits required for the minor.

### Honors College Plan 27 Credits.
- 27 credits that include 8 upper division credits as follows:
  - HONR 123, or HONR 124: 1 credit
  - HONR 131 (for transfer students): 4 credits
  - Text and Critics (Select one option)
    - HONR 201US and HONR 202IH: 8 credits
    - HONR 301US (for transfer students): 4 credits
  - HONR 450 (Student Fellow): 4 credits
  - Additional non-STEM honors courses to bring the credit total to 27. These courses include 400-level Honors Seminars, Honors Tutorials or Honors Independent Studies, Honors Special Topic Courses, Honors Sociology, Economics, Psychology, Music and Society, Mentoring Gifted Students, Great Expeditions, etc.

### Custom Plan.
- 27 Credits. If you are interested in using a plan other than the ones listed above, you may work with appropriate faculty to develope a custom plan. The plan must be approved by the appropriate parties. Meet with John Paxton to learn more.

### M.S. in Computer Science

An M.S. student must complete a minimum of 30 credits of coursework beyond the Bachelor's degree. Students may pursue the Master's degree under a thesis option or a courses only option. For more information, please refer to www.cs.montana.edu/current-students-masters-program.html.

Courses only Master’s candidates whose cumulative GPA is less than a 3.5 in their last semester must take a written comprehensive exam near the completion of their graduate program. Those students whose cumulative GPA is 3.5 or better do not need to take a comprehensive exam. Thesis Master’s candidates must present and defend their thesis in a public departmental seminar. Required courses include:

- CSCI 532: Algorithms
- CSCI 538: Computability
- CSCI 590: Master’s Thesis (thesis option only)

### Ph.D. in Computer Science

A Ph.D. student must complete a minimum of 60 credits of coursework beyond the Bachelor’s degree or a minimum of 30 credits of coursework beyond the Master’s degree. The degree requirements for the Ph.D. degree are found at www.cs.montana.edu/current-students-phd.html.

**Required courses include:**
- CSCI 532: Algorithms
- CSCI 538: Computability
- CSCI 690: Doctoral Thesis (thesis option only)

**And four courses from the following:**
- CSCI 520: Distributed Systems
Students. This requirement is met by students in the Doctoral program for degree requirement details.

Computer Engineering option. Please refer to the Program information tab for the Doctor of Philosophy (Ph.D.) degree in Engineering, Electrical and Computer Engineering under either Plan A (thesis) or Plan B (professional paper); and the Master of Science (M.S.) degree in Electrical Engineering, and the Doctor of Philosophy degree in Engineering, Electrical & Computer Engineering option. Fields in which the student may specialize include communication systems, computation systems, energy and materials, Micro-Electro-Mechanical Systems (MEMS), optical systems and photonics, and sensors and systems. Information regarding active research programs is available at http://ece.montana.edu/research/.

Admission

Admission to our graduate program requires a bachelor’s degree in electrical or computer engineering or a closely related field (for example, physics, computer science, mathematics, etc.). Students with bachelor’s degrees in fields other than electrical and computer engineering (ECE) complete several additional courses to gain proficiency in key undergraduate ECE areas.

All applicants are required to submit scores from the General Test of the Graduate Record Examination (GRE) along with other application materials. A minimum quantitative GRE score of 155 is required, and most students in our program score significantly higher. A minimum verbal GRE score of 150 is recommended.

International students must have a minimum TOEFL score of 90 on the internet-based test, or a minimum IELTS score of 7.0, to be considered for admission with full standing.

Details of the admission requirements and application procedures are available at http://ece.montana.edu/research/applying.htm.

Degree Requirements

Students may pursue the Master of Engineering (M.Eng.) degree, Electrical Engineering option; the Master of Science (M.S.) degree in Electrical Engineering under either Plan A (thesis) or Plan B (professional paper); and the Doctor of Philosophy (Ph.D.) degree in Engineering, Electrical and Computer Engineering option. Please refer to the Program information tab for degree requirement details.

Research Experience

Research experience is required of all Master’s of Science and Doctoral students. This requirement is met by students in the Doctoral program and the MS Plan A program through their thesis work, whereas students in the MS Plan B program must fulfill this requirement through satisfactory participation in an acceptable research or practice-oriented project approved by the student’s adviser. Each student in MS Plan B must register for EELE 575 Research/Prof Paper/Project for three credits.

Research

Faculty and graduate students participate in research in many important fields, including:

- Communication Systems: wireless communication systems, ad-hoc networks, fiber optic communication components and systems, micro-machined mm-wave components, antennas, and atmospheric propagation.
- Energy and Materials: fuel cells, fuel cell materials, fuel cell modeling and control; renewable resource and fuel cell distributed generation systems; fuzzy logic and neural network applications to power system control; load management; reduced-component power electronic design and motor drives.
- Optical Systems and Photonics: Micro-Optical-Electro-Mechanical Systems (MOEMS), micro-machined mirrors and applications in confocal microscopes, spectrometers, and sensors; optics of nanostructures and near-field optical interactions; optical remote sensing systems and applications; lidar development and applications to measuring atmospheric aerosols, clouds, and gases; radiometric and polarimetric imaging system development and calibration; optical sensors for detecting explosives and biological species; optical communication components, systems, and networks.
- Sensors and Systems: MEMS sensors and components; micro-machined sensors; lidars, laser sensors, radiometric and polarimetric imagers (see Optics section above); electronic sensors and systems for data acquisition and optical system control; acoustic and audio sensing of environmental noise and wildlife.

Research facilities in the department include: state-of-the-art electronics laboratories; optics laboratories with a variety of lasers, imagers, and electro-optical measurement tools; the Montana Microfabrication Facility with class 100, 1000, and 10,000 capabilities; a machine shop; a microwave and millimeter-wave electronics laboratory; a power and power electronics research laboratory, fuel cell characterization facilities; an audio and acoustics laboratory; and roof-port and roof-top facilities for optical remote sensing. Students have access to all the leading electronics, electromagnetic, and optical design and analysis software resources.

Financial Assistance

A number of research and teaching assistantships are available for qualified graduate students. All applicants are considered automatically for financial support and do not need to apply separately.

Degrees Offered

- M. Eng in, Electrical Engineering (p. 361)
• M.S. in Electrical Engineering Plan A (thesis) (p. 361)
• M.S. in Electrical Engineering Plan B (professional paper) (p. 361)
• Ph.D. in Electrical Engineering (p. 363)
• Ph.D. in Materials Science (p. 409)

Interdisciplinary Degrees Offered
• M.S. in Optics and Photonics Plan A (thesis) (p. 361)
• M.S. in Optics and Photonics Plan B (professional paper) (p. 362)

Additional information is available in the Electrical & Computer Engineering Department’s Graduate Student Handbook. (http://ece.montana.edu/research/gradbook.pdf)

M.Eng. in Engineering Electrical Engineering option

Degree requirements--30 credits total (credits older than 6 years are not applicable to the degree):
  • >= 18 500-600-level credits (no more than 12 credits can be at the 400 level)
  • <= 9 credits of non-EELE rubric classes
  • <= 6 credits Independent Study (EELE 592)
  • <= 3 credits pass/fail
  • <= 6 credits challenged
  • <= 9 credits credits can be reserved for graduate credit during an undergraduate program.
  • No credits of 488, 489, 490, 492, or 589

| 500-600 Level Courses (18 or more credits) | 18 |
| Other Graduate Courses (400 level or above, 12 or fewer credits) | 12 |
| **Total Credits** | **30** |

M.S. in Electrical Engineering Plan A

A written departmental Graduate Study Qualifying Examination is administered to all M.S. students in their first year of work.

Degree requirements--30 credits total:
  • 10 credits EELE 590, Master’s Thesis
  • 20 course credits:
    • >=10 500-600-level credits (no more than 10 credits can be at the 400 level)
    • <= 4 credits Independent Study (EELE 592)
    • <= 10 credits 592 + seminars (594)
    • <= 3 credits pass/fail (excluding thesis)
    • <= 6 credits challenged
    • No credits of 488, 489, 490, 492, or 589

| EELE 590 | Masters’ Thesis | 10 |
| 500-600 Level Courses (10 or more credits) | 10 |
| Other Graduate Courses (400 level or above, 10 or fewer credits) | 10 |
| **Total Credits** | **30** |

M.S. in Electrical Engineering Plan B

A written departmental Graduate Study Qualifying Examination is administered to all M.S. students in their first year of work.

Degree requirements--30 credits total:
  • 3 credits, EELE 575 (Professional Paper)
  • 27 course credits:
    • >= 17 500-600-level credits (no more than 10 credits can be at the 400 level)
    • <= 6 credits Independent Study (EELE 592)
    • <= 10 credits 592 + seminars (594)
    • <= 3 credits pass/fail
    • <= 6 credits challenged
    • No credits of 488, 489, 490, 492, or 589

| 500-600 Level Courses (17 or more credits) | 17 |
| Other Graduate Courses (400 level or above, 10 or fewer credits) | 10 |
| **Total Credits** | **30** |

M.S. in Optics and Photonics Plan A

The M.S. Degree in Optics and Photonics is an interdisciplinary, cooperative program managed by the Optics Program Committee on behalf of the three participating departments: Physics, Electrical and Computer Engineering, and Chemistry and Biochemistry. Students apply directly to the Optics and Photonics Graduate Program and are admitted through one of the participating departments, selected based on advisor affiliation and student interest.

The Optics and Photonics degree is distinct from the other graduate degrees offered by the participating departments because it requires interdisciplinary coursework involving at least two of the departments. The interdisciplinary program of study allows students to emphasize optics theory and applications in more depth than is possible through degrees in the traditional disciplines. Each optics student will be mentored by a graduate advisor from the faculty of one of the three participating departments, and a graduate supervisory committee made up of faculty from at least two of the three departments in the cooperative program.

The M.S. Plan A requires completion of an acceptable research-based Thesis describing independent research performed by the student with guidance from the advisor and graduate supervisory committee. The Thesis involves considerable effort on the part of the student, and must generate results that are of sufficient quality and significance to be reported in a national or international conference paper or presentation. The Master’s Thesis often serves as the basis for a peer-reviewed manuscript for an archival journal or book chapter.

More information on the admission requirements, application process, and degree requirements can be found at: M. S. in Optics and Photonics (http://www.physics.montana.edu/grad/opticsMS.html)

Choose two key courses (one PHSX and one EELE):
  • PHSX 427 Advanced Optics
  • PHSX 437 Laser Applications
  • EELE 482 Electro-Optical Systems
  • EELE 484 Laser Engineering

Choose one specialty course:
  • EELE 581 Fourier Optics/Imaging Theory
  • EELE 582 Optical Design
  • PHSX 531 Nonlinear Optics/Laser Spectroscopy
  • CHMY 527 Analytic Optical Spectroscopy
  • CHMY 560 Symmetry, Orbitals, and Spectroscopy
**M.S. in Optics Plan B**

The M.S. Degree in Optics and Photonics is an interdisciplinary, cooperative program managed by the Optics Program Committee on behalf of the three participating departments: Physics, Electrical and Computer Engineering, and Chemistry and Biochemistry. Students apply directly to the Optics and Photonics Graduate Program and are admitted through one of the participating departments, selected based on advisor affiliation and student interest.

The Optics and Photonics degree is distinct from the other graduate degrees offered by the participating departments because it requires interdisciplinary coursework involving at least two of the departments. The interdisciplinary program of study allows students to emphasize optics theory and applications in more depth than is possible through degrees in the traditional disciplines. Each optics student will be mentored by a graduate advisor from the faculty of one of the three participating departments, and a graduate supervisory committee made up of faculty from at least two of the three departments in the cooperative program.

The Plan B program emphasizes coursework, but also includes preparation of a required Professional Paper. The paper, prepared under the guidance of the student’s advisor, covers a focused aspect of research, design, or engineering education. The Professional Paper is generally not as comprehensive as the research Thesis required for the M.S. Degree Plan A, but it is desirable that the Plan B Professional Paper be of sufficient quality and scope to serve as the basis for a conference paper or presentation.

More information on the admission requirements, application process, and degree requirements can be found at: M.S. in Optics (http://www.physics.montana.edu/grad/opticsMS.html)

### Optics electives (choose at least 6 credits):  6

- EEE 432 Applied Electromagnetics
- EEE 482 Electro-Optical Systems
- EEE 484 Laser Engineering
- EEE 538 Adv Top Electromagnet & Optics
- EEE 581 Fourier Optics/Imaging Theory
- EEE 582 Optical Design
- EEE 583 Remote Sensing Systems
- PHSX 427 Advanced Optics
- PHSX 437 Laser Applications
- PHSX 507 Quantum Mechanics II
- PHSX 516 Advanced Topics In Physics
- PHSX 520 Electromagnetic Theory II
- PHSX 531 Nonlinear Optics/Laser Spectroscopy
- CHMY 421 Advanced Instrument Analysis
- CHMY 527 Analytic Optical Spectroscopy
- CHMY 557 Quantum Mechanics
- CHMY 560 Symmetry, Orbitals, and Spectroscopy
- CHMY 564 Adv Quantum Chemistry
- CHMY/PHSX/CHMY 591 Special Topics
- CHMY/PHSX/CHMY 592 Independent Study
- OPTI 594 Optics Seminar

### Technical electives (choose at least 5 credits):  5

- ECE, Physics, Math, Chemistry, Business, etc. (400-level or above)

### Master’s Thesis (EELE/PHSX/CHMY 590)  10

### Total Credits  30

**Note:** At least 20 credits must be at the 500 level.

1 A maximum of three (3) credits total among these courses is allowed if the subject is directly related to optics, upon approval by the academic advisor and research advisor/instructor.

2 A maximum of two (2) credits total of optics seminar is allowed.

### Choose two key courses (one PHSX and one EEELE):  6

- PHSX 427 Advanced Optics
- PHSX 437 Laser Applications
- EEE 482 Electro-Optical Systems
- EEE 484 Laser Engineering

### Choose one specialty course:  3

- EEE 581 Fourier Optics/Imaging Theory
- EEE 582 Optical Design
- PHSX 531 Nonlinear Optics/Laser Spectroscopy
- CHMY 527 Analytic Optical Spectroscopy
- CHMY 560 Symmetry, Orbitals, and Spectroscopy

### Optics electives (choose at least 6 credits):  6

- EEE 432 Applied Electromagnetics
- EEE 482 Electro-Optical Systems
- EEE 484 Laser Engineering
- EEE 538 Adv Top Electromagnet & Optics
- EEE 581 Fourier Optics/Imaging Theory
- EEE 582 Optical Design
- EEE 583 Remote Sensing Systems
- PHSX 427 Advanced Optics
- PHSX 437 Laser Applications
- PHSX 507 Quantum Mechanics II
- PHSX 516 Advanced Topics In Physics
- PHSX 520 Electromagnetic Theory II
- PHSX 531 Nonlinear Optics/Laser Spectroscopy
- CHMY 421 Advanced Instrument Analysis
- CHMY 527 Analytic Optical Spectroscopy
- CHMY 557 Quantum Mechanics
- CHMY 560 Symmetry, Orbitals, and Spectroscopy
- CHMY 564 Adv Quantum Chemistry
- CHMY/PHSX/CHMY 591 Special Topics
- CHMY/PHSX/CHMY 592 Independent Study
- OPTI 594 Optics Seminar

### Technical electives (choose at least 12 credits):  12

- ECE, Physics, Math, Chemistry, Business, etc. (400-level or above)

### Professional Paper (OPTI 575)  3

### Total Credits  30

**Note:** At least 20 credits must be at the 500 level.

1 A maximum of three (3) credits total among these courses is allowed if the subject is directly related to optics, upon approval by the academic advisor and research advisor/instructor.

2 A maximum of two (2) credits total of optics seminar is allowed.
Ph.D. in Electrical Engineering

Ph.D. students earn at least 60 post-baccalaureate credits, including at least 18 credits of dissertation work. In progressing toward this degree, the student must pass the following examinations:

1. A written departmental Graduate Study Qualifying Examination administered to all M.S. and Ph.D. students in their first year of work.
2. A comprehensive examination to be taken within two years of the qualifying examination and after completing two-thirds of their total coursework.
3. A final oral examination and defense of a dissertation based on the student's research.

There is no foreign language requirement for the degree.

Degree requirements—60 credits total:
- 3 credits Research & Experimental Methods in Engineering (ENGR 610) in 1st semester
- 2 credits Seminar (ENGR 694), taken just before the comprehensive examination
- 3 credits Advanced Math (committee approved)
- 3 credits Numerical Methods (committee approved)
- 18 credits Doctoral Thesis (EEL 690)
- At least 31 additional credits (400 and graduate level) comprising:
  - 24 credits of graded coursework
  - 7 credits of either additional graded coursework or additional dissertation work (EEL 690)

Notes:
- With the approval of the student’s doctoral committee, up to 24 credits of prior coursework with grade of B or better from a previously earned master’s degree can be applied toward the required coursework of the ECE PhD. With committee approval, master’s degree courses can be used to satisfy the Advanced Math and Numerical Methods course requirements.
- Applicable coursework taken beyond the master’s degree may include no more than 9 credits at the 400-level.
- All PhD credits no more than ten (10) years old at time of graduation (this limit does not apply to courses counted from a previously earned master’s degree).
- A minimum of 30 credits applicable to the degree must be taken at MSU (i.e., up to 30 credits can be transfer credits, if acceptable to the student’s committee).
- Regardless of how many course credits are applied from a previously earned master’s degree, the PhD program of study must include at least 12 credits of courses in the major area taken at Montana State University.
- ≤ 6 credits Independent Study (EEL 592)
- ≤ 9 credits pass/fail (excluding dissertation)
- ≤ 9 credits challenged
- No credits of 488, 489, 490, 492, 575, or 589 are allowed

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 610</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 694</td>
<td>2</td>
</tr>
<tr>
<td>Advanced Math Course</td>
<td>3</td>
</tr>
<tr>
<td>Numerical Methods</td>
<td>3</td>
</tr>
<tr>
<td>Doctoral Thesis</td>
<td>18</td>
</tr>
<tr>
<td>Graded Coursework</td>
<td>24</td>
</tr>
<tr>
<td>Other Graduate Courses or additional Doctoral Thesis credits</td>
<td>7</td>
</tr>
<tr>
<td>Total Credits</td>
<td>60</td>
</tr>
</tbody>
</table>

Department of Mechanical and Industrial Engineering

Contact Information

Department Head
Daniel A. Miller, Ph.D.
220 Roberts Hall; (406) 994-2203
danmiller@montana.edu

Graduate Program Coordinator
Sarah Codd, Ph. D.
314 Roberts Hall; (406) 994-1944
scodd@montana.edu

Application Deadlines

Priority Deadline for Domestic and International Students wanting to be considered for funded assistantships:
- Fall Priority - February 1st
- Spring Priority – September 15th

Regular Application Deadlines for Domestic Students:
- Fall - July 1st
- Spring - November 15th

Regular Application Deadlines for International Students:
- Fall - May 1st
- Spring - September 15th

Department funding for Graduate Teaching Assistants (GTA) and Graduate Research Assistants (GRA) is not guaranteed. GTA and GRA funding is typically decided in April and November for the upcoming semester. Applications received after that time will be considered for funding only if opportunities and funds are available.

Research Facilities

The Mechanical and Industrial Engineering Department has well-equipped facilities and laboratories to support instruction and research. These include Advanced Structures, Computer Integrated Manufacturing, Decision Support Systems and Operations Research, Fluid Mechanics, Fuel Cells, Heat Transfer, Human Factors, Facilities Design, Instrumental Analysis, Materials Science, and Micro-Electromechanical Systems. Extensive facilities for destructive and non-destructive testing of advanced materials and structures are available. Advanced manufacturing facilities for composite materials and structures are continually expanding. Arrangements can also be made for graduate students to use the research facilities of other University departments. The M&IE Department, the College of Engineering, and the MSU campus maintain well-equipped computer labs with a complete complement of hardware and software for student use in coursework and research activities. Research is sponsored by industry and governmental agencies.

Examinations

All Mechanical Engineering and Industrial and Management Engineering master’s degree students must follow the degree requirements listed in the Steps to Completing a Master’s Degree (http://www.montana.edu/gradschool/current-grad.html) section.
Doctoral candidates are required to pass three examinations: Ph.D. qualifying examination, Ph.D. comprehensive examination, and Ph.D. thesis defense. Refer to the Steps to Completing a Doctoral Degree (http://www.montana.edu/gradschool/current-grad.html) and Ph.D. in Engineering sections for additional information.

Students are expected to be familiar with department, college and Graduate School requirements.

Financial Assistance
Both teaching and research assistantships are available on a competitive basis. Teaching assistantships involve assisting professors with the conduct of their classes, including preparation and grading. Research assistantships provide the opportunity for work on a research grant or industry sponsored project under the direction of a faculty member. Interested applicants should make inquiry directly to the Graduate Program Coordinator in the Mechanical & Industrial Engineering Department.

See the Graduate Assistantships (http://www.montana.edu/gradschool) sections for detailed information on appointment criteria.

Graduate Programs
• M.S. in Industrial and Management Engineering (p. 364)
• M.S. in Mechanical Engineering (p. 364)
• M.Eng. in Mechanical Engineering (p. 364)
• Ph.D. in Engineering -- Industrial Engineering option (p. 351)
• Ph.D. in Engineering -- Mechanical Engineering option (p. 351)
• Ph.D. in Materials Science (p. 409)

Industrial and Management Engineering
The Master of Science degree in Industrial and Management Engineering degree may be accomplished under Plan A (thesis required) or Plan B (project or professional paper). Under either plan, a program of study is arranged for each student according to his/her particular goal.

Admission
Industrial and Management Engineering
The minimum requirement for admission is a Bachelor of Science degree and evidence of an ability to maintain a minimum 3.0 grade point average while pursuing a graduate degree. Applicants without a degree in Industrial Engineering (or similar) are eligible to apply, but may be required to make up subject matter deficiencies upon admission. For complete information, refer to the Admission Policies and Application Requirements sections in the department website. Successful applicants are accepted into both the department and The Graduate School.

Below are the GRE and TOEFL scores the graduate committee is looking for. They will consider lower scores with other excellent qualifications, but these higher scores will give you a better chance of success in this program.

• GRE average scores: GRE-V = 149, GRE-Q = 155, GRE-A = 3.7
• GRE preferred scores: GRE-V = 152, GRE-Q = 156, GRE-A = >3.8
• TOEFL average score: 84
• TOEFL preferred score: 99
• IELTS minimum score: 6.5

Research Requirements
Industrial and Management Engineering
Research experience is required for the M.S. degree in Industrial and Management Engineering, Plan A only. Areas of study include operations research, engineering economy, computer modeling, applied statistics, simulation, logistics, management engineering, human factors, ergonomics, computer integrated manufacturing, quality control, and production planning and scheduling.

Master’s students following Plan B (project or professional paper) choose additional coursework and a graduate project in lieu of completing a thesis. Plan B students complete a graduate project, under the supervision of a professor, in the student’s particular area of interest, and demonstrate their ability to define, organize, and follow through on a small research investigation. The project requires both oral and written reports.

Plan A - Thesis Option
If you earned an Industrial Engineering undergraduate degree, then you take the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I&amp;ME 500-level courses**</td>
<td>12 (min.)</td>
</tr>
<tr>
<td>I&amp;ME 400-level (or 400 level non-I&amp;ME courses)*</td>
<td>9 (max.)</td>
</tr>
<tr>
<td>EIND 590 Master’s Thesis</td>
<td>10</td>
</tr>
</tbody>
</table>

If you earned a Non-Industrial Engineering undergraduate degree, then you take the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I&amp;ME 500-level courses**</td>
<td>12 (min.)</td>
</tr>
<tr>
<td>I&amp;ME 400-level courses*</td>
<td>9 (max.)</td>
</tr>
<tr>
<td>EIND 590 Master’s Thesis</td>
<td>10</td>
</tr>
</tbody>
</table>

Plan B - Non-Thesis Option
If you earned an Industrial Engineering undergraduate degree, then you take the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I&amp;ME 500-level courses***</td>
<td>21</td>
</tr>
<tr>
<td>I&amp;ME 400-level (or 400 level non-I&amp;ME courses)*</td>
<td>12 (max.)</td>
</tr>
</tbody>
</table>

If you earned a Non-Industrial Engineering undergraduate degree, then you take the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I&amp;ME 500-level courses***</td>
<td>21</td>
</tr>
<tr>
<td>I&amp;ME 400-level courses*</td>
<td>12 (max.)</td>
</tr>
</tbody>
</table>

* A maximum of three credits of EIND 592 may be applied to satisfy 400 level requirement.
** EIND 575 may not be used to satisfy degree requirements.
*** In fulfilling the 500 level requirements, students may elect to complete a maximum of six credits of EIND 575.

Mechanical Engineering

Degrees Offered
• Master of Science In Mechanical Engineering (MSME)
• Master of Engineering in Mechanical Engineering (M.Eng. ME)
• Ph.D. in Engineering -- Mechanical Engineering Option

Admission
Applicants must present evidence of graduation with a bachelor’s degree in engineering with ability to maintain a “B” average. Graduates in other fields may be accepted, but generally these students have to make up background
material in certain subject areas. Refer to the Admission Policies and Application Requirements sections for detailed admission and application requirements. Successful applicants are accepted into both the Department and The Graduate School.

Below are the GRE and TOEFL scores the graduate committee is looking for. They will consider lower scores with other excellent qualifications, but these higher scores will give you a better chance of success in this program.

- GRE average scores: GRE-V = 149, GRE-Q = 155, GRE-A = 3.7
- GRE preferred scores: GRE-V = 152, GRE-Q = 156, GRE-A > 3.8
- TOEFL average score: 84
- TOEFL preferred score: 99
- IELTS minimum score: 6.5

For a M.S. in Mechanical Engineering, research is required in Plan A only. Students following Plan B or the Master of Engineering (M.Eng, ME) are not required to write a thesis, and will fill a total of 30 credits with coursework.

Research Requirements
For a M.S. in Mechanical Engineering, research is required in Plan A only.

Plan A - Thesis Option (MSME)
21 formal, graded course credits: 12 required, 9 elective; 1 seminar; 10 thesis = 32 credits minimum

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGEN 505</td>
<td>Advanced Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EGEN 506</td>
<td>Numerical Sol to Engr Problems</td>
<td>3</td>
</tr>
<tr>
<td>EM 525</td>
<td>Continuum Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>3 Graduate course credits outside the student’s emphasis</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EMEC 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>EMEC 590</td>
<td>Master’s Thesis (Minimum of 10 total credits required; take 1-10 per term.)</td>
<td>10</td>
</tr>
</tbody>
</table>

Elective Courses (Maximum of 3 cr. EMEC 592) 9

Total Credits 32

Plan B - Non-Thesis Option
The Plan B option substitutes an archival journal submission paper (3-4 credits) and additional coursework in lieu of the 10 thesis credits. This option is reserved for students enroute to a Ph.D.

Master of Engineering in Mechanical Engineering (M.Eng, ME) - Non-Thesis Option
Two major curricular/program components distinguish the Master of Engineering degree from the Master of Science degree:

- No professional paper or thesis is required for the M. Eng.

M. Eng. students are likely to either be practicing engineers or continuing students who wish to acquire credits required for professional licensure. In the first case, the students have experience in practical engineering and the concepts involved in a capstone experience. In the latter case, all senior engineering students at Montana State University have completed a senior design project that is of the same depth as most professional papers, and this is also true of practically all accredited undergraduate engineering programs. Eliminating the thesis or professional paper requirement provides students the opportunity for more coursework in an area of interest.

- The M. Eng. has no comprehensive examination.

Because this is a courses-only degree that requires students to maintain a 3.0 GPA, there will be no further proof of proficiency. The intent is to provide education for practicing professionals.

Students will be supervised by an option coordinator, not by a three-member committee typical for M.S. degrees.

General Requirements

- 30 credits total
- At least 18 of the total credits required for degree must be at 5xx level
- 3xx level courses are not allowed
- 4xx level courses may be used (maximum allowed is 12 credits)
- Courses with grades below C cannot be used to satisfy graduation requirements
- Three credits (min.) registration required during term of graduation (1 credit with in absentia graduation request on file)
- A maximum of six credits of individual problems courses (570) are allowed
- In addition to the required courses, the Master of Engineering requires additional coursework in lieu of the 10 thesis credits.

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credits</th>
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</thead>
<tbody>
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</tr>
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<td>EM 525</td>
<td>Continuum Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>3 Graduate course credits outside the student’s emphasis</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>EMEC 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>EMEC 590</td>
<td>Master’s Thesis (Minimum of 10 total credits required; take 1-10 per term.)</td>
<td>10</td>
</tr>
</tbody>
</table>

Elective Courses (Maximum of 3 cr. EMEC 592) 9

Total Credits 30

Link to M.Eng, home page for More Information (http://www.coe.montana.edu/m_eng.html#ME).

College of Letters and Science
Graduate Programs offered in the College of Letters and Science

American Studies Program (p. 366)
- M.A. in American Studies (p. 367)
- Ph.D. in American Studies (p. 366)

Department of Agricultural Economics and Economics (p. 291)
- M.S. in Applied Economics (p. 292)

Department of Cell Biology and Neuroscience (p. 368)
- M.S. in Biological Sciences (p. 369)
- M.S. in Neuroscience (p. 369)
- Ph.D. in Biological Sciences (p. 369)
- Ph.D. in Neuroscience (p. 369)

Department of Chemistry and Biochemistry (p. 369)
- M.S. in Chemistry (p. 371)
American Studies Program

The American Studies Graduate Program is designed to train students to think critically, to conduct research effectively, and to write lucidly. Students research and write in seminar settings as well as individually under the guidance of each student’s graduate committee. The program seeks to expand students’ intellectual horizons and expose students to the variety of roles in academic and public life through seminar discussions, classroom instruction, teaching assistantships, and internships.

Admission Requirements
- Baccalaureate degree in American Studies or closely related field
- Official undergraduate transcripts from all universities attended
- Three letters of recommendation
- Letter of intent that addresses the applicant’s areas of intended study and the applicant’s qualifications for Master's level work.
- Writing sample

Contact Information
For more information about the American Studies Graduate programs, please contact the History and Philosophy Department at amerstudies@montana.edu or by calling 406-994-4395.

Programs
- Ph.D. of Philosophy in American Studies (p. 366)
- M.A. in American Studies (p. 367)

American Studies offers the degrees of Master of Arts and Doctor of Philosophy, with a special focus on the American West. Major fields include American Arts, American History, American Literature, American Pluralism, and Public History.

Focus Areas
American Arts
Explore how visual and performing arts have shaped and reflected American culture, both past and present.

American History
MSU is internationally recognized for its strength in American history from the colonial period through the present.

American Literature
MSU offers a breadth and depth literary theory of past and present American Literature.

American Pluralism
Explore why American is considered a "nation of nations" by drawing on expertise from faculty in the departments of Anthropology, Latin American Studies, Native American Studies, Religious Studies, and Women's Studies.

Public History
Develop research interests and critical theory dedicated to understanding the roles of museums, historical sites, and heritage tourism in American culture.

Doctor of Philosophy in American Studies
Course Requirements
The program is built upon research and intensive course work that will normally require four years of full-time work. Students must complete a minimum of 60 credit hours post-baccalaureate, of which at least 18 must be dissertation credits.
All students are required to take AMST 501 Methods in American Studies and AMST 502 Research in American Studies. Additional coursework will be selected from by the student in conjunction with his or her committee chair and committee members.

**Major Field**

All students must declare a major field of emphasis, by the third semester of study. The major field will normally require at least 12 credits of coursework. The major fields are:

- American Arts
- American History
- American Literature
- American Pluralism
- Public History

**Supporting Area**

All students must declare a supporting area, which will normally be acquired through three courses (9 credits) and a four-hour written examination administered by the supporting area adviser. The supporting area will be a thematic field, for example, Native American Studies, Technology and Culture, Women’s Studies.

**Foreign Language Requirement**

PhD students are required to demonstrate reading knowledge of at least one foreign language. Competency will determined by an examination administered by the program, normally in conjunction with the Department of Modern Languages and Literatures. The foreign language requirement must be completed successfully before a student can present the dissertation proposal.

**Master of Arts in American Studies**

**Five-Year M.A.**

**Course Requirements**

The Master of Arts degree requires completion of 30 credits, of which no more than 9 can be at the 400-level. Students who enter the program after receiving their baccalaureate degree will normally require two years of full-time work to complete it.

The program includes a 10-credit Master's Thesis (Plan A) option, and an all course-work (Plan B) option. All students are required to take AMST 501 Methods in American Studies, and AMST 502 Research in American Studies. Additional course work will be selected by the student in conjunction with his or her committee chair and committee members. Under Plan A, students must register for a minimum of 10 credits of AMST 590 Master's Thesis and defend their thesis in an oral examination. The format of thesis work is determined by The Graduate School.

**Graduate Committee**

A student’s committee will consist of a chair and two additional members. The committee must be formed by the end of the second semester of attendance.

**Department of Agricultural Economics and Economics**

**Department Head**

Dr. Gregory Gilpin  
P.O. Box 172920  
306 Linfield Hall, Bozeman, MT 59717-2920  
Tel: 406-994-3701  Fax: 406-994-4838  
Email: ageconadvising@montana.edu

Our Master of Science degree in Applied Economics encourages students to develop and apply their skills in economic analysis and examine a wide array of economic and political issues. Learning takes place through coursework in economic theory, quantitative methods, and econometrics, through collaborative work with departmental faculty, and through an intensive research thesis that addresses an important economic issue selected by the student.

**Admission**

Core graduate courses are taught at a level that requires entering students to have successfully completed courses in intermediate microeconomic and macroeconomic theory, calculus, matrix algebra, and statistics. Applicants who have not completed the prerequisite material, but who have apparent potential for graduate study, may be admitted to the program on a provisional basis. A math review course is offered prior to Fall semester each year for all incoming graduate students. Applicants must submit Graduate Record Examination (GRE) scores, official transcripts of all degree coursework, three letters of recommendation, and an application fee of $60. A personal statement is recommended but is not required. Foreign applicants must also include English proficiency test scores from: TOEFL [80], IELTS [level 6.5] or PTE [54]; this test is necessary for applicants who are not U.S. citizens and not from countries where English is the official language. To apply for the M.S. in Applied Economics, visit our website: www.montana.edu/gradschool/apply.html

**Degree Requirements**

A core of economic theory and quantitative methods courses (or equivalent) is required. Students are required to maintain a 3.0 grade point average overall in their core courses and the courses in their graduate program. Failure to meet these requirements, as well as receipt of more than one grade less than a “B-” in the core courses will be grounds for termination.

See Program Requirements on the department website for course information.

**Student Graduate Committee**

Faculty members in our Department have expertise in a wide variety of fields. Some examples of graduate topics taught by our faculty are advanced economic theory, static and dynamic optimization models in economics, the dynamic effects of fiscal & monetary policy on the macroeconomy, theory and use of regression analysis, public policy, and research methodology. Our faculty takes an active interest in our students, and this one-on-one contact with faculty in our department is consistently given high praise among our students.

**Financial Assistance**

A number of research and teaching assistantships are available for graduate students and are awarded on a competitive basis. Late applications will be considered as space and funding become available. To ensure full consideration for assistantship awards for Fall semester, applications should be received by January 15. For further information, refer to the Graduate Assistantships sections on the department website.

**Degree Offered**

- M.S. in Applied Economics (p. 292)

**M.S. in Applied Economics**

**Program Requirements**

A core of economic theory and quantitative methods courses (or equivalent) is required. Students are required to maintain a 3.0 grade point average overall in their core courses and the courses in their graduate program. Failure to meet these requirements, as well as receipt of more than one
grade less than a "B−" in the core courses will be grounds for termination. The core includes:

**Required Core Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AGBE 467</td>
<td>Quantitative Method in Ag Econ</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 401</td>
<td>Microeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 501</td>
<td>Microeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 502</td>
<td>Macroeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 561</td>
<td>Econometrics I</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 562</td>
<td>Econometrics II</td>
<td>3</td>
</tr>
<tr>
<td>ECNS 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>ECNS 594</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>ECNS 590</td>
<td>Master’s Thesis</td>
<td>10</td>
</tr>
</tbody>
</table>

In addition to theory and quantitative methods core courses, students will successfully complete ECNS 569 Research Methodology. Supplementary coursework and research may focus on agricultural economics, natural resource economics, or general applied economics. Through continued discussions with the advisor and other faculty, students will select additional courses and either a thesis topic (Plan A) or research paper topic (Plan B) to complete a program of study consistent with their interests.

Students may choose to study special problems on an individual basis. Students desiring "Individual Problem" credit as either ECNS 592 Independent Study, AGBE 592 Independent Study, or AGBE 591 Special Topics should consult with a faculty member and agree upon a plan of study before the beginning of the semester in which the credits are to be undertaken. The Graduate School must approve all such courses, and limits the number of credits applicable toward degree requirements as: maximum of 3 credits for Option A or 6 credits for Option B.

**Under Plan A**, required minimums are: 20 semester credits (including the core courses of graduate coursework), and 10 semester credits of thesis. For those who have satisfied coursework prerequisites, the required degree coursework should be completed in two semesters. The thesis must be acceptable to the student’s graduate committee and to The Graduate School, and it must demonstrate independent and original research.

**Under Plan B**, a thesis is not required. This option includes at least 30 semester credits of graduate coursework. Students who select Option B are required to include a Professional Paper and Project (ECNS 575); maximum of 4 credits in a semester and a maximum of 6 credits for the program) as part of their program. For those who have satisfied coursework prerequisites, the required degree coursework (other than the research paper) should be completed in two or three semesters. The paper must be original, of professional quality (meet style and format requirements set forth in The Graduate School Guide for Preparation of Thesis and Professional Papers), be acceptable to the student’s graduate committee, and receive final approval by the Department Head.

Two examinations complete degree requirements. Each student is required to pass a Microeconomics Theory Core Exam – a written exam administered by the Department’s Graduate Affairs Committee. The exam is offered early spring semester, and may be offered one additional time each year; it will consist of questions covering the fundamental concepts of microeconomic theory and their application.

In addition to the Core Exam, each student is required to pass an oral examination in defense of their thesis (Option A) or research paper (Option B). The oral examination is administered by the student’s graduate committee and is open to all members of the faculty. Students are expected to present a typed draft, in final form, of the thesis or research paper to each member of their graduate committee at least seven days prior to the scheduled date of their examination. The examination for Option

A students should not be scheduled until the student’s thesis committee agrees that the thesis is essentially in a form acceptable to the University Library (that is, copies of the typed draft should be readable and have a table of contents, list of tables and figures, chapter titles, section headings, bibliography, and consecutively numbered pages). The examination for Option B students should not be scheduled until the paper is in a form that satisfies style and format requirements.

**Department of Cell Biology and Neuroscience**

**Department Head**
Roger Bradley, Ph.D.

**Graduate Coordinator**
Thomas Hughes, Ph.D.

Montana State University
510 Leon Johnson Hall, Bozeman, MT 59717
406-994-5395 Email: thughes@montana.edu

The Department of Cell Biology and Neuroscience offers exciting opportunities to work with nationally and internationally recognized faculty on a wide range of research topics, including cognitive neuroscience, neurophysiology, developmental biology, cell biology and biophysics. It is the goal of the faculty to prepare our students for successful careers in academic research, government, and/or the biotechnology industry. Successful applicants to the program will have already established a commitment to excellence through academic achievements and prior research experience.

We offer Ph.D. or M.S. degrees in Neuroscience or Biological Science to our graduate students. The Ph.D. Degree Program is designed for students who are committed to a scientific research career and are willing to commit an average of 5 to 6 years in pursuit of the training that is necessary to qualify for this degree. **Prospective student should secure a faculty sponsor prior to applying for admission.**

The M.S. degree is for students who wish to increase their knowledge base in basic research through an intensive 2- to 3-year training period. Students must identify a faculty sponsor prior to application to the CBN Graduate Program.

**Admission**

A Bachelor’s degree in an area of Biology, Chemistry, Physics, Applied Math or Psychology is recommended. Students with Bachelor’s degrees outside these areas are also encouraged to apply; such students will generally be required to complete appropriate courses while enrolled at MSU to make up subject matter deficiencies prior to full acceptance into the Ph.D. and Masters programs. Factors that the department uses in its admissions process include GRE scores, TOEFL scores (for non-native English speakers), reference letters, GPA and previous coursework and research experience.

The department of Cell Biology and Neuroscience also participates in the Molecular Biosciences Program at MSU (http://mhbprogram.montana.edu/index.asp). This is an interdisciplinary graduate training program that includes faculty from a wide range of departments specializing in aspects of biology on the MSU campus. For more information, and details about applying, please refer to http://www.montana.edu/cbn/.
Research Facilities
Graduate research will be performed primarily in the laboratory of the student’s thesis adviser. Additional facilities will be available from the department and in laboratories collaborating with the student’s adviser. Cell Biology and Neuroscience is housed in the 5th floor of Leon Johnson Hall, the basement of Lewis Hall and in the Cooley Laboratories.

Financial Assistance
A number of research and teaching assistantships are available for qualified graduate students. These appointments are normally for half-time assignments (20 hours per week) during the academic year. Some appointments may also be available during the summer. Assistantships will only be offered to formally admitted graduate students. Fellowships are available through MBS program.

Degrees Offered
• Master of Science in Biological Sciences (p. 369)
• Master of Science in Neuroscience (p. 369)
• Doctor of Philosophy in Biological Sciences (p. 369)
• Doctor of Philosophy in Neuroscience (p. 369)

Program Requirements
M.S. Degree
Students may pursue the Master’s degree under either Plan A or Plan B. Plan A requires the completion of 30 credits of acceptable graduate-level coursework and thesis credits. The exact proportion of credits will be determined for each student by their advisory committee. Under Plan B, a 4-credit project and 26 credits of acceptable graduate-level coursework must be completed. For more information, please refer to http://www.montana.edu/cbn/#

Research Experience
Master’s candidates must take an oral comprehensive exam near the completion of their graduate program. Required curriculum will be tailored to the needs and interests of each student in consultation with their graduate adviser and advisory committee.

Ph.D. Degree
As a general guideline, Ph.D. students are required to complete 60 credits. This will include a mix of dissertation and graduate-level coursework credits. The exact proportion of credits will be determined for each student by their advisory committee.

Research Experience
Ph.D. students will gain research experience through their doctoral work, journal or conference submissions, and attending conferences

M.S. in Neuroscience
Students may pursue the Master’s degree under either Plan A or Plan B. Plan A requires the completion of 30 credits of acceptable graduate-level coursework and thesis credits, with the exact proportion of credits determined for each student by their graduate advisor and committee. Under Plan B, a 4-credit project and 26 credits of acceptable graduate-level coursework must be completed. Master’s candidates must take an oral comprehensive exam near the completion of their graduate program.

Ph.D. in Neuroscience
Upon entering the program, students will be assigned an advisory committee to assist them in tailoring a curriculum that best fits their educational needs, research interests, and career plans.

Research Experience
Ph.D. students will gain research experience through their doctoral work, journal or conference submissions, and attending conferences

M.S. in Biological Sciences
Students may pursue the Master’s degree under either Plan A or Plan B. Plan A requires the completion of 20 credits of acceptable graduate-level coursework and 10 credits of thesis. Under Plan B, a 4-credit project and 26 credits of acceptable graduate-level coursework must be completed. Master’s candidates must take an oral comprehensive exam near the completion of their graduate program.

Required curriculum will be tailored to the needs and interests of each student in consultation with their graduate adviser and committee.

Research Experience
Plan A (thesis option) Master’s degree students gain research experience through their thesis and are expected to submit the results of their thesis work to at least one journal or conference.

Plan B (project option) Master’s degree students gain some research experience in the context of their project.

Ph.D. in Biological Sciences
Upon entering the program, students will be assigned an advisory committee to assist them in tailoring a curriculum that best fits their educational needs, research interests, and career plans.

As a general guideline, Ph.D. students are required to complete 60 credits. For students in Biological Sciences this will include a mix of dissertation credits and graduate-level coursework credits beyond the Bachelor’s degree or Master’s degree. The exact proportion of the above-mentioned credits will be determined for each student by their advisory committee.

Research Experience
Ph.D. students will gain research experience through their doctoral work, journal or conference submissions, and attending conferences

Department of Chemistry and Biochemistry
Departmental Office:
PO Box 173400, Bozeman , MT 59717
Tel: 406-494-4801 Fax: 406-494-5407

The Department of Chemistry and Biochemistry offers research-oriented programs culminating in the Doctor of Philosophy degree. The faculty in the department have expertise in a broad range of specialty areas including synthesis, structure, spectroscopy, and mechanism. In each of these fields,
the strength of MSU Chemistry and Biochemistry Department has been recognized at the international level. MSU is a growing and dynamic university of 16,000 students. MSU is rapidly increasing in research prominence and is now ranked among the nation’s 100 leading research universities by the Carnegie Foundation. The Department of Chemistry and Biochemistry has the largest and best-funded doctoral program on campus. Our doctoral students receive world-class mentoring in a spectacular northern Rocky Mountain setting and graduate to superb career opportunities.

Graduate programs in chemistry and biochemistry are designed to provide students with a solid and broad foundation on which to base their careers. An appropriate combination of coursework and independent investigation is planned with individual faculty advisors. In consultation with their graduate advisor, graduate students can tailor their program to their own needs and interests. We believe that at the conclusion of their graduate education at Montana State University, students should have a professional command of the fundamentals of their disciplines. We cultivate the ability to think independently and to critically analyze scientific problems that span disciplinary boundaries. A high level of creativity and originality in research is expected of candidates for the Ph.D.

Admissions
An entering graduate student is expected to have had a solid chemistry background, including general, analytical, organic, and physical chemistry courses; Mathematics through calculus; and college level physics. A student less well prepared may be provisionally admitted provided he or she can attain an acceptable background proficiency within one year. Applicants are strongly encouraged to take the GRE subject test appropriate to their area.

Applicants must be formally admitted to The Graduate School. See the Admission Policies and Application Requirements sections for additional information at www.montana.edu/wwwdg/.

Program Requirements
All entering graduate students are required to demonstrate proficiency in three of the six chemistry areas (analytical, biochemical, inorganic, organic, physical, and structural and molecular biology) within the first year. The exams are offered during August, November, February and April of the academic year.

During the second semester, each student selects a major adviser who assists the student in selecting other faculty members for the student’s graduate committee. This committee will offer the major guidance and direction to the student’s degree program and bears the prime responsibility for decisions that affect that program.

For the Doctor of Philosophy in Chemistry or Biochemistry, students must satisfy the proficiency requirement, complete a core program of coursework, advance to candidacy by passing the comprehensive examination, conduct independent research and analysis in their discipline and write and defend a dissertation based on the student’s research.

The comprehensive examination consists of written and oral parts. Most students satisfy the written examination by writing an original proposal describing the candidate’s planned dissertation research. The second part of the comprehensive examination is an oral defense of the proposal. The student is admitted to Ph.D. candidacy upon successful completion of the written and oral portions.

For the Master of Science Plan A in chemistry or biochemistry, the minimum requirements are twenty (20) credit hours of appropriate courses, ten (10) credit hours of Master’s Thesis BCH 590 or CHMY 590 and an acceptable thesis based on the student’s research and a satisfactory oral defense of the thesis. Plan A candidates must present a seminar in addition to the final thesis defense, which constitutes the comprehensive examination. For the Master of Science Plan B in chemistry or biochemistry, the requirements are thirty (30) credit hours of appropriate courses, a seminar, and satisfactory performance in an oral comprehensive examination during the last term of residency for the degree.

Course Requirements
To earn a Ph.D. in chemistry or biochemistry, a student must successfully complete at least six, three-credit courses maintaining a "B" average or better. Four of these must be Department of Chemistry and Biochemistry courses and at least three must be in the student’s area of specialization.

The Graduate Program and Admissions Committee will advise entering students on course selection. The listed courses can provide guidance in planning the first year’s courses.

<table>
<thead>
<tr>
<th>Biochemistry</th>
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<tbody>
<tr>
<td>BCH 524  Mass Spectrometry</td>
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<tr>
<td>BCH 526  Adv Protein NMR Spectroscopy</td>
<td>3</td>
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<tr>
<td>BCH 543  Proteins</td>
<td>3</td>
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<tr>
<td>BCH 544  Molecular Biology</td>
<td>3</td>
<td></td>
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<tr>
<td>BCH 545  Advanced Physical Biochemistry</td>
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<td></td>
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<tr>
<td>BCH 547  Bioinorganic Chemistry</td>
<td>3</td>
<td></td>
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<tr>
<td>BCH 550  X-ray Crystallography</td>
<td>3</td>
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<tr>
<td>BCH 575  Professional Paper</td>
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<tr>
<th>Inorganic</th>
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<tbody>
<tr>
<td>CHMY 515  Structure and Bonding in Inorganic Chemistry</td>
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<tr>
<td>CHMY 516  Mechanisms and Dynamics in Inorganic Chemistry</td>
<td>3</td>
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<tr>
<td>CHMY 525  Chemical Reactions</td>
<td>3</td>
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<th>Organic</th>
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<tr>
<td>CHMY 523  Organic Reaction Mechanisms</td>
<td>3</td>
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<td>CHMY 533  Physical Organic Chemistry</td>
<td>3</td>
<td></td>
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<tr>
<td>CHMY 535  Reagent Chemistry</td>
<td>3</td>
<td></td>
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<tr>
<td>CHMY 540  Organic Synthesis</td>
<td>3</td>
<td></td>
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<tr>
<td>CHMY 554  Organometallic Chemistry</td>
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<tr>
<th>Physical/Analytical</th>
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<tr>
<td>CHMY 557  Quantum Mechanics</td>
<td>3</td>
<td></td>
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<tr>
<td>CHMY 558  Classical &amp; Stat Thermodynamic</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CHMY 559  Kinetics &amp; Dynamics</td>
<td>3</td>
<td></td>
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<tr>
<td>CHMY 564  Adv Quantum Chemistry</td>
<td>3</td>
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* Students can take a 400 level course provided that it is outside of their specific area of interest. (For example, students may be served well by Advanced Instrument Analysis (CHMY 421) or one of the 400-level organic classes).

Research Facilities
The Department of Chemistry and Biochemistry at Montana State University provides students, faculty, and staff with access to the state-of-the-art instrumentation that is required to stay at the forefront of research. We have the region’s best mass spectrometers for proteomics, metabolomics, chemical composition, and imaging. Current MS techniques that are ideal for many projects in chemical biology include ultra high
pressure LCMS, ion traps with CID and ECD, chip and standard nanoflow ESI, MALDI-TOF-TOF, and ultra-high resolution Q-TOF MS/MS. Chemists and biochemists benefit from excellent NMR Instrumentation, which includes 600, 500, and 300 MHz NMR spectrometers. These instruments are used in routine analysis of small molecules and also protein structural determination. Our instrumentation for dynamic light scattering, zeta potential, isothermal titration microcalorimetry, cryogenic electron microscopy, and stopped flow spectrophotometry is also state of the art. Two protein crystallographers have all the necessary equipment for macromolecular crystal structure determination. Protein-protein interactions can be studied using surface plasmon resonance (Biacore), quartz crystal microbalance with dissipation (Q-Sense), and a fluorescence lifetime microplate reader.

The department has some of the nation’s most advanced facilities for time-resolved laser spectroscopy on time scales from femtoseconds to seconds. Multiple Ti:sapphire-based ultrafast laser systems provide tunable laser pulses from UV to mid-IR wavelengths, enabling a rich array of transient absorption and emission spectroscopies. Investigations of high-energy gas-phase and gas-surface molecular interactions are conducted using a molecular beam apparatus that was originally designed by Nobel Laureate, Y. T. Lee, for crossed-beam studies of elementary reaction dynamics. Other advanced instrumentation includes CW and pulsed multifrequency EPR, Raman, FTIR, circular dichroism and fluorescence spectrometers.

In addition to the equipment housed in our department, campus microscopy capabilities include transmission electron microscopy (TEM), scanning electron microscopy with cryogenics (SEM), atomic force microscopy (AFM), confocal imaging, and laser micro dissection and capture.

The National NSF Center for Biofilm Engineering is located at Montana State University. Several faculty and students have collaborative research projects with staff associated with this Center and those listed below.

Center for Computational Biology (CCB)
The CCB is an interdisciplinary academic unit supporting research, training and technology transfer in the general area of Computational Biology, combining state-of-the-art experimental techniques with state-of-the art computer-based analysis and modeling capabilities. The research and training environment in the CCB encourage partnerships between experimentalists, theorists and engineers in diverse fields, providing opportunities to establish genuine research partnerships between students and scientists at many different institutions around the world.

MSU Optical Technology Center (OpTeC)
OpTeC is an interdisciplinary center with research groups from three university departments: Physics, Chemistry & Biochemistry, and Electrical & Computer Engineering. Each of the ten research groups is led by a faculty principal investigator and specializes in a different area of optical research. Collaborating teams profit from a multidisciplinary approach to problems. The primary goals of OpTeC are to foster collaboration with local industry and economic growth of the state. OpTeC promotes research on optical materials, lasers and optoelectronic devices, sensors, micro-optical systems, holography, and coherent optics. For more information, visit www.optec.montana.edu.

Molecular Biosciences Program
The Molecular Biosciences Program offers numerous graduate research and training opportunities in Basic and Applied Life Sciences. Internationally recognized interdisciplinary research programs and Research Centers of Excellence provide students excellent career development opportunities.

The MB Program provides students with the opportunity to view faculty involved in life science research divided into research areas. The new approach should be easier for the prospective student to find a faculty conducting the research of most interest to them. For more Information visit www.mbprogram.montana.edu/index.asp

Financial Assistance
Graduate students in the program are supported continuously throughout their studies by stipends that average between $22,000 and $24,000 per year and by tuition waivers. First-year students are supported as graduate teaching assistants, while most students in their second and later years are appointed to grant-funded projects as graduate research assistants. Funding per investigator in the Department of Chemistry and Biochemistry is at a very high level found at only a small number of departments nationwide.

Degrees Offered
- M.S. in Chemistry (p. 371)
- M.S. in Biochemistry (p. 371)
- Ph.D. in Chemistry (p. 371)
- Ph.D. in Biochemistry (p. 371)

Interdisciplinary Degrees Offered
- M.S in Optics and Photonics Plan A (p. 361)
- M.S in Optics and Photonics Plan B (p. 362)

M.S. in Biochemistry
The Departmental Master’s Program is available ONLY to students who wish to obtain a Masters Degree en route to the Doctoral Degree, or in lieu of a terminal doctorate to which they had originally subscribed. Graduate students are attracted to the MSU program in biochemistry because of the strength of the research program, the collaborative nature of the faculty, and the beautiful setting of the new research building in a mountain environment.

M.S. in Chemistry
The Departmental Master’s Program is available ONLY to students who wish to obtain a Masters Degree en route to the Doctoral Degree, or in lieu of a terminal doctorate to which they had originally subscribed. Graduate students are attracted to the MSU program in chemistry because of the strength of the research program, the collaborative nature of the faculty, and the beautiful setting of the new research building in a mountain environment.

Ph.D. in Biochemistry
The Department of Chemistry and Biochemistry offers a Ph.D. in Biochemistry that is designed to provide students with a solid and broad foundation on which to base their careers. An appropriate combination of coursework and independent investigation is planned with individual faculty advisers. In consultation with their graduate adviser, graduate students can tailor their program to their own needs and interests. At the conclusion of their graduate education in chemistry, students will have a professional command of the fundamentals of their discipline. They will be able to critically analyze scientific problems that span disciplinary boundaries and will be able to perform research with a high level of creativity and originality.

Ph.D. in Chemistry
The Department of Chemistry and Biochemistry offers a Ph.D. in Chemistry that is designed to provide students with a solid and broad foundation on which to base their careers. An appropriate combination
of coursework and independent investigation is planned with individual faculty advisers. In consultation with their graduate adviser, graduate students can tailor their program to their own needs and interests. At the conclusion of their graduate education in chemistry, students will have a professional command of the fundamentals of their discipline. They will be able to critically analyze scientific problems that span disciplinary boundaries and will be able to perform research with a high level of creativity and originality.

Department of Earth Sciences

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226 Traphagen Hall, Bozeman, MT 59717-3480
Tel: 406-994-3331, Fax: 406 994 6923
Email: earth@montana.edu
Home Page: http://www.montana.edu/wwwes/
Contact Information for graduate coordinators:
Jean Dixion, jean.dixon@montana.edu
or
David Varricchio, djq@montana.edu

Earth Sciences offers M.S. and Ph.D. degrees in Earth Sciences (Geography, Geology, and Geobiology content areas). We stress independent thesis research with supporting course work. Our expertise spans most of the subfields of Earth Sciences. Our Geography faculty includes specialties including historical and cultural geography, settlement geography, resource geography (energy and water), economic geography, planning, bioclimatology, applications of GIS and snow science. The interests of our Geology Faculty include composition and structure of the crust, quantitative geomorphology, sedimentation and stratigraphy. Our Geobiology faculty have research interests in vertebrate paleontology, paleoecology, biogeography, paleoecology, and geomicrobiology. Our program strengths are in basin analysis and energy resources, crustal tectonics and mountain building, dinosaur paleontology, paleoecology of the northern Rocky Mountains, snow science and cryospheric processes, and climate change. Examples of thesis titles can be found on the Department of Earth Sciences web page (see above).

Admission

The department generally expects applicants to have a GPA of 3.0 or higher and GRE Scores better than the 50th percentile and a strong academic background in Earth Sciences (Geography, Geology, or Geobiology). International students must have an English proficiency score (at or above) the following: TOEFL [iBT: 93, CBT: 237, or PBT: 580], IELTS [level 7.0], or PTE [level 61]. The department does not accept general applicants to our graduate program. An applicant should identify a major advisor from the list of faculty (found on the department website above), contact that individual, and determine whether there is space available in that adviser’s program.

For applicants who wish to study geography, the department requires the equivalent of a geography minor (eight semester geography courses including map skills, world regional, human, and physical geography) as background. A geography undergraduate degree is preferred and coursework involving geographic skills such as cartography, field methods, aerial photograph interpretation, remote sensing, GIS and quantitative methods are considered a desirable part of an applicant’s background.

For applicants who wish to study geology, the department expects him/her to have a year each of calculus, physics and chemistry as well as physical geology, mineralogy, petrology, historical geology, geomorphology, sedimentation, stratigraphy, structural geology, and a field geology course which emphasizes mapping. These requirements are typically met by an undergraduate degree in geology. Applicants who have not completed all requirements may be admitted, but are expected to make up deficiencies during the first year of graduate study.

For applicants who wish to study geobiology, the department expects an applicant to have a degree in geology, biology or a closely related field. The most competitive applicants have significant upper-division course work in both geology and biology.

For optimum course scheduling, applicants are accepted into the graduate program only at the start of Fall semester. Under certain conditions, we will admit a student for summer or spring, but this must be coordinated by the major professor. Successful applicants must be accepted both by the department and by The Graduate School.

Program Requirements

Students are expected to develop a solid curricular foundation in geography, geology or geobiology. Graduate programs include a core of geography, geology, or geobiology courses and are further tailored in consultation with the advisor and graduate committee to the specific talents and interests of the individual student. Coursework in disciplines outside the department is encouraged to support and enhance specific research areas in the Earth Sciences.

Graduate and 400-level (senior) courses in earth science include: snow dynamics, geobiology, geomicrobiology, Quaternary Environments of the Western US, Quaternary paleoecology, and Quaternary environments. Graduate and 400-level (senior) courses of study in geography include: historical geography, geographic thought, population geography, water and society, vulnerability and environmental hazards, advanced topics in resource geography, topics in political ecology, mountain geography, applied GIS and spatial analysis, tourism planning, advanced regional geography, East Asia in the global system, GIS research fundamentals, settlement geography, and land use planning. All graduate students with a concentration in Geography are required to complete a 1-credit (500 level) course entitled Current Research and Applications in Geography in the Fall of their first year. Graduate and 400-level (senior) courses of study in geology include: tectonics, igneous petrology, metamorphic petrology, sedimentary petrology, graduate structural geology, volcanology, glacial geology, advanced stratigraphy, clastic sedimentology, tectonics of sedimentary basins, petroleum geology, depositional systems, vertebrate paleontology, macroscale and the fossil record, taphonomy, comparative vertebrate anatomy, geology of the northern Rocky Mountains.

All graduate students enroll in a 2-credit seminar during their first fall semester.

Facilities

The primary research facility is the northern Rocky Mountain field laboratory which includes Yellowstone National Park, and the Greater Yellowstone GeoEcoSystem. Field work is also done in China, Argentina, Chile, Nepal, Namibia, and New Zealand. Field-based research in the Rocky Mountains is a component of many Earth Sciences graduate students’ study. Field equipment include tools for location and altitude (from conventional compasses and altimeters to auto levels, a total station and GPS ground stations), sampling devices including suspended and bedload sediment samplers, current meters paleomagnetic rock drills, hammer seismograph, auto level, total station, snow density kits, U.S. Federal Snow samplers, ram sondes, shear frames, lake-sediment coring equipment and the like. Field work is supplemented by laboratory analysis in several facilities across campus. The Department has crushers, Franz magnetc-susceptibility separator, balances, rock saws, lap wheels, and a paleontology preparation laboratory. The Department also has several high-quality (Leitz and Nikon) transmitted and reflected light research petrographic microscopes with photo microscopy and cathode luminescence capability and computer-driven image analysis capabilities. There is
an MSU Paleoecology Lab under the direction of Cathy Whitlock, a
gemicrobiological/geochemical laboratory under the direction of Mark
Skidmore, a structural geology laboratory under the direction of David
Lagerson and Mary Hubbard, a snow and avalanche laboratory under the
direction of Jordy Hendrikx, and a geochem wet laboratory under the
direction of Jean Dixon.

There are other laboratories on campus that Earth Scientists use. The MSU
Spatial Sciences Center under the direction of Rick Lawrence provides
instruction and research opportunities for faculty and students interested in
Global Positioning Systems, GIS and remote sensing. This center supports
ARC/INFO and ERDAS on workstations, pCARC/INFO and IDRISI
and IMAGINE on PCs, and a variety of digitizers, scanners, printers and
plotters for data input and output.

The Imaging and Chemical Analysis Laboratory (ICAL) contains analytical
equipment which includes a scanning electron microscope (with EDS,
BSE, and CL. spectrometers), automated powder X-ray diffraction, X-ray
photoelectron spectroscopy, Auger electron spectroscopy, and time-of-flight
SIMS.

The Subzero Science and Engineering Laboratory under the direction of Ed
Adams has a variety of cold rooms for research on snow and ice including a
flume laboratory for the study of ice in streams and lakes, and laboratories
with radiation and thermal pulses to examine snow and ice properties under
varying weather and climatic regimes.

The vertebrate (dinosaur) paleontology laboratory of the Museum of the
Rockies, contains state-of-the-art microcomputer and computerized image-
enhancement equipment for the study of dinosaur bones, as well as other
chemical and mechanical equipment for the preparation and analysis of
fossilized vertebrates.

Graduate students in Geography may also work closely with faculty and
facilities in the Departments of Political Science, Native American Studies,
Sociology and Anthropology, Agricultural Economics and Economics, and
History and Philosophy.

**Assistant**

Graduate students in Earth Sciences have been successful with National
Science Foundation Fellowships and research grants from Geological
Society of America, the American Association of Petroleum Geologists, the
Society for Sedimentary Geology, the U.S. Forest Service, and Sigma Xi,
and have won University-wide and regional awards for thesis research.

Teaching and research assistantships are available each year. Graduate
scholarships are awarded annually on a competitive basis in the second year
of residence to assist with thesis research. See the Earth Sciences website or
contact the department for more information

**Degree Offered**

- M.S. in Earth Sciences (p. 373)
- M.S. in Land Rehabilitation (p. 300) (Interdisciplinary degree)
- Ph.D. in Earth Sciences (p. 373)

**M.S. in Earth Sciences**

Students are expected to develop a solid curricular foundation in geography,
geology or geobiology. Graduate programs include a core of geography,
geology, or geobiology courses and are further tailored in consultation with
the advisor and graduate committee to the specific talents and interests of
the individual student. Coursework in disciplines outside the department is
couraged to support and enhance specific research areas in the Earth
Sciences.

Graduate and 400-level (senior) courses in earth science include: snow
dynamics, physiography, geobiology, geomicrobiology, Quaternary
Environments of the Western US, Quaternary paleoecology, and
Quaternary environments. Graduate and 400-level (senior) courses of study in geography include: historical geography, geographic thought,
population geography, water and society, vulnerability and environmental
hazards, advanced topics in resource geography, topics in political ecology,
mountain geography, applied GIS and spatial analysis, tourism planning,
avanced regional geography, East Asia in the global system, GIS research
fundamentals, settlement geography, and land use planning. All graduate
students with a concentration in Geography are required to complete a
1-credit (500 level) course entitled Current Research and Applications in
Geography in their first year. Graduate and 400-level (senior)
courses of study in geology include: glacial geography, sedimentology,
advanced stratigraphy, clastic sedimentology, ancient ocean systems, tectonics of sedimentary basins, petroleum geology, depositional systems, vertebrate paleontology, macroevolution and the fossil record, taphonomy, comparative vertebrate anatomy, Hell Creek paleontology, geology of the northern Rocky Mountains, structural analysis, tectonics, igneous geochemistry, igneous geochemistry, and volcanology.

All graduate students take our graduate seminar, ERTH 594 (2 credits),
during their first fall semester.

**Ph.D. in Earth Sciences**

**Program Requirements**

Students are expected to develop a solid curricular foundation in geography,
geology or geobiology. All graduate students in the Earth Sciences
Department are required to take Seminar (ERTH 594)(2 credits) in the
fall of their first year. Graduate programs include a core of geography,
geology, or geobiology courses and are further tailored in consultation with
the adviser and graduate committee to the specific talents and interests of
the individual student. Coursework in disciplines outside the department is
couraged to support and enhance specific research areas in the Earth
Sciences.

Graduate and 400-level (senior) courses in earth science include: surface-
water resources, ground-water resources, snow dynamics, physiography,
geobiology, geomicrobiology, Quaternary Environments of the Western
US, Quaternary paleoecology, and Quaternary environments. Graduate
and 400-level (senior) courses of study in geography include: historical
geography, geographic thought, population geography, water and society,
vulnerability and environmental hazards, advanced topics in resource
geography, topics in political ecology, mountain geography, applied GIS
and spatial analysis, tourism planning, advanced regional geography, East
Asia in the global system, GIS research fundamentals, settlement geography,
and land use planning.

All graduate students with a concentration in Geography are required to complete a 1-credit (500 level) course entitled Current Research and
Applications in Geography in the fall of their first year.

Graduate and 400-level (senior) courses of study in geology include:
gravicology, sedimentology, applied geological hydrology, advanced
stratigraphy, clastic sedimentology, ancient ocean systems, tectonics of
sedimentary basins, petroleum geology, depositional systems, vertebrate
depositional systems, vertebrate paleontology, macroevolution and the
fossil record, taphonomy, comparative vertebrate anatomy, Hell Creek
paleontology, geology of the northern Rocky Mountains, structural analysis,
tectonics, igneous geochemistry, igneous geochemistry, and volcanology.

**Department of Ecology**

310 Lewis Hall, Bozeman, MT 59717-3460
Email: ecology@montana.edu
The department offers advanced work leading to Master of Science degrees in biological sciences and fish and wildlife management. The Master’s degree generally requires a thesis and research publication. At the doctoral level, the Doctor of Philosophy degree is offered in ecology and environmental sciences, biological sciences and in fish and wildlife biology. At both the Master’s and Doctoral level the following areas of study are available: terrestrial and aquatic ecology, fish and wildlife management, evolutionary biology, quantitative ecology, and conservation biology. Successful applicants are accepted into both the department and The Graduate School.

Admission
Only a limited number of graduate students are admitted to our program each year. We accept students into the program based on their academic performance, graduate record examination scores, recommendation letters, experience, and potential for scientific and professional excellence. Students must meet the minimum entrance requirements for the department to recommend admission. In exceptional cases, at the request of a faculty member, the Department Head may waive one of the qualifications. The following is a list of admission requirements:

- A composite of the applicant’s letters of recommendation must indicate the student has good prospects of success in graduate school.
- The applicant should have at least the equivalent of three-fourths of the science courses required in the undergraduate curriculum at Montana State University in the option chosen for graduate study.
- Official Graduate Record Examination (GRE) General Test scores must be submitted at the time the student submits the full application. The sum of the verbal and quantitative scores should be at least 1100 for GRE scores before July, 2011. The sum for the verbal and quantitative scores should be a minimum of 300 for the current GRE tests.
- The applicant should have maintained the following minimal undergraduate grade-point averages: 3.0 average in all biology courses; 3.0 average in all courses taken during the junior and senior years; and 2.5 average in all chemistry, physics and mathematics courses.

All qualified students must secure an agreement from a faculty member who is willing to serve as major professor, or graduate academic advisor, to be considered for admissions. We do not accept students into the program unless a department faculty member first confirms an agreement to mentor a student’s degree completion. Generally the major professor will have identified a research project and possible sources of funding before seeking a new graduate student.

Program Requirements
The minimum credit requirement for a master’s degree is 30 credits, and at least 20 credits must be from course work other than thesis work. A minimum of 18 thesis credits must be successfully completed. A maximum of 30 credits from a previously earned master’s degree may be applied toward the 60 credit requirement. No specific courses are required for a doctoral degree. The program of study is determined by the graduate committee following The Graduate School guidelines.

Financial Assistance
Available Graduate Teaching Assistant (GTA) appointments are assigned in the semester before the teaching semester and reflect teaching needs and financial assistance available. GTAs receive tuition fee waivers and a stipend. Part of stipend may be used for medical insurance which is not provided directly by the department. For further graduate school expenses, consult the MSU fee schedules as provided in the Graduate Catalog. A Graduate Research Assistant (GRA) appointment is project-specific and is awarded by individual faculty as funds are available. GRA stipends have a considerable range of amounts, and some fee waivers and health insurance may be available with GRAs depending upon funding sources.

Degree Offered
- M.S. in Biological Sciences (p. 374)
- M.S. in Fish and Wildlife Management (p. 375)
- Ph.D. in Fish and Wildlife Biology (p. 375)
- Ph.D. in Biological Sciences (p. 375)
- Ph.D. in Ecology and Environmental Sciences (p. 375) (interdisciplinary)

M.S. in Biological Sciences
The M.S. in Biological Sciences covers a broad array of ecological topics and serves the needs of students whose thesis research addresses basic, fundamental ecological principles or of those conducting applied research not involving fish or wildlife management. It may be a terminal degree leading to professional employment as an ecologist, but may also lead to a Ph.D. in Biological Sciences or other discipline. Coursework associated with this degree tends to emphasize fundamental principles of ecology.

The student’s graduate committee will work with the student following a required oral qualifying exam during the second semester in attendance to finalize the following required plan of study. The committee may require additional electives for completing a Master’s degree in the Department of Ecology. Statistics courses may be recommended as electives.

Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOE 554</td>
<td>Foundations of Ecology &amp; Mgmt</td>
<td>1</td>
</tr>
<tr>
<td>BIOE 555</td>
<td>Communication in Ecol Sciences</td>
<td>1</td>
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<tr>
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<td>3</td>
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<tr>
<td>BIOE 521</td>
<td>Conservation Biology</td>
<td></td>
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<td>BIOE 548</td>
<td>Conservation Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOE 532</td>
<td>Physiological Plant Ecol</td>
<td></td>
</tr>
<tr>
<td>WILD 501</td>
<td>Applied Population Ecology</td>
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</tr>
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<td>Choose one</td>
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<tr>
<td>BIOE 542</td>
<td>Community Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOE 515</td>
<td>Landscape Ecol &amp; Mgmt</td>
<td></td>
</tr>
<tr>
<td>LRES 568</td>
<td>Ecosystem Biogeochem</td>
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</tr>
<tr>
<td>Electives (minimum)</td>
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<td>11-12</td>
</tr>
<tr>
<td>Thesis</td>
<td></td>
<td>10</td>
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</table>
## M.S. in Fish and Wildlife Management

The M.S. in Fish and Wildlife Management serves the needs of students whose thesis research addresses an applied fish or wildlife management problem. It may be a terminal degree leading to professional employment as a fisheries or wildlife biologist, but may also lead to a Ph.D. in Fish and Wildlife Biology or other discipline. Coursework associated with this degree tends to emphasize applied fish and wildlife management.

The student’s graduate committee will work with the student following a required oral qualifying exam during the second semester in attendance to finalize one of the following required plans of study. The committee may require additional electives for completing a Master’s degree in the Department of Ecology. Statistics courses may be recommended as electives.

### Courses

#### Wildlife Interest Program

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOE 554</td>
<td>Foundations of Ecology &amp; Mgmt</td>
<td>1</td>
</tr>
<tr>
<td>BIOE 555</td>
<td>Communication in Ecol Sciences</td>
<td>1</td>
</tr>
<tr>
<td>Choose two</td>
<td></td>
<td>6-7</td>
</tr>
<tr>
<td>BIOE 515</td>
<td>Landscape Ecol &amp; Mgmt</td>
<td></td>
</tr>
<tr>
<td>BIOE 521</td>
<td>Conservation Biology</td>
<td></td>
</tr>
<tr>
<td>BIOE 542</td>
<td>Community Ecology</td>
<td></td>
</tr>
<tr>
<td>WILD 501</td>
<td>Applied Population Ecology</td>
<td></td>
</tr>
<tr>
<td>WILD 502</td>
<td>Population &amp; Habitat Data</td>
<td></td>
</tr>
<tr>
<td>WILD 504</td>
<td>Wildlife-Habitat Relationships</td>
<td></td>
</tr>
<tr>
<td>WILD 525</td>
<td>Human Dimensions of Fisheries and Wildlife Management</td>
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**Electives (minimum)**: 11-12

**Thesis**: 10

#### Fisheries Interest Program

<table>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOE 554</td>
<td>Foundations of Ecology &amp; Mgmt</td>
<td>1</td>
</tr>
<tr>
<td>BIOE 555</td>
<td>Communication in Ecol Sciences</td>
<td>1</td>
</tr>
<tr>
<td>Choose two</td>
<td></td>
<td>6</td>
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<tr>
<td>WILD 510</td>
<td>Fisheries Science</td>
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<tr>
<td>WILD 513</td>
<td>Fisheries Habitat Management</td>
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</tr>
<tr>
<td>WILD 525</td>
<td>Human Dimensions of Fisheries and Wildlife Management</td>
<td></td>
</tr>
</tbody>
</table>

**Electives (minimum)**: 12

**Thesis**: 10

### Ph.D. in Biological Sciences

The Ph.D. in Biological Sciences covers a broad array of ecological topics and serves the needs of students whose dissertation research addresses basic, fundamental ecological principles or of those conducting applied research not involving fish or wildlife management. It serves the interests of students primarily interested in research careers in federal or state agencies or in academic careers in ecology and environmental science departments. Coursework associated with this degree tends to emphasize fundamental principles of ecology.

All students earning a doctoral degree from Montana State University must complete a minimum of 60 credit hours post-baccalaureate, of which 18-28 of must be dissertation credits. (This may include 10 thesis credits from a master’s degree program.) A maximum of 30 credits from a previously earned master’s degree (from MSU or another accredited University) may be applied toward the 60 credit minimum required for the doctoral degree.

1. **Special Topics (591)**: Credits allowed toward degree requirements for Special Topics (591) courses may not exceed the number defined by each degree program.
2. **Individual Problems (592)**: Not more than six credits of Individual Problems (592) courses may be included on a doctoral Program of Study.
3. **Pass/Fail Credits**: A maximum of nine credits (excluding dissertation) may be included on a doctoral Program of Study. 4XX level courses may be used on a Program of Study: a maximum of 9 credits are allowed.
4. **Limit on Age of Courses**: The age of courses at the time of graduation for a doctoral degree may not exceed 10 years.
5. **Courses from a master’s program**: The graduate Program of Study lists those courses the student’s committee feels are required to earn the doctoral degree.
6. **Resident Credit Requirements**: A minimum of thirty (30) credits applicable to the degree must be taken from MSU.
7. **Dissertation Credit Requirements**: All Ph.D. candidates are required to register for and complete a minimum of eighteen dissertation (690) credits. An unlimited number of 690 credits may be taken to finish a dissertation; however, only the 18-28 690 credits are applicable toward degree requirements.

Courses taken while in a master’s degree program at MSU, beyond those listed on the graduate Program of Study, may be used on an additional master’s program or a doctoral program at a later time.

### Ph.D. in Ecology and Environmental Sciences (interdisciplinary)

The Ph.D. in Ecology and Environmental Sciences (http://www.montana.edu/ees/) was developed jointly by the Departments of Ecology and Land Resources & Environmental Sciences as a broad interdisciplinary Ph.D. program open to graduate students in several departments in the Colleges of Letters & Science and Agriculture. The degree program was approved by the MUS Board of Regents in 2006, and now meets the interests of graduate students in Ecology in a broad array of subjects. Other participating departments include Animal and Range Sciences, Earth Sciences, Plant Science and Plant Pathology, and the College of Nursing.

Because of the substantial diversity in disciplinary and multidisciplinary foci within the EES doctoral program, there is no universal required core curriculum. The student’s individual coursework program will be developed in partnership with the major advisor and graduate committee usually following the Department of Ecology’s required oral qualifying exam during the third semester in attendance. The plan must be consistent with all of the home department and the Graduate School guidelines and requirements. A minimum of 30 credits of resident coursework must be taken from MSU.

There is an extensive list of potential courses (http://www.montana.edu/ees/courses.html) that may be applied to this interdisciplinary degree program and other helpful information on the degree website, http://www.montana.edu/ees/.

### Ph.D. in Fish and Wildlife Biology

The Ph.D. in Fish and Wildlife Biology serves the needs of students whose dissertation research addresses an applied fish or wildlife management problem. It serves the interests of students primarily interested in research careers in federal or state fish and wildlife agencies or in academic careers in fish and wildlife departments. Coursework associated with this degree tends to emphasize applied fish and wildlife management.
All students earning a doctoral degree from Montana State University must complete a minimum of 60 credit hours post-baccalaureate, of which 18-28 of must be dissertation credits. (This may include 10 thesis credits from a master’s degree program.) A maximum of 30 credits from a previously earned master’s degree (from MSU or another accredited University) may be applied toward the 60 credit minimum required for the doctoral degree.

1. Special Topics (591h): Credits allowed toward degree requirements for Special Topics (591) courses may not exceed the number defined by each degree program.

2. Individual Problems (592): Not more than six credits of Individual Problems (592) courses may be included on a doctoral Program of Study.

3. Pass/Fail Credits: A maximum of nine credits (excluding dissertation) may be included on a doctoral Program of Study. 4XX level courses may be used on a Program of Study; a maximum of 9 credits are allowed.

4. Limit on Age of Courses: The age of courses at the time of graduation for a doctoral degree may not exceed 10 years.

5. Courses from a Master’s program: The graduate Program of Study lists those courses the student’s committee feels are required to earn the doctoral degree.

6. Resident Credit Requirements: A minimum of thirty (30) credits applicable to the degree must be taken from MSU.

7. Dissertation Credit Requirements: All Ph.D. candidates are required to register for and complete a minimum of eighteen dissertation (690) credits. An unlimited number of 690 credits may be taken to finish a dissertation; however, only the 18-28 690 credits are applicable toward degree requirements.

Courses taken while in a master’s degree program at MSU, beyond those listed on the graduate Program of Study, may be used on an additional master’s program or a doctoral program at a later time.

Department of English

PO Box 172300
2-176 Wilson Hall, Bozeman, MT 59717-2300
Tel: 406-994-3768 Fax: 406-994-2110
Email: english@montana.edu

Director of Graduate Studies

Kathleen Ryan
2-276 Wilson Hall, Bozeman, MT 59717
Tel: 406-994-5191 Email: kathleen.ryan3@msu.montana.edu

Department Chair

Kirk Branch
2-176 Wilson Hall, Bozeman MT 59717
Tel: 406-994-3768 Email: kirk.branch@montana.edu

The Master of Art in English focuses on writing, teaching, and literary studies. Serious intellectual work takes place in the landscape of the Northern Rocky Mountains and Yellowstone region. Students develop close mentoring relationships with faculty members who have expertise in fields such as British Literature, education and pedagogy, literature of the American West, and Writing Studies. Students may elect to write either a scholarly thesis (Plan A) or a professional paper (Plan B) in our two-year program.

Students’ interests for earning the degree varies. The MA in English can prepare students to go on to PhD programs in literature or writing studies, as well as MFA programs in creative writing. Students also go on to teach in secondary education and higher education, work in the business sector, and work for non-profit agencies. Others pursue the degree for personal enrichment.

The department awards up to six teaching assistantships to our top applicants each year.

Admission*

University standards for admission with full standing to The Graduate School:

• 3.0 grade point average (A=4.0) and official transcripts for all undergraduate course work

Additionally, the Department of English requires:

• Three letters of recommendation from people who can comment on the applicants potential for success in a graduate program in English
• A personal essay in which the applicant discusses their reasons for pursuing the Master of Arts in English
• 10-15 page writing sample
• Optional--Official Graduate Record Exam (GRE) General Test score

*Deadline for admission and consideration for a teaching assistantship is January 31st. The final deadlines for admission only are July 1 (fall semester) and November 1 (spring semester). Deadlines for international students are May 15 (fall semester and September 15 (spring semester).

Financial Assistance

Graduate students may apply for departmental teaching assistantships, which are awarded on a competitive basis. To apply for an assistantship, discuss your interest in teaching in the personal essay you will submit as part of your application packet.

Graduate Program

• M.A. English (p. 376)

M.A. in English

The Master of Art in English focuses on writing, teaching, and literary studies. Serious intellectual work takes place in the landscape of the Northern Rocky Mountains and Yellowstone region. Students develop close mentoring relationships with faculty members who have expertise in fields such as British Literature, education and pedagogy, literature of the American West, and Writing Studies. Students may elect to write either a scholarly thesis (Plan A) or a professional paper (Plan B) in our two-year program.

Students’ interests for earning the degree varies. The MA in English can prepare students to go on to PhD programs in literature or writing studies, as well as MFA programs in creative writing. Students also go on to teach in secondary education and higher education, work in the business sector, and work for non-profit agencies. Others pursue the degree for personal enrichment.

The department awards up to six teaching assistantships to our top applicants each year.

Program Requirements

The Master of Arts degree requires the minimum completion of 30 course credits. Students will select one of two options, either the professional paper or the thesis. The first option involves 24 hours of course work and 6 hours of professional paper, the latter 20 hours of course work and 10 hours of thesis. Students are expected to have completed the equivalent of a
baccalaureate degree in English. Students with undergraduate degrees other than English are encouraged to apply; however, they may be required to take additional English courses as a condition of their acceptance.

Required Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 510</td>
<td>Studies in Critical Theory (Max 6 credits)</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 530</td>
<td>Writing Theory and Practice (Max 6 credits)</td>
<td>3</td>
</tr>
<tr>
<td>Choose one of the following:</td>
<td></td>
<td>1-10</td>
</tr>
<tr>
<td>ENGL 575</td>
<td>Professional Paper (Max 6 credits (Plan B Only))</td>
<td></td>
</tr>
<tr>
<td>ENGL 590</td>
<td>Master’s Thesis (1-10 credits (Plan A Only))</td>
<td></td>
</tr>
</tbody>
</table>

Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 505</td>
<td>Teaching College Composition</td>
<td>2</td>
</tr>
<tr>
<td>ENGL 520</td>
<td>Pedagogy Theory and Practice (Max 6 credits)</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 550</td>
<td>Focused Research Seminar (Max 6 credits)</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 592</td>
<td>Independent Study</td>
<td>1-4</td>
</tr>
<tr>
<td>ENGL 598</td>
<td>Internship</td>
<td>1-12</td>
</tr>
<tr>
<td>ENGL 580</td>
<td>Special Topics (Max 9 credits)</td>
<td>1-4</td>
</tr>
</tbody>
</table>

Total Credits: 30

Department of History and Philosophy

2-155 Wilson Hall
Bozeman, Montana 59717
406-994-4395
www.montana.edu/history/

Department Chair

Dr. Susan Cohen
2-155 Wilson Hall, Bozeman, MT 59717
406-994-4395

The Department of History and Philosophy is dedicated to providing quality education in History for Masters and Doctoral students. The Department offers concentrated training in three particular areas: the history of science, technology, and society; environmental history; and the history of the American West. While the degrees offered by the Department are grounded in American history, the faculty is committed to familiarizing students with critical theoretical concerns, the history of women in a multi-cultural context, and to encouraging students to think about the history of the United States in a global context.

Admission

Prospective graduate students should follow the guidelines in the Admission Policies and Application Requirements sections. The GRE General Exam is not required, but scores will be reviewed if submitted. If you wish to be considered for funding, your completed application must be submitted to the MSU Graduate School no later than January 31st. For a Spring admit, the application deadline is November 1st. Those wishing to be considered for a Spring teaching assistantship, the application deadline is October 1st.

The primary form of financial support available through the Department is the teaching assistantship, which is awarded on a competitive basis. There are sometimes other opportunities available for financial support, such as grading, research assistantships with individual faculty members.

Graduate Handbook

Degree Offered

- MA in History (p. 377)
- PhD in History (p. 377)

MA in History

Master of Arts Degree, History

The Department of History and Philosophy Graduate Program at MSU is designed to train students to think historically, to conduct research effectively, and to write lucidly. Students research and write in seminar settings as well as individually under the guidance of a faculty committee. The program seeks to expand students' intellectual horizons and expose students to the variety of roles played by historians in academic and public life through seminar discussions, classroom instruction, teaching assistantships, and internships.

The Department offers concentrated training in three particular areas: the history of science, technology, and society; environmental history; and history of the American West. While the degrees offered by the Department are grounded in American history, the faculty is committed to familiarizing students with critical theoretical concerns, the history of women in a multicultural context, and to encouraging students to think about the history of the United States in a global context.

The MA degree requires a total of 30 credit hours. The following required courses have been created to serve as the core of each graduate student's program. Each student will work with a committee to design a program of study that fits their research interests. Students may also take up to 9 credits of 400-level courses in history or in related disciplines, such as historical geography. Internships at museums and historical societies may also count for credit.

Required Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIST 503</td>
<td>America Before 1860</td>
<td>3</td>
</tr>
<tr>
<td>HIST 505</td>
<td>U.S. History 1860-Present</td>
<td>3</td>
</tr>
<tr>
<td>HIST 512</td>
<td>Topics in World History</td>
<td>3</td>
</tr>
<tr>
<td>HIST 540</td>
<td>History Methods</td>
<td>3</td>
</tr>
</tbody>
</table>

PhD in History

The Graduate Program is designed to train students to think historically, to conduct research effectively, and to write lucidly. Students research and write in seminar settings as well as individually under the guidance of each student's graduate committee. The program seeks to expand students' intellectual horizons and expose students to the variety of roles played by historians in academic and public life through seminar discussions, classroom instruction, teaching assistantships, and internships.

All students will declare a Major Field of emphasis and two Minor Areas.

The PhD in History requires a minimum of 30 course credit hours above the MA degree (total of 60 credits) and a minimum of 18 credits of HIST 690 Doctoral Thesis. Coursework will be chosen by the student, in conjunction with their committee.

Admission Requirements

- Bachelors or Masters degree in history or related field
- Letter of intent that addresses the applicant’s areas of intended study and the applicant’s qualifications for doctoral-level work
- Three academic letters of recommendations
- Writing Sample (major research paper or M.A. thesis chapter)
- Official undergraduate and graduate transcripts from all schools attended.
Contact Information
For more information about the History and Philosophy Department Graduate programs, please contact the History and Philosophy Department at history@montana.edu or by calling 406-994-4395.

Department of Mathematical Sciences
PO Box 172400
Wilson Hall 2-214
406-994-3601

The Department offers graduate study leading to the degree of Master of Science in either Mathematics or Statistics. The M.S. in Mathematics degree is available with two options: Mathematics and Mathematics Education. The Doctor of Philosophy degree is offered in Mathematics and Statistics. The Ph.D. in Mathematics is available with two emphases: Mathematics and Mathematics Education. The Ph.D. in Statistics is available with two emphases: Statistics and Statistics Education. The Department also offers a Graduate Certificate in Applied Statistics.

Admission
For regular admission to either the M.S. or the Ph.D. degree program, a student should have completed at least eighteen (18) credits of mathematics or statistics beyond calculus. For mathematics majors, this should include a year of advanced calculus. For statistics majors, it should include theory courses in probability and mathematical statistics and applied courses in statistical methods and data analysis. Admission to the mathematics education program determined on an individual basis. Successful applicants are accepted into both the Department and The Graduate School.

Financial Assistance
Graduate assistantships are available to qualified graduate students in Mathematics, Mathematics Education, Statistics, or Statistics Education. Graduate Teaching Assistantships (GTA) usually require teaching one course each semester. Graduate Research Assistantships (GRA) may also be available to qualified students. GRA time requirements are similar to those for teaching assistantships. See the Graduate Assistantships section on the department website for detailed information on appointment criteria.

Degrees Offered
• M.S. in Mathematics (p. 378)
• M.S. in Mathematics (Mathematics Education Option) (p. 398)
• M.S. in Statistics (p. 379)
• Ph.D. in Mathematics (p. 380)
• Ph.D. in Mathematics - Mathematics Education Emphasis (p. 381)
• Ph.D. in Statistics (p. 382)
• Graduate Certificate in Applied Statistics (p. 378)

Graduate Certificate in Statistics
Training in statistical methods is a required part of the education of graduate students in engineering and the sciences. The Graduate Certificate in Statistics is designed to provide additional education in statistical thinking and methodology over and above the basic coursework taken by the typical graduate student. This transcriptable certificate will provide a clear record of additional training in statistics for future graduate programs or employers. The Graduate Certificate will also be of interest to those currently employed in technical fields that utilize statistics in the and to post-baccalaureate students.

Current graduate students must:
Course Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 511</td>
<td>Methods of Data Analysis I</td>
<td>6</td>
</tr>
<tr>
<td>&amp; STAT 512</td>
<td>Methods of Data Analysis II</td>
<td></td>
</tr>
<tr>
<td>Choose two from the following, at least one of which must be either STAT 446 or STAT 541</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>STAT 446</td>
<td>Sampling</td>
<td></td>
</tr>
<tr>
<td>STAT 431</td>
<td>Nonparametric Statistics</td>
<td></td>
</tr>
<tr>
<td>STAT 436/536</td>
<td>Introduction to Time Series Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 437</td>
<td>Introduction to Applied Multivariate Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 439</td>
<td>Introduction to Categorical Data Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 448</td>
<td>Mixed Effects Models</td>
<td></td>
</tr>
<tr>
<td>STAT 525</td>
<td>Biostatistics</td>
<td></td>
</tr>
<tr>
<td>STAT 528</td>
<td>Statistical Quality Control</td>
<td></td>
</tr>
<tr>
<td>STAT 541</td>
<td>Experimental Design</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 12

• Obtain the approval of the department head/graduate coordinator of the student’s major department and the Department of Mathematical Sciences.
• Obtain a grade of B or better in all coursework counted toward the certificate.

Non degree seeking students must:
• Obtain the approval of the department head/graduate coordinator of the Department of Mathematical Sciences and the Graduate School.
• Obtain a grade of B or better in all coursework.

M.S. in Mathematics
Requirements
The Master of Science degrees are offered under Plan A (Thesis) and Plan B (Non-thesis). Of the required thirty (30) credit minimum, at least eighteen (18) credits of 500-level coursework must be taken under either plan.

Available under Plan B is a comprehensive master’s degree in either mathematics or statistics. Although no thesis is required in this plan, a sound knowledge of several areas of mathematics and/or statistics is expected. Also available under Plan B is a master’s degree in mathematics with an option in mathematics education. This option is designed primarily for secondary teachers and is offered as a combination of on-line academic year course work and summer sessions. The mathematics education option requires completion of a program portfolio through a series of seminars.

For further information, refer to the For Master’s Students section. Students are expected to be familiar with both the Department and the Graduate School degree requirements.

Program Guidelines
The Master of Science degree in mathematics at Montana State University is designed to prepare students for further graduate work or for employment in academic, industrial, business, or government forums. Upon entrance, each student meets with the department’s Graduate Program Committee to discuss career objectives and first year course work. During the second semester in the program each student forms a Graduate Committee and together, they outline the student’s degree program. The prerequisites for the master’s degree program in mathematics consist of the following courses or their equivalent: Linear Algebra (M 333), Introduction to Analysis I (M 383), Introduction to Analysis II (M 384). Students who have not completed these courses or their equivalent may still enter the master’s program but it is suggested that these courses then be taken.
Both non-thesis and thesis plans are offered for the
M.S. in Mathematics – Mathematics Option degree:

Non-Thesis Plan
This plan requires both completing the course work and passing the written comprehensive exam. At least 30 credits of course work are required. Of these, at least 18 credits must be numbered 500 or higher. Regardless, all of the following core courses must be completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 503</td>
<td>Advanced Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>M 504</td>
<td>Abstract Algebra</td>
<td>3</td>
</tr>
<tr>
<td>M 505</td>
<td>Principles of Mathematical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>M 511</td>
<td>General Topology</td>
<td>3</td>
</tr>
</tbody>
</table>

Additionally, students must fulfill a breadth requirement by completing at least two of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 441</td>
<td>Numerical Linear Algebra &amp; Optimization</td>
<td>6</td>
</tr>
<tr>
<td>M 450</td>
<td>Applied Mathematics I</td>
<td></td>
</tr>
<tr>
<td>M 454</td>
<td>Introduction of Dynamical Systems I</td>
<td></td>
</tr>
<tr>
<td>STAT 421</td>
<td>Probability Theory</td>
<td></td>
</tr>
</tbody>
</table>

* Either or both of these two required courses may be replaced by the corresponding semester of the appropriate 500 level course: M 581 Numerical Solution of Partial Differential Equations I, M 560 Methods of Applied Mathematics I, M 595 Dynamical Systems I, or STAT 501 Intermediate Probability and Statistics, respectively.

Any other exceptions to the course requirements must be approved by the student’s graduate committee and adhere to the minimum policy requirements set forth in the Graduate Catalog (Plan B).

Requirements for the written comprehensive exam are listed separately below.

Thesis Plan
This plan requires completing the course work, writing a thesis, and an oral defense of the thesis. At least 30 credits must be completed of which 10 must be thesis credits. Students must also complete both the core and breadth course requirements described in the Non-Thesis Plan above. Any exceptions to the course requirements must be approved by the student’s graduate committee and adhere to the minimum policy requirements set forth in the Graduate Catalog (Plan A). Thesis and oral defense requirements must be arranged with and approved by the student’s graduate committee.

M.S. in Mathematics Comprehensive Exam
The M.S. comprehensive exam for mathematics is a written exam administered in two disjoint 3-hour components, one on Analysis (M 505) and one on Linear Algebra (M 503). Each component is graded as pass or fail. To pass the comprehensive exam a student must pass both components within two examination periods.

The examinations are typically given in August and January with the specific dates and times for each component determined by the department. Typically, the students take the exams in August before their third semester of study.

If the student fails one or more components in the first examination period, a failure will be reported to The Graduate School. The student must then pass the remaining required components in a second examination period. If the student has not passed the remaining required components after the second examination period, a second failure of the comprehensive exam will be reported to The Graduate School and the student will be dismissed from the program.

For more information, refer to the Department of Mathematical Sciences [http://www.math.montana.edu].

M.S. in Statistics

Program Guidelines
The Master of Science degree in statistics at Montana State University gives students a solid background in the applications as well as the theory of statistics. Students in this program prepare either for further graduate work or for academic, industrial, business, or government employment. Upon entrance, each student meets with the department’s Graduate Program Committee to discuss career objectives and first year course work. During the second semester in the program each student forms a Graduate Committee and together, they outline the student’s degree program. The prerequisites for the master’s degree program in statistics consist of the following semester courses or their equivalent: Multivariable Calculus (M 273Q), Linear or Matrix Algebra (M 221), Methods of Data Analysis (STAT 411 and STAT 412), Probability (STAT 421), and Mathematical Statistics (STAT 422). Students who have not completed these courses may be accepted into the master’s program with the understanding they should make up these courses by adding one or two additional semesters to their program of study.

Either Plan A (thesis and 20 credits of course work) or Plan B (30 credits of course work) can be chosen. In either case, all courses on a graduate program must be numbered 400 or higher and STAT courses must be numbered 408 or higher. The specific program of study depends on the student’s previous training and experience. Regardless of the plan chosen, (i) at least half of the required non-thesis credits must be STAT courses, (ii) at least two-thirds of the required non-thesis credits must be numbered 500 or higher, and (iii) the following core course credits are required.

M.S. in Statistics Required Courses (16 semester credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 505</td>
<td>Linear Models</td>
<td></td>
</tr>
<tr>
<td>STAT 506</td>
<td>Advanced Regression Analysis</td>
<td></td>
</tr>
<tr>
<td>Statistical Consulting Seminar (STAT 510); take two semesters (1 credit a semester)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>STAT 575</td>
<td>Professional Paper and Project</td>
<td>2</td>
</tr>
</tbody>
</table>

Total Credits 16

Additional requirements
1. The M.S. in Statistics degree requires completion of either a thesis or a writing project.
   a. Thesis (Plan A): The Plan A thesis typically requires at least 400 hours of work. The student must register for at least 10 Master’s Thesis (STAT 590) in addition to the required 20 credits of course work. The student must give an oral defense or his/her thesis.
   b. Writing Project (Plan B): The Plan B writing project typically requires at least 90 hours of work, for which the student earns 2 credits of Professional Paper and Project (STAT 575). With permission from the student’s committee, additional credits of STAT 575 (no more than 4 total) may be earned. Students should enroll in STAT 575 in their final Spring semester, and must give a seminar on the writing project before graduating.

2. Experience in data collection – either through a course such as Sampling (STAT 446) or Experimental Design (STAT 441)/Experimental Design (STAT 541)), or a course taken in a former degree program, or real-life experience.
3. For either Plan A or Plan B, the student must pass a comprehensive examination.

**M.S. in Statistics Comprehensive Exam**

The M.S. comprehensive exam consists of a written exam over material from Intermediate Probability and Statistics (STAT 501), Intermediate Mathematical Statistics (STAT 502), Linear Models (STAT 505), and Advanced Regression Analysis (STAT 506).

The exam is given in August with the specific date determined by the department. Examinees will be informed of the results within five working days of taking the exam. The M.S. comprehensive exam may be repeated once.

**Ph.D. in Mathematics**

Students in mathematics are expected to develop competence in real and complex analysis and at least two areas chosen from applied mathematics, dynamical systems, functional analysis, numerical analysis, partial differential equations, probability, topology or other topics the student’s committee may approve.

The student’s graduate committee determines additional requirements. Degree candidates are expected to be familiar with both departmental and The Graduate School degree requirements.

**Departmental Requirements**

Described below are the Department of Mathematical Sciences requirements for the Ph.D. in Mathematics. These departmental requirements supplement those set out by the Graduate School in the Graduate Catalog for Ph.D. Students.

There are no foreign language requirements or qualifying exam for a Ph.D. in Mathematics.

**Ph.D. Committee**

- The Ph.D. committee must include a minimum of five members excluding the Graduate School-assigned Graduate Representative.
- A committee must be formed before the end of the student’s second semester of study.
- The Committee Chairperson (Advisor) must be a faculty member within the Department of Mathematical Sciences.
- The first three committee members listed on a candidate’s Program of Study read and assess the dissertation.

**Course Requirements**

- A minimum of 30 credit hours beyond the M.S. degree are required (see the Graduate Catalog for Ph.D. Students for details).
- A minimum of 18 credit hours of Doctoral Thesis (M 690) must be taken.
- The Ph.D. student’s Program of Study listing their intended coursework must be approved by all committee members.
- The student must take a minimum of 4 credits of the M 594 seminar series.

Typically, a Ph.D. student takes 18 credits of mathematics in courses numbered 500 or higher to prepare for their comprehensive examination. Students are encouraged to begin some form of doctoral reading or research (either informally or in the form of M 689 credits) with a committee member by their second year of study.

**Ph.D. in Mathematics Comprehensive Exam**

The Ph.D. Comprehensive examination consists of both a written and an oral comprehensive examination. The candidate must pass the written comprehensive exam before taking the oral comprehensive examination.

**Written Comprehensive Exam**

How a student may choose and retake exam components is determined by all of the following:

1. The written comprehensive exam consists of 4-hour exam components graded as Pass or Fail.
2. The candidate must pass three components to pass the written comprehensive examination though they may attempt more.
3. If a candidate fails a component it may be attempted at most once more time.
4. The candidate must pass the following “required” components:
   a. Measure Theory (M 547) - Complex Analysis (M 551)
5. Normally the remaining components are from the following list of “standard” components:
   a. General Topology (M 511) - Geometry & Algebraic Topology (M 512)
   b. Dynamical Systems I (M 595) - Dynamical Systems II (M 596)
   c. Functional Analysis I (M 584) - Functional Analysis II (M 585)
   d. Numerical Solution of Partial Differential Equations I (M 581) - Numerical Solution of Partial Differential Equations II (M 582)
   e. Partial Differential Equations I (M 544) - Partial Differential Equations II (M 545)
   f. Methods of Applied Mathematics I (M 560) - Methods of Applied Mathematics II (M 561)
   g. Measure Theory (M 547) - Probability Theory (M 586)
6. At most one “nonstandard” component not from the “standard” components (list above) may be taken. To take such a component, a petition form must be completed.

**Oral Comprehensive Exam**

After passing the written comprehensive exam the candidate must pass an oral comprehensive exam at a date agreed upon by the candidate’s committee. Normally the oral comprehensive exam is a thesis topic proposal where the candidate’s ability to conduct research on the proposal is assessed. When this is not the case, the candidate will be informed of the nature of the oral comprehensive exam by their committee. The candidate has at most two attempts to pass the oral comprehensive examination.

**Ph.D. in Mathematics Dissertation Requirements**

Once the Ph.D. candidate has passed the comprehensive exam (both written and oral parts) the student has at most five years to submit an acceptable dissertation and pass their final defense. The first three committee members listed on a candidate’s Program of Study must be given a dissertation draft at least two weeks prior to the Final Defense. Regardless, all committee members must have access to a dissertation draft at least one week prior to the Final Defense. The dissertation should embody the results of extended research by the candidate, be an original contribution to knowledge, and include new material worthy of publication. The dissertation must be submitted as an electronic dissertation, in final form to the Graduate School not later than 14 working days before the end of the term in which graduate work is completed.
Ph.D. In Mathematics Final Defense
Department policies on the final defense and all other administrative procedures regarding the degree completion are exactly those as set out by The Graduate School.

Ph.D. in Mathematics - Mathematics Education Emphasis

Program Overview
The Ph.D. in Mathematics with an emphasis in mathematics education combines study in advanced mathematics, mathematics education, and quantitative and qualitative research methods in education. This pathway is designed for candidates who plan a future of teaching, research, and service focused on mathematics education in K-12 settings. The program focuses on the teaching and learning of K-12 mathematics including curriculum, instruction, assessment, and teacher preparation or professional development in the K-12 education system. Graduates typically go on to faculty positions in mathematics departments that involve teacher preparation and research in K-12 mathematics education. Applicants are expected to possess K-12 teaching experience or to gain such experience through internships.

Admission (preferred qualifications)
• An earned master’s degree in mathematics, statistics, or mathematics education, including graduate-level mathematics coursework in topics such as algebra and analysis. (Applicants with a strong undergraduate degree in mathematics or mathematics teaching may also be considered for an extended version of the program.)
• One of the following:
  • Teacher licensure in secondary mathematics
  • Two years K-12 teaching experience
  • Two years college teaching experience

Required Equivalencies (upon completion of coursework)
Provisional Licensure: All graduates of this program are expected to acquire a minimum level of competency in secondary mathematics instruction, comparable to satisfying the requirements for Montana’s provisional license to teach mathematics. This includes a Bachelor of Science degree in mathematics and at least six credit hours of education coursework. Ph.D. candidates who fall short of the six-credit requirement will select courses from the following:

- Complete a secondary mathematics methods course Methods: 9-12 Mathematics (EDU 497) or Methods: 5-8 Mathematics (EDU 497R)
- Complete either Standards-Based Mathematics for Teaching (M 520), Mathematics Learning Theory for Teaching (M 521), or another approved course.

K-12 Classroom Experience: Students who lack sufficient exposure to instruction at the elementary or secondary level will be required to complete school-based internships prior to beginning dissertation research. Each internship calls for 135 hours of field experience as well as participation in a spring seminar that may address reviews of research, lesson study, analysis of student work, and reflection on classroom experiences.

• Elementary internship: teach, tutor, and observe students in a K-8 classroom
• Secondary internship: teach one or more courses at the high school level

Required Course Work (60 credits)
Mathematics - required (minimum 15 credits at MSU)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 503</td>
<td>Advanced Linear Algebra</td>
</tr>
<tr>
<td>M 504</td>
<td>Abstract Algebra</td>
</tr>
</tbody>
</table>

One two-course doctoral sequence from the list below (6 credits)
Additional mathematics courses to be selected (3+ credits)

Mathematics Education - required (minimum 9 credits)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 528</td>
<td>Curriculum Design</td>
</tr>
<tr>
<td>M 529</td>
<td>Assessment Models and Issues</td>
</tr>
<tr>
<td>M 534</td>
<td>Research in Mathematics Education</td>
</tr>
</tbody>
</table>

Research Methods and Statistics - required (minimum 12 credits)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 511</td>
<td>Methods of Data Analysis I</td>
</tr>
<tr>
<td>STAT 512</td>
<td>Methods of Data Analysis II</td>
</tr>
<tr>
<td>EDCI 506</td>
<td>Applied Educational Research</td>
</tr>
<tr>
<td>EDUC 610</td>
<td>Qualitative Educational Research</td>
</tr>
</tbody>
</table>

Seminars and Internships - see explanation above (0 to 6 credits)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 576</td>
<td>Internship</td>
</tr>
<tr>
<td>M 594</td>
<td>Seminar</td>
</tr>
</tbody>
</table>

Supporting Coursework - to be approved by committee (3+ credits)
May include specialized research courses or additional mathematics education coursework

Dissertation - required (21 credits)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 689</td>
<td>Doctoral Reading &amp; Research</td>
</tr>
<tr>
<td>M 690</td>
<td>Doctoral Thesis</td>
</tr>
</tbody>
</table>

Doctoral Mathematics - choose one two-course sequence from the following:
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 544</td>
<td>Partial Differential Equations I</td>
</tr>
<tr>
<td>M 545</td>
<td>Partial Differential Equations II</td>
</tr>
<tr>
<td>M 547</td>
<td>Measure Theory</td>
</tr>
<tr>
<td>M 551</td>
<td>Complex Analysis</td>
</tr>
<tr>
<td>M 560</td>
<td>Methods of Applied Mathematics I</td>
</tr>
<tr>
<td>M 561</td>
<td>Methods of Applied Mathematics II</td>
</tr>
<tr>
<td>M 581</td>
<td>Numerical Solution of Partial Differential Equations I</td>
</tr>
<tr>
<td>M 582</td>
<td>Numerical Solution of Partial Differential Equations II</td>
</tr>
<tr>
<td>M 584</td>
<td>Functional Analysis I</td>
</tr>
<tr>
<td>M 585</td>
<td>Functional Analysis II</td>
</tr>
<tr>
<td>M 586</td>
<td>Probability Theory</td>
</tr>
<tr>
<td>M 591</td>
<td>Topics in Applied Math I</td>
</tr>
<tr>
<td>M 592</td>
<td>Topics in Applied Math II</td>
</tr>
<tr>
<td>M 595</td>
<td>Dynamical Systems I</td>
</tr>
<tr>
<td>M 596</td>
<td>Dynamical Systems II</td>
</tr>
</tbody>
</table>

Comprehensive Examinations
Graduates of the program earn the equivalent of a master’s degree in mathematics, and must successfully complete a comprehensive examination in mathematics. Two additional examinations address knowledge related to K-12 mathematics’ teaching and learning and educational research design.

• One comprehensive exam in Mathematics. This exam will be determined by the graduate committee and administered according to the guidelines for mathematics.
• One comprehensive exam in Mathematics Education. This exam is developed and scored by the current (or most recent) instructors
of Curriculum Design (M 528) and Assessment Models and Issues (M 529).
• One comprehensive exam in Educational Statistics and Research Methods. This exam is collaboratively developed by the current (or most recent) instructor of Research in Mathematics Education (M 534) and appropriate research methods faculty in Statistics and Education.

Dissertation Research Component
The dissertation is a study in mathematics education. Scholarship in mathematics education examines teaching and learning, with roots in the disciplines of mathematics and educational theory and practice. It is grounded in mathematics content through the study of curriculum and mathematical practice and is generally carried out through social science research methods, including both qualitative and quantitative analysis. Mathematics education research at Montana State University adopts an applied approach, and research efforts often focus on the development and ongoing support of K-12 mathematics teachers. Doctoral students conduct research in areas relevant to current faculty research interests or funded projects.

Ph.D. in Statistics
Ph.D. in Statistics Program Requirements
The Ph.D. program in Statistics at Montana State University prepares students for academic, industrial, business, or government employment. To earn a Ph.D. in Statistics, a student must pass a qualifying exam, pass written and oral Ph.D. comprehensive exams, and write and defend a Ph.D. dissertation. The exams are described below. The dissertation must be an original contribution to statistical science and must include new material worthy of publication. There is no departmental foreign language requirement for the Ph.D.

A Ph.D. student typically takes at least 30 credits of statistics in courses numbered 500 and higher. Credits from graduate courses taken from another department can be included in the Program of Study with the approval of the student’s Ph.D. Graduate Committee. Additional course work in statistics and/or mathematics may be necessary, depending on the candidate’s chosen area of specialization and background. For example, a Ph.D. student is expected to have completed all courses required for the M.S. degree in statistics and may need to make-up one or more of these courses if deficient.

Once admitted to the Ph.D. program, the Ph.D. student will participate in the Statistical Consulting Seminar (STAT 510). Through this participation, the student will gain important experience in practical problem solving, computational statistics and statistical report writing. A minimum of two credits of Statistical Consulting Seminar (STAT 510) are required.

Also, it is expected that a Ph.D. student will take a directed study course in Doc Reading & Research (STAT 689) in his/her area of specialty before taking the written and oral comprehensive exams followed by Doctoral Thesis (STAT 690).

Qualifying Exam
The Ph.D. qualifying exam is identical to the statistics M.S. comprehensive exam except that the exam must be passed at what is deemed to be at a Ph.D. level (i.e., Ph.D. pass). A student who earned an M.S. in Statistics from MSU need not take the PhD qualifying exam if the M.S. comprehensive exam was passed at the Ph.D. level. Other prospective students are expected to take the Ph.D. qualifying exam as soon as relevant coursework has been completed. Two post-master’s attempts to pass the qualifying exam are allowed.

Comprehensive Exam
The comprehensive exam has two components: written and oral. The topics and format of the written comprehensive exam for the Ph.D. in Statistics will be determined by the student’s committee. They are given each August, with a specific date determined by the student’s Ph.D. Committee. Once the written comprehensive examination has been passed, the student must pass the oral comprehensive examination. The student has 2 chances to pass each exam. The written part of the Ph.D. comprehensive will consist of several components. These will typically include:

• A general review/summary related to the proposed research area.
• Reading and critiquing at least one journal article related to the proposed research area.
• Performing a data analysis with a written summary. The data analysis will be related to coursework taken by the student.
• A component related to Bayesian statistics and/or other relevant coursework determined by the student’s Ph.D. Graduate Committee.

The student will be given several days to submit her/his written summaries.

Each student must devise areas of concentrated study. The requirements associated with each component are flexible, however the concentration areas must be approved by the student’s committee and must include an amount of material equivalent to at least 6 graduate level courses. An area could involve course material from a discipline outside the department. That is, the Ph.D. Graduate Committee will determine the exact details of each component with the goal of assessing the student’s potential for performing independent research in the proposed research area.

Department of Microbiology and Immunology
Microbiology and Immunology office:
PO Box 173520
Tel: 406-994-2902 Fax: 406-994-4926
Email: Mbi@montana.edu

The Department of Microbiology and Immunology (MBI) conducts one of the premier infectious disease research programs in the Northwest, as demonstrated by the success of our faculty in competing nationally for extramural grant funding and publishing high-impact papers. Research funding comes from a range of sources such as the National Institutes of Health, US Department of Agriculture, National Science Foundation and the Montana Agricultural Experimental Station among others. Over the past five years, MBI averaged over $6 million for annual research expenditures. MBI is also home to an NIH Center of Biomedical Research Excellence in Zoonotic and Emerging Infectious Diseases, which provides substantial core facilities and training opportunities for junior investigators. MBI is housed in a state-of-the-art facility with core laboratories for flow cytometry, cell biology, and molecular sciences, as well as pathogen containment facilities for small (BSL-3) and large animal research (ABSL-2). Instrumentation suites house equipment for DNA sequencing, genomic analysis, flow cytometry and cell sorting, and confocal microscopy.

We are truly unique in our close proximity to Yellowstone National Park. On our doorstep is one of the most exciting microbial ecosystems in North America, ripe with opportunities to discover new microbial life forms and contribute to major biotechnological advances. Many of our undergraduate and graduated students conduct research in the Park under the mentoring of our distinguished faculty.
Weekly seminars are offered by the department and the Frank N. Nelson Distinguished Lecture Series brings many accomplished scientists to Montana State University.

**Admission**

For detailed information, refer to the Admission Policies and Application Requirements sections. The MBI Graduate Committee will screen all applications and make recommendations to the Graduate Dean for acceptance to the MBI graduate program. Successful applicants are accepted into both the Department and The Graduate School.

In addition to the documents required in the Application Requirements section, the Graduate Committee will consider the applicant’s research experience and the potential of the applicant to complete an appropriate program of study and an independent research project. The final disposition of each application will also take into account other factors, such as the availability of research positions (stipends).

The Graduate Committee, MBI faculty, and the MBI head will decide on the acceptability of all applicants. The Graduate Committee will serve as the adviser for all students accepted into the program during their first year of study.

**Research**

The research problem will be chosen in consultation with the student’s thesis or dissertation advisor. Research areas include microbiology, molecular biology and immunology, bacteriology, cell biology, mycology, parasitology, protozoology, physiology, genetics, biochemistry, ultrastructural cytology, virology, immunopathology, and a strong focus on biomedical research. Specialized equipment and facilities include large and small animal isolation units, a flow cytometry core facility, automated DNA sequencers, proteomics and genomics instrumentation, a microscopy core, numerous analytical equipment, multiple tissue-culture and histopathology laboratories.

Our research facilities at MSU include modern, well-equip laboratories and specialized state of the art equipment for instruction and research. In addition, the Department hosts three major university facilities, currently supported through Montana IDeA Network of Biomedical Research Excellence (INBRE) program, including:

- Functional Genomics Core Facility ([http://www.inbre.montana.edu/bioinformatics/functional_genomics.html](http://www.inbre.montana.edu/bioinformatics/functional_genomics.html))
- Bioinformatics Teaching and Research Facility ([http://www.inbre.montana.edu/bioinformatics/bioinformatics_facility.html](http://www.inbre.montana.edu/bioinformatics/bioinformatics_facility.html))
- Community Based participatory Research (CBPR) and Health Disparities Core Facility ([http://www.inbre.montana.edu/cce/cbpr.html](http://www.inbre.montana.edu/cce/cbpr.html))
- COoley Laboratory ([http://www.montana.edu/mbi/facilities/CooleyLab.html](http://www.montana.edu/mbi/facilities/CooleyLab.html))

**Financial Assistance**

Students of high scholastic caliber are encouraged to contact the Department of Microbiology and Immunology for information about teaching and research assistantships, and fellowships. Most of our graduate students are supported financially throughout their graduate training. Both assistantships and fellowships are awarded for one-year periods but are renewable if the graduate student’s progress has been satisfactory. See the Graduate Assistantships sections of the departmental website for detailed information on appointment criteria.

**Graduate Programs**

- M.S. in Microbiology and Immunology (Plan A) (p. 296)
- M.S. in Microbiology and Immunology (Plan B) (p. 297)
- Ph.D. in Microbiology and Immunology (p. 297)

**Department of Native American Studies**

P.O. Box 172340
2-179 Wilson Hall, Bozeman, MT 59717-2340
406-994-3881 Email: nas@montana.edu

Montana State University has an American Indian enrollment of approximately 700 students. There is an active American Indian Student Council (AIC) as well as chapter of the American Indian Science and Engineering Society (AISES) and the Society of American Indian Graduate Students (SAIGS). NAS houses the Native American Student Center and the American Indian and Alaska Native Student Support Services office, with staff providing Native students with academic advising, counseling, and mentoring. The Student Center offers tutorial assistance, telephone and fax access, and a computer lab.

**Admission**

Candidates are not required to complete the Graduate Record Examination (GRE) General Test, but may do so if they feel it will strengthen their applications. The closing date for receipt of completed applications for admission is April 15 for Summer, July 15 for Fall, and November 15 for Spring, although we encourage an earlier submission.

A bachelor’s degree or equivalent from an accredited institution is required for admission to the master’s program in Native American Studies. The Graduate School recommends that prospective applicants reach out to the Native American Studies Department by email or phone call in order to ascertain the suitability of the program for the applicant.

Each applicant must submit the following during the online application process ([http://www.montana.edu/gradschool/admissions/apply.html](http://www.montana.edu/gradschool/admissions/apply.html)):

1. Application to MSU-Bozeman (link above): application process includes a non-refundable $60 application fee.
2. Official transcripts from all institutions attended: applicants must have a minimum GPA of 3.00 for the last two years of undergraduate study. If the applicant received their degree from MSU; transcripts are not necessary.
3. A 2-5 page statement of purpose and goals: this paper includes the applicant’s experience and knowledge of historical and contemporary American Indian issues, work background, how the M.A. in NAS will help the applicant reach long range goals, and benefit American Indian peoples/communities.
4. Two academic writing samples (demonstrating the applicant’s research and writing capabilities).
5. Three letters of recommendation: each recommender will address the applicant’s potential as a graduate student. The letters, preferably from previous faculty, must be signed and sealed in envelopes or emailed by the faculty member (once prompted during the online process).
6. A current curriculum vita or résumé.
7. International Students Only: English proficiency scores are required for applicants who are not U.S. citizens and not from countries where English is the official language. This requirement is waived if the applicant has earned an undergraduate or graduate degree from an institution in the U.S. Minimum scores are as follows: TOEFL [80], IELTS [level 6.5] or PTE [54].

Limited slots are available, and admissions are competitive.
Deadlines
For applicants also applying for graduate teaching assistantships, the deadline is April 15 for the following academic year.

Applicants must be formally accepted by The Graduate School with departmental endorsement from Native American Studies.

Financial Assistance
Graduate Teaching Assistantships, awarded on a competitive basis, are available in NAS to formally admitted graduate students. The GTA includes a 6 credit tuition waiver and stipend. Selected graduate students will teach two recitation sections of Introduction to Native American Studies and/or other NAS courses. A prerequisite for application is the successful completion of NASX 530 Federal Indian Law and Policy. See the Graduate Assistantships sections on the Graduate School website for detailed information on appointment criteria.

Graduate classes in Native American Studies
The Following upper division and graduate level courses are offered in Native American Studies:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASX 405</td>
<td>Gender Issues in Native American Studies</td>
<td>3</td>
</tr>
<tr>
<td>NASX 415</td>
<td>Native Food Systems</td>
<td>3</td>
</tr>
<tr>
<td>NASX 430</td>
<td>American Indian Education</td>
<td>3</td>
</tr>
<tr>
<td>NASX 440</td>
<td>Montana Indian Literature</td>
<td>3</td>
</tr>
<tr>
<td>NASX 450</td>
<td>History of American Indians</td>
<td>3</td>
</tr>
<tr>
<td>NASX 476</td>
<td>American Indian Policy and Law</td>
<td>3</td>
</tr>
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<td>NASX 490R</td>
<td>Undergraduate Research</td>
<td>1-6</td>
</tr>
<tr>
<td>NASX 490Z</td>
<td>Undergraduate Research</td>
<td>1-6</td>
</tr>
<tr>
<td>NASX 491</td>
<td>Special Topics</td>
<td>1-4</td>
</tr>
<tr>
<td>NASX 492</td>
<td>Independent Study</td>
<td>1-3</td>
</tr>
<tr>
<td>NASX 494</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>NASX 498</td>
<td>Internship/Cooperative Educ</td>
<td>2-12</td>
</tr>
<tr>
<td>NASX 505</td>
<td>Proseminar Native Amer Studies</td>
<td>3</td>
</tr>
<tr>
<td>NASX 515</td>
<td>Native Food Systems</td>
<td>3</td>
</tr>
<tr>
<td>NASX 520</td>
<td>Fem/Gender Theories IN NAS</td>
<td>3</td>
</tr>
<tr>
<td>NASX 521</td>
<td>Tribal Government: Yesterday &amp; Today</td>
<td>3</td>
</tr>
<tr>
<td>NASX 523</td>
<td>Am Indians/Minority in High Ed</td>
<td>3</td>
</tr>
<tr>
<td>NASX 524</td>
<td>Contemporary Issues in American Indian Studies</td>
<td>3</td>
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<tr>
<td>NASX 525</td>
<td>Indigenous Philosophies/Sacred Ecologies</td>
<td>3</td>
</tr>
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<td>NASX 530</td>
<td>Federal Law and Indian Policy</td>
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</tr>
<tr>
<td>NASX 540</td>
<td>Theoretical Positions in NAS</td>
<td>3</td>
</tr>
<tr>
<td>NASX 541</td>
<td>Critical Approach to NAS Methods</td>
<td>3</td>
</tr>
<tr>
<td>NASX 550</td>
<td>Native Americans: Dispelling the Myths</td>
<td>3</td>
</tr>
<tr>
<td>NASX 551</td>
<td>Native North America: Art, Agency, Activism</td>
<td>3</td>
</tr>
<tr>
<td>NASX 552</td>
<td>Indigenous Nations of Montana</td>
<td>3</td>
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<td>NASX 553</td>
<td>Indigenous Literature and the West</td>
<td>3</td>
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<tr>
<td>NASX 560</td>
<td>Native American Lit Tradition</td>
<td>3</td>
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<tr>
<td>NASX 575</td>
<td>Professional Paper</td>
<td>1-6</td>
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<td>NASX 589</td>
<td>Graduate Consultation</td>
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<td>NASX 590</td>
<td>Master’s Thesis</td>
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<td>Special Topics</td>
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<td>NASX 592</td>
<td>Independent Study</td>
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<td>NASX 594</td>
<td>Seminar</td>
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<tr>
<td>NASX 598</td>
<td>Internship</td>
<td>1-6</td>
</tr>
</tbody>
</table>

Further Information
For further information regarding the program, contact Native American Studies at (406) 994-3881 or e-mail Megan Gourneau at megangourneau@montana.edu (francesca.pine@montana.edu). In addition, applicants may refer questions to The Graduate School or find the graduate catalog and policies on-line (http://www.montana.edu/gradschool/policy). All applicants are expected to be familiar with the degree requirements of both the department and The Graduate School. Also see the MSU University home page (http://www.montana.edu) or the home page for Native American Studies (http://www.montana.edu/wwwnas).

Graduate Programs
• M.A. in Native American Studies (p. 384)
• Online certificate in Native American Studies (p. 400)

M.A. in Native American Studies
Native American Studies offers a Master of Arts (MA) degree in Native American Studies with an inter-disciplinary approach which makes the best possible use of university resources. The program allows each graduate student the opportunity to select a course of study that combines Native American Studies and a student’s particular area of interest (e.g., history, business, literature, political science). The 30/31-credit program is designed so that each graduate student could complete the program within three to four semesters of concentrated work. Students will be expected to attend at least two full semesters on campus. Students who have completed the graduate certificate in Native American Studies may transfer 9 credits of coursework to the Master’s degree. The program’s mission, purpose, and objective emphasis is to graduate, in a timely manner, knowledgeable professionals and academicians well grounded in Native American issues and scholarship.

The Master’s program offers two plans: Plan A – Thesis Option or Plan B – Professional Paper/Project Option.

Plan A requires course work, oral defense of a research prospectus, a written thesis, and an oral defense of the thesis. This option is preparation for doctoral work in Native American Studies or a related field of study.

Plan B requires course work, oral defense of a research prospectus, and completion of a professional paper or project. The non-thesis option is preparation for employment in tribal, state, or federal government, a small or large business, and/or a tribal college.

Admission
Candidates are not required to complete the Graduate Record Examination (GRE) General Test, but may do so if they feel it will strengthen their applications. The closing date for receipt of completed applications is April 15 for Summer, July 15 for Fall, and November 15 for Spring. For detailed Graduate School requirements, please see the Policies and Procedures (http://www.montana.edu/gradschool/policy/dates-deadlines.html) online. Successful applicants must have their applications accepted by The Graduate School (with departmental endorsement) before an individual is considered a graduate student at MSU.

A bachelor’s degree or equivalent from an accredited institution is required for admission to the Master’s program in Native American Studies. The Graduate School recommends that prospective applicants reach out to the Native American Studies Department by email or phone call in order to ascertain the suitability of the program for the applicant.

Each applicant must submit the following during the online application process (http://www.montana.edu/gradschool/admissions/apply.html)
Plan A – Thesis Option, 31 credits required:

1. The Graduate Record Exam (GRE) is optional for students who feel it may strengthen their application.
2. Official transcripts from all institutions attended (students must have a minimum GPA of 3.00 for the last two years of undergraduate study). The applicant does not need to submit transcripts from a degree awarded from MSU.
3. Two academic writing samples, demonstrating the applicant’s graduate-level research and writing capabilities.
4. A 2-5 page statement of purpose and goals which includes applicant’s experience and knowledge of historical and contemporary American Indian issues, work background, and how the M.A. in NAS will help the applicant reach long range goals, and benefit American Indian peoples/communities.
5. Three letters of recommendation addressing the applicant’s potential as a graduate student, preferably by academic sources. The applicant will be prompted to submit contact information of their recommenders directly in the online application.
6. A current curriculum vita or résumé.
7. International Applicants ONLY: Mandatory English proficiency test score are required for all applicants who are not U.S. Citizens are are not from countries where English is the “official” language. Minimum scores required are as follows: TOEFL (80), IELTS [level 6.5] or PTE [54].

Limited slots are available, and admissions are competitive.

**Deadlines & Assistantships**

For students applying for graduate teaching assistantships, the application deadline is April 15 for the following academic year.

For all other applicants, the deadline is July 15 for fall and November 15 for spring semester. Applicants must be formally accepted by The Graduate School with departmental endorsement from Native American Studies.

**Financial Assistance**

Graduate Teaching Assistantships, awarded on a competitive basis, are available in NAS to formally admitted graduate students. The GTA includes a 6 credit tuition waiver and stipend. Selected graduate students will teach a section of Introduction to Native American Studies and/or other NAS courses. A prerequisite for application is the successful completion of NASX 530 Federal Law and Indian Policy. See the Graduate Assistantships sections on the Graduate School website for detailed information on appointment criteria.

**Further Information**

For further information regarding the program, contact Native American Studies at (406) 994-3881 or e-mail Megan Gourneau at megangourneau@montana.edu (francesca.pine@montana.edu). In addition, you may refer questions to The Graduate School (http://www.montana.edu/gradschool). Students are expected to be familiar with the degree requirements of both the department and The Graduate School.

**Master’s Degree Requirements**

**Plan A – Thesis Option, 31 credits required:**

- 10 credits minimum Thesis (590) credits
- ½ of total credits must be at 500 level
- Maximum of four (4) Independent Study (592) credits

**Plan B – Non-thesis - Professional Paper or Project, 30 credits required:**

- Maximum of 6 Professional Paper/Project (575) credits
- 15 credits minimum at 500 level
- Maximum of six (6) 570 credits
- Maximum of six (6) Independent Study (592) credits
- Pass/Fail – Maximum of 3 credits allowed (excluding thesis)

**Requirements for both Plan A and Plan B:**

- 490, 492/470, 494/400, 498/476, 588, 589 credits – Not allowed on the program of study
- 594/500, 598/576, 592/570 credits – May not exceed 1/3 of total credits required for degree (10 credits)
- Non-Degree/Reserved credits – Maximum of six (6) to nine (9) credits allowed depending upon admissibility at the time the course(s) were taken. (See graduate catalog)
- All Course work credits may not be more than six (6) years old at time of graduation.
- Transfer credits – May not exceed 9 total credits on program.
- Grade performance for courses on Program of Study – Grades below “C-” must be repeated. “I” grades must be resolved before graduation.
- 3 credits (minimum) Registrar Registration required during term of comprehensive exams, defense of thesis, and graduation.
- 3 credits (minimum) Registrar Registration required for continuous enrollment. Continuous enrollment applies to all master’s students who have passed a comprehensive examination or students who have completed program content coursework (excludes thesis credits).

**Required Content Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>NASX 530</td>
<td>Federal Law and Indian Policy</td>
<td>3</td>
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<tr>
<td>NASX 540</td>
<td>Theoretical Positions in NAS</td>
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</tr>
<tr>
<td>NASX 541</td>
<td>Critical Approach to NAS Methods</td>
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**Graduate classes in Native American Studies**

The Following upper division and graduate level courses are offered in Native American Studies:

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<td>NASX 440</td>
<td>Montana Indian Literature</td>
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</tr>
<tr>
<td>NASX 450</td>
<td>History of American Indians</td>
<td>3</td>
</tr>
<tr>
<td>NASX 470</td>
<td>Indigenous Planning: Strategic Economic and Human Development Approaches</td>
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<tr>
<td>NASX 476</td>
<td>American Indian Policy and Law</td>
<td>3</td>
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<td>NASX 490R</td>
<td>Undergraduate Research</td>
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<td>NASX 490Z</td>
<td>Undergraduate Research</td>
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<td>NASX 491</td>
<td>Special Topics</td>
<td>1-4</td>
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<td>NASX 492</td>
<td>Independent Study</td>
<td>1-3</td>
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<td>NASX 494</td>
<td>Seminar</td>
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<td>NASX 505</td>
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NASX 525  Indigenous Philosophies/Sacred Ecologies  3
NASX 530  Federal Law and Indian Policy  3
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NASX 589  Graduate Consultation  1-3
NASX 590  Master’s Thesis  1-10
NASX 591  Special Topics  1-4
NASX 592  Independent Study  1-3
NASX 594  Seminar  1-4
NASX 598  Internship  1-6

Faculty
Chair
Walter Fleming
PhD

Associate Professors
Matthew Herman
PhD
Kristin Ruppel
PhD

Assistant Professor
Gail Small
JD

Professor Emeritus
Wayne Stein
EdD

Department of Physics

Physics Graduate Programs
Information about the Physics Department can be found at Physics Department Home Page (http://www.physics.montana.edu)

Details on Physics graduate programs, application process, and degree requirements can be found at: Physics Graduate Program Overview (http://www.physics.montana.edu/grad)

Degrees Offered
M.S. Physics: The Department of Physics grants the Master of Science Degree under two options: Plan-A (thesis required), and Plan-B (without thesis).
Ph.D. Physics: The Physics Ph.D. degree has an option to obtain an M.S. degree en route to a Ph.D.

M.S. Optics: The M.S. Degree in Optics and Photonics is an interdisciplinary managed by the three participating departments: Physics, Electrical and Computer Engineering, and Chemistry and Biochemistry. There are two options: Option A (thesis) and Option B (professional paper).

Department Head
Yves Idzerda, Ph.D
Professor, Department Head & Graduate Program Coordinator
Barnard Hall (EPS) Room 264C, Bozeman MT, 59717-3840
406-994-7838

Research
Research programs in the Department of Physics are currently focused in several areas: optical science and laser technology, condensed matter physics, gravitational physics, astrophysics, solar physics, and science education. The MSU Gravity Group studies extreme astrophysical phenomena, such as the inspiral and merger of black holes and neutron stars, to further our understanding of astrophysics and fundamental physics. Our programs in astrophysics and relativity are directed toward a fundamental understanding of the behavior of matter and energy on the astrophysical scale. Our solar physics group studies phenomena such as solar flares and prominences associated with the star nearest us, the sun. Our research in the physics of lasers and condensed matter systems - such as magnetic and dielectric materials, semiconductor and metal surfaces and thin films, microwave photonic devices, laser materials and superconducting solids - enlarges the knowledge base on which future advances in technology are founded. Our research in science education aims to improve the understanding of how students can best learn science in the schools, colleges, and universities. Faculty working with the most advanced techniques on current topics carry their research experience into the classrooms at all levels.

Our research groups foster interactions among the faculty, undergraduate and graduate students, research scientists, visiting scientists, and other departments and centers. Our research facilities at the Engineering and Physical Science (EPS) Building include state-of-the-art laboratories and equipment. External collaborations bring national and international experts to the department and open opportunities for research to be conducted at other world-class laboratories around the globe. On-campus, interdisciplinary research include collaborations with the departments of Chemistry and Biochemistry, Electrical and Computer Engineering, Mechanical Engineering, and several research centers and institutes on campus including the Space Science and Engineering Laboratory (SSEL), the Imaging and Chemical Analysis Laboratory (ICAL), Montana Space Grant Consortium (MSGC), the Optical Technology Center (OptTeC), and the Spectrum Lab and interdisciplinary academic programs, such as Material Science and Optics and Photonics undergraduate and graduate degree programs. Research collaborations with local industries are numerous and actively pursued. For more information on each research program, look at the departmental Research and Programs (http://www.physics.montana.edu/research/resgroups.htm) page.

Application Deadline & Financial Assistance
Information
Fall admission: May 1st of each year. New graduates are accepted for Fall term only. Applications received before January 1st will be acted upon and notification of admission given by April 15th. Applications received after January 1st will be treated individually on a “space-available” basis.

Most physics graduate students demonstrating satisfactory progress are awarded financial aid throughout their graduate program in the form of research and teaching assistantships, and tuition and fee waivers.

Masters in Optics
The M.S. Degree in Optics and Photonics is an interdisciplinary, cooperative program managed by the Optics Program Committee on behalf of the three participating departments: Physics, Electrical and Computer Engineering, and Chemistry and Biochemistry. Students apply directly to the Optics and Photonics Graduate Program and are admitted through one
of the participating departments, selected based on advisor affiliation and student interest.

The Optics and Photonics degree is distinct from the other graduate degrees offered by the participating departments because it requires interdisciplinary coursework involving at least two of the departments. The interdisciplinary program of study allows students to emphasize optics theory and applications in more depth than is possible through degrees in the traditional disciplines. Each optics student will be mentored by a graduate advisor from the faculty of one of the three participating departments, and a graduate supervisory committee made up of faculty from at least two of the three departments in the cooperative program.

Optics and Photonics graduate students are required to pass the optics qualifying examination at the end of their first year of enrollment. Students who fail the qualifying examination may have a second chance to pass the exam the second year, but in that case financial assistance may not be available the second year. Optics and Photonics graduate students will defend their thesis or professional paper in an oral examination. There is an Option A (thesis) and Option B (professional paper).

More information on the M.S. Degree in Optics can be found at: M.S. Degree in Optics (http://www.physics.montana.edu/grad/opticsMS.html)

**Ph.D. in Material Science**

MSU is part of a collaborative Ph.D. program with UMT and MTech in materials science (MatSci). At MSU, the Ph.D program involves multiple departments, faculty, courses, and research infrastructure. Research specialties are focused in biomaterials; electronic, photonic, and magnetic materials; materials for energy storage, conversion, and conservation; and materials synthesis, processing, and fabrication. The curriculum integrates a broad range of physical science and engineering disciplines with an even broader range of applications: from health and medicine to nanotechnology to energy, environment, and natural resources. Each student will complete original, independent research culminating in a dissertation.

More information on the M.S. Degree in Optics can be found at: Ph.D. in Materials-science (http://www.montana.edu/gradschool/graduate-programs/materials-science.html)

**Degrees Offered**

- M.S. in Physics (p. 387)
- Ph.D. in Physics (p. 387)
- Ph.D. in Materials and Science (p. 409)

**Interdisciplinary Degrees Offered**

- M.S. in Optics & Photonics Plan A (thesis) (p. 361)
- M.S. in Optics & Photonics Plan B (professional paper) (p. 362)

**M.S. in Physics**

The Department of Physics grants the Master of Science Degree under two options: Plan-A (thesis required), and Plan-B (without thesis).

**Plan-A Requirements**

**Coursework**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 594</td>
<td>Seminar (01 - Teaching Seminar)</td>
<td>1</td>
</tr>
<tr>
<td>PHSX 594</td>
<td>Seminar (15 - Research Introduction Seminar)</td>
<td>1</td>
</tr>
<tr>
<td>PHSX 501</td>
<td>Advanced Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 506</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 519</td>
<td>Electromagnetic Theory I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 566</td>
<td>Mathematical Physics I</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>(see electives)</td>
<td>6</td>
</tr>
</tbody>
</table>

**Thesis**

- Master’s Thesis (An acceptable thesis and at least 10 credits of this course are required)

**Comprehensive Examination**

- A written comprehensive examination is required. A final oral examination is also required, covering the thesis and related areas.

**Total Credits**

- 30

**Plan-B Requirements**

**Coursework**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 594</td>
<td>Seminar (01 - Teaching Seminar)</td>
<td>1</td>
</tr>
<tr>
<td>PHSX 594</td>
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<td>1</td>
</tr>
<tr>
<td>PHSX 501</td>
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<td>3</td>
</tr>
<tr>
<td>PHSX 506</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>&amp; PHSX 507</td>
<td>and Quantum Mechanics II</td>
<td>6</td>
</tr>
<tr>
<td>PHSX 519</td>
<td>Electromagnetic Theory I</td>
<td>6</td>
</tr>
<tr>
<td>&amp; PHSX 520</td>
<td>and Electromagnetic Theory II</td>
<td>6</td>
</tr>
<tr>
<td>PHSX 566</td>
<td>Mathematical Physics I</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>(see electives)</td>
<td>10</td>
</tr>
</tbody>
</table>

**Thesis**

- A minimum of 30 credits of acceptable course work is required, which shall be distributed as follows:

**Total Credits**

- 30

**Ph.D. in Physics**

**Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 594</td>
<td>Seminar (01 - Teaching Seminar)</td>
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<tr>
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<td>Seminar (15 - Research Introduction Seminar)</td>
<td>1</td>
</tr>
<tr>
<td>PHSX 501</td>
<td>Advanced Classical Mechanics</td>
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<td>Quantum Mechanics I</td>
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<tr>
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<td>6</td>
</tr>
<tr>
<td>PHSX 519</td>
<td>Electromagnetic Theory I</td>
<td>6</td>
</tr>
<tr>
<td>&amp; PHSX 520</td>
<td>and Electromagnetic Theory II</td>
<td>6</td>
</tr>
<tr>
<td>PHSX 535</td>
<td>Statistical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 566</td>
<td>Mathematical Physics I</td>
<td>6</td>
</tr>
<tr>
<td>&amp; PHSX 567</td>
<td>and Mathematical Physics II</td>
<td>6</td>
</tr>
<tr>
<td>Electives</td>
<td>(see electives)</td>
<td>14</td>
</tr>
</tbody>
</table>

**Thesis (an acceptable thesis is required)**

Doctoral Thesis (PHSX 690); minimum of 20 credits is required in addition to the courses listed above.
Examinations
A written comprehensive examination and an oral comprehensive examination are required. A final oral examination is also required, covering the thesis and related areas.

Total Credits 60

Electives Requirements
All elective courses must be approved by the student’s Graduate Committee and the Physics Department Head. This approval will ensure that the electives represent a coherent block of study of substantial relevance to Physics. The following limitations normally apply to Elective Courses which may be listed on the Graduate Program for the M.S. or Ph.D. degree in Physics:

1. No more than half of the Elective credits in the above Course Requirements may be at the 400 level in a student’s Graduate Program for any graduate degree in Physics. The remaining Elective credits must be at the 500 level.

2. The Electives will include courses in Physics and minor or supporting fields. At least half of the elective credits must be in Physics.

3. PHSX 461, PHSX 490R, PHSX 492, PHSX 494, PHSX 589, PHSX 590, PHSX 689, and PHSX 690 cannot be used as Electives in any Physics Graduate Program.

4. PHSX 592 is allowed as an Elective to a maximum of 3 credits for an M.S. Program and 6 credits for a Ph.D. Program.

5. No more than 2 credits of non-required seminar courses are applicable as Electives in any Physics Graduate Program.

Comprehensive Examination
The Ph.D. Comprehensive Examination has written and oral portions that are considered separate examinations, and each must be passed separately.

Details concerning the physics Ph.D. Comprehensive Examination and dates of exam can be found at http://www.physics.montana.edu/grad/programinfo.htm#phd

Department of Political Science
Master of Public Administration
Welcome!

Thank you for your interest in the Master of Public Administration Program at Montana State University. Our program has a long and rich history, and our graduates have gone on to distinguished careers at all levels of government and in a wide range of public, non-profit and private organizations. We are proud to have built a program that focuses on smaller, live and in-person classes where students have the opportunity for rich interaction with our faculty and each other. We have created a strong community of learning and a culture of collaboration among the students and faculty, with explicit attention to the development of skills necessary for immediate professional success, and the normative awareness for career and professional development well into the future. We’re excited about the sound preparation in a wide range of administrative competencies. MPA coursework includes studies in public administration theory, human resource management, public budgeting, leadership, ethics, organization dynamics, and research methods for public administrators. Available courses support specialization in local government, non-profit management, administration of Native American affairs, education leadership, planning and other subspecialties. For early career students, practical experience is gained through a supervised internship with an agency of the student’s choosing.

Upon graduation, MPA students are expected to have built their capacities in the following areas:

- To lead and manage in public governance;
- To participate in and contribute to the policy process;
- To analyze, synthesize, think critically, solve problems and make decisions;
- To articulate and apply a public service perspective;
- To communicate and interact productively with a diverse and changing workforce and citizenry.

Mission Statement
The Master of Public Administration (MPA) program at MSU provides students with professionally relevant, and theoretically grounded training, enabling them to become effective and ethically reflective practitioners, guided by values of integrity and service, as they pursue careers in the diverse settings of democratic governance.

Program Description
The MPA degree is a professional degree designed to prepare both pre- and mid-career professionals and administrators for supervisory, analytical support and policy-making positions in public sector agencies, and non-profit organizations, at local, state and federal levels. The program stresses sound preparation in a wide range of administrative competencies. MPA coursework includes studies in public administration theory, human resource management, public budgeting, leadership, ethics, organization dynamics, and research methods for public administrators. Available courses support specialization in local government, non-profit management, administration of Native American affairs, education leadership, planning and other subspecialties. For early career students, practical experience is gained through a supervised internship with an agency of the student’s choosing.

Admissions Requirements
Your application for the MSU MPA Program must be submitted through MSU’s Graduate School (http://www.montana.edu/gradschool/admissions/apply.html) and must include:

- An Application for Graduate Admission (with application fee; http://www.montana.edu/gradschool/forms.html)
- Official transcripts from all undergraduate and post-baccalaureate studies (MSU alumni do not need to submit transcripts)
- Three letters of reference from individuals who can attest to the applicant’s ability to be successful as a graduate student
- A personal statement that describes personal and professional objectives, research interests, applicable experience or any other information relevant to the admissions review
- Graduate Record Exams (GRE; use code 4488; information about the GRE can be found at MSU’s testing Service http://www.montana.edu/ehhd/testing/index.html)
- For international students, you will need a TOEFL or IELTS. Please see Graduate School for other documents needed for admission, such as a Financial Certificate: http://www.montana.edu/gradschool/policy/admissions_intl.html

Admission standards for full admission to MSU’s MPA Program are:

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Admission standards for full admission to MSU’s MPA Program are:
• Completion of a baccalaureate degree from an accredited college or university
• A sum of at least 844 from the following formula: (GRE X 4) + (Undergraduate GPA X 80)
• For International students who are not native English speakers, an English proficiency test such as the TOEFL or IELTS is required. For the TOEFL a score of 80; for the IELTS a score of 7.

Application Deadlines
Applications for regular, Fall admissions must be received by April 15th. Applications received after April 15th will be considered on a rolling, space available basis until July 15th.

A very limited number of applications for Spring admission will be considered under some circumstances, though applicants should be aware that the curriculum is designed to be started in the Fall. Applications for the Spring semester must be received by November 15th.

Admissions Outcomes
Full graduate status: is granted to students who have demonstrated a high quality of performance in prior academic preparation and have otherwise met university and departmental standards on the criteria listed above.

Provisional Admission: may be granted to a student whose application shows reasonable potential for effective graduate work even though the applicant’s record may be deficient in some area. A decision to recommend provisional admission to The Graduate School for an applicant may be based on prior work experience, success in another academic field, completion of supplemental course work, or other criteria pertinent to academic success. A provisionally admitted student will be informed of any special requirements that must be met in order to be granted full graduate status. Upon meeting the specified requirements, recommendations of the Political Science Department, and with approval of the Dean of Graduate Education, a student on provisional status may be advanced to full graduate standing. Full graduate standing is usually considered only after completion of nine or more credits of satisfactory graduate work.

Non-degree Status: Students who desire to take courses of interest but who do not wish to pursue a graduate degree, or those who have not yet been accepted into the program by the Graduate School, may enroll with non-degree graduate status. Graduate credits earned while in non-degree status will not automatically be applied toward graduate degree requirements if the student later applies for and is admitted into the MPA program. Montana State University will allow no more than nine credits of non-degree course work. Furthermore, these credits may only be applied toward the degree if the student would have met all the criteria for admission into full graduate status at the time of entering as a non-degree student.

Degree Requirements
The degree requirements given below are effective for students admitted to the program in the Fall Semester of 2016 or after. The curriculum is structured so that full time students (those taking 9 credits per semester) should be able to graduate in two academic years. Students taking 6 credits per semester can graduate in three years.

The MPA degree requires completion of 36 credits.

Core Required Courses (15 credits):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSCI 520</td>
<td>Government Leadership &amp; Ethics</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 551</td>
<td>Research Methods for Public Administrators</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 552</td>
<td>Public Policy Processes</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 554</td>
<td>Foundations of Public Administration</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives (18 credits)
Students will select six elective courses that support both their intellectual interests as well as their professional and career objectives. We encourage students to explore the Political Science course catalog as well as course offerings from other departments to identify potential electives. Elective courses will be selected in cooperation with either the MPA Director or the student’s Professional Paper Chairperson. Pre-career students (those entering the program with fewer than two years of progressively responsible professional work experience) will be required to complete a 3 credit, 300 work-hour internship as one of the six elective courses. Elective courses may be taken in our Political Science Department, and may include up to three 400 level courses with the consent of the student’s advisor or committee chair.

Course Options in Political Science

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PSCI 406</td>
<td>The Political Economy of Energy</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 407</td>
<td>Public Policy Analysis</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 423</td>
<td>Politics of Development</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 429</td>
<td>National Security Policy Decision-Making</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 451</td>
<td>State and Local Government</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 461</td>
<td>Administrative Law</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 525</td>
<td>Non-Profit Management</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 530</td>
<td>Tools of Public Administration</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 553</td>
<td>Research Methods II: Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 559</td>
<td>Program Evaluation</td>
<td>3</td>
</tr>
<tr>
<td>PSCI 598</td>
<td>Internship</td>
<td>3-12</td>
</tr>
</tbody>
</table>

Professional Paper (3 credits)
The Professional Paper course (PSCI 575 Directed Professional Research Project) is taken during the student’s last semester of course work. The purpose of the Professional Paper is to allow MPA students an opportunity to effectively integrate underlying theories, concepts, themes, and patterns found throughout the program’s course work into a final original research project. A formal presentation of the Professional Paper will be given to Public Administration and Political Science faculty, student peers, and other interested parties. All MPA students in the program are expected to attend these presentations. Completion of the Professional Papers must occur in the Fall or Spring semester, not during the summer.

Comprehensive Exams
Comprehensive Exams are administered the semester before the student graduates, (e.g., If graduating in the spring, comprehensive exams are taken in the fall. Comprehensive exams are not administered in the summer). The purpose of the comprehensive exam is to verify the student’s mastery of the general concepts derived from the course of study, the integration of those concepts across course topics and the ability to apply the material to real-world administrative problems.

Transfer of Credits
Acceptance/transfer of up to nine credit hours of academic course work performed at other institutions is possible by The Graduate School upon recommendation by the Political Science Department. All such credits must have been earned while in graduate status at an accredited college or university.

Financial Assistance
Applicants interested in Graduate Assistantships, or departmentally awarded financial aid must apply by April 15th. A supplemental application
for Departmental aid can be obtained from http://www.montana.edu/politicalscience/graduate/.  

Department of Psychology
Dr. Brandon Scott - Graduate Coordinator
PO Box 173440, Bozeman, MT 59717-3440
406-994-5218

Admission
The Graduate School application process can be completed online (http://www.montana.edu/gradschool/apply.html). Prior to starting the online application process, applicants should visit the Psychology Department’s Application Page (http://www.montana.edu/psychology/gradprogram/application.html) which contains information about what materials applicants should prepare for the online application process. Review this information before applying. Please note, applicants must include a 1-2 page personal statement that summarizes one’s academic background in psychology or related field, career plans, research experience, research interests, and why the applicant is applying to Montana State University’s Ph. D. program in Psychological Science.

Overall, the Psychology department requires the following application materials during the online application process:

1. GRE scores; subject test not required
2. All previous college/university transcripts (official transcripts only); MSU graduates do not need to supply official transcripts
3. Three letters of recommendation (be prepared to supply your recommenders’ contact information)
4. A Personal statement

* The Psychology Department requires that applicants submit Graduate Record Exam Scores (General test, which yields a Verbal and Quantitative score). The GRE Psychology Subject Test is not required, but recommended, especially for applicants who did not major in psychology as an undergraduate. Please arrange to have scores sent to Montana State University (code: 4488). All successful candidates must demonstrate knowledge of the fundamentals of psychology, as well as undergraduate-level training in statistics and research methods.

Deadline
The closing date for receipt of completed applications is January 1. For detailed admission requirements, review the Admission Policies and Application Requirements sections on The Graduate School website. Successful applicants must have their applications accepted by The Graduate School (with departmental endorsement) before an individual is considered a graduate student at MSU.

Financial Assistance
Teaching Assistantships or Research Assistantships, which are awarded on a competitive basis, are usually available to formally admitted graduate students during their four years of study. See the Financial Support (http://www.montana.edu/psychology/gradprogram/financial.html) for Graduate Students section on the departmental home page for more information (assistantships are requested by the student’s home department).

Graduate Program

- Ph.D. in Psychological Science (p. 390)

The Department of Psychology at Montana State University offers a research-oriented Ph.D. degree in Psychological Science. Psychological Science is a broad term for scientific research in the core academic areas of psychology. These areas include cognitive, developmental, health, learning, physiological, and social psychology. Psychologists conducting psychological research work in a wide range of settings such as colleges and universities, health care facilities, federal & state government, small & large businesses, and many other places.

The goal of our graduate program is to train students to think critically about theory and evidence, to understand and use statistical procedures, and to design, conduct, and publish psychological research. The psychology department at MSU does not have graduate faculty who specialize in clinical, counseling, community, or school psychology. Moreover, we are not a practitioner-oriented program. We are a program for students who want to conduct research and pursue research-oriented careers, academic or otherwise.

To satisfy the degree requirements, students must work intensively with their advisor to complete a research project culminating in a written master’s thesis by their second year, complete qualifying exams by the beginning of the fourth year, and complete an advanced research project culminating in a written dissertation within or after the fourth year. Students must complete at least 3 graduate-level psychology courses on statistics/research methods, 1 credit of a teaching course, and 8 content courses. General areas of faculty research interest include: cognitive psychology, physiological psychology, social psychology, health psychology, statistics, and research methods.

The psychology faculty at MSU uses an individualized mentorship approach to graduate training. Students and their advisors work together to devise a program of coursework and research best suited for the students’ career goals. The opportunity to conduct research with a faculty member is a unique component of our graduate program as it provides training useful for the ultimate pursuit of a research-related career in academic or non-academic settings.

Ph.D. in Psychological Science

Program Requirements

The Ph.D. program requires a minimum of 62 credit hours of graduate level coursework. The required coursework is designed to provide students with a strong foundation in statistics, research methods, and teaching, and the elective coursework provides overviews of specific content areas. An Overview of the Ph.D. Program in Psychological Science can be found at the Course Catalog page for Psychology (p. 390), and the Department of Psychology (http://www.montana.edu/psychology/graduate.html) page.

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYX 501</td>
<td>3</td>
</tr>
<tr>
<td>PSYX 502</td>
<td>3</td>
</tr>
<tr>
<td>PSYX 505</td>
<td>1</td>
</tr>
</tbody>
</table>

1 additional graduate-level research methods/statistics course from either the Psychology department or outside the department with approval of the mentoring committee.

Elective Courses

Students must complete 8 courses (24 credits) of elective courses. Up to 6 of these elective credits can be taken outside of the Psychology Department. Electives must be approved by the students faculty advisor.

<table>
<thead>
<tr>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYX 590</td>
</tr>
<tr>
<td>PSYX 690</td>
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</tbody>
</table>

Total Credits

62

Below are courses we typically offer:

| PSYX 502 | Advanced Design/Stat I | 3 |
The ADRN to Masters option offers a unique opportunity for licensed registered nurses prepared with an associate degree in nursing from an accredited institution to be provisionally accepted, acquire the knowledge, skills and abilities necessary to meet the Baccalaureate Essentials through two bridge courses, and then matriculate into the Masters of Nursing program. See separate admissions criteria (http://www.montana.edu/nursing/graduate/adrntomn.html).

**Doctor of Nursing Practice (DNP)**
The Doctor of Nursing Practice (DNP) degree program is fully accredited by the Commission on Collegiate Nursing Education (CCNE) and focuses on educating nurses to the highest standards of the profession to care for people living in Montana and beyond and lead change in health care systems. Two areas of specialty are available for the DNP degree seeking student at MSU: Family or Psychiatric / Mental Health.

**Non Degree Options**
The Certificate in Nursing Education is available to graduate nursing students and nurses with a BSN or greater.

**Program Synopsis**
Students are admitted for either a Master in Nursing degree (MN) with a focus on Nursing Leadership or Doctorate of Nursing Practice degree (DNP). For the DNP degree, students select a specialty area to be prepared as a Family or Psychiatric/Mental Health Nurse Practitioner. Each student completes courses in advanced health assessment, advanced pathophysiology, advanced pharmacotherapeutics, evidenced based practice, ethics, leadership, and finance and budgeting of health care systems. Remaining courses are determined by specialty. The graduate student’s experience culminates in a professional or scholarly paper.

The graduate program curriculum is taught by College of Nursing faculty who are recognized nationally for their broad and wide-ranging expertise, scholarship, and dedication to providing quality nursing education. Rich clinical opportunities exist in Montana for nurses seeking to expand their professional practice and outreach. Students experience an educational preparation that positions them well for exciting opportunities to practice and lead in rural and frontier areas of Montana and beyond.

Graduate courses are offered primarily through asynchronous distance delivery with occasional synchronous teleconference and video conference used to supplement content. Travel to the Bozeman campus is required at the beginning of Fall semester. A variety of teaching methods (http://www.montana.edu/nursing/graduate/teaching_methods.html) are used in the graduate programs.

**Admission Requirements**

1. Minimum undergraduate GPA of 3.0.
2. A baccalaureate degree in nursing from a nationally accredited upper division program, which included supervised clinical practice in a variety of nursing settings, including community/public health and management.
3. Successful completion of undergraduate courses in physical assessment, community/public health, research, statistics (which included inferential statistics), and an undergraduate psych/mental health course for the DNP (Psych/Mental Health).
4. Current unencumbered licensure as a registered nurse. If clinical educational experiences are to be completed in Montana, licensure in Montana is required.
5. Favorable recommendation from the College of Nursing admissions committee.
6. International applicants only: TOEFL score of 580 or computer equivalent, if applicable.

*Applicants must be admitted formally to The Graduate School.*
Clinical Experience Preferred
In general, one year of clinical experience is preferred for DNP (Family/Individual) and DNP (Psych/Mental Health) degree applicants. There are no clinical experience preferences for MN degree.

Steps to Apply
Application Deadline February 15th
1. Fill-out the Graduate School Application (online (http://www.montana.edu/gradschool/apply.html))
2. During the online process, complete the Cumulative Undergraduate Grade Point Average and Grade Point Average for Final Two Years Undergraduate Work forms.
3. Three recommendation forms; be prepared to provide contact information during the online process.
4. Finally, have official transcripts and test scores mailed to:
   College of Nursing, Attn: Graduate Program
   PO Box 173560
   Bozeman, MT 59718-3560

Further Information
Further information: Graduate Program Assistant, College of Nursing, 122 Sherrick Hall, 406-994-3500

Degree Offered
ADRN to MN Distance Graduate Education (MN)
Degree (http://www.montana.edu/nursing/graduate/adrntomn.html)
A track to a Masters in Nursing (MN) degree has been designed for experienced Associate Degree-prepared Registered Nurses (ADRNs).

Master of Nursing (MN) Graduate Degree (p. 392)
The focus of the MN degree is to prepare graduates with advanced leadership skills to be applied in the healthcare delivery system across a wide range of settings. Graduates of this program are also eligible to sit for the Clinical Nurse Leader certification. The professional roles of the CNL include clinician, outcomes manager, client advocate, educator, information manager, team manager, systems analyst/risk anticipator, and reflect the need for lifelong learning.

Doctor of Nursing Practice (DNP) Graduate Degree (p. 393)
The DNP prepares advanced practice nurses who demonstrate clinical expertise, judgment, scholarship, and leadership to provide the highest level of nursing practice in the primary health care setting.

Online Certificate Program (Non-Degree Option) (p. 401)
The Certificate in Nursing Education program consists of four theory courses (total of 10 credits) that prepare students for careers in nursing education. These courses are open to all graduate nursing students and also to nurses with a minimum of a BSN who are interested in taking such coursework for personal enrichment or professional advancement.

Clinical Nurse Leader
Master of Nursing (MN) Graduate Degree
Focus
The focus of the MN degree (Clinical Nurse Leader, CNL) is to prepare graduates with advanced leadership skills to be applied in the healthcare delivery system across a wide range of settings. Functions of the CNL include client advocacy, team manager, information manager, outcomes manager, systems analyst/risk anticipator, educator, and active professional.

Program Educational Objectives
1. Effect change through advocacy for the client, interdisciplinary health care team and the profession.
2. Communicate effectively to achieve quality client outcomes and lateral integration of care for a cohort of clients.
3. Pursue knowledge and skills as the CNL role, needs of clients, and the health care delivery system evolve.
4. Delegate and utilize the nursing team resources (human and fiscal) and serve as a leader and partner in the interdisciplinary health care team.
5. Identify clinical and cost outcomes that improve safety, effectiveness, timeliness, efficiency, quality, and the degree to which they are client-centered.
6. Use information systems and technology at the point of care to improve health care outcomes.
7. Participate in systems review to critically evaluate and anticipate risks to client safety to improve quality of client care delivery.
8. Assume accountability for healthcare outcomes for a specific group of clients within a unit or setting recognizing the influence of the meso-system and macro-system on the microsystem.
9. Assist and apply research-based information to design, implement and evaluate clients’ plans of care.
10. Synthesize data, information and knowledge to evaluate and achieve optimal client and care environment outcomes.
11. Use appropriate teaching learning principles and strategies as well as current information, materials and technologies to facilitate the learning for clients, groups, and other health care professionals.
12. Complete and successfully defend a professional project appropriate to the role and scope of the Clinical Nurse Leader.

MN Degree 5 Semester Program of Study

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Credits</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>NRSG 601 - Advanced Health Assessment</td>
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<td>NRSG 604 - Evidence Based Practice I</td>
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<td>NRSG 606 - Statistical Applications (recommended)</td>
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<td>NRSG 608 - Design H C Delivery Systems</td>
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<td>NRSG 612 - Ethics, Law, and Policy for Advocacy in Healthcare</td>
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<tr>
<td>NRSG 509 - Clinical Nurse Leader Lab I</td>
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<td>NRSG 511 - Pathophysiology and Pharmacology for the Clinical Nurse Leader</td>
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<tr>
<td>NRSG 611 - Program Planning &amp; Evaluation, Outcomes, &amp; Quality Improvement</td>
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<tr>
<td>NRSG 508 - Clinical Leadership Practicum</td>
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</table>
Montana State University

Scholarship
Each student completes a professional project developed in collaboration with a faculty advisor and committee. Examples of exciting and innovative student projects include: development of mental health outreach programs to the rural elderly; examination of alternative health practices for healing; establishment of pediatric cancer support groups for the rural client; and development of a school based clinic. A comprehensive exam and an oral defense of the professional project is required for MN students.

Doctor of Nursing Practice (DNP)

Focus
The DNP prepares advanced practice nurses who demonstrate clinical expertise, judgment, scholarship, and leadership to provide the highest level of nursing practice in the primary health care setting.

DNP (Family/Individual) Program Educational Objectives
1. Integrate nursing science and theory, biophysical, psychosocial, ethical, analytical, and organizational sciences as the foundation for the highest level of nursing practice.
2. Analyze complex health care systems to assess strengths and weaknesses and facilitate organization-wide changes in practice delivery.
3. Synthesize, interpret, and apply knowledge from nursing practice, research, theory, and informatics to evaluate outcomes and sustain evidence-based advanced nursing practice.
4. Advocate for health care policy addressing issues of social justice and equality in the delivery of advanced practice nursing services.
5. Enact leadership and effective communication in inter- and intra-professional collaborator relationships to facilitate and improve outcomes for individuals, populations, and health care systems.
6. Assess epidemiological, financial, sociopolitical, occupational, and organizational forces in the development, implementation, and evaluation of clinical prevention and population health.
7. Integrate professional standards, values, accountability, and ongoing self-reflection into role acquisition as an advanced practice nurse.
8. Influence health outcomes by providing advanced independent comprehensive health care services including health promotion and counseling, health assessment and diagnosis, disease prevention, and management of health and illness of individuals and families throughout the lifespan.
9. Complete and successfully defend a scholarly project appropriate to the role and scope of the doctorally prepared advanced practice registered nurse.

BSN to DNP (Family/Individual) 3 Year Program of Study
see http://www.montana.edu/nursing/academic/fnp.htm for the 4 Year Program of Study

Year 1

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<th>Course</th>
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<tbody>
<tr>
<td>NRSG 601 - Advanced Health Assessment</td>
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<tr>
<td>NRSG 602 - Adv Physio/Pathophysiology</td>
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<tr>
<td>NRSG 604 - Evidence Based Practice I</td>
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<td>NRSG 606 - Statistical Applications</td>
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<td>NRSG 603 - Advanced Pharmacology I</td>
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<td>NRSG 605 - Evidence Based Practice II</td>
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<td>NRSG 607 - Diagnostic Reasoning</td>
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<td>NRSG 620 - Adv Pharm II</td>
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<td>NRSG 621 - Advanced Clinical I-FI</td>
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Year 2

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<td>NRSG 622 - Advanced Clinical II Primary Care for Midlife Families</td>
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<td>NRSG 612 - Ethics, Law, and Policy for Advocacy in Healthcare</td>
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<td>NRSG 675 - Professional Paper and Project</td>
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<td>NRSG 623 - Advanced Clinical II: Psychotherapeutic Modalities</td>
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Year 3

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<td>NRSG 614 - Vulnerability and Health Care in Diverse Communities</td>
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<td>NRSG 615 - Translational Research Adv Pra</td>
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<td>NRSG 675 - Professional Paper and Project</td>
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<td>NRSG 624 - Advanced Clinical IV (NP, Family/Individual) Primary Care Clinical Preceptorship</td>
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</table>

Year Total: 10 7

Total Program Credits: 83

Total Clinical Hours: 1125 (25 cr x 3 = 75 x 15 wks = 1125)

DNP (Psych/Mental Health) Program Educational Objectives
1. Integrate nursing science and theory, biophysical, psychosocial, ethical, analytical, and organizational sciences as the foundation for the highest level of nursing practice.
2. Analyze complex health care system to assess strengths and weaknesses to facilitate organization-wide changes in practice delivery.
3. Synthesize, interpret, and apply knowledge from nursing practice, research, theory, and informatics to evaluate outcomes and sustain evidence-based advanced nursing practice.

4. Advocate for health care policy addressing issues of social justice and equality in the delivery of advanced practice nursing services.

5. Enact leadership and effective communication in inter- and intra-professional collaborator relationships to facilitate and improve outcomes for individuals, populations, and health care systems.

6. Assess epidemiological, financial, sociopolitical, occupational, and organizational forces in the development, implementation, and evaluation of clinical prevention and population health.

7. Integrate professional standards, values, accountability, and ongoing self-reflection into role acquisition as an advanced practice nurse.

8. Influences health outcomes by providing advanced independent comprehensive health care services including health promotion and counseling, health assessment and diagnosis, and disease prevention and management of health and illness of individuals and families throughout the lifespan.

9. Complete and successfully defend a scholarly project appropriate to the role and scope of the doctorally prepared advanced practice registered nurse.

BSN to DNP (NP, Psych/Mental Health) 3-Year Program of Study

see http://www.montana.edu/nursing/graduate/dnp.html for the 4-Year Program of Study

Year 1

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<td>NRSG 601</td>
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<td>NRSG 602</td>
<td>Adv Physio/Pathophysiology</td>
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<td>NRSG 606</td>
<td>Statistical Applications</td>
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<td>NRSG 603</td>
<td>Advanced Pharmacology I</td>
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<td>NRSG 605</td>
<td>Evidence Based Practice II</td>
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<td>NRSG 607</td>
<td>Diagnostic Reasoning</td>
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Year 2

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<td>NRSG 611</td>
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Year 3

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<tr>
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<td>NRSG 615</td>
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Year Total: 10 7

Total Program Credits: 83

Total Clinical Hours: 1125 (25 cr x 3 = 75 x 15 wks = 1125)
Scholarship
Each student completes a scholarly project developed in collaboration with a faculty advisor and committee. Examples of exciting and innovative student projects include: development of mental health outreach programs to the rural elderly; examination of alternative health practices for healing; establishment of pediatric cancer support groups for the rural client; and development of a school based clinic. A comprehensive exam (written and oral components) and oral defense of the scholarly project is required for DNP students.

Montana State Online
Whether you’re on campus or around the world, MSU offers every student a hands-on, active learning environment and welcoming “Mountains and Minds” attitude. Online courses present a flexible choice for many students, and our team is here to help you find the best course of study to achieve your goals; information on tuition, registration and grades; and support and best practices for succeeding as an Online Bobcat!

Admission
To take any online course or to enter an online degree program an applicant needs to apply formally to MSU as an undergraduate or graduate student.

Online course System
Online courses at MSU utilize the Brightspace (https://ecat1.montana.edu) system.

To learn more about being an online student
Please visit Montana State Online (http://www.montana.edu/online)

For more Information
Request Information: distance@montana.edu
1-866-540-5660
1-406-994-6550

Montana State Online - Undergraduate Programs
• B.A. Degree Completion in Liberal Studies (p. 224)
• Gerontology Certificate (p. 147)

Montana State Online - Graduate Programs
• M.S. in Agricultural Education (p. 395)
• M. Ed in Curriculum and Instruction (p. 317)
• M.S. in Family and Financial Planning (p. 343)
• M.S. in Land Resources and Environmental Sciences Online (p. 398)
• M.S. in Mathematics - Mathematics Education Option (p. 398)
• Nursing MN - Clinical Nurse Leader (p. 392)
• Nursing DNP - Doctor of Nursing Practice (p. 392)
• M.S. in Science Education (p. 399)

Montana State Online - Graduate Certificates
• Addiction Counseling (p. 344)
• Native American Studies (p. 400)
• Nursing Education (non-degree option) (p. 401)
• Library Media Certificate (p. 313)
• Science Teaching (p. 402)

M.S. in Agricultural Education
The graduate program in Agricultural Education at Montana State University is designed to prepare graduates for entry into or advancement in formal and non-formal teaching careers. This program also provides development of professional leadership skills for other careers in agribusiness, government service, extension, or adult education.

The master’s degree program in Agricultural Education, with its various options, provides a program that can be tailored to meet each student’s career goals. In addition to the wide variety of professional courses in agricultural education, offerings are also available from all academic Departments in the College of Agriculture, including agricultural economics, animal and range sciences, land resources and environmental sciences, plant sciences and plant pathology, and veterinary molecular biology. Specialization areas such as adult education, educational administration, career education, and curriculum coordination are also available through cooperation with the College of Education, Health and Human Development. Plan A (thesis), Plan B (project or professional paper), and an online option are available.

Program Requirements
The program offers considerable flexibility to students to help them meet their professional and personal objectives. Plan A requires a thesis. A minimum of 30 credit hours must be completed, 20 credits of course work and 10 credits of thesis preparation. Students who choose Plan B are required to complete a professional paper based on a current research issue related to the student’s emphasis area. Students will take a minimum of 30 hours of course work (no thesis credits). The final selection of the student’s research activity will be the student’s responsibility in collaboration with the advisor and the graduate committee.

The requirements for students in the on-line program are similar to those for students following the Plan B program. Taking a minimum of 6 credits per semester, students will take a minimum of 30 semester hours of graduate coursework. Their coursework must include: Research Methods in Agricultural Education (AGED 506), Program Planning and Evaluation (AGED 507), Graduate Seminar (AGED 594) each year of the program, and Philosophy of Teaching and Learning in Agricultural Education (AGED 511). A final written exam and a professional paper are required in lieu of a thesis.

Required Core Courses

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<td>AGED 511</td>
<td>Philosophy of Teaching and Learning in</td>
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<td></td>
<td>Agricultural Education</td>
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</table>
Professional Educator Option

Objectives
Students who complete the Professional Educator option of the Curriculum & Instruction Master’s degree are expected to demonstrate the knowledge, skills, and dispositions of a Master Teacher.

Four options are available:
- Elementary (K-8) Teachers
- Secondary (6-12) Teachers
- K-12 Music Teachers
- Library Media Certificate Core

Graduates will exhibit:
1. Deep understanding of student development, diversity, and learning processes;
2. Content mastery of the subjects they teach and how to teach those subjects to students;
3. Skill in managing, monitoring, and assessing student learning;
4. Systematic reflection regarding their professional practice and experience; and
5. Commitment to membership in a community of learners.

Program of Study for Elementary (K-8) Teachers
Signature Content - 12 credits
- EDCI 504 Assessment and Evaluation in Education
- EDCI 506 Applied Educational Research
- EDCI 514 Mentoring New Teachers
- EDCI 531 Contemporary Issues in Education

Core Content - 15 credits; choose from the following
- EDCI 510 Issues and Trends in Social Studies Instruction
- EDCI 512 Writing and Its Improvement
- EDCI 520 Visual Arts and Learning
- EDCI 525 Improvement of Instruction in Science
- EDCI 530 Improvement of Math Instruction
- EDCI 532 General School Curriculum
- EDCI 533 Middle Years School
- EDCI 534 Literacy Assessment and Instruction
- EDCI 536 Construction of Curriculum
- EDCI 540 American Indian Studies for Ed
- EDCI 551 Education Technology: Teaching, Learning, and Leadership
- EDCI 604 Advanced Educational Psychology

Or Electives relevant to licensure area and approved by graduate advisor

Master’s Capstone - 3 credits
- EDCI 575 Professional Paper/Project

Total Credits 30

Program of Study for Secondary (6-12) Teachers
Signature Content - 12 credits
- EDCI 504 Assessment and Evaluation in Education
- EDCI 506 Applied Educational Research

Core Content - 15 credits; choose from the following
- EDU 610 Qualitative Educational Research
- EDCI 604 Advanced Educational Psychology
- EDCI 532 General School Curriculum
- EDCI 540 American Indian Studies for Ed

Or Electives relevant to licensure area and approved by graduate advisor

Master’s Capstone - 3 credits
- EDCI 575 Professional Paper/Project

Total Credits 30

Program of Study for K-12 Music Teachers
Signature Content - 12 credits
- EDCI 504 Assessment and Evaluation in Education
- EDCI 506 Applied Educational Research
- EDCI 514 Mentoring New Teachers
- EDCI 531 Contemporary Issues in Education

Core Content - 9 credits
- MUSI 504 Studies in Hist and Analysis
- MUSE 530 Music, Society, Education
- MUSE 532 Music Ed: Res and Practice

Music Education Electives - 6 credits; choose from the following
- MUSI 540 Advanced Conducting
- MUSE 542 Graduate Vocal Pedagogy
- MUST 544 Comp App Mus Ed
- MUSE 545 General Music Practicum
- MUSI 595 Applied Music

Or Electives relevant to licensure area and approved by graduate advisor

Master’s Capstone - 3 credits
- EDCI 575 Professional Paper/Project

Total Credits 30

Program of Study for Library Media Certificate Core
A student must apply to the full MEd program either initially or before 9 credits of Library Media coursework have been completed.

Signature Content - 21 credits
- EDCI 522 Info Resources & Services
- EDCI 545 Organization of Information in School Library Media Centers
- EDCI 546 School Library Media Specialist
- EDCI 547 Info Inquiry & Ed Change
- EDCI 548 Management of Information & Resources
- EDCI 549 Applications of Literature for Children and Young Adults
- EDCI 598 Internship

Or
- EDCI 591 Special Topics

Master’s Content and Capstone - 9 credits
- EDCI 531 Contemporary Issues in Education
The absence of the student, the entire committee will discuss their evaluation of the oral presentation and thesis defense. The chair will lead the committee to a determination regarding the passing or failing of both the written and oral components of the thesis.

The thesis defense is graded with either a passing or failing grade - determined by a majority committee vote. The student will officially pass the written and oral components of the thesis by demonstrating evidence of knowledge of pertinent literature, academic and theoretical grounding, development of professional skills, and the ability to conduct effective educational research.

A “fail” occurs when a majority of the committee determines that a student has not demonstrated sufficient evidence of knowledge of pertinent literature, academic and theoretical grounding, development of professional skills, or the ability to conduct effective educational research. A failure on either portion of the thesis is considered to be a failed exam. A failed defense may be repeated once. At least two months must elapse before the second defense takes place.

Failure to pass a second thesis defense results in termination of graduate study and dismissal from the academic program. Students who are dismissed from the program due to a failed thesis are ineligible to reapply to the same degree program at any time.

**Technology Education Option**

**Objectives**

Students who complete the Technology Education option of the Curriculum & Instruction Master’s degree are expected to demonstrate the knowledge, skills, and dispositions of a Master Teacher.

Graduates will exhibit:

1. Skill in managing, monitoring, and assessing student learning; and
2. Systematic reflection regarding their professional practice and experience; and
3. Commitment to membership in a community of learners.

**Program of Study**

<table>
<thead>
<tr>
<th>Core Content - 12 credits</th>
<th>12</th>
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<tbody>
<tr>
<td>Four courses appropriate to student’s area of specialization and approved by graduate advisor</td>
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<table>
<thead>
<tr>
<th>Thesis - 9 credits</th>
<th>9</th>
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<tbody>
<tr>
<td>EDCI 590 Master’s Thesis</td>
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</tbody>
</table>

Total Credits 30

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**Educational Researcher Option**

**Objectives**

Students who complete the Educational Researcher option of the Curriculum & Instruction Master’s degree are expected to demonstrate the knowledge, skills, and dispositions of a professional researcher.

**Program of Study**

<table>
<thead>
<tr>
<th>Signature Content - 9 credits; choose from the following</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 501 Educational Statistics I</td>
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</tr>
<tr>
<td>EDU 602 Educational Statistics II</td>
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<tr>
<td>EDCI 506 Applied Educational Research</td>
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</tr>
<tr>
<td>EDU 610 Qualitative Educational Research</td>
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<tr>
<td>EDU 607 Quantitative Educational Research</td>
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<table>
<thead>
<tr>
<th>Core Content - 12 credits</th>
<th>12</th>
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<tr>
<td>Four courses appropriate to student’s area of specialization and approved by graduate advisor</td>
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<th>Thesis - 9 credits</th>
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</thead>
<tbody>
<tr>
<td>EDCI 590 Master’s Thesis</td>
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</table>

Total Credits 30

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**Written Comprehensive Exam - Thesis**

As MEd students in the Educational Researcher option approach the end of their first year of study, they will contact their committee chair to discuss the format, content, and time frame of their Master’s Thesis. The content of the Master’s Thesis will be an original research project determined by consultation between the chair and the student and must be approved by the student’s Master’s Committee. Students are required to complete the Master’s Thesis using APA format.

The completed Master’s Thesis will be submitted to the student’s committee for evaluation. Committee members will have approximately two weeks to read and evaluate the written and competency (quality, thoroughness, and completeness of the research) of the thesis.

**Oral Comprehensive Exam - Thesis Defense**

When the committee members have read and evaluated the thesis, the student will give a 1-2 hour oral presentation and thesis defense to the Master’s Committee. Students can be queried about all areas of program content during the oral presentation and thesis defense. The presentation will be evaluated for research content and oral competency.

The committee chair will facilitate the meeting and the order of questioning. Committee members can ask follow-up and clarifying questions in all areas. At the completion of the questioning and in the absence of the student, the entire committee will discuss their evaluation of the oral presentation and thesis defense. The chair will lead the committee to a determination regarding the passing or failing of both the written and oral components of the thesis.

The thesis defense is graded with either a passing or failing grade - determined by a majority committee vote. The student will officially pass the written and oral components of the thesis by demonstrating evidence of knowledge of pertinent literature, academic and theoretical grounding, development of professional skills, and the ability to conduct effective educational research.

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**Program of Study**

<table>
<thead>
<tr>
<th>Core Content - 12 credits</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 504 Assessment and Evaluation in Education</td>
<td></td>
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<tr>
<td>EDCI 506 Applied Educational Research</td>
<td></td>
</tr>
<tr>
<td>EDCI 514 Mentoring New Teachers</td>
<td></td>
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<tr>
<td>EDCI 531 Contemporary Issues in Education</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Signature Content - 15 credits; choose from the following</th>
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</thead>
<tbody>
<tr>
<td>TE 501 History and Philosophy of Technology Education</td>
<td></td>
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<tr>
<td>TE 530 3D Modeling &amp; Animation</td>
<td></td>
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<tr>
<td>TE 594 Seminar</td>
<td></td>
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<tr>
<td>EDCI 532 General School Curriculum</td>
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<tr>
<td>EDCI 555 Technology, Instructional Design, and Learner Success</td>
<td></td>
</tr>
<tr>
<td>EDCI 571 In-Service Education</td>
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</tbody>
</table>

Electives relevant to licensure area and approved by graduate advisor

<table>
<thead>
<tr>
<th>Master’s Capstone - 3 credits</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCI 575 Professional Paper/Project</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 30
Contact Information
Dr. Gilbert Kalonde
406-994-5775 Email: kalonde@montana.edu

M.S. in Land Resources and Environmental Sciences Online

Overview
The online M.S. program in Land Resources and Environmental Sciences is designed to provide outstanding graduate training opportunities across a substantive breadth of disciplinary interests. Programs are specifically adapted to each graduate student and often address processes at multiple scales through well-integrated, multi-disciplinary efforts. Student projects are directed toward improving understanding of principles and processes important to land resources and environmental sciences, with opportunities for direct ties to management.

Understanding is developed through targeted advanced coursework tailored to the student. Professional papers may involve, but are not limited to, topics such as watershed hydrology, integrated management of invasive plant species, soil nutrient management, bioremediation, land reclamation, restoration ecology, fluvial systems ecology and restoration, riparian ecology, microbial ecology of natural systems, chemical fate and transport, water quality, crop diversification, precision agriculture, environmental risk assessment, remote sensing and GIS applications, and climate variability.

Requirements
A minimum of 30 credits:

- 27 credits course work from 400/500 level courses from the electives list
- 3 credits professional paper requirement

Prerequisites
- Bachelor’s degree in a related field, or a strong science background
- Undergraduate GPA of 3.0 or better
- Official GRE combined score of greater than 300.
- Show significant promise for success in a graduate program
- TOEFL (Test of English as a Foreign Language) score of 550 (paper-based test), 231 (computer-based test), and 80 (internet-based test)—required only for international students whose native language is not English

Meeting the minimum department standards does not ensure admission to the program. The minimum GPA and GRE scores are not absolute thresholds. Admission to Montana State University graduate programs is based on a number of factors, including prior academic and professional experience and the personal statement.

Curriculum
The flexible and interdisciplinary nature of this program allows you to select online courses to fit your professional goals and interests.

Elective Courses (27 credits will be from this list of courses)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGSC 401</td>
<td>Integrated Pest Management</td>
<td>3</td>
</tr>
<tr>
<td>LRES 507</td>
<td>Environmental Risk Assessment</td>
<td>3</td>
</tr>
<tr>
<td>LRES 510</td>
<td>Biodiversity Survey and Monitoring Methods</td>
<td>3</td>
</tr>
<tr>
<td>LRES 515</td>
<td>Microbial Ecology</td>
<td>3</td>
</tr>
<tr>
<td>LRES 521</td>
<td>Holistic Thought &amp; Management</td>
<td>3</td>
</tr>
<tr>
<td>LRES 531</td>
<td>Applied Watershed Hydrology</td>
<td>3</td>
</tr>
<tr>
<td>LRES 532</td>
<td>Soil Ecosystems and Processes</td>
<td>3</td>
</tr>
<tr>
<td>LRES 533</td>
<td>Wetland Ecology &amp; Management</td>
<td>3</td>
</tr>
<tr>
<td>LRES 534</td>
<td>Environmental Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>LRES 536</td>
<td>Ecology of Invasive Plants I</td>
<td>1</td>
</tr>
<tr>
<td>LRES 540</td>
<td>Ecology Plants &amp; Community</td>
<td>3</td>
</tr>
<tr>
<td>LRES 544</td>
<td>Water Quality</td>
<td>3</td>
</tr>
<tr>
<td>LRES 565</td>
<td>Environmental Biophysics</td>
<td>3</td>
</tr>
<tr>
<td>LRES 566</td>
<td>Chemical Ecology</td>
<td>3</td>
</tr>
<tr>
<td>LRES 569</td>
<td>Ecol of Invasive Plants in GYE</td>
<td>2</td>
</tr>
<tr>
<td>LRES 571</td>
<td>Landscape &amp; Ecosys Ecology</td>
<td>3</td>
</tr>
<tr>
<td>LRES 573</td>
<td>Remote Sensing Env Sci</td>
<td>3</td>
</tr>
<tr>
<td>LRES 592</td>
<td>Independent Study</td>
<td>3</td>
</tr>
<tr>
<td>LRES 598</td>
<td>Internship</td>
<td>3</td>
</tr>
<tr>
<td>PSPP 546</td>
<td>Herbicide Physiology</td>
<td>3</td>
</tr>
<tr>
<td>MB 527</td>
<td>Toxicology</td>
<td>3</td>
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</tbody>
</table>

**LRES 592 and LRES 598 may not be used as a course on students program of study.

Required Course - all students must take the 3 credit professional paper course at the end of your program of study

LRES 575 Prof Paper & Project 3

For More Information
- Scott Powell, Assistant Professor and Program Coordinator, at spowell@montana.edu or (406) 994-5017
- Lisa Brown, Program Manager, at lisa.brown@montana.edu or (406) 994-3062

M.S. in Mathematics - Mathematics Education Option (MSMME)

The MSMME program emphasizes the teaching and learning of secondary mathematics and offers a blend of courses addressing key topics in mathematics content and pedagogy. The MSMME curriculum incorporates problem-based and active learning and aligns with the NCTM Principles and Standards for School Mathematics as well as the Common Core State Standards for Mathematics. The 30-credit-hour program includes four required core content foundation courses, two required pedagogy courses from a choice of four, and a variety of elective courses. Completing the program typically requires taking a series of online courses over two academic years and attending at least one (required) three-week summer session in Montana. Embedded in the required coursework are classroom-based research projects that address specific challenges in teaching, investigate new instructional strategies, or allows teachers to design, teach, and assess lessons in a specific content area.

Admission
Preference will be given to applicants who have:

1. An earned B.S. or B.A. degree from a mathematics or mathematics teaching program
2. Licensure in at least one state to teach secondary mathematics
3. A current position in secondary teaching
Program Requirements

1. Core Content Courses (4 required):
   - M 518 Statistics For Teaching
   - M 524 Linear Algebra for Teaching
   - M 525 Analysis for Teaching
   - M 527 Geometry for Teaching

2. Pedagogy Courses (2 required):
   - M 520 Standards-Based Mathematics for Teaching
   - M 521 Mathematics Learning Theory for Teaching
   - M 528 Curriculum Design
   - M 529 Assessment Models and Issues

3. Elective Courses (4 required)
   Elective courses are offered on a rotating schedule or on demand. The pedagogy courses listed above also serve as electives.
   - M 516 Language of Mathematics for Teaching
   - M 517 Advanced Mathematical Modeling for Teaching
   - M 522 Assessment of Mathematics for Teaching
   - M 523 Number Structure for Teaching
   - M 526 Discrete Mathematics for Teaching
   - M 533 History of Mathematics for Teaching
   - M 535 Technology and Mathematics for Teaching
   - M 577 Conducting Action Research in Mathematics Education

Total Credits 42

MSMME Program Portfolio

Graduates of the MSMME program must demonstrate a thorough understanding of the standards that guide their profession and how these standards undergird their own professional growth. In addition, they are expected to continuously reflect on their learning; to recognize personal gains in content knowledge and pedagogical skills; and to engage in classroom research experiences. To meet these capstone requirements, teachers build a program portfolio throughout their course of study and present a summative reflection upon completion of coursework. This portfolio, which must be publicly presented and discussed with committee members, represents the capstone event of the program and replaces a comprehensive examination.

Master of Science in Science Education

451 Reid Hall, Bozeman, MT 59717
406-994-5679
Home Page: www.montana.edu/msse

Program Director
Dr. Gregory Francis

Admission

Entrance requirements include: a bachelor’s degree in an area of science, science education, or related area; at least two years of science teaching in educational settings; and an undergraduate GPA of 3.0 or higher. Students with a GPA of less than 3.0 have the opportunity to begin the program as a non-degree student to earn admissions.

Applications are accepted throughout the fall, spring, and summer sessions. Application documents include all official transcripts, three letters of recommendation, essay, and resume. For more information about the application process, visit the MSSE website (http://www.montana.edu/msse).

Program Features

- Designed for science educators by experienced science, science education, and mathematics faculty with the collaboration of outstanding classroom teachers
- Over 80% of the courses may be taken on-line by asynchronous, computer-mediated communication
- Accredited 30-credit graduate program
- Graduate in 2 to 3 years
- Courses are structured to support both formal classroom teachers and informal science educators
- The opportunity to work at home without frequent trips to campus
- The chance to participate in classes when it is most convenient for you
- Popular campus based summer field and lab experiences that vary in length from one day to two weeks
- Emphasizes Next Generation Science Standards
- Personalized science education capstone project for each student
- Interdisciplinary program with the opportunity to expand knowledge in all science disciplines
- Self-paced program
- Affordable online only graduate tuition fees

Online graduate courses are offered during the fall, spring, and summer sessions. Montana-based field and lab graduate courses are offered during the summer session.

In addition to completing a group of core courses (14 credits total) which includes the 3-credit capstone project, students develop interdisciplinary combinations of science courses (12 credits minimum) from offerings in biology, chemistry, earth science, microbiology, physics, plant sciences, and
other related areas. The final four credits in the thirty-credit program are electives selected from education and/or science courses.

Interdisciplinary efforts and incorporation of both science content and pedagogy have been encouraged during the development of courses. Each student seeking the degree is advised by a three-person faculty committee, and programs are designed taking into account the student’s background, interests, and career goals.

Instructors

The MSSE degree program was developed by Montana State University faculty members who are active in science, science education, and mathematics. The program is a unique, cooperative effort of several colleges and departments. Faculty members of the departments of Biology, Chemistry and Biochemistry, Earth Science, Education, Health and Human Development, Land Resources and Environmental Science, Mathematics, Microbiology, Plant Science and Environmental Science, Physics, and other related areas such as Engineering will teach most courses. Faculty members of other departments and units will play a major role in some courses. When appropriate, courses may be taught by faculty members of other institutions.

The program of study may begin with online courses in any semester, or summer field/lab courses based from the MSU-Bozeman campus. Study continues with online courses that students take from their homes or workplaces, and ends with a campus visit for presentation of the results of a personalized science education capstone project. Over 80% of the courses and credits may be taken off-campus by asynchronous, computer-mediated communication. Thirty-semester credits are required for the degree. Students typically will complete the degree in two or three years.

All students seeking the MSSE degree complete core courses (14 credits) in education which includes a three-credit capstone project. For the remaining credits (16), students select interdisciplinary combinations of science content courses (12 credits minimum) from offerings in biology, chemistry, computer science, earth science, engineering, health and human development, land resources and environmental science, microbiology, physics, and plant science. Interdisciplinary efforts and incorporation of both science content and pedagogy have been encouraged during the development of courses. The final four credits in the thirty-credit program are electives selected from education and/or science courses.

For a full list of courses visit the Master of Science in Science Education Webpage (http://www.montana.edu/msse).

**Required Core Courses**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MSSE 501</td>
<td>Inquiry Sci Eng Prac</td>
<td>2</td>
</tr>
<tr>
<td>EDCI 504</td>
<td>Assessment and Evaluation in Education</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 505</td>
<td>Foundations of Action Research in Teaching and Learning</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 509</td>
<td>Implementing Action Research in Teaching and Learning</td>
<td>3</td>
</tr>
<tr>
<td>EDCI 575</td>
<td>Professional Paper/Project</td>
<td>3</td>
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**Online Certificate in Native American Studies**

The graduate certificate in Native American Studies requires 12 semester credits, fully available through online classes. Although other courses may be developed and offered during any semester, the classes presently available are:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>NASX 515</td>
<td>Native Food Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

**NASX 524**  Contemporary Issues in American Indian Studies | 3 |
**NASX 530**  Federal Law and Indian Policy (NASX 530 is required, three classes are elective) | 3 |
**NASX 550**  Native Americans: Dispelling the Myths | 3 |
**NASX 551**  American Indian Art Survey | 3 |
**NASX 553**  Indigenous Literature and the West | 3 |
**NASX 554**  Indian Education for All: A Model for Culturally Responsive Pedagogy in Practice | 3 |
**NASX 591**  Special Topics | 3 |

**Total Credits** 12

We will also accept EDCI 540 American Indian Studies for Ed

If the student wishes to continue in Native American Studies and obtain a Master’s degree, 9 credits, less than 6 years old, earned under the Graduate Certificate may be transferred to the MA program. The Master’s program is not wholly available online, requiring at least two semesters (one fall term, one spring term) on campus.

Our online classes generally are on the same schedule as the in-person classes; here is a link to registration and detailed information for online classes: http://btc.montana.edu/courses/aspx/credit.aspx#NASX

Certificate students who reside in Bozeman may fulfill the certificate with in-person classes.

**Admission**

**Each applicant must submit the following:**

1. Application to MSU-Bozeman through the Graduate School (https://www.applyweb.com/msug/online application process (http://www.montana.edu/gradschool/admissions/apply.html) (which includes a non-refundable $60 application fee).

2. Official transcripts from all institutions attended (students must have a minimum GPA of 3.00 for the last two years of undergraduate study) (MSU graduates do not need to submit MSU transcripts).

3. Two academic writing samples, demonstrating the applicant’s graduate-level research and writing capabilities.

4. A 2-5 page personal statement and goals which includes applicant’s experience and knowledge of historical and contemporary American Indian issues, work background, how the Graduate Certificate in NAS will help the applicant reach long range goals, and benefit American Indian peoples/communities.

5. A current curriculum vita or resumé.

All application materials should be uploaded during the online application process. If there are any additional materials or official documents, they may be submitted to:

The Department of Native American Studies  
Montana State University  
2-179 Wilson Hall, Bozeman, MT 59717  
Attn: Megan Gourneau

Or e-mailed to: megangourneau@montana.edu

**Upon admission, students should be aware of the following administrative requirements:**

After acceptance, you will need to contact MSU Student Health to clear immunization holds that will prevent you from registering for classes - it is easily taken care of. Call (406) 994-2311 for further information,
or visit the Student Health website: http://www.montana.edu/health/immunization.php. Even distance students are required to clear this hold.

BEFORE YOU ARE FINISHED WITH YOUR FIRST SEMESTER, The Graduate School requires that you file a Program of Study form.

BEFORE YOU ARE FINISHED WITH YOUR FOURTH CLASS, The Graduate School requires that you file an Application for Advanced Degree form.

Complete instructions and forms can be found on the Graduate School webpage for Certificate students, found here: http://www.montana.edu/gradschool/policy/degreq_certificate.html

Costs associated with the certificate:

The cost of classes varies slightly, but currently our online graduate courses are $975.15 for Montana residents, and $1,255.05 for non-residents per class, and four classes are required to graduate. There are additional administrative fees assessed by the registrar and Graduate School offices:

Application process: $60 Grad School application fee (one time) per semester: $30 Registration fee
Graduation process:

• Application for Graduate Admissions

$60.00 nonrefundable application fee

• Program of Study & Committee Form

A one-time $50.00 processing fee will be charged to your student account for processing this form.

• Application for Advanced Degree

$20.00 audit fee will be assessed to the student's account each semester an application is submitted (this fee must be paid through the Student Accounts Office).

A certificate of completion signed by the Native American Studies Department Head will be awarded upon confirmation by the Graduate School that all requirements have been met.

Further Information

For further information regarding the program, contact Native American Studies at (406) 994-3881 or e-mail Megan Gourneau at megangourneau@montana.edu (francesca.pine@montana.edu) or Dr. Kristin Ruppel, at 406-994-5261, or via email at krruppel@montana.edu.

For most recent information please visit: http://www.montana.edu/nativeamerican/online.html

In addition, you may refer questions to The Graduate School or find the graduate catalog and policies on-line at http://www.montana.edu/gradschool. Students are expected to be familiar with the degree requirements of the department, The Graduate School and Extended University.

Online Certificate in Nursing Education (non-degree)

The Certificate in Nursing Education program consists of four theory courses (total of 10 credits) that prepare students for careers in nursing education. These courses are open to all graduate nursing students and to nurses with at least a BSN (those interested in coursework for personal enrichment or professional advancement). Nursing educators work in a variety of settings, the most common being schools/colleges of nursing or larger health care agencies. The courses offered in the distance delivered program are excellent for individuals planning a career with an educational focus; either now or in the future.

Year 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRSG 503 - Curriculum Development*</td>
<td></td>
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Year Total: 3

Year 2

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Year Total: 2 2 3

Total Program Credits: 10

* NRSG 503 Curriculum Development is offered in even years and NRSG 504 Assmnt and Eval of Education is offered in odd years.

** NRSG 574 Teaching Practicum is a 1-4 variable credit elective clinical practicum offered during any semester. Prerequisite: NRSG 504 Assmnt and Eval of Education or the consent of instructor.

Library Media Certificate

Program Objectives

This program is geared toward licensed teachers who want to obtain the school library media endorsement. This certification program/endorsement can only be added to an existing teaching license.

We have received official approval from accreditation officials in Alaska, Colorado, Idaho, Montana, Oregon, South Dakota, North Dakota, Washington, and Wyoming. Many other states accept our program as well. Contact your state’s Department of Education to ensure that the program is accepted. Our education programs are accredited by the Montana Board of Public Education. We participate in the National Association of State Directors of Teacher Education and Certification’s (NASDTEC) Interstate Contract.

Additionally, the Library Media program offers an option to earn a Master’s degree (MEd) in Curriculum & Instruction after completion of all Library Media coursework. The Master’s portion involves completion of 9 additional credits past the 21 required by the Library Media Certificate program, and these courses are also offered online. A student must apply to the full MEd program either initially or before 9 credits of Library Media coursework have been completed. See Master of Education in Curriculum & Instruction - Professional Educator Option (p. 321).

Program Flow

Following admission, the student should register for the course(s) offered in the upcoming semester. Two to three courses are typically offered each semester.

This is a fully online program. Therefore, students must have reliable Internet access. Students also need:

1. Basic understanding of word processing and email applications
2. Familiarity with spreadsheet and database applications and software
3. Basic knowledge of the Web, search engines, and experience using different browsers and online databases
4. Experience with software downloads and multimedia plug-ins

**Program of Study**

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<tr>
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<td>EDCI 545</td>
<td>Organization of Information in School Library Media Centers</td>
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<td>EDCI 546</td>
<td>School Library Media Specialist</td>
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<td>Info Inquiry &amp; Ed Change</td>
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<td>Management of Information &amp; Resources</td>
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<td>Applications of Literature for Children and Young Adults</td>
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**Contact Information**

Micki MacGregor, Graduate Program Assistant
PO Box 172880, Reid Hall 215
Department of Education, Montana State University
Bozeman, MT 59717-2880
Phone: 406-994-6786 Email: edgrad@montana.edu

**Science Teaching**

Montana State University’s online graduate certificates help science educators gain knowledge and competence in specialized Science Teaching, in the following areas:

- Chemistry
- Earth Science
- Elementary School Science
- Life Science
- Physics

**Program Features**

- Certificates are offered through MSU, creator of the National Teachers Enhancement Network. NTEN has been known since 1993 for high-quality online science courses.
- Science certificates are designed for teachers of all backgrounds; fellow students will be K-12 teachers, community college instructors, museum professionals and informal science educators. Students will learn along with peers from around the world; absorbing new ideas and fresh perspectives.
- Courses are rigorous, content-focused and specially designed for teachers. NTEN’s model pairs university professors with in-service teachers during course development.
- Instructors are experts in their fields; having been specially trained in online teaching.
- Courses are 100% online without the need to come to the MSU campus. However, there are several field experience courses available.
- Courses are asynchronous; allowing students to log in any time of the day or night. In order to maximize interaction among students, instructors will set weekly schedules and assignment deadlines.
- Our NTEN team offers fast, friendly, one-on-one support from the application process to certificate completion.

**Application Process for the Library Media Certificate Program**

Prior to applying for the Library Media Certificate program applicants must hold a teaching license and have gained at least one year teaching experience.

1. Complete the online application through the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html)
2. Provide official transcripts from all higher education institutions attended to the Department of Education Graduate Programs Office, 215 Reid Hall, PO Box 172880, Montana State University, Bozeman, MT 59717.
   • Note: Admission to the program requires a cumulative GPA of 3.0 for the last two years of undergraduate coursework.

**Application Deadlines**

The following are the preferred application deadline dates by which all of the application materials must be submitted via the Graduate School Online Application System (http://www.montana.edu/wwwdg/apply.html):

- Fall Semester: April 1st
- Spring Semester: November 1st
- Summer Semester: April 1st

The following are the absolute application deadline dates. If an applicant is unable to submit all application materials via the online application system by the preferred dates listed above, he or she can submit the materials by the date listed below, as there will be a second review.

- Fall Semester: July 15th

**Time to Complete**

Most students will complete the Certificate in 1-2 years. Because students have different responsibilities at work and home, not all students will progress in the program at the same pace. However, all coursework for each Certificate must be completed within a 3-year window of time.

Students may transfer into the program a maximum of 3 graduate credits from MSU NTEN or Masters of Science in Science Education (MSSE) courses. All transfer credit is subject to approval.

Graduate Science Teaching certificates are not licensing and/or endorsement programs. Students interested in initial licensure should check with the Department of Education in their states for local certification policies. Graduate science teaching certificate coursework could be used toward licensure/endorsements depending on the requirements of individual states.

**For More Information**

Kelly Boyce, Program Manager
Certificate in Science Teaching in Chemistry

The Certificate in Science Teaching in Chemistry covers the broad field of chemistry. These courses are high-energy, high-interest courses; increasing a student's content knowledge and confidence when teaching chemistry in the classroom. The subject matter can be used as an introduction to chemistry or to strengthen one's current knowledge.

Complete 12 credits selected from the below list:

- CHMY 505 Critical Concepts in Chemistry 3
- CHMY 506 Integrating Computers into Laboratory Instruction 2
- CHMY 591 Special Topics (An Atoms-First Primer for AP/IB Chemistry Teachers) 3
- CHMY 591 Special Topics (Chemistry of the Environment Water, Air, and Earth) 3
- CHMY 591 Special Topics (Exploring Biochemistry for Teachers) 3
- CHMY 591 Special Topics (Exploring Biochemistry II: Metabolism) 3
- CHMY 591 Special Topics (Exploring Chemistry for Middle & High School Teachers) 3
- CHMY 591 Special Topics (Exploring Organic Chemistry for Teachers) 3
- CHMY 591 Special Topics (Special Topics in Chemistry: Kinetics, Equilibrium, & Thermodynamics) 3
- CHMY 594 Seminar (Science Lab Safety & Risk Management) 1

Certificate in Science Teaching in Earth Science

The Certificate in Science Teaching in Earth Science offers courses ranging from geology and landforms to hydrology and paleontology. Also included and recommended while earning this certificate is a broad scoped course listed as Earth System Science.

Complete 12 credits selected from the below list:

- ERTH 516 North Rocky Mtn Geology 2
- ERTH 591 Special Topics (Understanding Climate Change for Teachers) 3
- ERTH 591 Special Topics (Fundamentals of Oceanography) 3
- ERTH 591 Special Topics (Geology of Glacier National Park) 2
- ERTH 591 Special Topics (Geology of the Moon) 3
- ERTH 591 Special Topics (Historical Geology for Educators) 3
- ERTH 591 Special Topics (Plant and Animal Response to a Changing Climate) 3
- ERTH 591 Special Topics (K-14 Earth System Science) 2
- ERTH 591 Special Topics (Teaching Middle School Earth System Science) 3
- ERTH 591 Special Topics (Weather and Climate for Teachers) 3
- ERTH 594 Seminar (Geology Seminar) 1
- GEO 521 Dinosaur Paleontology 2
- GEO 560 Geology Yellowstone Volcanic 2
- GEO 591 Special Topics (Advanced Paleontology for Teachers) 2
- LRES 591 Special Topics (Streamside Science for Teachers) 3
- LRES 591 Special Topics (The Twelve Principles of Soil Science for Teachers) 3
- LRES 591 Special Topics (Water Quality in the Classroom for Teachers) 3

Certificate in Science Teaching in Elementary School Science

This certificate is designed to give K-8 teachers a basic understanding of a broad range of topics in physical science, life science and earth/space science. These courses are specially designed to help K-8 teachers integrate inquiry-based science into the classroom while improving their own science content knowledge.

Complete 12 credits selected from the below list:

- BIOL 591 Special Topics (Plant Science: It Grows on You) 1
- BIOL 591 Special Topics (Using Local Ecosystems to Implement Elementary Biology Activities) 1
- EDCI 591 Special Topics (Symbiosis - Eat, Prey, Love) 3
- EDCI 591 Special Topics (History of Spaceflight and Space Technology) 3
- ERTH 591 Special Topics (Elementary Weather) 1
- ERTH 591 Special Topics (Landforms for Elementary Teachers) 1
- ERTH 591 Special Topics (Teaching Middle School Earth System Science) 3
- LRES 591 Special Topics (The Dirt on Soil Science for Elementary Teachers) 1
- PHSX 591 Special Topics (Electric Circuits & Magnetism) 2
- PHSX 591 Special Topics (Elementary Space Science) 1
- PHSX 591 Special Topics (The Science of Sound) 1
- PHSX 591 Special Topics (The World of Forces) 1
- PHSX 591 Special Topics (The World of Motion) 1
Certificate in Science Teaching in Life Science

This certificate offers a broad spectrum of courses. From these, students can create a diverse program that includes anatomy and physiology, nutrition, ecology, plants, microbiology, insects and slime, or focus in on a specific area of interest.

Complete 12 credits selected from the below list:

- ARNR 529 Yellowstone Wildlife Habitat Ecology 2
- BIOL 591 Special Topics (Alpine Ecology) 2
- BIOL 591 Special Topics (Anatomy & Physiology - An Inquiry Based Approach for Teachers) 3
- BIOL 591 Special Topics (Ecology of Trout Streams) 2
- BIOL 591 Special Topics (Land Use Issues in the Greater Yellowstone Ecosystem) 2
- BIOL 591 Special Topics (Teaching Evolution) 3
- BIOE 513 Terrestrial Ecology of Plains and Prairies 1
- BIOE 519 Riparian Zones/Wetlands 2
- BIOE 520 Animal Biodiversity in GYE 2
- BIOE 522 Birds of Prey 2
- BIOE 523 Wildlife Ecology 2
- BIOE 591 Special Topics (Advanced Ecology) 2
- BIOE 591 Special Topics (Ecology & Conversation of the World’s Marine Ecosystems - An Online Course for Teachers) 3
- ERTH 591 Special Topics (Plant and Animal Response to a Changing Climate) 3
- EDCI 591 Special Topics (Environmental Science Education: Fall Ecological Field Studies) 3
- EDCI 591 Special Topics (Environmental Science Education: Summer Ecological Field Studies) 3
- EDCI 591 Special Topics (Environmental Science Education: Winter Ecological Field Studies) 3
- EDCI 591 Special Topics (Symbiosis - Eat, Prey, and Love) 3
- LRES 557 Thermal Biology in YNP 2
- LRES 569 Ecol of Invasive Plants in GYE 2
- LRES 591 Special Topics (Yellowstone Lake Ecology) 2
- MB 536 Exploring Microbiology 3
- MB 538 Cell & Molecular Biol 2
- MB 539 Infection and Immunity 3
- MB 540 Environmental Microbiology 3
- MB 541 Microbial Genetics 3
- MB 542 Microbial Ecology 3
- MB 591 Special Topics (Special Topics in Microbiology) 3
- NUTR 526 Nutrition for Fitness/Perform 3
- PSPP 548 Flower Plnts of North Rock Mtn 2
- PSPP 591 Special Topics (Biomimicry: The Technology of Biology) 2
- PSPP 591 Special Topics (Plants, People, and Health) 2

Certificate in Science Teaching Physics

From the study of basic forces to investigating the farthest reaches of the universe, this certificate allows the student to meet varying interests or focus on a single area, such as mechanical physics or astronomy.

Complete 12 credits selected from the below list:

- ECIV 591 Special Topics (Snow and Avalanche Physics for Science Educators) 3
- EELE 591 Special Topics (Solar Cell Basics for Science Teachers) 2
- PHSX 401 Physics by Inquiry I 3
- PHSX 402 Physics by Inquiry II 3
- PHSX 403 Physics by Inquiry III 3
- PHSX 405 Special Relativity Online 3
- PHSX 491 Special Topics (Conceptual Physics) 3
- PHSX 511 Astronomy for Teachers 3
- PHSX 512 General Relativity Online 3
- PHSX 513 Quantum Mechanics Online 3
- PHSX 514 Comparative Planetology Online 3
- PHSX 582 Astrobiology for Teachers Online 3
- PHSX 591 Special Topics (Physics of Renewable Energy) 3
- PHSX 591 Special Topics (The Science of Sound) 1
- PHSX 591 Special Topics (The World of Motion) 1
- PHSX 591 Special Topics (Electric Circuits & Magnetism) 2
- PHSX 591 Special Topics (Teaching Electricity and Magnetism Using Research-Based Curriculum) 2
- PHSX 591 Special Topics (Teaching Mechanics Using Research-Based Curriculum) 2
- PHSX 591 Special Topics (The World of Forces) 1

Interdisciplinary and Other Programs

Graduate Programs Available:

- Doctor of Philosophy in Ecology and Environmental Sciences (p. 408)
- Master of Science in Optics and Photonics Plan A (p. 361)
- Master of Science in Optics and Photonics Plan B (p. 362)
- Master of Science in Environmental Engineering (http://catalog.montana.edu/graduate/interdisciplinary-other-programs/profiles-engineering-management)
- Master of Science in Health Science (p. 404)
- Master of Science in Science Education (p. 399)
- Molecular BioSciences Program (p. 407)
- Post Baccalaureate Pre-Medical Certificate (p. 408)
- Doctor of Philosophy in Materials Science (p. 409)
- WIMU Regional Program in Veterinary Medicine (p. 410)
- WWAMI Medical Education Program (p. 411)

Master of Science in Health Sciences

The intent of the MS in Health Sciences program is to provide students with an opportunity to diversify or further enhance their educational foundation through graduate education that can be applied to any of several career paths in the health care field. The program supports and formalizes the educational endeavors of MSU graduates, Post Baccalaureate...
Pre-Medical Certificate (p. 408) students, and other students who attend MSU to better prepare for matriculation into health care-related professional schools. The MS in Health Sciences program was approved in early 2009 and the first students matriculated in August 2009. The program requires at least two consecutive semesters and the class size is capped at 30 students.

The MS in Health Sciences program can be combined with the Post Baccalaureate Pre-Medical Certificate program to provide a continuous and more in-depth degree program and educational experience. For those students applying to health professional school, the MS in Health Sciences can be completed during the application ‘glide’ year.

Additionally, students who have a solid science background, and thus do not qualify for the Certificate program, can be eligible to enter directly into the one year MS in Health Sciences program. The pre-requisites are such that students are able to build on a substantial foundation in the basic sciences and broaden their academic experience.

Coordinator:
Sheila Nielsen, PhD (http://www.montana.edu/hpa/drnp.html)

Assistant:
Kathy Weaver
Health Professions Advising
308 Leon Johnson Hall, PO BOX 173075,
Bozeman, MT 59717
Tel: 406 994-1670  Fax: 406 994-6400
Email: hpa@montana.edu
Home page for HPA (http://www.montana.edu/hpa)

How to Apply
1. An online application for the MS in Health Sciences can be found at PostBacCAS. (https://postbaccas.liaisoncas.com/applicant-ux/#!/userAccount)
2. Applicants who have been accepted to the program through PostBacCAS will be invited to complete the MSU Graduate School application to complete the full admissions process.
3. Applications to PostBacCAS are accepted Oct 1- March 31.
   Applications are reviewed throughout the cycle by the admissions committee and decisions are made and communicated to the applicant as quickly as possible.
4. Pre-requisites include a year each of general chemistry, organic/biochemistry, biology, and physics. A year of math to include one semester of statistics is also required.

Program Specifics
• Available to students is a clinical observation course (MEDS 541 Clinical Practicum) and a health-care focused, graduate-level journal club (MEDS 594 Seminar).
• Students will choose an emphasis among Molecular Medical, Community Health, International, or Health and Medicine.
• Students will complete a scholarly project and present in a public forum and provide a written report (MEDS 575 Professional Paper and Project).
• Students are encouraged to participate in a semester-long application preparation process (Prep2Apply) for health professional school, if appropriate.
• Students who successfully complete program will receive their degree during the spring graduation ceremony.

Recommended Courses:
Molecular Medicine

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<td>BCH 442</td>
<td>Metabolic Regulation</td>
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<td>BCH 444R</td>
<td>Biochemistry &amp; Molecular Biology Methods</td>
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<td>BCH 524</td>
<td>Mass Spectrometry</td>
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<td>BCH 543</td>
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<td>BIOM 410</td>
<td>Immunology</td>
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<tr>
<td>BIOM 425</td>
<td>Adv Cell &amp; Molecular Biology</td>
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<td>BIOM 524</td>
<td>Ethical Practice of Science</td>
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<td>BIOH 405</td>
<td>Hematology</td>
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<td>BIOH 422</td>
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<td>BIOH 511</td>
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<td>BIOH 425</td>
<td>Sensory Neurophysiology</td>
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<td>BIOH 435</td>
<td>Cognitive Neuroscience</td>
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<td>BIOH 445</td>
<td>Intro Pharmacology</td>
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<td>BIOH 455</td>
<td>Molecular Medicine</td>
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<tr>
<td>BIOH 465R</td>
<td>Gene Expression Lab: From Genes to Proteins to Cells</td>
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<td>Gene Expression Lab: From Genes to Proteins to Cells</td>
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<td>BIOM 400</td>
<td>Medical Microbiology</td>
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<td>BIOM 425</td>
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<td>BIOM 441</td>
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<td>MB 505</td>
<td>Host-Associated Microbiomes</td>
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<td>MB 520</td>
<td>Microbial Physiology</td>
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<td>MB 525</td>
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<td>Advanced Genetics</td>
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<td>BIOH 509</td>
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Community Health

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<tr>
<td>CHTH 405</td>
<td>Caregiving &amp; Aging Families</td>
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<td>CHTH 430</td>
<td>Mental Health &amp; Social Issues in Aging</td>
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<td>CHTH 502</td>
<td>Theories and Models in Health</td>
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<tr>
<td>EIND 506</td>
<td>Healthcare Delivery Systems</td>
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<td>Design H C Delivery Systems</td>
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<td>EIND 511</td>
<td>Advanced Human Factors</td>
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<td>EIND 513</td>
<td>Human Factors in the Safety of Complex Systems</td>
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<tr>
<td>EIND 514</td>
<td>Occupational Biomechanics</td>
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Admission

Entrance requirements include: a bachelor’s degree in an area of science, science education, or related area; at least two years of science teaching in educational settings; and an undergraduate GPA of 3.0 or higher. Students with a GPA of less than 3.0 have the opportunity to begin the program as a non-degree student to earn admissions.

Applications are accepted throughout the fall, spring, and summer sessions. Application documents include all official transcripts, three letters of recommendation, essay, and resume. For more information about the application process, visit the MSSE website (http://www.montana.edu/msse).

Program Features

- Designed for science educators by experienced science, science education, and mathematics faculty with the collaboration of outstanding classroom teachers
- Over 80% of the courses may be taken on-line by asynchronous, computer-mediated communication
- Accredited 30-credit graduate program
- Graduate in 2 to 3 years
- Courses are structured to support both formal classroom teachers and informal science educators
- The opportunity to work at home without frequent trips to campus
- The chance to participate in classes when it is most convenient for you
- Popular campus based summer field and lab experiences that vary in length from one day to two weeks

Master of Science in Science Education

451 Reid Hall, Bozeman, MT 59717
406-994-5679
Home Page: www.montana.edu/msse

Program Director
Dr. Gregory Francis
• Emphasizes Next Generation Science Standards
• Personalized science education capstone project for each student
• Interdisciplinary program with the opportunity to expand knowledge in all science disciplines
• Self-paced program
• Affordable online only graduate tuition fees

Online graduate courses are offered during the fall, spring, and summer sessions. Montana-based field and lab graduate courses are offered during the summer session.

In addition to completing a group of core courses (14 credits total) which includes the 3-credit capstone project, students develop interdisciplinary combinations of science courses (12 credits minimum) from offerings in biology, chemistry, earth science, microbiology, physics, plant sciences, and other related areas. The final four credits in the thirty-credit program are electives selected from education and/or science courses.

Interdisciplinary efforts and incorporation of both science content and pedagogy have been encouraged during the development of courses. Each student seeking the degree is advised by a three-person faculty committee, and programs are designed taking into account the student’s background, interests, and career goals.

Instructors
The MSSE degree program was developed by Montana State University faculty members who are active in science, science education, and mathematics. The program is a unique, cooperative effort of several colleges and departments. Faculty members of the departments of Biology, Chemistry and Biochemistry, Earth Science, Education, Health and Human Development, Land Resources and Environmental Science, Mathematics, Microbiology, Plant Science and Environmental Science, Physics, and other related areas such as Engineering will teach most courses. Faculty members of other departments and units will play a major role in some courses. When appropriate, courses may be taught by faculty members of other institutions.

The program of study may begin with online courses in any semester, or summer field/lab courses based from the MSU-Bozeman campus. Study continues with online courses that students take from their homes or workplaces, and ends with a campus visit for presentation of the results of a personalized science education capstone project. Over 80% of the courses and credits may be taken off-campus by asynchronous, computer-mediated communication. Thirty-semester credits are required for the degree. Students typically will complete the degree in two or three years.

All students seeking the MSSE degree complete core courses (14 credits) in education which includes a three-credit capstone project. For the remaining credits (16), students select interdisciplinary combinations of science content courses (12 credits minimum) from offerings in biology, chemistry, computer science, earth science, engineering, health and human development, land resources and environmental science, microbiology, physics, and plant science. Interdisciplinary efforts and incorporation of both science content and pedagogy have been encouraged during the development of courses. The final four credits in the thirty-credit program are electives selected from education and/or science courses.

For a full list of courses visit the Master of Science in Science Education Webpage (http://www.montana.edu/msse).

Required Core Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSSE 501</td>
<td>Inquiry Sci Eng Prac</td>
<td>2</td>
</tr>
<tr>
<td>EDCI 504</td>
<td>Assessment and Evaluation in Education</td>
<td>3</td>
</tr>
</tbody>
</table>

EDCI 505  Foundations of Action Research in Teaching and Learning  3
EDCI 509  Implementing Action Research in Teaching and Learning  3
EDCI 575  Professional Paper/Project  3

Molecular Biosciences Program

Program Chair
Matthew Fields
113A Lewis Hall
P.O. Box 172580, Bozeman, MT 59717-2580
406-994-6652 Email: mbprogram@montana.edu

Program Description
The Molecular BioSciences Program offers an interdisciplinary program towards a Doctorate in Philosophy. You are able to pursue your science in a research area across departmental boundaries. Our integrated curriculum provides you with broad academic training necessary to excel in life science research. You will be able to participate in a first-year rotation in three different laboratories in your chosen research area.

Research Areas:
• Biolimns & Engineering (http://mbprogram.montana.edu/dept.asp?in_id=1)
• BioInspired Materials (http://mbprogram.montana.edu/dept.asp?in_id=5)
• Bioinformatics/Genomics/Proteomics (http://mbprogram.montana.edu/dept.asp?in_id=3)
• Biomedical Sciences (http://mbprogram.montana.edu/dept.asp?in_id=7)
• Biophysics (http://mbprogram.montana.edu/dept.asp?in_id=9)
• Cell, Developmental, & Molecular Biology (http://mbprogram.montana.edu/dept.asp?in_id=2)
• Chemical Biology (http://mbprogram.montana.edu/dept.asp?in_id=4)
• Environmental Microbiology (http://mbprogram.montana.edu/dept.asp?in_id=11)
• Ecology & Environmental Sciences (http://mbprogram.montana.edu/dept.asp?in_id=14)
• Immunology & Infectious Disease (http://mbprogram.montana.edu/dept.asp?in_id=8)
• Life in Extreme Environments (http://mbprogram.montana.edu/dept.asp?in_id=10)
• Plant Sciences (http://mbprogram.montana.edu/dept.asp?in_id=12)
• Neuroscience (http://mbprogram.montana.edu/dept.asp?in_id=15)
• Virology (http://mbprogram.montana.edu/dept.asp?in_id=6)

Our program offers students a common but rigorous educational experience for the first year, and continued challenge as you begin to specialize during your second year. MB Program students participate in seminar series, program retreats, teaching, and may attend scientific meetings. In the second year once you have chosen a research advisor based on your first-year rotation process, you will be formally admitted to one of the eleven participating departments to conduct a research project leading to the awarding of a Doctorate of Philosophy.

Professors
This interdisciplinary program brings together faculty from over eleven basic science departments: Cell Biology and Neuroscience; Chemical and Biological Engineering; Chemistry and Biochemistry; Computer
Science; Earth Sciences; Ecology; Immunology and Infectious Disease; Land Resources and Environmental Sciences; Mathematics; Microbiology; Plant Sciences and Plant Pathology; and three research centers: Center for Biofilm Engineering, Center for BioInspired Materials and the Thermal Biology Institute to provide students with the didactic and laboratory instruction they require to become successful research scientists. Members of the MB Program faculty are internationally recognized for their research. We have over 68 participating faculty (http://mbprogram.montana.edu) for the above mentioned departments and centers.

**Admission**

**Ph.D. Degree Program**

It is recommended that applicants for the Ph.D. program have a Bachelor’s or Master’s degree with a solid foundation of science courses.

Admission to the doctoral program follows the requirements of The Graduate School. Factors that the department uses in its admissions process include GRE scores, TOEFL scores (for non-native English speakers), reference letters, GPA, research experience and previous coursework.

Details about applying can be found at http://mbprogram.montana.edu/application.asp. The Molecular BioSciences Program encourages applicants to use the online application procedure.

**Financial Assistance**

The Molecular BioSciences Program at Montana State University is offering outstanding students a fellowship of $22,000 plus tuition per year to fund their Ph.D. graduate education in the life sciences.

**Program Requirements**

**Ph.D. Program First-Year**

A Ph.D. student must complete a minimum of 6 credits of coursework each semester their first-year. Required courses include:

**Fall Semester**

- MBSP 594 Molecular Biosc Prgrm Sem
- MBSP 561 Molec Biosci Lab Rotation I
- MBSP 562 Molec Biosci Lab Rotation II
- Two courses from any of the approved courses in the eleven participating sciences departments

**Spring Semester**

- MBSP 594 Molecular Biosc Prgrm Sem
- MBSP 563 Molec Biosci Lab Rotation III
- MBSP 564 Molec Biosci Lab Rotation IV
- MBSP 575 Mol BioSci Prgm Rsch Project
- Two courses from any of the approved courses in the eleven participating sciences departments

**Research Experience**

Ph.D. students will gain research experience through their lab rotation, conference submissions, and attending conferences.

**Research Facilities**

Research Facilities vary on lab rotation selection

**Ph.D. Degree in Ecology and Environmental Sciences**

This cross-college doctoral degree represents a broad collaboration among departments and faculty from across MSU. It provides the opportunity for motivated students to integrate our world-class faculty research programs in diverse aspects of ecology and environmental sciences, often within the unparalleled natural laboratory that is the Greater Yellowstone Ecosystem. Particular program strengths include terrestrial and aquatic ecology, environmental biogeochemistry, evolutionary biology, hydrology and watershed analysis, quantitative ecology, agroecology, environmental risk assessment, invasive plant ecology and management, conservation biology, land rehabilitation/restoration ecology, environmental microbiology, remote sensing and spatial sciences, chemical ecology and land-atmosphere interactions.

Graduates will be well-trained professionals who will compete strongly in research, teaching, and related fields nationally and internationally.

Ecology and Environmental Sciences doctoral students will be affiliated with a home department that corresponds to that of their major faculty advisor. Other specific graduate program criteria, procedures, and processes vary among departments; students will follow those of their home department, which are also consistent with policies set forth by The Graduate School (http://www.montana.edu/gradschool).

**Core Curriculum**

Because of the substantial diversity in disciplinary and multidisciplinary foci within the Ecology and Environmental Sciences doctoral program, there is no universal required core curriculum. The student’s individual coursework program will be developed in partnership with the major advisor and graduate committee, and must be consistent with the home department and the Graduate School guidelines and requirements. A minimum of 30 credits of resident coursework must be taken from MSU.

**Program Participants**

The program is jointly centered in the departments of Land Resources and Environmental Sciences (http://landresources.montana.edu) (College of Agriculture) and Ecology (http://www.montana.edu/ ecology) (College of Letters and Science) but is also open to students and faculty mentors in other MSU departments who undertake relevant doctoral study, such as the departments of:

- Animal and Range Sciences (http://animalrange.montana.edu)
- Plant Sciences and Plant Pathology (http://plantsciences.montana.edu)

in the College of Agriculture and

- Earth Sciences (http://www.montana.edu/earthsciences)
- College of Nursing (http://www.montana.edu/nursing)

in the College of Letters and Science.

Stipend and operations funding are generally from research grants awarded to faculty members, but graduate teaching assistantships and other forms of support are also available on a limited basis.

For more information about the Ph.D. degree in Ecology and Environmental Sciences, faculty and their areas of research, application requirements and procedures, visit the departmental web pages listed below.

- Ecology - http://www.montana.edu/ ecology/
- Land Resources & Environmental Sciences - http://landresources.montana.edu/

**Post Baccalaureate Pre-Medical Certificate**

The Post Baccalaureate Pre-Medical Certificate Program is a career-changing opportunity afforded to students by Montana State University through the Health Professions Advising Office. As a ‘career-changing’ program, students accepted into this program have earned a non-science bachelor’s degree and have often been employed prior to deciding to pursue a career in
Certificate of Completion
Certificate of Completion is awarded to students who complete a minimum of 36 credits during the program and will be awarded at the Spring Gala in April.

Students will need to submit and have approved both the Program of Study and Application for Graduation forms (http://www.montana.edu/gradschool/forms.html), the Certificate will be included on the student’s transcript.

How to Apply
1. Application for the Post Baccalaureate Pre-Medical Certificate can be found online at PostBacCAS. (https://postbaccas.liaisoncas.com/applicant-ux/#/userAccount)
2. Applicants who have been accepted to the program through PostBacCAS will be invited to complete the MSU Graduate School application to complete the full admissions process.
3. Admission is rolling and applications are accepted Oct 1- Feb 15. Applications are reviewed monthly by the admissions committee and decisions are made and communicated to the applicant as quickly as possible.
4. Competency in math, as defined by MSU Math Level 4 or successful completion of College Algebra within the last 5 years, is required at the time of course registration and matriculation. If the appropriate Math is not indicated on your transcripts, please reference in your application how you plan to meet this pre-requisite. It is also recommended that you have 2 semesters of college writing prior to beginning the program.

Recommended Schedule of Courses

<table>
<thead>
<tr>
<th>Summer Session</th>
<th>Fall Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 141</td>
<td>Organic Chemistry I</td>
</tr>
<tr>
<td>CHMY 143</td>
<td>Cellular and Molecular Biology</td>
</tr>
<tr>
<td>PHSX 205</td>
<td>Integrated Physiology I</td>
</tr>
<tr>
<td>PHSX 207</td>
<td>Introduction to Statistics</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
</tr>
<tr>
<td>MEDS 541</td>
<td>(optional)</td>
</tr>
<tr>
<td>MEDS 594</td>
<td>(optional)</td>
</tr>
<tr>
<td>Spring Semester</td>
<td></td>
</tr>
<tr>
<td>CHMY 323</td>
<td>Organic Chemistry II</td>
</tr>
<tr>
<td>BCH 380</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>BIOB 375</td>
<td>General Genetics (or)</td>
</tr>
<tr>
<td>or BIOH 185</td>
<td>Biomedical Genetics</td>
</tr>
<tr>
<td>or BIOB 320</td>
<td>Cellular and Molecular Biology</td>
</tr>
<tr>
<td>electives</td>
<td></td>
</tr>
<tr>
<td>MEDS 541</td>
<td>(optional)</td>
</tr>
<tr>
<td>MEDS 594</td>
<td>(optional)</td>
</tr>
</tbody>
</table>

Ph.D. in Materials Science

Participating Departments:
Chemistry and Biochemistry, Physics, Chemical and Biological Engineering, Mechanical and Industrial Engineering, and Electrical and Computer Engineering.

Program Director
Professor Robert Walker
Department of Chemistry and Biochemistry

Information Contact
Doreen Brown Ed.D
Department of Chemistry and Biochemistry
Tel: 406-994-4802 Fax: 406-994-5407

Link to home page for General information (http://www.mttmatsci.org)
Overview
MSU is part of a collaborative Ph.D. program with UMT and MTech in materials science (MatSci). At MSU, the Ph.D program involves multiple departments, faculty, courses, and research facilities. Research specialties are focused in biomaterials; electronic, photonic, and magnetic materials; materials for energy storage, conversion, and conservation; and materials synthesis, processing, and fabrication. The curriculum integrates a broad range of physical science and engineering disciplines with an even broader range of applications: from health and medicine to nanotechnology to energy, environment, and natural resources. Each student will complete original, independent research culminating in a dissertation.

Admission
To enter the Ph.D. program, the student must have earned a B.S. or a B.A degree (or equivalent) in materials science, materials engineering, physics, chemistry, metallurgy, or a related science or engineering field. The student’s academic record must provide evidence of a strong background in the fundamentals of science and/or engineering principles. A student with such a background, who has not passed certain undergraduate courses, that are prerequisites for their required or elective graduate courses, must remedy this gap as expeditiously as possible, either by taking the prerequisite undergraduate course or through independent study and “credit by examination.”

Applicants must be formally admitted to The Graduate School. See the Admission Policies and Application Requirements sections for additional information at www.montana.edu/wwwdg/.

Financial Assistance

Degree Requirements and Curriculum
The MatSci Ph.D. curriculum is designed to be flexible, but still provide students with an exceptionally strong and broad understanding of the theory, experimental techniques, current challenges, and societal/economic impacts of materials science and engineering. All students in the program—regardless of specialty—will understand how classes of materials derive their properties from the atomic to the macroscopic level and be familiar with the growing set of materials fabrication, assembly, processing, and characterization tools and techniques. Furthermore, students will be aware of and committed to the professional and ethical standards of the field. Students are also expected to become aware of the economic, societal, and other broader impacts of materials and materials research. Through their dissertation research, students will demonstrate that they can conceive, plan, design, conduct, analyze, defend, publish, and communicate original and creative research that advances understanding in an area important to MatSci.

The MatSci Ph.D. will require a minimum of 60 semester credits beyond the bachelor’s degree. Of the 60 credits, at least 18 credits must be obtained for dissertation research, and at least 32 credits must be earned for coursework.

In addition to the core curriculum, each student must earn at least 12 credits of electives within or related to the chosen specialty. Typically, this coursework would be completed by the end of the student’s second year. Additional elective courses intended to provide a student with specialized expertise and/or skills relevant to their dissertation research may be recommended by the individual student’s advisor and committee.

Other Requirements
Other requirements include the qualifying exam, the candidacy exam, the dissertation, participation in the program’s annual summer symposium, annual meetings with a student’s advisory committee, and an optional internship.

Core Courses
• MTSC 501 Advanced Materials Science I
• MTSC 502 Adv Materials Science II
• MTSC 511 Thermodynamics of Materials
• MTSC 512 Kinetics Phase Transformations
• MTSC 551 Adv Material Character I/ MTSC 552 Adv Material Character II
• MTSC 594 Seminar
• MTSC 690 DISSERTATION RESEARCH

ELECTIVES
• MTSC 580 SPECIAL TOPICS
• MTSC 589 COLLABORATIVE PROJECT

Other Electives
Elective courses will be available, allowing students to deepen their understanding and research skills in the program’s focus areas:

1. biomaterials;
2. materials for energy storage, conversion, and conservation;
3. electronic, magnetic, and photonic materials; and
4. materials synthesis, processing, and fabrication.

Some electives will be developed specifically for the MatSci Ph.D. program, others would be graduate courses from other related graduate programs at the three campuses. Courses in mathematics, statistics, and numerical modeling would be recommended for students with special interests in theory and simulation.

Graduate students in the program are supported continuously throughout their studies by stipends that average between $22,000 and $24,000 per year and by tuition waivers. First-year students are supported as graduate teaching assistants, while most students in their second and later years are appointed to grant-funded projects as graduate research assistants.

WIMU Regional Program in Veterinary Medicine

Why WIMU Regional Program in Veterinary Medicine?
Montana State University (MSU) has joined the University of Idaho (UI) and Utah State University (USU) as partners with Washington State University (WSU) in its Regional Program in Veterinary Medical Education to serve the states of Washington, Idaho, Montana, and Utah. This innovative and highly successful program, now known as the Washington-Idaho-Montana-Utah (WIMU) Regional Program, has served hundreds of students in the Northwest and northern Rockies for nearly 40 years.

The WIMU regional program serves students with interests in all facets of the veterinary profession, whether they are interested in companion animals, horses or livestock, in private practice, industry or academia, or whether they are unsure. The opportunities available for DVM education in the WIMU regional program prepares graduates for entry into any of the exciting dimensions of veterinary medicine.

Montana students will spend their first year in Bozeman at Montana State University.* MSU faculty members teach the first year curriculum which includes Anatomy, Histology, Physiology, Neuroscience, Immunology,
General Pathology, Professionalism and Ethics, Introduction to Clinics, and Introduction to Surgery. The majority of WIMU faculty are experienced veterinarians and several faculty have earned both the DVM and Ph.D degree.

Classroom and clinical study will continue in years 2 and 3 on WSU’s Pullman campus. Students then have the opportunity to learn in a wide network of clinical placements throughout the four-state region in the 4th year before graduating as part of the Class of 2019.

Please see our prospective student website (http://dvm.vetmed.wsu.edu/prospective-students) for more information on the WIMU Regional Program through the Washington State University College of Veterinary Medicine.

Why apply to the WIMU Program?
Small Class Size, Big Network
The small class sizes at the Montana State University campus will provide very personalized attention to student success while offering the same opportunities for professional growth and the development of clinical, leadership, and interpersonal skills as afforded all students across the Regional Program.

- Montana’s small class size provides a friendly atmosphere and allows you to really get to know your professors and get one-on-one instruction.
- Students at the MSU location will learn with faculty and classmates in Bozeman, and also with faculty and classmates in Logan and Pullman through faculty and student exchanges and real-time video conferencing and lectures.
- Montana students will have access to all other major educational sites in the cooperative network, including shelter programs in Seattle, Washington and Boise, Idaho, the satellite small animal specialty clinic in Spokane, Washington, the Caine Livestock Center in Caldwell, Idaho, the Washington Animal Disease Diagnostic Laboratory in Pullman, Washington, the Veterinary Diagnostic Lab in Logan, Utah, and the Paul G. Allen School for Global Animal Health in Pullman, Washington. Students will also have access to a wide array of basic and clinical research opportunities throughout this network of four university partners.
- WSU’s College of Veterinary Medicine ranks 4th best veterinary college on FindtheBest.com, which uses objective criteria such as average license exam pass rates, average admitted GPA, and GRE scores. (http://veterinary-schools.FindtheBest.com)

Hands-on Experience
Students in the Regional Program gain hands-on experience early in the program. Courses in client communication, diagnostic challenges, and business skills give our students the tools they need to succeed.

- Local practitioners will provide personal hands-on experience for students on the Montana State University campus.
- Montana specialists in internal medicine, pathology, radiology, surgery, lab animal medicine, and clinical practice will participate and enrich the first year curriculum.
- Courses in client communication, diagnostic challenges, and business skills, give our students the tools they need to succeed. All students participate in the Cougar Orientation Leadership Experience (COLE), an off-site retreat designed to promote leadership skills and team building. COLE brings students from different places and sets the foundation for cooperation and teamwork over the next four years.
- The MSU hands-on approach continues through WSU faculty, who encourage students to maximize their time in the Veterinary Teaching Hospital and through educational trips relevant to academic programming.
- As part of the Regional Program Montana students will have choices to study in a wider network of clinical practice sites throughout the region as we add more Montana practices and facilities to our fourth year curriculum.

WWAMI Medical Education Program
Director
Martin Teintze, Ph.D.
937 Highland Blvd., Suite 5220
Bozeman, MT 59715
Email: mteintze@montana.edu
Home Page: www.montana.edu/wwami

Program Manager
Kayla Ouer
t/37 Highland Blvd., Suite 5220
Bozeman, MT 59715
Tel: 406-994-4411
Email: Kayla.Ouer@montana.edu

Program Description
Sponsored by the University of Washington School of Medicine and leading to an M.D. degree from that school, the WWAMI program is designed to provide medical education for citizens of the participating states (Washington, Wyoming, Alaska, Montana and Idaho), to provide a physician workforce for these states, and to encourage physicians to practice in locations where they are most needed.

WWAMI is a medical school program, not a premedical program. The program is supported by the State of Montana and guarantees that 30 qualified Montana residents can be admitted to the Medical School at the University of Washington School of Medicine each year.

Students who enter the program complete their Foundations Phase (18 months) at the participating university in their home state. First year programs exist at University of Washington-Seattle, and Spokane, the University of Wyoming-Laramie, the University of Alaska in Anchorage, Montana State University-Bozeman, and the University of Idaho-Moscow. The curriculum at each site has been standardized and is compatible with the University of Washington School of Medicine curriculum which integrates the basic and clinical sciences, and includes rural health care at an early time in medical education.

Course subject matter at MSU includes seven, 3-10 week Blocks and five Threads that will continue throughout the 18th month foundations phase.

At the conclusion of the foundations phase, students enter the Patient Care Phase of their education. During this phase students have the opportunity to complete their third year and part of their fourth year of medical school at either Billings, Bozeman or Missoula. Students receive training from physicians in the communities where the physicians live and practice (community phase). These “Clerkships” are established for a given educational need (e.g., pediatrics, family medicine). Clerkship sites have been established all over the State:

Billings: Chronic Care, Emergency Medicine, Family Medicine, Internal Medicine, Neurology, OB/GYN, Pediatrics, Psychiatry and Surgery
Bozeman: Emergency Medicine, Family Medicine, Internal Medicine, OB/GYN, Pediatrics, Psychiatry, and Surgery
Butte: Family Medicine
Dillon: Internal Medicine
Great Falls: Internal Medicine, Neurology, Pediatrics
Helena: OB/GYN, Pediatrics & Psychiatry  
Kalispell: OB/GYN, Surgery, Neurology  
Lewistown: Family Medicine  
Libby: Family Medicine  
Missoula: Anesthesiology, Family Medicine, Internal Medicine, Neurology, OB/GYN, Ophthalmology, Pediatrics, Psychiatry and Surgery  
Whitefish: Family Medicine  

To be eligible for the Montana State University WWAMI program, the prospective medical student must be certified by the Montana University System as a resident of Montana and must satisfy the admission requirements of the University of Washington School of Medicine. It is not necessary for a student to complete the premedical (undergraduate) education at MSU in order to be eligible for the WWAMI program. Students are selected by the Admissions Office at the University of Washington School of Medicine and are registered at the University of Washington School of Medicine as well as at their home institution for the first year and a half of the program.

Foundations Medical School Curriculum  
The following courses are completed in Bozeman over an 18-month period from August in the first year through December of the following year. Student then study for and take Step I of their National Board exams and then continue to the Patient Care Phase of the curriculum.

Required Courses: First Fall Semester  
Block I: Molecular & Cellular Basis of Disease (MCBD)  
MEDS 510  
This course teaches the principles of cell and molecular biology, physiology, biochemistry and genetics. Aspects include the organization of the genome and units of heredity, properties of macromolecules, and cytoarchitecture. Students will gain an understanding of intracellular communication, cell-cell interactions, properties of differentiated cells, and the diversity of their physiological properties and functions. Introduction to anatomy, histology and pharmacology content will be incorporated into the course.

Block II: Invaders & Defenders  
MEDS 520  
This course will involve integrated content in immune system, microbial biology, infectious diseases, inflammation and repair, skin and connective tissue. Introduction to anatomy, histology and pharmacology content will be incorporated into the course.

Required Courses: Spring Semester  
Block III: Circulatory Systems (CPR)  
MEDS 530  
Circulatory systems will present students with an integrated approach to the key supply chain and waste management systems of the body. Students will follow the movement of oxygen from the environment to the tissues, and movement of waste products of metabolism along the opposite path, examining the coordinated roles of the lungs, heart and kidney in the control and regulation of these processes. Introduction to anatomy, histology and pharmacology content will be incorporated into the course.

Block IV: Blood & Cancer  
MEDS 540  
This course familiarizes students with the basic pathophysiologic mechanisms leading to disturbances of red cell, white cell, and platelet production, as well as abnormalities of hemostasis presenting clinical problems, with an emphasis on pathophysiology. Additionally, this course will include relevant fundamental scientific principles in anatomy, pathology, and pharmacology.

Required Courses: Summer Term  
Block V: Energetics & Homeostasis  
MEDS 550  
This course will involve integrated content in metabolism, nutrition, obesity, diabetes, gastrointestinal/liver physiology, and endocrinology. Additionally, this course includes relevant fundamental scientific principles in anatomy, pathology, and pharmacology.

Required Courses: Second Fall Semester  
Block VI: Mind, Brain & Behavior  
MEDS 560  
In this course, students will learn the fundamental scientific principles of the structure and function of the normal human nervous system in situ, define major neurologic, psychiatric and behavioral disorders, and develop a systematic approach to their differential diagnosis and management.

Block VII: Lifecycle & Reproduction  
MEDS 570  
This course will cover normal and abnormal human development, reproductive functions including formation and maturation of ova and sperm, menstruation, normal pregnancy, and labor and delivery. Additionally, this course includes relevant fundamental scientific principles in pelvic anatomy, pathology, and pharmacology.

Threads  
Anatomy, Pathology, Pharmacology, Foundations of Clinical Medicine and a Primary Care Practicum in which students are paired up with a local physician throughout the entire foundations phase.

Further Information  
Contact Whitney Foster (WWAMI Program Manager) at MSU or follow the URL http://www.montana.edu/wwami for the complete application, admissions, and program requirements.

Jake Jabs College of Business & Entrepreneurship  
Dean  
Kregg Aytes, Ph.D.  
302 Jabs Hall, Bozeman, MT  59717  
406-994-4423  

Program Director  
Marc Giullian, Ph.D.  
424 Jabs Hall, Bozeman, MT  59717  
302 Jabs Hall, Bozeman, MT  59717  
406-994-1965 Email: busgrad@montana.edu  

The mission of the MPAc program is to prepare students for professional careers in accounting. Candidates for the degree will build on the broad general and business education obtained at the undergraduate level to gain more advanced competencies in the practice and theory of financial accounting, auditing, taxation, law, and other business and professional areas. Students will also be introduced to research methods and resources used by accounting professionals. The MPAc program’s goals include:

- To produce graduates who will have long-term success in their accounting careers
considered complete and eligible for review:

The following documents are required in order for your application to be

• To prepare our graduates to meet the educational requirements
recommended by the American Institute of Certified Public
Accountants
• To provide our students with access to professional opportunities
through career placement services

Master of Professional Accountancy (MPAc)
The Jake Jabs College of Business & Entrepreneurship (JJCBE) offers
the Master of Professional Accountancy degree. This highly regarded
program, in which students consistently pass the CPA exam at rates above
the national average, should be considered by students who are interested in
pursuing CPA certification or advanced financial positions. When students
enter our program, they will have the opportunity to work closely with our
nationally-recognized accounting and business faculty, using state-of-the-
technology. With the assistance of the Director of the MPAc program,
students will formulate a graduate program of study that will integrate their
educational background, areas of interest, and career path.

This emphasis on excellence has created a strong demand for our
accounting graduates. Companies from most states in the western United
States recruit on campus. Our graduates are employed by international
public accounting firms, regional and local public accounting firms,
corporations, and federal and state government entities.

Admission
A bachelor’s degree in accounting or business from an accredited college or
university provides the best foundation for this program. Applicants who
have undergraduate course deficiencies may be provisionally admitted while
attending to subject matter deficiencies. To apply, see Application Process
below. Applicants must be formally admitted by The Graduate School after
the preliminary recommendation for admission is reached by the JJCBE.
Refer to The Graduate School’s Admission Policies webpage for additional
information at: http://www.montana.edu/gradschool/admissions/.

Dates & Deadlines
• Fall term: June 15th (June 1, international applicants)
• Spring term: November 15th (November 1, international applicants)
• Summer term: April 15 (April 1, international applicants)

Priority Deadlines: Priority deadlines are important for
students applying for scholarships and Graduate Teaching
Assistantships.
• Fall term: March 15th (March 1, international applicants)
• Spring term: October 15th (August 1, international applicants)
• Summer term: March 15 (January 1, international applicants)

Application Process
Applicants to the MPAc program must complete an online Application for
Graduate Admission, which can be accessed at: http://www.montana.edu/
gradschool/apply.html.

The following documents are required in order for your application to be
considered complete and eligible for review:

• Application (http://www.montana.edu/gradschool/apply.html) and the
non-refundable $60 application fee
• Official transcripts from each university attended (MSU transcripts past
1988 need not be submitted)
• Official entrance exam scores (GRE or GMAT)

• Three letters of recommendation. Applicants will be prompted to
submit contact information for each recommender during the online
application process. The applicant should ask people who are able to
judge the applicants ability to succeed in graduate school (e.g., one’s
undergraduate accounting professors, a CPA who served as a supervisor
during an internship, other faculty). Please do not ask for letters of
recommendation from family members, friends, roommates, etc.
• One page essay about one’s motivations for entering the program
• International students must also submit official TOEFL or IELTS
scores,a financial certificate with supporting documents, and degree
certificates.

The MPAc program is highly selective, with a limited number of openings
available to qualified students. The MPAc Advisory Council will admit
those students whose previous academic performance and/or work
experience indicate a desire and ability to excel. Test scores and records
of academic performance (with close scrutiny of grades earned in 300 &
400-level accounting courses) are evaluated individually in the admissions
procedure. Of equal importance, however, are the applicant’s personal
qualifications, accomplishments, and letters of recommendation. The
applicant’s entire file is reviewed in order to ensure the admission of those
with the highest aptitude, motivation, and qualifications.

For priority consideration, a complete application package must be received
by the deadlines noted above. Applications received after the priority
deadline may be considered, depending on a variety of factors. Contact
the MPAc Director immediately to determine if circumstances will permit
consideration of your late application.

Applicants with non-accounting bachelor degrees, please review this section:
http://www.montana.edu/business/accounting/MPAc/FAQ.html#non-
accounting

Financial Assistance
The Jake Jabs College of Business & Entrepreneurship (JJCBE) offers
scholarships for graduate students. A scholarship application is made
available during the month of November only, and is an electronic
application (a paper copy is not available).

Frequently Asked Questions
For a list of frequently asked questions, please see the MPAc webpage
within the JJCBE website at: http://www.montana.edu/business/
accounting/MPAc/FAQ.html

Degree Offered
The Master of Professional Accountancy (MPAc) degree is designed to
prepare students for professional careers in accounting. With the assistance
of the MPAc Director, students will formulate a graduate program of study
that will integrate their educational background, areas of interest, and career
path.

Program Requirements
At least 30 credits of acceptable coursework must be completed. Of those,
at least 21 credits must be taken at MSU-Bozeman. Elective credits are
selected by the student, with approval from the MPAc Director. Students
are required to maintain at least a 3.0 semester grade point average, and at
least a 3.0 cumulative grade point average at all times while in the MPAc
program.

Required Courses

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<tr>
<th>Course</th>
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<th>Credits</th>
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<tr>
<td>ACTG 521</td>
<td>Advanced Auditing</td>
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<td>ACTG 522</td>
<td>Accounting Information Systems II</td>
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</tbody>
</table>
ACTG 525  Accounting Theory and Complex Issues in Accounting  3
ACTG 526  Advanced Taxation  3
ACTG 529  Research in Accounting  3
ACTG 536  Advanced Accounting  3
Approved Electives  12
Total Credits  30

For a complete list of approved electives offered, please refer to the MPAc curriculum information within the JJCBE website at: http://www.montana.edu/business/accounting/MPAc/

Refer to The Graduate School’s Policies and Procedures webpage for additional degree requirements at: http://www.montana.edu/gradschool/policy/index.html. Students are expected to be familiar with the degree requirements of both the Jake Jabs College of Business & Entrepreneurship (JJCBE) and The Graduate School.
Course Descriptions

ACT - Activities: General

ACT 104. Beginning Bowling. 1 Credit. (1 Lab; 3 cr max) F,S
Bowling fundamentals will be stressed along with bowling etiquette and equipment. Fee required.

ACT 109. Beginning Racquetball. 1 Credit. (1 Lab; 3 cr max) F,S
This class is designed for beginning to intermediate skill levels. Students will develop the skills, rules and terminology necessary to play recreational racquetball and to appreciate this lifetime sport. Students will also learn singles, doubles, 3 player and a variety of serves and shots.

ACT 110. Beginning Weight Training. 1 Credit. (1 Lab; 3 cr max) F,S
Learn proper weight lifting techniques, how to create a personalized weight training program, and the basics of anatomy/physiology as they relate to weight lifting.

ACT 114. Fundamentals of Rock Climbing. 1 Credit. (1 Lec) F
S PREREQUISITES: Comfortable with heights. This course is a basic introduction to the fundamentals of rock climbing through skill sessions, demonstrations, and practical experience. Emphasis will be placed on skill development, health and fitness climbing, and safety in the sport of climbing.

ACT 115. Soccer. 1 Credit. (1 Lab) F
Learn rules and regulations of soccer, basic skills of dribbling, passing, shooting, and play small-sided and full II versus II games.

ACT 116. Wallyball. 1 Credit. (1 Lab) F,S
Introduces wallyball skills, techniques, strategies, rules and scoring.

ACT 120. Beginning Alpine Skiing. 1 Credit. (1 Lab) S
Instruction at the beginner level, skiing novice runs. Acquire knowledge and skills regarding equipment, proper stance, balance, stopping, turning, chairlift loading and unloading.

ACT 121. Beginning Snowboarding. 1 Credit. (1 Lab) S
Instruction at the beginner level, snowboarding novice runs. Acquire knowledge and skills regarding equipment, proper stance, balance, stopping, turning, chairlift loading and unloading.

ACT 122. Skiing; Telemarking. 1 Credit. (1 Lab; 3 cr max) S
PREREQUISITES: Participants should already be comfortable to make parallel turns on alpine or telemark equipment on all groomed terrain. Instruction at all levels of skill from beginner to advanced. Fee required. Transportation, tickets, and equipment not included.

ACT 129. Circuit Training. 1 Credit. (1 Lab; 3 cr max) S
Learn different modes of fitness utilizing a timed sequence of exercises. This includes instruction on weight training and aerobic training. Students will gain knowledge on how to improve muscular strength, body composition, and cardiovascular endurance.

ACT 140. Beginning Basketball. 1 Credit. (1 Lab; 3 cr max) F,S
PREREQUISITES: ACT 140 or played a minimum of 3 years High School basketball. In this beginning course, one will learn the rules, skills, different types of recreational play.games, strategy, and coaching principles of basketball.

ACT 150. Beginning Yoga. 1 Credit. (1 Lab; 3 cr max) F,S,Su
This class is designed for the beginning yoga student. Students will learn to demonstrate basic knowledge of yoga postures and philosophy, identify basic anatomy and principles of alignment and identify the values of mind-body fitness toward a healthy lifestyle. Pass/Fail.

ACT 151. Beginning Billiards. 1 Credit. (1 Lab; 3 cr max) F,S
Pocket billiard fundamentals, most popular games, and appropriate rules will be stressed. Fee required.

ACT 156. Beginning Aikido. 1 Credit. (1 Lab; 3 cr max) F,S
Cover beginning level Aikido techniques, principles, theory and history. Learning all aspects of modern Aikido practice from standard techniques and receiving practice to the history and theory of the martial art.

ACT 158. Beginning Taekwondo. 1 Credit. (1 Lab; 3 cr max) F,S
To teach basic Taekwondo skills including kicking, punching, footwork, training routines, and philosophy. The curriculum fulfills requirements by the World Taekwondo Federation for the rank of 7th gup yellow belt.

ACT 163. Race Training 5/10 K. 1 Credit. (1 Lab; 3 cr max) F,S,Su
Learn about running mechanics, modes of training, and achieve that goal a 5K or 10K! Pass/Fail.

ACT 165. Power Cycling: Indoors. 1 Credit. (1 Lab; 3 cr max) F,S
This is a course designed to introduce proper form and safe cycling techniques. Participants will retain knowledge on basic bike fit principles and biking drills. Pass/ Fail.

ACT 169. Beginning Tennis. 1 Credit. (1 Lab; 3 cr max) F,S,Su
Students will learn the rules of tennis and how to play singles and doubles. The instructor will teach the basic tennis strokes including forehand, backhand, overhead, volley, and the serve.

ACT 170. Beginning Swimming. 1 Credit. (1 Lab; 3 cr max) F,S
This class designed for the non-swimmer or weak swimmer. Students will learn to develop the skills, breathing, body awareness to learn how to swim, feel safe and comfortable in and around water. Must be able to swim 100 yards without stopping. Swim assessment on first day. Pass/Fail.

ACT 173. Beg Fly Fishing/Fly Tying. 1 Credit. (1 Lab) F
Basic skills and knowledge of fly fishing including; casting, entomology, habitat, stream ethics, tackle, tactics, and strategy.

ACT 174. Introduction to Backpacking. 1 Credit. (1 Lec) Su
Students will learn the fundamentals of multi-day wilderness travel and low impact camping techniques in a backcountry setting. Students will spend a weekend in a surrounding Bozeman Wilderness Area.

ACT 176. Fundamentals of Whitewater Rafting. 1 Credit. (1 Lec) F
PREREQUISITES: Students entering the course should have minimum swimming ability to be able to traverse lengthwise the university pool (unassisted at least twice). Whitewater rafting is potentially hazardous and each student is responsible for ensuring certain he or she has adequate swimming ability and comfort with moving water to participate in the field based portion of the class. Ability to attend all classroom and field sessions. Introduction to Whitewater Rafting by spending time on the river the students are immersed in the learning environment. Students will be introduced to the basic components of this activity including: Equipment, hydrology & feature terminology, river safety & scenarios and rescue techniques.

ACT 177. Fundamentals of Kayaking. 1 Credit. (1 Lec) F
S PREREQUISITES: Ability to swim, comfortable in water. Introduction to the fundamentals of Whitewater Kayaking. Including the components of kayaks, basic strokes, rescue and eskimo roll. Introduction to kayaking on moving water and boating safety will be emphasized. On-River field component included.

ACT 180. Beginning Volleyball. 1 Credit. (1 Lab; 3 cr max) F,S
This class is designed for beginning to intermediate skill levels. Students will develop the skills, rules and terminology necessary to play recreational volleyball and to appreciate this lifet ime sport. Students will learn the rules for 6v6, 3v3 and beach variations. Students will also learn how to set, pass, spike, dig, block, and rotate.

ACT 191. Special Topics. 1 Credit. (1 Lab; 4 cr max) On Demand
Special Activity classes offered as needed using the unique skills of the instructional faculty in any given semester. May be repeated.

ACT 201. Power Cycling 2: Advanced. 1 Credit. (1 Lab) F,S
Advanced indoor cycling instruction: progressive training techniques and intensities, exercises necessary to improve cycling form, transition from indoor training to outdoor riding, and develop cycling workouts and class structure.

ACT 202. Intermediate Racquetball. 1 Credit. (1 Lab) F,S
PREREQUISITE: ACT 109 or intermediate skill/knowledge in shot selection, strategy, games. Provide the student with intermediate level skills and knowledge in techniques, safety, strategy, and strokes of racquetball.

ACT 209. Intermediate Volleyball. 1 Credit. (1 Lab) F,S
PREREQUISITE: Must have previously taken ACT 180 or played on a Varsity high school team. Students will learn advanced offenses, team concepts, combination drills, and a variety of playing styles.

ACT 210. Intermediate Weight Training. 1 Credit. (1 Lab) F,S
PREREQUISITE: ACT 110 or experience/safety knowledge of how to weight train. This course is designed to help students identify and understand the benefits of weight training, how weight training affects the body, and learn intermediate level training routines for complete muscular development.

ACT 220. Intermediate Alpine Skiing. 1 Credit. (1 Lab) S
PREREQUISITE: Participants should already be able to comfortably ski all beginner runs with control. Instruction at the intermediate level, skiing intermediate and easy advanced runs, develop parallel turning skills, learn bump and powder skiing.

ACT 221. Intermediate Snowboarding. 1 Credit. (1 Lab) S
PREREQUISITE: Participants should already be able to comfortably ride all beginner runs with linked turns and control. Instruction at intermediate level, develop efficient riding skills, carving turns, parallel turns on intermediate and easy advanced runs. Introduction to Park Smart and un-groomed terrain.
ACTG 101. Accounting Procedures I. 4 Credits. (4 Lec) F

Offered by Gallatin College. This first course in financial accounting covers the complete accounting cycle including creating source documents, journalizing transactions, posting to ledgers, preparing work sheets and basic financial statements. This includes the income statement and balance sheet, end of period closing activities, and special journals for service and merchandising businesses. The accrual basis of accounting will be emphasized though other accounting methods will be addressed.

ACTG 102. Accounting Procedures II. 4 Credits. (4 Lec) S

PREREQUISITE: ACTG 101. For Gallatin College students only. This financial accounting course is a continuation of Accounting Procedures I. Topics include accounts receivable and uncollectible accounts, notes payable and notes receivable, plant assets and depreciation, partnership accounting, corporate organization, capital stock, taxes, dividends and bonds, statements of cash flows, financial statement analysis, and manufacturing accounting.

ACTG 122. Accounting & Business Decision. 3 Credits. (3 Lec) S

PREREQUISITE: ACTG 101. For Gallatin College students only. Introduces the use of accounting information by managers to make operational and financial decisions in a business entity. Topics covered include selecting a financial entity, registering with the tax authorities, applying ethical behavior to professional situations, decision making in a business entity. Topics covered include selecting a financial entity, registering with the tax authorities, applying ethical behavior to professional situations, decision making in a business entity. This course helps students learn how to prepare and analyze financial statements, and understand the role that accounting plays in business decisions. Additional topics include: stock and bond investments, cash flow reporting, and a study of the conceptual framework and process by which accounting standards are established.

ACTG 201. Principles of Financial Accounting. 3 Credits. (3 Lec) F,S

PREREQUISITE: ACTG 101. An introduction to the principles of financial accounting for students of all business curricula. Specific topics include: accounting concepts, accounting transaction recording, financial statement preparation, accounting systems overview, business entity structures and financial statement analysis.

ACTG 202. Principles of Managerial Accounting. 3 Credits. (3 Lec) F,S

PREREQUISITE: ACTG 201. An introduction to the principles of managerial accounting. The majority of the semester will address managerial accounting, the process of providing information to managers for use in planning, control and decision making. Managerial accounting topics include: product costing, cost-volume-profit analysis, budgeting, variance analysis, and decision analysis tools. The managerial accounting coverage will be preceded by a brief continuation of study of selected principles of financial accounting.

ACTG 205. Computerized Accounting. 3 Credits. (3 Lec) S

PREREQUISITE: ACTG 101, CAPP 156. CORREQUISITE: ACTG 102, ACTG 122. Studies how computers are used in today's accounting environments through the use of an integrated accounting software package. Uses a hands-on approach to complete the accounting cycle for merchandise or service businesses as well as entries for voucher systems, departmentalized accounting, financial statement analysis, depreciation, inventory, and payroll.

ACTG 220. Survey of Accounting. 3 Credits. (3 Lec) F

On Demand
A survey of the basic accounting model, accounting records, recording business transactions, preparation and analysis of financial statements, and elementary income tax issues in a small business environment. This course is intended for non-business majors and may not substitute for any required business course.

ACTG 223. Principles of Accounting II. 3 Credits. (3 Lec) F,S

PREREQUISITE: ACTG 201. A continuation of the financial accounting topics introduced in ACTG 201. The course helps students learn how to prepare and analyze financial statements, and understand the role that accounting plays in business decisions. Additional topics include: stock and bond investments, cash flow reporting, and a study of the conceptual framework and process by which accounting standards are established.

ACTG 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F

Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

ACTG 291. Special Topics. 1-4 Credits. (1-4 Lec, 12 cr max) F

On Demand
PREREQUISITE: None required but some may be determined necessary by each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ACTG 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F

On Demand
PREREQUISITE: Consent of instructor and approval of Associate Dean. Directed research and study on an individual basis. Not to be used as a substitute for a required course.

ACTG 298. Internship. 1-12 Credits. (1-12 Ind. Study. Max 6 credits) F,S

PREREQUISITE: ACTG 298. Internship. 1-12 Credits. (1-12 Ind. Study. Max 6 credits) F,S

PREREQUISITE: ACTG 101. Using QuickBooks, an accounting system for small-business owners and bookkeepers, students will complete a variety of accounting projects. Topics of this course include creating a company, setting up company lists, editing a preset chart of accounts, entering opening balances, entering sales and invoices, receiving payments and making deposits, handling expenses and bills, working with bank accounts, analyzing financial data, tracking and paying sales tax, managing inventory, and preparing payroll.

ACTG 298. Internship. 1-12 Credits. (1-12 Ind. Study. Max 6 credits) F,S

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ACTG 321R. Acct Information Systems I. 3 Credits. (3 Lec) F, S
PREREQUISITE: ACTG 223 and BMIS 211. For business majors: Formal admission to the College of Business. A study of how organizations capture, record, store, protect, analyze, and report accounting information. Topics include business processes, transaction processing, internal controls, data security, systems documentation, information technology, and software applications.

ACTG 327. Intermediate Financial Accounting and Reporting I. 3 Credits. (3 Lec) F, S
PREREQUISITE: ACTG 223. An in-depth study of the theory of financial accounting and reporting and its application to: cash, current and long-term receivables, inventories, plant assets, natural resources, intangible assets, asset impairments, current liabilities, long-term debt, and contingencies. Fair value concepts, present value measurements, and comparisons between US and international accounting standards will be incorporated.

ACTG 328. Inter Fin Acct & Reporting II. 3 Credits. (3 Lec) F, S
PREREQUISITE: ACTG 321R and ACTG 327. For business majors: formal admission to the College of Business. Development of knowledge, skills, and organizational methods needed to improve business efficiency and effectiveness.

ACTG 401. Principles of Federal Taxation-Individuals. 3 Credits. (3 Lec) F, S
PREREQUISITE: ACTG 401. For business majors: formal admission to the College of Business. Focus on cost accounting concepts, with emphasis on developing and evaluating information that management needs to plan, make key decisions, and monitor business performance. Key topics include cost and overhead allocation, behavior and how each impacts decision-making and product costing, cost-volume-profit analysis, flexible budgeting, incremental decision analysis, and performance evaluation.

ACTG 410. Cost Management Accounting I. 3 Credits. (3 Lec) F, S
PREREQUISITE: ACTG 327 and ACTG 202. For business majors: formal admission to the College of Business. Focus on cost accounting concepts, with emphasis on developing and evaluating information that management needs to plan, make key decisions, and monitor business performance. Key topics include cost allocation, behavior and how each impacts decision-making and product costing, cost-volume-profit analysis, flexible budgeting, incremental decision analysis, and performance evaluation.

ACTG 411. Auditing I. 3 Credits. (3 Lec) F, S
PREREQUISITE: ACTG 321R and ACTG 328. For business majors: formal admission to the College of Business. Practice and theory of auditing financial statements. A study of most of the major activities performed during the conduct of a financial statement audit, from client acceptance to issuance of an audit report with a focus on auditing standards generally accepted in the United States.

ACTG 415. Government and Nonprofit Accounting I. 3 Credits. (3 Lec) S
PREREQUISITE: Senior standing, and ACTG 328 as pre- or co-requisite. For business majors: formal admission to the College of Business. A study of the accounting principles and financial reporting unique to the governmental and not-for-profit sectors of the U.S. economy.

ACTG 426. Advanced Accounting. 3 Credits. (3 Lec) On Demand
PREREQUISITE: ACTG 328. For business majors: formal admission to the College of Business. The theory and practice of financial accounting and reporting pertaining to business combinations and consolidated financial statements, accounting for partnerships and related business forms, foreign currency transactions and financial statement translations, and other advanced accounting topics.

ACTG 441. Financial Statement Analysis. 3 Credits. (3 Lec) F, S
PREREQUISITE: ACTG 327. For business majors: formal admission to the College of Business. Cross-listed with BMIS 441. Analysis with emphasis on how managers' investing and financing decisions have financial statement implications. Coverage includes: revenue-recognition methods, cash flow analysis, ratios, inventory analysis, capitalizing vs. expensing, depreciation, leasing vs. buying, and overall financial health and earnings quality of the firm.

ACTG 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max)
On demand PREREQUISITE: Senior standing and consent of instructor. For business majors: formal admission to the College of Business. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

ACTG 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max)
F, S
PREREQUISITE: Formal admission to the College of Business, consent of instructor and course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ACTG 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max)
On Demand PREREQUISITE: Formal admission to the College of Business, consent of instructor, and approval of Associate Dean. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Not to be used as a substitute for a required course. May be repeated.

ACTG 494. Seminar. 1 Credit. (1 Sem; 4 cr max)
On Demand PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level that are not covered in regular courses. Students participate in preparing and presenting discussion material.

ACTG 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max)
F, S
PREREQUISITE: ACTG 327 or other upper-level accounting course relevant to the specific internship. Formal admission to the College of Business and consent of committee. An individualized arrangement assigned with an agency, business or other organization to provide guided experience in the field.

ACTG 514. Fraud Examination. 3 Credits. (3 Lec) F
PREREQUISITE: ACTG 411 and admission to MPAc Program or consent of instructor. An overview of fraud examination, including the extent and nature of fraud, motivations of perpetrators, fraud symptoms, legal issues, as well as methods of detection, investigation, and prevention of various asset misappropriation schemes and fraudulent financial statements.

ACTG 515. Professional Services Mgmt. 3 Credits. (3 Lec) F
On demand PREREQUISITE: Admission to the MPAc program or consent of instructor. This course is designed to expose students to the internal operations and client management efforts of professional services organizations and providers, with a particular focus on accounting firms. Topics include managing service relationships, service firm structure and the service-profit chain.

ACTG 521. Advanced Auditing. 3 Credits. (3 Lec) S
PREREQUISITE: ACTG 411 and admission to MPAc Program. An in-depth analysis of contemporary auditing and assurance theory, statistical sampling, internal control, and audit evidence.

ACTG 522. Accounting Information Systems II. 3 Credits. (3 Lec) F, S
PREREQUISITE: Admission to MPAc program and completion of ACTG 321R. Contemporary issues in accounting information systems. Emphasis on the practical application of information technology to improve business efficiency and effectiveness and to improve decision-making. Co-convened with ACTG 421.

ACTG 524. International Accounting. 3 Credits. (3 Lec) S
PREREQUISITE: ACTG 328 and admission to MPAc Program. Introduction to international accounting with special emphasis on four major topics: 1) accounting systems as expressions of cultural, political, and ideological forces, 2) comparative international accounting patterns, 3) efforts to harmonize international accounting standards worldwide, and 4) accounting issues faced by multinational corporations.

ACTG 525. Accounting Theory and Complex Issues in Accounting. 3 Credits. (3 Lec) S, F
PREREQUISITE: ACTG 328 and admission to MPAc Program. A study of complex financial accounting issues and the underlying theoretical rationale. Key topics include derivative financial instruments, hedge accounting, elements of the other comprehensive income, sale-leaseback transactions, consignment accounting, and troubled debt restructuring.
ACTG 526. Advanced Taxation. 3 Credits. (3 Lec) S
PREREQUISITE: ACTG 401 and admission to MPAc Program or consent of instructor. This course provides an introduction to tax law for accountants, including taxation of individuals, partnerships, subcorporations, estates, and trusts. Emphasis is placed on current developments in tax law and practice, and on tax planning and problem solving skills.

ACTG 527. Estate and Gift Taxation. 3 Credits. (3 Lec) S
PREREQUISITE: ACTG 401 and admission to MPAC Program or consent of instructor. This course provides an introduction to estate and gift tax law for accountants, including taxation of estates, trusts, and transfers. Emphasis is placed on current developments in tax law and practice, and on tax planning and problem solving skills.

ACTG 528. Legal Issues for Accountants. 3 Credits. (3 Lec) S
PREREQUISITE: BG 361 or equivalent and admission to MPAC Program. Analysis of legal issues for accounting students, including debitor/creditor law, bankrupcty, securities regulation, antitrust, employment regulation, uniform commercial code and real property. Course includes significant written work and oral presentations.

ACTG 529. Research in Accounting. 3 Credits. (3 Lec) F
PREREQUISITE: ACTG 328 and admission to MPAC Program. A project-oriented seminar that focuses on developing tools for researching, developing and communicating defensible solutions to accounting issues and problems of the type likely to be encountered throughout a professional career in accounting.

ACTG 530. Tax Research and Planning. 3 Credits. (3 Lec) F
PREREQUISITE: ACTG 401 and admission to MPAC Program or consent of instructor. This course provides an introduction to tax research, planning, and techniques, as well as, development of tax practitioner communication skills.

ACTG 531. Tax Practicum. 3 Credits. (3 Lec) S
PREREQUISITE: ACTG 401 and concurrent enrollment in ACTG 526 or consent of instructor. This course provides an introduction to tax research, planning, and techniques, as well as, development of tax practitioner communication skills.

ACTG 532. Government and Nonprofit Accounting II. 3 Credits. (3 Lec) S
PREREQUISITE: ACTG 328 and admission to MPAC Program or consent of instructor. This course provides an introduction to tax research, planning, and techniques, as well as, development of tax practitioner communication skills.

ACTG 533. Special Topics. 1-3 Credits. (1-3 Ind) S
PREREQUISITE: Consent of instructor. This course provides an introduction to tax research, planning, and techniques, as well as, development of tax practitioner communication skills.

ACTG 534. Tax Practicum. 3 Credits. (3 Lec) F
PREREQUISITE: ACTG 401 and admission to MPAC Program or consent of instructor. This course provides an introduction to tax research, planning, and techniques, as well as, development of tax practitioner communication skills.

ACTG 535. Advanced Accounting. 3 Credits. (3 Lec) F
PREREQUISITE: ACTG 328 and admission to MPAC Program or consent of instructor. This course provides an introduction to tax research, planning, and techniques, as well as, development of tax practitioner communication skills.

ACTG 536. Advanced Accounting. 3 Credits. (3 Lec) F
PREREQUISITE: ACTG 328 and admission to MPAC Program or consent of instructor. This course provides an introduction to tax research, planning, and techniques, as well as, development of tax practitioner communication skills.

ACTG 537. Professional Paper and Project. 1-4 Credits. (1-4 Ind; 4 cr max) On Demand
PREREQUISITE: Graduate standing and consent of instructor. This course provides an introduction to tax research, planning, and techniques, as well as, development of tax practitioner communication skills.

ACTG 538. Graduate Consultation. 1-3 Credits. (1-3 Ind; 3 cr max) On Demand
PREREQUISITE: Graduate standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and Thesis if on a Thesis Plan) but who need additional faculty or staff time or help.

ACTG 539. Special Topics. 1-4 Credits. (1-4 Ind; 4 cr max) On Demand
PREREQUISITE: Graduate standing and courses as determined for each offering. Courses are required in only current curriculum for which there is a particular one time need, or on a trial basis to determine acceptability and demand before requesting a regular course number.

ACTG 540. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of College of Business Associate Dean and The Graduate School Dean. Directed research and study on an individual basis.

ACTG 541. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Graduate standing. Topics offered at the graduate level that are not covered in regular graduate courses. Students participate in preparing and presenting discussion material.
AGBE 353. Co-operative Business Principles and Practice. 3 Credits. (3 Lec) F
PREREQUISITES: ECNS 101IS or AGBE 210IS, and junior level standing. The course will acquaint students with co-operatives and the co-operative way of doing business. Students will learn the role of cooperatives in marketing, bargaining, purchasing, and service. Cooperative business decision making will be emphasized throughout the course.

AGBE 394. Seminar. 1-2 Credits. (1-2Sem; 3 cr max) F,S
PREREQUISITE: Junior standing. Current agricultural problems and writings of people in the profession. Topics vary each semester; check with the department before registering.

AGBE 421. Advanced Ag Marketing. 3 Credits. (3 Lec) S
PREREQUISITE: AGBE 321 or consent of instructor. Economic analysis of current issues in agricultural marketing including market structure, risk, and efficiency; commodity promotion; futures and options markets; price forecasting; and retained ownership options.

AGBE 445. Agribusiness Management. 3 Credits. (3 Lec) S
PREREQUISITE: ECNS 301, STAT 216Q, and either AGBE 345 or ECNS 345 or BFIN 322. Students are expected to use tools and concepts developed in earlier course work to address typical problems faced by agribusiness and agricultural producers. Case studies modified from actual situations are used extensively.

AGBE 451IS. Economics of Ag Policy. 3 Credits. (3 Lec) F
PREREQUISITE: ECNS 301. Senior capstone course. Consideration of the economic problems of American agriculture and of alternative solutions. Rigorous analysis of the causes and consequences of government programs (both past and present) on consumers, producers, and taxpayers.

AGBE 467. Quantitative Method in Ag Econ. 3 Credits. (3 Lec) F
PREREQUISITE: ECNS 301, M 221 and approval of instructor. Static and dynamic optimization models in economics. Nonlinear and dynamic programming models are introduced. Emphasis on formulating economic and management problems in terms of quantitative models.

AGBE 490R. Undergraduate Research. 1-8 Credits. (1 Ind; 8 cr max) F,S,Su
PREREQUISITE: ECNS 204IS, junior standing, and approval of instructor. Intended for upper division undergraduate research/undergraduate scholars program. The student will work closely with the supervising faculty. Course will address responsible conduct of research.

AGBE 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Course prerequisites are dependent on the offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

AGBE 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

AGBE 589. Graduate Consultation. 3 Credits. (3 Ind) F,S,Su
PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

AGBE 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing. May be repeated.

AGBE 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand.
Maximum 12 cr. PREREQUISITE: Upper division courses, and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

AGBE 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand.
Maximum 6 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of the Graduate School. Directed research and study on an individual basis.

AGED - Agricultural Education

AGED 105. Microcomputers in Agricultural. 3 Credits. (1 Lec, 2 Lab) S
Utilizing and selecting microcomputer software for the broad field of agriculture. Decision aid software, spreadsheets, database, telecommunication and financial records are emphasized. Application of computers to control, monitor, and calibrate devices in addition to aiding management decisions.

AGED 140US. Leadership Dev For Agriculture. 3 Credits. (2 Lec, 1 Lab) F,S,Su
Process of developing and managing individuals by providing leadership and guidance at all levels of personnel development. Self-concepts developed through situational leadership and management, principles of people management, goal setting, and belief systems. Collaborative learning and field experience utilized.

AGED 253. Ag Ed in Public Schools. 3 Credits. (3 Lec) S
PREREQUISITE: AGED 140US and HDFS 101IS. Establish a philosophy of agricultural education at the secondary, middle school, and elementary level. Instructional content in agricultural science, mechanics, and leadership will be identified. Principles needed in developing agricultural experiences associated with agricultural education will be presented.

AGED 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Maximum 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

AGED 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
IND Maximum 6 cr. PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

AGED 294. Seminar. 3 Credits. (3 Sem; 6 cr max) On Demand
PREREQUISITE: Consent of instructor. Focuses on planning and implementing agricultural activities for youth. The emphasis is on planning an event, developing awareness and utilization of resources (people and things), developing a log and records regarding the event, and evaluating the effectiveness of an implementation plan and the actual event.

AGED 309. Philosophy and Programs in Extension. 3 Credits. (3 Lec) S
Alternate years to be offered odd years Designed for students from any major who are interested in pursuing a career in the Cooperative Extension Service, community education, or other non-formal educational settings. The course focuses on land-grant and extension history, philosophies, and program areas; teaching methods, non-formal educational philosophies, instilling community change through education, basic program development and evaluation, and development of career preparation skills.

AGED 312R. Communicating Agriculture. 3 Credits. (3 Lec) F
PREREQUISITE: Lower level computer class or AGED 105 and WRIT 101W. Provides an overview of communications strategies associated with the agricultural and natural resources industries. Different types of communication skills will be emphasized including written, oral, digital media, and research. This course is open to all majors interested in learning practical communications techniques.

AGED 315. Electrical and Power Systems Operation. 3 Credits. (2 Lec, 3 Lab) S
PREREQUISITE: Junior standing. Provides students an opportunity to develop knowledge and skills related to the basic wiring requirements for agricultural buildings and electrical motors as well as the principles of engine operation, control, repair and maintenance. Agricultural Education.

AGED 333. Construction Technology. 3 Credits. (1 Lec, 2 Lab) F
Various construction systems that are used to construct structures on site. Includes all aspects of the construction industry such as basic planning, materials, estimating, building techniques, managing, and the actual construction of building projects.

AGED 363. Agricultural Youth Event Planning & Management. 3 Credits. (1 Lec, 2 Lab) S
Various construction systems that are used to construct structures on site. Includes all aspects of the construction industry such as basic planning, materials, estimating, building techniques, managing, and the actual construction of building projects.

AGED 397. Educational Methods in Ag. 1 Credit. (5 Lab) F
COREQUISITE: Taken concurrently with EDU 497. Provides additional experience in planning, teaching, and evaluating lessons in agricultural education.

AGED 401. Agricultural Issues and Research. 3 Credits. (3 Lec) S
PREREQUISITE: Senior standing in AGED. This course will prepare students for future careers by researching agricultural issues and refining professional skills. Current issues in extension, leadership, and communications, as well as social science research methodologies, will serve as course content. Students will conduct and apply techniques, methodologies and procedures that can be used in numerous social science research contexts. In addition, these students will become more familiar with the industry and have a better understanding of current agricultural issues and methods.

AGED 475. Professional Paper. 1-4 Credits. (1-4 Ind; 4 cr max) On Demand
IND A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.
AGED 482. Non-Formal Teaching Methods in Agriculture. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: Junior standing. Designed for students in Agricultural Communications, Leadership and Extension and other majors who will be designing, implementing and evaluating learning in non-formal environments and/or other careers. Graduate students may also take this course to aid in developing their teaching skills. The course covers theories, principles and practices associated with effective non-formal teaching and learning for adults and youth. The lab provides hands-on experience in planning, teaching, and evaluating lessons/seminars in the non-formal educational setting.

AGED 485. Laboratory Management and Teaching in Agricultural Education. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITES: AGED 315 or AGED 333. COREQUISITE: EDU 497, Teaching Methods in Agriculture & Technology Education. The purpose of this course is to provide students an opportunity to develop the pedagogical knowledge, skills, and attributes required for organizing and delivering laboratory instruction in agricultural systems. An emphasis is placed on planning, implementing, and evaluating effective laboratory management and teaching strategies.

AGED 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) On Demand
IND May be repeated. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research.

AGED 491. Special Topics. 1-6 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

AGED 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

AGED 494. Seminar. 3 Credits. (3 Sem; 6 cr max) S
PREREQUISITE: Junior standing and as determined for each offering and consent of instructor. Focuses on planning and implementing agricultural activities for youth. The emphasis is on planning an event, developing awareness and utilization of resources (people and things), developing a log and records regarding the event, and evaluating the effectiveness of an implementation plan and the actual event.

AGED 498. Internship. 4-8 Credits. (2-8 Ind; 12 cr max) On Demand
IND PREREQUISITE: Junior standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field of Agricultural Education.

AGED 506. Research Method in Agricultural Education. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing. This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty or staff time or help.

AGED 508Z. Professional Development. 2 Credits. (2 Lec) On Demand
PREREQUISITE: Graduate Standing. This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty or staff time or help.

AGED 588Z. Professional Development. 2 Credits. (2 Lec) On Demand
Courses offered on a one-time basis to fulfill professional development needs of in service educators. A specific focus is given to each course which is appropriately subtitled.

AGED 589. Graduate Consultation. 3 Credits. (3 Ind) F,S,Su
IND PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan), but who need additional faculty or staff time or help.

AGED 590. Master’s Thesis. 1-10 Credits. (1 Ind; 10 cr max) S,F,S
PREREQUISITE: Master’s Standing.

AGED 591. Special Topics. 1-4 Credits. (1-4 Lec; 4 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

AGED 592. Independent Study. 1-6 Credits. (1 Ind; 6 cr max) S,F
SU PREREQUISITE: Graduate Standing, consent of instructor, approval of department head and Dean of Graduate Studies. Direct research and study on an individual basis.

AGED 594. Graduate Seminar. 1 Credit. (3 Sem; 4 cr max) S
PREREQUISITE: Graduate standing. Course prerequisites as determined for each offering. This course will focus on the guidelines, procedures, and processes necessary to complete your Master’s degree, either on-campus or online. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and present discussion material.

AGED 598. Internship. 2-12 Credits. (2 Ind; 12 cr max) S,F,S
SU PREREQUISITE: Graduate Standing, consent of instructor, approval of department head and Dean of Graduate Studies. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

AGSC - Agricultural Science

AGSC 101. Introduction to Agricultural and Environmental Resources. 1 Credit. (1 Lec) F
PREREQUISITE: Freshman or New Transfer Students. This course is optional but all freshmen in the College of Agriculture are strongly encouraged to enroll. Students taking this course will be introduced to all areas of the very broad field of agriculture, including all department programs and areas of specialty, career opportunities, professionalism, history, and ethics.

AGSC 242. Crop Identification. 1 Credit. (1 Lab) F
Meets first third of semester. Recognition and identification of seed, vegetative parts, and floral structure of selected field and forage crops.

AGSC 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) S,F
PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research.

AGSC 291. Special Topics. 1 Credit. (1 Lec) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

AGSC 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of department head.

AGSC 341. Field Crop Prod. 3 Credits. (3 Lec) S
Production of field crops using practical and applied crop management principles. Emphasis includes understanding of crop management principles and application of problem solving capabilities to field crop management situations.

AGSC 342. Forages. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: Sophomore standing or higher or consent of instructor. Principles of applied forage crop management including establishment, irrigation, fertilization, pests, harvesting, and forage integration of many legume and grass species.
AGSC 556. Plant Nutrition and Soil Fertility Management. 3 Credits. (3 Lec) F
PREREQUISITES: ENSC 245IN and CHMY 121IN or CHMY 141. Applied management of soil fertility to meet plant nutrition needs in agronomic and horticultural systems. Diagnosis of plant nutrient deficiency and toxicity, management of fertilizer and organic sources of plant nutrients, and assessment of environmental effects of soil fertility management.

AGSC 401. Integrated Pest Management. 3 Credits. (3 Lec) F
PREREQUISITE: BIOO 262IN and one of the following: BIOB 100IN, BIOB 170IN or consent of instructor. This course focuses on conceptual approaches to integrated pest management. The overall framework will be the effective production of foodstuffs to meet increasing demands for safe and healthy commodities for consumers. By integrating multiple tactics, the production of food can be optimized given the current limitations to traditional “silver bullet” pest management. Material covered will include the definitions of IPM terminology as applied to weed, arthropod, and microbial pests; management tactics including biological, cultural, and chemical controls; host plant resistance and genetic modification; sample case studies; and applicability to specialized production systems.

AGSC 428. Cropping Systems and Sustainable Ag. 3 Credits. (3 Lec) S
PREREQUISITE: ENSC 245IN and either AGSC 341 or AGSC 342 or consent of instructor. The course goal is to elevate agricultural students’ awareness of peer-reviewed literature that demonstrates application of principles to address issues of sustainability in agriculture. The course will use a student-led discussion format to highlight issues and principles in review of a series of papers that the class will read. It will focus on the interaction among agronomy, ecology, economics, and sociology to create an awareness of the interdisciplinary issues associated with sustainability in agriculture. Topical issues associated with climate change impacts, system resilience and thresholds and ways to understand complex interactions will be considered for discussion. Co-convened with LRES 529.

AGSC 441. Plant Breeding & Genetics. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: BIOB 375 or BIOB 377. The genetic principles and practices involved in plant breeding. Selection of plant breeding methods based on an understanding of a plant species genetics and reproductive mechanisms. The class includes hands on experience in plant breeding through a series of lab and greenhouse exercises.

AGSC 450. Plant Disease Control. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: BIOM 421 or consent of instructor. This course will provide comprehensive coverage of the concepts of integrated management of plant diseases. Concepts covered include regulatory, cultural, chemical, host plant resistance, and biological controls. Students will be introduced to epidemiology and weather-based predictive computer models for use in disease management programs.

AGSC 454. Agrostology. 3 Credits. (1 Lec, 2 Lab) F alternate years, to be offered odd years.
PREREQUISITE: BIOB 170IN and BIOO 230. Determination, classification, evolution, and nomenclature of grasses and grass-like plants; morphological and ecological features; preparation of reference specimens.

AGSC 455. Molecular Plant-Microbe & Insect Interactions. 3 Credits. (3 Lec) S alternate years
PREREQUISITE: BIOB 160. This course is to teach students the molecular mechanisms by which plants and pathogens/insects interact during the progress of pathogenesis or resistance, the understandings of how plants recognize relatively conserved microbial patterns to active defense.

AGSC 465R. Health, Agriculture, Poverty. 4 Credits. (1 Lab) F,S
PREREQUISITE: Junior standing in student’s major. Students will explore causes and solutions to rural, economic poverty holistically by discovering the interconnections of health, agriculture, and governance. Students will gain skills appropriate to their own academic major to provide leadership in alleviating poverty worldwide. Students will conduct service-learning, community-based research with guided mentoring using the holistic process.

AGSC 481. Ag Ambassador Seminar. 1-6 Credits. (1-6 Sem; 6 cr max) F,S
Class meetings, a retreat, a variety of recruiting opportunities, and College of Agriculture and MSU events will make up the largest portion of this course. Students will have to participate in a selection process in order to become an Agriculture Ambassador and participate in this course.

AGSC 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S
PREREQUISITE: Junior or Senior standing and approval of instructor. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. USP scholarships or project support grants are available in many cases. Course will address responsible conduct of research. May be repeated.

AGSC 491. Plant Nutrition and Soil Fertility Management. 3 Credits. (3 Lec) F
PREREQUISITE: Approval of instructor, ENCS 245IN and CHMY 121IN or CHMY 141. Applied management of soil fertility to meet plant nutrition needs in agronomic and horticultural systems. Diagnosis of plant nutrient deficiency and toxicity, management of fertilizer and organic sources of plant nutrients, and assessment of environmental effects of soil fertility management.

AGSC 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

AH - Allied Health

AH 140. Pharmacology. 2 Credits. (2 Lec) F
General principles of drug action on multiple body systems, pharmacology of the major drug classifications, and drug side effects as well as basic concepts of mathematics used in the calculation, preparation, and administration of various medications.

AHMA - Allied Health: Medical Assist

AHMA 201. MA Clinical Procedures I. 4 Credits. (4 Lec) F
Performance of CLIA waived laboratory tests. Topics include specimen collection, phlebotomy, specimen processing, record keeping, universal precautions, infection control, and quality control.

AHMA 203. MA Clinical Procedures II. 4 Credits. (4 Lec) S
Patient assessment, physical examination and patient treatments including: vital signs, patient education, medical emergencies and assisting the physician in medical specialty examinations and minor surgery. Students will learn the theoretical, technical, and practical aspects of infection control, medical and surgical asepsis and EKG.

AHMA 280. Med Assisting Exam Prep. 1 Credit. (1 Sem) Su
Preparation for the AMT (American Medical Technologists) registration exam and/or AAMA (American Association of Medical Assistants) certification exam.

AHMA 298. Medical Assisting Externship. 4 Credits. (4 Ind) Su
Prerequisites: AHMA 203 and AHMA 220 Practical experience in clinical medical environments under supervision.

AHMS - Allied Health: Medical Support

AHMS 100. Math Applications Health. 3 Credits. (3 Lec) S
Prepares health science students for the mathematics required in their profession. Topics investigated include: measurement systems, whole number review, decimals, fractions, ratios, proportions, percentages, conversions.

AHMS 108. Health Data Content and Structure. 3 Credits. (3 Lec) S
PREREQUISITE: AHMS 160, AHMS 162 This course provides orientation to the health information department and its organizational interrelationship in healthcare facilities and the interchange of healthcare information. This course examines the collection, review and security of health.

AHMS 144. Medical Terminology. 3 Credits. (3 Lec) F
Offered by Gallatin College. Basic elements, rules of building and analyzing medical words, and medical terms associated with the body as a whole. In addition to medical terms, common abbreviations applicable to each body system will be interpreted.

AHMS 156. Medical Billing Fundamentals. 3 Credits. (4 Lec) S
PREREQUISITE: AHMS 160, AHMS 162 The most common commercial, managed care and federal health insurance plans in the US will be covered. Billing processes and procedures as well as legal, regulatory, and ethical issues in health insurance will also be covered.

AHMS 158. Legal and Regulatory Aspects of Healthcare. 2 Credits. (2 Lec) S
This course covers legal relationships of physicians and patients, contractual agreements, professional liability, malpractice, medical practice acts, informed consent, and bioethical issues. Emphasis is placed on legal terms, professional attitudes, and the principles and basic concepts of ethics and laws involved in providing medical services. This course also identifies patient behaviors and stressors related to illness, cultural influences, death, and dying.

AHMS 160. Beginning Procedural Coding. 4 Credits. (4 Lec) F
This course covers basic and intermediate levels of theory and application of CPT and HCPCS principles and guidelines for coding procedures. Students perform procedural coding using health records, case studies, and scenarios. The course uses applicable coding books and an overview of electronic encoder programs.
AHMS 162. Beginning Diagnostic Coding. 4 Credits. (4 Lec) F
This course covers basic and intermediate levels of theory and application of ICD principles and guidelines for coding procedures. Students perform diagnostic coding using health records, case studies, and scenarios. The course uses applicable coding books and an overview of electronic encoder programs.

AHMS 220. Medical Office Procedures. 3 Credits. (3 Lec) S
Electronic patient information system to include appointment scheduling, gathering patient data, posting charges/payments/adjustments, submitting claims, claims management, understanding the various third-party payers (Medicaid, Medicare, Blue Cross, Work Comp, etc.) medical coding (ICD10, CPT, RVU, DRG), manual bookkeeping procedures, and medical records management.

AHMS 250. Advanced Medical Coding. 4 Credits. (3 Lec) S
PREREQUISITE: AHMS 160. AHMS 162 Through realistic patient cases the student will be able to assign service and diagnostic codes to a variety of complex medical visits, diagnostic testing, and interpretation, treatments, surgeries, and anesthesia as well as properly audit these cases.

AHMS 298. Professional Practice Experience - Coding. 1 Credit. (1 Lec) S
PREREQUISITE: AHMS 160. AHMS 162. AHMS 144, AH 140, BIOH 112. CORREQUISITE: BIOH 113, AHMS 250. AHMS 156, AHMS 108, AHMS 158. This course provides students with authentic coding practices in a hospital, physician’s office, clinic or other healthcare setting with directed projects common to a clinical coding specialist on the job.

AMST - American Studies

AMST 101D. Introduction to American Studies, 3 Credits. (2 Lec, 1 Lab) F
Introduction to the field of American Studies and to major issues in American history, literature, and the arts.

AMST 201IH. American Identity, American Dreams. 3 Credits. (3 Lec.) S
AMST 201IH explores the historical development of the notion of a singular American identity, the reality of varied American identities, and expressions of Americanness in contemporary culture. Iterations of national identity are examined in contexts like American gun culture, the gender-based pay gap, reservation policy and Indian Boarding Schools, LGBTQ activism, the ethos surrounding National Parks, and the popularity of extreme sporting competitions.

AMST 202RA. The Arts in America. 3 Credits. (3 Lec) F,S
PREREQUISITE: WRIT 101W Uses the methodologies of American Studies to question the history, theory, and criticism of various American art forms and movements. Disciplines covered include: film, photography, television, sculpture, painting, architecture, and music.

AMST 291. Special Topics. 3 Credits. (3 Lec) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

AMST 301. Reproduction in America. 3 Credits. (3 Lec) S
PREREQUISITE: WRIT 101W Provides historical context for human reproduction and examines the ways in which women and men in America - both in the past and in contemporary culture - adapt and shape reproductive practices to the unique events of their lives.

AMST 401. Seminar in American Studies. 4 Credits. (4 Sem) F,S
PREREQUISITE: AMST 201. Capstone course in American Studies. Students will research and design solutions to contemporary problems in American Society.

AMST 401R. Seminar in American Studies. 4 Credits. (4 Sem) S to be offered even years.

AMST 410. Religion and the United States Supreme Court. 3 Credits. (3 Sem) S
PREREQUISITE: Successful completion of at least one core “D” or “IH” course and at least two other courses from any of the following: HSTA, HSTR, AMST: RLST, PHL, PSCI, NASS, SOCI. This course investigates the symbiotic relationship between American religion and the US Supreme Court. Topics include legal discourse surrounding religious freedom, the legal status of minority religions, and the social impact of landmark Supreme Court decisions.

AMST 491. Special Topic for Spring 2016: American Religion and the United States Supreme Court. 3 Credits. (3 Lec, 2 Sem) S
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

AMST 501. Methods in American Studies. 3 Credits. (3 Sem) F
Introduction to major trends in American Studies scholarship, with a particular focus on American Studies in an international context. The course will also introduce students to the range of scholarship in the American Studies program. Co-convened with AMST 401R.

AMST 502. Research in American Studies. 3 Credits. (3 Sem) F,S
PREREQUISITE: AMST 501. Graduate research and advanced readings in American Studies. Co-convened with AMST 401R.

AMST 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S
PREREQUISITE: Master’s standing.

AMST 591. Special Topics. 3 Credits. (3 Sem) On Demand
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Advanced study of topics in the discipline, in courses not required in any curriculum, including experimental offerings of visiting professors, trial offerings of new courses, or one-time offerings of current topics.

AMST 592. Independent Study. 1-4 Credits. (1-4 Ind; 8 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Vice Provost of Graduate Education. Directed research and study on an individual basis.

AMST 594. Seminar. 1 Credit. (1 Sem) F
PREREQUISITE: Graduate standing. Graduate level topics which are not covered in other courses. Students will prepare and present discussion material.

AMST 689. Doctoral Reading and Research. 3-6 Credits. (3-6 Ind; max 15) F,S
PREREQUISITE: Doctoral standing. Presentation and discussion of dissertation research and writing.

AMST 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S
Max credits unlimited PREREQUISITE: Doctoral standing.

ANSC - Animal Science

ANSC 100. Introduction to Animal Science. 3 Credits. (3 Lec) F,S
Introductory Animal Science includes basic principles of animal genetics, nutrition, live animal evaluation, reproduction, and their application to the production of beef and dairy cattle, sheep, swine, horses, and poultry.

ANSC 202. Livestock Feeding. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITES: ANSC 100 and placement in Math Level 3 or ACT 23 or SAT 540. Nutrient composition and classification of feedstuffs, feeding recommendations, diet formulation, and ration balancing for various classes of livestock.

ANSC 205. Intro to Meat Evaluation. 2 Credits. (1 Lab) F
PREREQUISITE: ANSC 100. Techniques for the evaluation of carcasses. Procedures include U.S. grading standards, introduction to carcass pricing and objective carcass measurements.

ANSC 215. Calving Management. 2 Credits. (1 Lec, 1 Lab) F
PREREQUISITE: ANSC 100 or consent of instructor. Procedures to correctly identify calving problems and subsequently assist the birthing process and application of techniques to maximize calf survival.

ANSC 222. Livestock in Sustain Systems. 3 Credits. (3 Sem) S
PREREQUISITE: Sophomore standing and ANSC 106 is recommended. The role of livestock in balanced sustainable and organic systems will be explored with a primary focus on incorporating targeted grazing into farming systems. The principles of sustainable animal production and the regulations associated with organic animal production will be presented.

ANSC 232. Livestock Management - Sheep I. 1 Credit. (1 Lab) S
PREREQUISITE: ANSC 100. Management practices associated with farm flock and range sheep enterprises.

ANSC 234. Livestock Management - Beef I. 1 Credit. (1 Lab) S
PREREQUISITE: ANSC 100. Hands-on laboratories to familiarize students with the principles of beef cattle handling and management.
ANSC 265. Anatomy and Physiology of Domestic Animals - Lecture. 3 Credits. (3 Lec) S
PREREQUISITE: BIOL 160, Sophomore standing. COREQUISITE: ANSC 266. The lecture defines and identifies the organization of cell types into tissues and organ systems. The lecture explains the physiology of organ systems in domestic farm animals.

ANSC 266. Anatomy and Physiology of Domestic Animals - Lab. 1 Credit. (1 Lab) S
PREREQUISITE: BIOL 160, Sophomore standing. CO-REQUISITE: ANSC 265 Location, structure and identification of various tissues, organs, and systems of domestic animals through dissection of cadaver animals through dissection of cadaver animals. Lab utilizes ruminants and monogastric species.

ANSC 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) PREREQUISITE: Consent of instructor and approval of department head. Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

ANSC 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ANSC 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

ANSC 305. Advanced Meat Evaluation. 2 Credits. (2 Lec) F PREREQUISITE: ANSC 205 or consent of instructor. Advanced skills in carcass evaluation, U.S. grading standards, and carcass pricing.

ANSC 308. Livestock Evaluation. 2 Credits. (1 Lab) F PREREQUISITE: ANSC 100 and ANSC 205, or consent of instructor. Techniques and experience in live animal evaluation. Practical use of production data and other evaluation techniques.

ANSC 316. Meat Science. 4 Credits. (3 Lec, 1 Lab) S PREREQUISITE: ANSC 100, BIOL 160, and CHMY 121LN or CHMY 141 and CHMY 145 and junior standing. The meat industry within North America and beyond will be discussed. Live animal evaluation, pricing and carcass evaluation will be discussed. The class will include an explanation of muscle structure and function and its effect on tenderness and functionality.

ANSC 320. Animal Nutrition. 3 Credits. (3 Lec) F PREREQUISITE: ANSC 100, ANSC 265, ANSC 266, and CHMY 123 or CHMY 211. Concepts of digestion and metabolism of nutrients, integrated with practical feeding of various classes of livestock.

ANSC 321. Physiology of Animal Reproduction. 4 Credits. (4 Lec) F PREREQUISITE: ANSC 100, ANSC 265, and CHMY 123 or CHMY 211. A study of the anatomy and physiology of reproduction of vertebrates with major emphasis on mammalian domestic animal and wildlife species. This class introduces students to emerging concepts and current technologies for altering reproductive efficiency in a variety of animal species, including humans.

ANSC 322. Principles of Animal Breeding and Genetics. 3 Credits. (3 Lec) S PREREQUISITE: ANSC 100, BIOL 160, and STAT 216GQ. Genetic improvement of farm animals through performance testing, methods of selection, and application of mating systems such as crossbreeding.

ANSC 337. Disease of Domestic Livestock. 3 Credits. (3 Lec) S PREREQUISITE: ANSC 100, ANSC 222, ANSC 265 and ANSC 266. This course is structured to familiarize students with the common diseases of domestic livestock. Infectious and non-infectious diseases of horses, cattle, sheep and swine will be covered. Particular emphasis will be placed on regional diseases.

ANSC 395. Field Experience: Livestock. 1 Credit. (1 Lab) On Demand PREREQUISITE: ANSC 100 and junior standing. Exposure of students to livestock operations and related business enterprises in different geographical locations. One three-day field trip. Graded P/F.

ANSC 408. Advanced Livestock Evaluation. 3 Credits. (3 Lec) FS PREREQUISITE: ANSC 308 or equivalent. Advanced skills in evaluation of animals and data associated with growth and genetic improvement. Develop decision making and oral communication skills.

ANSC 410. Veterinary Entomology and Parasitology. 3 Credits. (3 Lec) S Alternate Even Years PREREQUISITE: ANSC 100 and BIOL 160 or higher level biology. This course will provide an overview of the importance of arthropods and their effects on human and animal health. Topics covered will include classification and identification of insects, mites, and ticks, basic biology, behavior and ecology, feeding mechanisms, pathogen transmission, vector competency, production impacts, integrated management and prevention.

ANSC 416R. Meat Processing. 3 Credits. (2 Lec, 1 Lab) F PREREQUISITE: ANSC 316 or consent of instructor. Students will learn to manufacture processed meat products such as fresh sausage, ham, bacon and cooked sausages. They will also be developing new flavor profiles and new products that will be presented to a panel with proposed marketing plans.

ANSC 418. Topics in Beef Nutrition. 2 Credits. (2 Lec) S alternate years, to be offered even years. PREREQUISITE: ANSC 320 and Junior standing or consent of instructor. Critical evaluation of current issues and related scientific literature in beef cattle nutrition; application to decision making and problem solving.

ANSC 421. Assisted Reproduction Technologies w/ Lab. 4 Credits. (2 Lec, 2 Lab) F PREREQUISITE: ANSC 321. Reproductive management programs applying physiological knowledge to increase meat and milk production in cattle. Experience in the techniques of artificial insemination and pregnancy evaluation in cattle.

ANSC 432R. Sheep Management. 3 Credits. (2 Lec, 1 Lab) S PREREQUISITE: ANSC 232 and ANSC 302 and ANSC 321. COREQUISITE: ANSC 232. Management of the ewe flock, nutrition, reproduction, economics, breeding, and health related to efficient sheep production will be discussed. Production preparation and wool marketing in U.S. and world markets and economics of Montana wool production will be covered.

ANSC 434R. Beef Cattle Management. 4 Credits. (2 Lec, 2 Lab) F PREREQUISITE: NRSM 101, NRSM 102, and ANSC 320; preferred ANSC 321 and ANSC 322. Integration of the principles of nutrition, genetics, physiology, range ecology, and economics into practical and profitable ranch management and business plans. Utilization of performance and financial records, budgeting, feed resource planning, marketing strategies, breeding plans, computer applications, and case studies.

ANSC 436. Professional Development in Beef Production Systems. 2 Credits. (1 Lec, 1 Lab) F PREREQUISITES: ANSC 100, ANSC 320, or ANSC 408. This course will allow for hands-on experiences in livestock operations. Students will directly interact with professionals and be exposed to topics such as nutrition, health care, management and marketing in the beef cattle industry.

ANSC 437. Professional Development in Beef Feedlot Systems. 2 Credits. (1 Lec, 1 Lab) S PREREQUISITES: ANSC 100, ANSC 320 and/or ANSC 408. This course will allow for hands-on experiences in beef cattle operations, specifically feeding and marketing for finished beef. Students will directly interact with industry professionals and be exposed to topics such as nutrition, health, management and marketing in the beef cattle industry.

ANSC 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) PREREQUISITRES: Consent of instructor and approval of department head. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. May be repeated.

ANSC 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ANSC 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

ANSC 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

ANSC 498. Internship. 1-6 Credits. (1-6 Ind; 6 cr max) On Demand PREREQUISITE: Completion of 2 of the following courses: ANSC 316, ANSC 320, ANSC 321, ANSC 322 or ANSC 357 and junior standing, consent of instructor and approval of department head. COREQUISITE: 2 of the following: ANSC 316, ANSC 320, ANSC 321 or ANSC 357 An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.
ANTY - Anthropology

ANTY 101D. Anthropology and the Human Experience. 3 Credits. (3 Lec) Comparative focus on human behavior and human cultural systems from the local to global levels. The nature and sources of diversity associated with the human experience are explored and reinforced using examples from archaeology, biological anthropology, cultural anthropology, and linguistics.

ANTY 212CS. Bones, Apes, and Ancestors. 3 Credits. (3 Lec) On Demand. Exploration of human biological evolution from an anthropological perspective, emphasizing scientific understanding through examination of important fossil discoveries and of the behavior and anatomy of living non-human primates, especially apes. Aimed particularly at students not majoring in anthropology.

ANTY 215IS. Human Prehistory. 3 Credits. (3 Lec) F,S Introduction to basic concepts and ideas about the biological and cultural evolution of human species. Topics include primate ancestors, human origins, evolutionary theory, genetics, archaeological interpretation, and cultural change from the earliest stone tools to the rise of ancient civilization.

ANTY 223IS. Anthropology, Pop Culture, and Everyday Life. 3 Credits. (3 Lec) On Demand. Introduction to basic principles and approaches of socio-cultural anthropology. Covers diverse thoughts, every day practices and popular culture in the world. Aimed particularly at students not majoring in Anthropology.

ANTY 225IS. Culture, Language, and Society. 3 Credits. (3 Lec) F,S The nature of culture through selected societies: symbolism and world view as related to cultural dynamics and representational forms. A survey of social practices, linguistic and cultural representations, exchange, identity, and the dynamics of power.

ANTY 242D. Contemporary Japan. 3 Credits. (3 Lec) On Demand Introduction to major political, economic, social and cultural issues in contemporary Japanese society. On-going legacy of WWII, re-emerging nationalism, and backlash against ideas and institutions of "post-war democracy". Citizen activism on these issues in and outside Japan.

ANTY 252IS. Mysteries of the Past. 3 Credits. (3 Lec) On Demand. Focuses on archaeological thinking and the use of the scientific method in archaeology. Examines a variety of archaeological and pseudo archaeological claims from this perspective.

ANTY 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) On Demand PREREQUISITE: ANTY 101 or ANTY 225. Undergraduate experiences for non-majors fulfilling their core research requirement. Course content is determined by the upper level anthropology course to which this class is linked and by student’s interests. Upper level majors serve as research mentors. At least fifty percent of the course grade is based on library and field or laboratory research.

ANTY 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: None required but some may be determined necessary by each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ANTY 292. Independent Study. 1-3 Credits. (1-3 Ind; 3 cr max) On Demand PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

ANTY 313. Biological Anthropology. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 215IS or consent of instructor. Human evolution and biology from an anthropological perspective: the fossil record, nonhuman primates, biological variation, and basic techniques of physical anthropology.

ANTY 315. Forensic Anthropology. 3 Credits. (3 Lec) PREREQUISITE: Junior standing or consent of instructor. Detailed study of human cranial and post cranial skeletal anatomy. Analyses of skeletal materials for estimating sex, age at death, living stature, biological ancestry, cause of death, and other factors of forensic interest. Methods in the recovery of skeletal remains.

ANTY 327. Medical Anthropology. 3 Credits. (3 Lec) On demand PREREQUISITE: Junior standing, ANTY 215IS, ANTY 225IS. Anthropological research materials, their methodological treatment and theoretical grounding as applied to health-related practices in local and trans cultural contexts. Cultural constructions of diseases, intervention and treatment strategies, and the analysis of health concerns associated with globalization and accelerated culture change.

ANTY 332. Native North America. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 225IS or consent of instructor. An anthropological view of native North American cultures from the perspective of the ethnographic present. Continental-wide diversity in native adaptations and life ways are examined along lines of anthropologically-defined culture areas.

ANTY 336. Myth, Ritual and Religion. 3 Credits. (3 Lec) On Demand. PREREQUISITE: Junior standing, ANTY 225IS. Forms of religious representation and practice in cultural and historical context; from liminality and symbolic innovation to mythic charmers and social transformations, cosmological scenarios and ritual forms are explored in this course.

ANTY 337. Sex, Gender, Sexuality Japan. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 225IS, or WS 201, or SOCI 326, or any course on Japanese, or consent of instructor. Dominant constructions of sex, gender and sexuality in contemporary Japanese society, and how such constructions are reinforced, contested or resisted in Japan. This includes interaction with race, ethnicity, class and other social and historical factors (e.g., colonialism, globalization).

ANTY 338. Contemporary Pacific Societies. 3 Credits. (3 Lec) On Demand. PREREQUISITE: Junior standing, ANTY 101D and ANTY 215IS. Current ethnological and theoretical considerations of creative cultural processes in relation to classical adaptations and world views of Pacific Island peoples.

ANTY 343. Popular Culture - Japan. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 225IS, or SOCI 374, or any course on Japan, or consent of instructor. This course examines socio-historical and political meanings of mass/popular culture in our everyday lives in personal, local and global contexts. There is an emphasis on materials originating from or related to Japan including manga, anime, music, performance arts, food, fashion, the internet, toys and television.

ANTY 350. Old World Prehistory. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 215IS or consent of instructor. This course provides an understanding of the origins and development of human culture in the Old World (Africa, Europe, Asia, and Australia) over the past three million years. The emphasis is on key theoretical and methodological developments in the archaeology and paleoanthropology of the Old World.

ANTY 351. Archaeology of North America. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 215IS or consent of instructor. Prehistoric cultural adaptations and developments in North America from the earliest archaeological evidence through historic times; basic archaeological methods and theory.

ANTY 355. Peoples and Prehistory. 3 Credits. (3 Lec) On Demand. PREREQUISITE: Junior standing, ANTY 215IS, ANTY 225IS. The study of ancient and extant cultures of a selected world region with a comparative focus between the archaeology and ethnography of ancient and extant societies. Explores theoretical and methodological implications associated with the linkages between archaeology and ethnography.

ANTY 356. Archaeology of Southwest Asia. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 215 or consent of instructor. Examination of the archaeology of Southwest Asia from the earliest traces of humanity through the historical periods. An emphasis on key transitional developments including agricultural origins and the rise of complex societies.

ANTY 357. Foragers of Sub-Saharan Africa. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 215IS or consent of instructor. Examination of the archaeology and ethnography of ancient and extant forager peoples in Sub-Saharan Africa. Considers varying research approaches and cross-cultural similarities and variability.

ANTY 425R. Social Organization. 3 Credits. (3 Sem) On Demand. PREREQUISITE: ANTY 225IS or consent of instructor. Senior capstone course. An analysis of culturally relevant components of the social order in small-scale and complex societies, and local constructs of personal and group identity. Considers classical and recent approaches to interpersonal relationships and the organization of social life.

ANTY 427. Anthropology of Gender. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 225IS or WS 201 or SOCI 326 or consent of instructor. Examination of anthropological approaches to the studies of gender, and discussion of contemporary issues and topics related to gender and sexuality across cultures. Topics include construction of femininity and masculinity, kinship and family, sexualities, religion, globalization and activism.

ANTY 428RS. Anthropological Theory. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 225IS or consent of instructor. Senior capstone course. An analysis of theories of anthropological science within their social context of development; exploration and critique of representative classics.
ANTA 441. Social Movements in Japan. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 225IS or WS 201HL, or any course on Japan, or consent of instructor. Examination of contemporary social movements and their historical antecedents in Japan. Discussion of the claims and organizational strategies of various movements, such as left and right wing, religious, communist, feminist and queer movements, and the new virtual movement utilizing the internet.

ANTA 450. Archaeological Theory. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 215IS or consent of instructor. Examination of current methodological and theoretical issues in archaeology and how they are applied to our understanding of the past.

ANTA 453. Zooarchaeology. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 215IS or consent of instructor. The analysis of animal remains from archaeological sites, emphasizing mammal bones of taxa present at Montana archaeological sites. Hands-on learning of bone identification and the recognition of butchery marks and the like, and discussion of methodological and theoretical concepts and topics.

ANTA 454. Lithic Technology. 3 Credits. (3 Lec) On Demand. PREREQUISITE: ANTY 215IS or consent of instructor. This course examines prehistoric stone technology and the methodological and theoretical understandings of archaeological interpretations. The course material is conveyed through hands-on activities, individual analyses, and discussions of the theoretical foundations for archaeological interpretations.

ANTA 467. Archaeology Field School. 1-9 Credits. (1-9 Ind; 9 cr max) On Demand. PREREQUISITE: ANTY 215IS or consent of instructor. A summer of archaeological field work at a location away from the University; training in excavation and laboratory methods. (Offered when funding available.).

ANTA 472. Descriptive Linguistics. 3 Credits. (3 Lec) On Demand. PREREQUISITE: Junior standing, ANTY 225IS. Language as a subsystem of culture, fundamentals of linguistic analysis and the use of language in social contexts. Also explores relationships between perception and conception, thought and representation.

ANTA 473. Language & Culture. 3 Credits. (3 Lec) On Demand. PREREQUISITE: Junior standing, ANTY 225IS. Language as a subsystem of culture, fundamentals of linguistic analysis and the use of language in social contexts. Also explores relationships between perception and conception, thought and representation.

ANTA 490R. Undergraduate Research and Instruction. 1-6 Credits. (1 Ind; 12 cr max) On Demand. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research.

ANTA 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand. PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ANTA 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand. PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed study on an individual basis.

ANTA 494. Seminar. 1-12 Credits. (1-12 Sem; 12 cr max) On Demand. PREREQUISITE: ANTY 215IS or ANTY 225IS or consent of instructor. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

ANTA 495. Field Experience. 1-9 Credits. (1-9 Lec; 9 cr max) On Demand. PREREQUISITE: ANTY 101D or consent of instructor. A summer of anthropological field work at a location away from the University; training in appropriate field methods. (Offered when funding available.).

ANTA 591. Special Topics. 1-4 Credits. (1-4 Lec) On Demand. PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ANTA 592. Independent Study. 1-3 Credits. (1-3 Ind; 4 cr max) On Demand. PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

ARAB - Arabic

ARAB 101. Elementary Modern Arabic I. 3 Credits. (3 Lec) An elementary level course designed to facilitate students' acquisition of basic proficiency in communication within culturally significant contexts. Students learn Modern Standard Arabic language skills in an environment integrating interactive video and classroom instruction.

ARAB 102D. Elementary Modern Arabic II. 3 Credits. (3 Lec) PREREQUISITE: ARAB 101 or consent of instructor. This course builds upon the foundation established in 101. Greater emphasis is placed upon oral and written expression. Cultural issues are explored in an environment integrating interactive video and classroom instruction.

ARAB 201. Intermediate Modern Arabic I. 3 Credits. (3 Lec) PREREQUISITE: ARAB 102D or equivalent, or a minimum three years of high school Arabic or placement interview. Intensive, methodical review of grammar and syntax combined with the integrated development of proficiency in the four language skills. Expansion of cultural knowledge and functional vocabulary through intermediate-level readings and discussions. Increased emphasis on written communication.

ARAB 201D. Intermediate Modern Arabic I. 3 Credits. (3 Lec) PREREQUISITE: ARAB 102D or equivalent, or a minimum three years of high school Arabic, or placement interview. Intensive, methodical review of grammar and syntax combined with the integrated development of proficiency in the four language skills. Expansion of cultural knowledge and functional vocabulary through intermediate-level readings and discussions. Increased emphasis on written communication.

ARAB 202. Intermediate Modern Arabic II. 3 Credits. (3 Lec) PREREQUISITE: ARAB 201 or equivalent, or placement interview. Continuation of ARAB 201. Students who successfully complete this course will have ‘survival’ skills for daily life in the Arab world, and will be ready for more advanced course work using authentic materials. Expansion of cultural knowledge.

ARAB 202D. Intermediate Modern Arabic II. 3 Credits. (3 Lec) PREREQUISITES: ARAB 201 or equivalent, or placement interview. Continuation of ARAB 201. Students who successfully complete this course will have ‘survival’ skills for daily life in the Arab world, and will be ready for more advanced course work using authentic materials. Expansion of cultural knowledge.

ARAB 201. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ARCH - Architecture

ARCH 121IA. Introduction to Design. 3 Credits. (2 Lec) F,S,Su PREREQUISITE: For majors and non-majors. Introduction to the design and creative process through global architecture and allied professions. Exploration of the history of design. Emphasis on 20th and 21st century architecture. Individual projects where students apply and explore creative process are required.

ARCH 151RA. Design Fundamentals I. 4 Credits. (2 Lec, 2 Lab) A study of the creative design process with emphasis on two-dimensional design, basic three dimensional design concepts and introduction to the essential tools for graphic communication. Development of students’ self-critical skills.

ARCH 152. Design Fundamentals II. 4 Credits. (3 Snu, 1 Rec)S,Su A study of the design process and methods employed by design disciplines as an introduction to architectonic principles, architectural graphic skills and further understanding of the creative process. Development of student’s ability to make critical and analytical judgments.

ARCH 152IA. Design Fundamentals II. 4 Credits. (3 Std, 1 Lec) A study of the design process and methods employed by design disciplines as an introduction to architectonic principles, architectural graphic skills and further understanding of the creative process. Development of student’s ability to make critical and analytical judgments.

ARCH 221. World Architecture: Modern to Contemporary. 3 Credits. (3 Lec) On Demand This course will examine the historical development of architecture from the 19th century to the present. Within an historical context, the course will focus on the impact of cultural and philosophic trends, technological changes and innovations and the globalization of the digital revolution on our built environment. Students will be introduced to seminal theoretical approaches professed by architects and thinkers of the 20th and early 21st centuries.
ARCH 225. Intro to Arch Theory. 3 Credits. (3 Lec) On Demand
Introduction to theoretical approaches advocated by architects and urban designers, planners, and theorists throughout history. Emphasis is placed on theoretical positions, their advocates and their impact on architecture.

ARCH 231CS. Issues in Sustainability. 3 Credits. (3 Lec) On Demand
Introduction to concepts and practices intended to create more sustainable communities where present generations are accountable for the needs of future generations and the natural environment. The course will explore current multidisciplinary practices in "ecological design".

ARCH 241. Building Construction I. 3 Credits. (1 Lec, 2 Stu) S
PREREQUISITE: Course only open to the following majors/minor: PEVD-BA, ENVBD-BA, CET-BS, MBES-MINOR, TEBD-BS, TET-BS, TTH-MINOR.
Introduction to the materials of construction and an overview of building construction systems. Emphasis upon an understanding of materials and systems as a means to effective and creative design utilization.

ARCH 253. Architectural Design I. 5 Credits. (1 Lec, 4 Lab) F
PREREQUISITE: Successful Completion of ARCH 151RA and ARCH 152IA.
Small-scale design projects requiring integration of spatial, visual concepts, emphasizing relationship of architecture to its context with principles of order, constitutents of form, light, structural awareness, nature of materials, architectural coherence. Includes inclusive orthographic graphics design drawing conventions.

ARCH 254. Architectural Design II. 5 Credits. (1 Lec, 4 Lab) S
PREREQUISITE: ARCH 253 Small to medium-size projects extending the development of the design process to site and adjacency analysis, diagramming, fundamental relationship to landscape and context. Topics include hybrid uses of hand and digital graphic communication including 2D and 3D drawing and modeling.

ARCH 261. Architectural Graphics I. 3 Credits. (1 Lec, 2 Lab)
PREREQUISITE: Formal admission into the environmental design program- PEVD-BA or ENVBD-BA majors Fundamental techniques in architectural graphics. Course utilizes observation and design drawing studios supplemented by design drawing lecture/demonstration sessions. Topics include freehand observation drawing and constructed multi-view, paraline, perspective and shade/shadow drawing leading towards the formal graphic presentation of architectural intentions.

ARCH 262. Arch Graphics II. 3 Credits. (1 Lec, 2 Lab)
PREREQUISITE: ARCH 261 Basic techniques in architectural graphic expression. Course emphasizes observation drawing studio supplemented by design drawing lecture/demonstration sessions. Topics include freehand, perspective, and shade and shadow drawing techniques. Two and three-dimensional digital applications introduced. Notebook computer required.

ARCH 289R. Undergraduate Research and Instruction. 1-3 Credits. (1-3 Ret; max unlimited) F,S
Classroom instruction associated with directed undergraduate research/creative activity projects. May be repeated.

ARCH 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

ARCH 291. Special Topics. 1-4 Credits. (1-4 Sem; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ARCH 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of department head. Directed study and research on an individual basis.

ARCH 294. Seminar. 1-2 Credits. (1 Sem; 4 cr max) F,S,Su
PREREQUISITE: Determined for each offering. Topics offered at the lower division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

ARCH 322IA. World Architecture I. 3 Credits. (3 Lec) F
PREREQUISITE: Junior standing for non-majors, WRIT 101W. A survey of world architectural history from primitive developments to the Gothic.

ARCH 323IA. World Architecture II. 3 Credits. (3 Lec) S
PREREQUISITE: Junior standing for non-majors, WRIT 101W. A survey of world architectural history from the Renaissance to Industrial Revolution.

ARCH 331. Environmental Controls I. 4 Credits. (3 Lec, 1 Studio)
PREREQUISITE: ARCH 254. Analysis of climate, passive design strategies, and heat flow fundamentals. Analysis and design of basic heating, ventilating, and air-conditioning systems. Analysis and design of water supply, sanitation and vertical transportation systems. Notebook computer required.

ARCH 332. Environmental Controls II. 4 Credits. (3 Lec, 1 Lab)
PREREQUISITE: ARCH 331. Analysis and design of architectural lighting systems, acoustics, electrical systems, fire protection, and signal systems. Notebook computer required.

ARCH 340. Building Construction II. 4 Credits. (2 Lec, 2 Lab)
PREREQUISITE: ARCH 241, ARCH 343. ARCH 355 Development and integration of building materials and assemblies, construction costs and building systems into the construction documents, specifications and design of a small project. Building systems to be investigated include: structural environmental and enclosure, life safety and sustainability. Notebook computer required.

ARCH 343. Architectural Structures I. 4 Credits. (3 Lec, 1 Stu) F,Su
PREREQUISITE: ENVBD-BA major. Formal admission into Environmental Design program. Introduction to structural design/analysis of horizontal and vertical members as applied to architectural works; basic statics, moment and shear of rigid bodies and architectural forms; strength concepts using stress and strain assessment; application of analytical and intuitive structural concepts in a design context.

ARCH 344. Architectural Structures II. 4 Credits. (3 Lec, 1 Stu) S
PREREQUISITE: ARCH 343. Understanding of design for structural elements in wood, steel, masonry, and concrete. Lateral considerations and calculations including wind, soil and seismic loads. Understanding of structural systems; building systems; diaphragms; connections; structural engineer-architect communications.

ARCH 355. Architectural Design III. 5 Credits. (1 Lec, 4 Lab) F,Su
PREREQUISITE: ARCH 254. Further exploration of ecologically-sound design with emphasis on the integration of structures, building envelope service systems, and building materials, including design for life safety and accessibility. Building scale and program complexity increases, utilizing long-span structural systems. Notebook computer required. Field trip required.

ARCH 356. Arch Design IV. 5 Credits. (1 Lec, 4 Lab) S
PREREQUISITE: ARCH 355. Advanced architectural design projects integrating site analysis, programming, building systems, and contemporary design theory. Emphasis placed on the inclusive synthesis of conceptual processes, analysis preliminary design investigation, and design development. Notebook computer required.

ARCH 363. Architectural Graphics III. 3 Credits. (1 Lec, 2 Lab)
PREREQUISITE: ARCH 261 and ARCH 262 Advanced principles of computer-aided design and hand applications in architectural practice, including three-dimensional computer-aided design, hand and digital delineation, and presentations. Topics provide foundation for graphic applications in ARCH 354 design studio. Notebook computer required.

ARCH 413. Professional Practice. 3 Credits. (2 Lec, 1 Lab)
PREREQUISITE: ARCH 356 and ARCH 340. Architecture as a process by which social, economic, and environmental ideas are realized. Topics include: marketing, business planning, project management, legal issues, delivery methods, technology, regulation, ethics, accessibility, interdisciplinary relations, community relations, client relations, and trends of practice. Notebook computer required.

ARCH 414. Architectural Study Abroad. 9 Credits. (6 Lec, 3 Ind) F,Su
PREREQUISITE: ARCH 356. COREQUISITE: ARCH 428. Structured study in foreign countries under the direction of an architecture faculty member to obtain an understanding of modern and historical architecture and the forces shaping them. Holistic study of urban environments combines design, urban design, architectural history, drawing, and pre-travel design and research. Itineraries include opportunities for additional destinations and independent travel.

ARCH 424. Contemporary Architectural History and Theory. 3 Credits. (3 Lec)
On Demand
PREREQUISITE: ARCH 322IA and ARCH 323IA. Critique and discussion of architectural projects built and ideologies proposed in writings, drawings, and models during the 20th and 21st centuries as the relate to their social, cultural, technical and economic context.

ARCH 425. West Architectural History. 3 Credits. (3 Lec, 6 Ind)
PREREQUISITE: ARCH 254. Analysis and design of architectural lighting systems, acoustics, electrical systems, fire protection, and signal systems. Notebook computer required.

ARCH 424. Contemporary Architectural History and Theory. 3 Credits. (3 Lec)
On Demand
PREREQUISITE: ARCH 322IA and ARCH 323IA. Study of events and influences that led to the development of western architectural styles, ideology, and forms of individual expression.
ARCH 426. History of Identity of Contemporary Places. 3 Credits. (3 Lec; 6 cr max) On Demand
PREREQUISITE: ARCH 322IA and ARCH 323IA. A course in applied architectural history and theory. Lectures, discussions, and student projects investigate characteristics which convey a sense of place based on historical development, architectural styles, and urban design.

ARCH 427. Non-Western Architectural History. 3 Credits. (3 Sem; 6 cr max) On Demand
PREREQUISITE: ARCH 322IA and ARCH 323IA. A study of events and influences that led to the development of non-western architectural styles, ideology, and forms of individual expression.

ARCH 428. Foreign Study History. 3 Credits. (2 Lec, 1 Ind) F,S
PREREQUISITE: ARCH 356. COREQUISITE: ARCH 414. An on-site study in a foreign country of the social, cultural, and historic influences on architectural design. This course is only offered in conjunction with the foreign study program within the School of Architecture. Course shall include research on-site visits documented in an appropriate media form.

ARCH 431. Sustainability in Architecture. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: ARCH 332 and ARCH 356. Architectural and site strategies for reducing the energy footprint of structures and spaces with an emphasis on the profession’s ethical responsibility and techniques that maximize the potential of active and passive design strategies to sustain our natural resources.

ARCH 444. Computational Design for Structures. 3 Credits. (2 Lec, 1 Lab) On Demand
PREREQUISITE: ARCH 243 and ARCH 263. Introduction to spreadsheets and computational software; spreadsheet developments for typical structural computations used in architecture; introduction to structural design/analysis software; and development of a library of computational software tools for the application of structural architectural design. Notebook computer required.

ARCH 450. Community Design Center. 5 Credits. (1 Lec, 4 Lab) F,S
PREREQUISITE: ARCH 356. The CDC assists public and non-profit groups by providing planning, programming, and conceptual design ideas. Emphasis and scope of projects are determined by the community needs. Projects are intended to complement and promote the professional practice of architecture in the State of Montana.

ARCH 451. Design for Community. 1-3 Credits. (3 Ind; 6 cr max) On Demand
PREREQUISITE: ARCH 355. Students will be engaged in architecturally-related activities with government and non-profit agencies. This will enable students to be involved in a service learning academic experience.

ARCH 452. Research Methods in Arch. 3 Credits. (3 Lec) S
PREREQUISITE: ARCH 356. Students are introduced to systematic architectural inquiry, its purpose in architectural design, the different approaches to conducting architectural research, and the major components of architectural research.

ARCH 457. Architectural Design V. 5 Credits. (1 Lec, 4 Lab) S,S
PREREQUISITE: ARCH 356. Senior capstone course. Architectural design integrating building, landscape, and urban context using multi-story projects of medium scale and complexity with particular focus on mixed-use. Integrated topics include programming structural and mechanical integration, ecologically-sound design, building envelope systems and building codes.

ARCH 458. Arch Design VI. 5 Credits. (1 Lec, 4 Lab; 12 cr max) On Demand
PREREQUISITE: ARCH 356. A continuation of the holistic design synthesis encountered in ARCH 356 with emphasis on development of student’s emerging design values and theoretical perspective. Field trip possible. Notebook computer required.

ARCH 464. Intermediate Computer Applications. 3 Credits. (2 Lab, 1 Snu) On Demand
PREREQUISITE: ARCH 263 or ARCH 363. Investigation of digital design, fabrication, modeling and drawing as applied to architectural practice. Lectures and products will explore the use of 2D and 3D applications to explore design and construction processes.

ARCH 465. Advanced Computer Application I. 3 Credits. (2 Lab) On Demand
PREREQUISITE: ARCH 464, or consent of instructor. The investigation and application of advanced two-dimensional and three-dimensional digital applications for design, modeling, and presentation techniques for architectural practice. Lectures and projects may include topics of three-dimensional modeling, animation, delineation, or digital fabrication.

ARCH 471. Directed Research/Creative Act. 1-6 Credits. (1-6 Ind; max unlimited)
PREREQUISITE: ARCH 472. Directed research/creative activity which may culminate in a research paper, journal article, or design project. May be repeated.

ARCH 472. Directed Research/Creative Activity Instruction. 1-2 Credits. (1-2 Rct; 4 cr max) F,S,Su
COREQUISITE: ARCH 471. Classroom instruction associated with directed research/creative activity projects.

ARCH 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su
COREQUISITE: ARCH 489. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

ARCH 491. Special Topics. 1-4 Credits. (1-4 Ind; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ARCH 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

ARCH 494. Seminar. 1-3 Credits. (1-3 Sem; 4 cr max) F,S,Su
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

ARCH 498. Architecture Residency Design Studio. 6 Credits. (6 Ind) F
PREREQUISITE: ARCH 340, ARCH 355 and all other architectural courses through the third year. Students arrange for employment in an architectural office for a continuous period of 6 months. Students will participate in a structured work study professional practice experience and are required to present the content of this experience upon their return to campus.

ARCH 510. Leadership in Prof Practice. 3 Credits. (3 Rct) S
This course broadens your perspective an understanding of the architect’s value as it relates to different types of economics. It presents the leading edge of traditional practice, alternative opportunities, and civic engagement that utilize the architect’s skill set.

ARCH 519. Synthesis of Arch Practice. 3 Credits. (3 Rct) S
PREREQUISITE: ARCH 540, ARCH 545. A capstone which will synthesize the learning acquired in previous courses to culminate in development of a transformative business plan for the student’s office. Focus: Research in design milieu; Development of thesis; Evaluative strategies for measuring success; Total cost accountability.

ARCH 521. Arch Theory. 3 Credits. (3 Sem; 9 cr max) On Demand
PREREQUISITE: Graduate standing or seniors by petition. Specific architectural, urban, planning and preservation theories, their application and context within contemporary practice will be investigated through the study of essays, drawings, models and built projects. May be repeated.

ARCH 522. Historical Issues in Arch. 3 Credits. (3 Sem; max unlimited) On Demand
PREREQUISITE: Graduate standing or seniors by petition. Close examination of historic periods and individuals. Emphasis upon in-depth studies of particular personalities and the social, cultural, artistic and scientific developments that influenced the progress of architecture, urban design and city planning. May be repeated.

ARCH 523. Issues in City Planning. 3 Credits. (3 Rct) On Demand
PREREQUISITE: Graduate standing or seniors by petition. Problems and issues, processes and regulations in planning, urban design, and historic preservation. Field trip possible.

ARCH 524. Design Competition. 3 Credits. (3 Seminar; max 6cr) On Demand
PREREQUISITE: Graduate standing or seniors by petition. Students will work under the direction of a faculty member in the research, design, development and presentation of a project in response to a design competition.

ARCH 525. Special Design Topic. 3 Credits. (3 Lab; 12 cr max) F,S,Su
PREREQUISITE: Graduate standing or seniors by petition. Students will work under the direction of a faculty member in the research, design, development and presentation of a design, research, or historic preservation project. May be repeated as topics vary.

ARCH 526. Advanced Architectural Theory. 3 Credits. (3 Lec)
PREREQUISITE: Graduate Standing. COREQUISITE: ARCH 558, ARCH 535. This course focuses on the critique and discussion of current architectural projects built and ideology proposed in writings, drawings and model including historic traditions and the simultaneous global, social, and technical context, in order to examine current architectural issues. To be taken concurrently with ARCH 558 by new Graduate students.
ARNR 524. Adv Animal Breeding. 3 Credits. (3 Lec) S alternate years, to be offered every even year. PREREQUISITE: ANSC 322. Quantitative and molecular genetics applied to the improvement of animals. Study of relationships among relatives, methods of estimating genetic parameters, application of crossbreeding systems and selection techniques, and the application of molecular biology to understand the basis of economically important traits in livestock.

ARNR 525. Muscle Growth & Biology. 3 Credits. (3 Lec) S alternate years, to be offered every even year. PREREQUISITE: BCH 380 AND BIOB 160. Growth and development of muscle, muscle structure and how growth is controlled by hormones and DNA will be studied. The impact of growth manipulation on the final product, meat, will also be evaluated.

ARNR 529. Yellowstone Wildlife Habitat Ecology. 2 Credits. (2 Lec) Su PREREQUISITE: WILD 426 OR WILD 438 or equivalent. This course will describe the native communities of the internationally prominent northern Yellowstone winter range for wild ungulates. The ecology of many organisms, both plant and animal will be studied. Plant identification skills will be incorporated with an emphasis on the recognition of the Yellowstone northern range’s flora and its importance as wildlife habitat. Ecosystem interrelationships will form the basis for understanding the ecology of the range and interpreting the consequences of management alternatives.

ARNR 541. Range Ecophysiology. 3 Credits. (3 Lec) S alternate years, to be offered every even year. PREREQUISITE: NRSM 240 or BIOE 370 or consent of instructor. Lectures and selected readings on the response of range plants and animals to daily and seasonal changes in their environment, including physiology, animal behavior, and plant population biology.

ARNR 543. Riparian Process & Function. 3 Credits. (3 Lec) S alternate years, to be offered odd years. PREREQUISITE: NRSM 455, BIOE 370 and ERTH 432R. This course involves an in depth investigation of the geomorphological physical and biological parameters unique to riparian areas of the Northern Rocky Mountains and Great Plains. Emphasis will be placed on how these parameters interact to create the biotic communities associated with riparian areas.

ARNR 544. Advanced Grazing Management and Ecology. 3 Credits. (3 Lec) S alternate years, to be offered odd years. PREREQUISITE: NRSM 240 or NRSM 350 or NRSM 351 or BIOE 370. Review of management principles for livestock grazing rangelands and their ecological relationships. Study design and scientific results will be examined to critically review information.

ARNR 555. Rangeland Wildlife Ecology & Management. 3 Credits. (3 Lec) F PREREQUISITE: Graduate student standing. Course explores the history, ecology, and management of wildlife populations occurring on rangelands. Emphasis will be placed on habitat and population management with primary consideration of management issues facing wildlife populations in the West.

ARNR 575. Prof Paper & Project. 1-4 Credits. (1-4 Ind; 6 cr max) F,Su PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major adviser and graduate committee.

ARNR 589. Graduate Consultation. 3 Credits. (3 Ind; max unlimited) F,Su PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

ARNR 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,Su PREREQUISITE: Master’s standing.

ARNR 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ARNR 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

ARNR 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand PREREQUISITE: Graduate standing or senior by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

ARNR 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; 10 cr max) F,S,Su PREREQUISITE: Doctoral standing.

ARTH - Art: Art History

ARTH 200IA. Art of World Civilization I. 4 Credits. (3 Lec) F This course examines the visual arts from their beginnings to ancient Egypt, Greece, and Rome through the Medieval period. It focuses on an understanding of art as the nonverbal expression of universal cultural concepts.

ARTH 201IA. Art of World Civilization II. 4 Credits. (3 Lec) S A survey of Renaissance, Baroque, and 19th and 20th century art which focuses on the evolution of humanistic expression and the emergence of the artist as an individual responding to the impact of modern society.

ARTH 240IH. Exploring Artists on Film. 3 Credits. (3 Lec) F Analyzes a variety of portrayals of art and artists throughout history in Hollywood and foreign feature films. Artists and their works will be studied in their historical context, and in terms of how history is mediated by fictional depiction in film.

ARTH 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 6 cr max) F,S,S,Su Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research.

ARTH 302. Survey of Ancient Art. 3 Credits. (3 Lec) F Alternate years to be offered even years PREREQUISITE: ARTH 200IA. This course will examine the art and architecture of ancient civilizations surrounding the Aegean and Mediterranean seas. Beginning with the Aegean civilizations, the course will then examine the rise of the historical Greeks and will conclude with the Roman world.

ARTH 310. Ancient Art Mesoamerica. 3 Credits. (3 Lec) Su alternate years to be offered even years A comparative survey that will examine the art and architecture of selected cultures of Mesoamerica, Central America and South America, commonly grouped under the designation of New World civilizations. The material presented will focus on the Aztecs and Maya of Mesomarica (southern Mexico and northern Central America) and the Incas of Central Andes of South America.

ARTH 312. History of Decorative Arts. 3 Credits. (3 Lec) S alternate years PREREQUISITE: ART 203. This course introduces students to the history of decorative arts in western Europe and the United States from the Renaissance through the early 20th Century. Emphasis will be placed on major media and stylistic trends. Attention will also be given to the use of objects in their original spatial environments.

ARTH 323. History of Printmaking. 3 Credits. (3 Lec) S alternate years to be offered odd years PREREQUISITE: ARTH 201IA. This course introduces students to the vocabulary, techniques and history of printmaking in the western world from the mid-fifteenth century to end of World War II.

ARTH 360. History of Asian Art and Architecture. 3 Credits. (3 Lec) S alternate years to be offered odd years PREREQUISITE: ARTH 200IA or ARTH 201IA. The purpose of this course is to offer students a broad exposure to art and architecture produced in China, Japan, Southwest Asia and India from the Neolithic period through the 20th century with special emphasis placed on Chinese developments.

ARTH 375. Roman, Etruscan, Greek. 3 Credits. (3 Lec) S PREREQUISITE: ARTH 200IA. What role the exchange of cultural ideas had on the Italic Peninsula between 600BCE and 100BCE. How the culture of Rome and the Mediterranean influenced the art and architecture of Etruscan and Greek civilizations.

ARTH 391. Visual Analysis of Film and Video. 3 Credits. (3 Seminar) S PREREQUISITE: ARTH 200/201 Art of World Civilization I & II This course will teach students to analyze and communicate the meaning in moving and still video images. Through the screening of short and feature length films, lectures and discussion, we will undertake a detailed study of content and form and various moviemaking processes.

ARTH 400. Art and Architecture of Egypt. 3 Credits. (3 Lec) S alternate years to be offered even years PREREQUISITE: ARTH 200IA. This course is an exploration of the art and architecture of ancient Egypt and the Near East (Anatolia, Mesopotamia and Persia). Due to the nature of the surviving material, the emphasis will be on the ideas and attitudes of these civilizations about the relationship between humans and divinities, the cult of the ruler/king, and funerary cult and the afterlife.

ARTH 402. Greek Art and Architecture. 3 Credits. (3 Lec) F Alternate years to be offered odd years PREREQUISITE: ARTH 200IA and ARTH 201IA. This lecture-based course will present a survey of the art and architecture of ancient Greece from its origins in the Dark ages through the Hellenistic period. Study begins with the Bronze Age of antecedents of Hellenic art and ends with the wide-spread dissemination of Greek material culture after the death of Alexander the Great.
ARTH 406. Roman Art and Architecture. 3 Credits. (3 Lec) S
PREREQUISITE: ARTH 200IA. This course is a survey of the public and private art and architecture of Republican and Imperial Rome. The study encompasses both the Etruscan and Republican foundations-cultural, political and artistic-of Rome and then moves on to the period when emperors ruled and the borders of the empire at its height ranged from Britain to North Africa. The course is arranged as a chronological survey moving from the prehistory of theItalic peninsula to the reign of the emperorConstantine in the fourth century CE.

ARTH 410. Medieval Art. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: ARTH 200IA. Early Christian, Byzantine, Romanesque, and Gothic periods.

ARTH 421. Late Gothic Painting. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: ARTH 201IA. This course will deal with the development of Gothic painting in Italy and its subsequent influence on the Northern tradition of painting in the Netherlands and Germany. Major masters include Giotto, Van Eyck, Bosch, Cranach, Durer, and Bruegel.

ARTH 422. Early Renaissance to 15th Century Art. 3 Credits. (3 Lec) F alternate years to be offered even years PREREQUISITE: ARTH 201IA. A study of painting, sculpture, and architecture in Italy in the 15th century. Major artists include Donatello, Masaccio, Piero della Francesca and Botticelli, Michelangelo, and Giorgione.

ARTH 424. High Renaissance and Mannerism. 3 Credits. (3 Lec) S alternate years to be offered even years PREREQUISITE: ARTH 201IA. This course is a study of the high renaissance in Rome, Florence, and Venice, and the reactions to this in the style of mannerism. Major artists include Leonardo, Michelangelo, Raphael, Pontormo and Titian.

ARTH 426. Baroque Art in Italy and Southern Europe, 1600-1700. 3 Credits. (3 Lec) F alternate years to be offered even years PREREQUISITE: ARTH 201IA. This course is a history of painting, sculpture, and architecture produced in Italy during the 17th century. Emphasis will be placed on major artists and stylistic trends as well as the various social, political and religious contexts for viewing art.

ARTH 427. Baroque Art in Northern Europe. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: ARTH 201IA. The purpose of this course is to offer students a more in-depth study of art in the Baroque period in Europe (1600-1700) by focusing on cultural developments in the Republic of the Netherlands and its colonies.

ARTH 430. 19th Century Art. 3 Credits. (3 Lec) F PREREQUISITE: ARTH 201IA. This course examines the major artists of the 19th century in Europe and America and the development of the styles of Neoclassicism, Romanticism, Realism, and Impressionism.

ARTH 432. Art in the Age of Revolution. 3 Credits. (3 Lec) S alternate years to be offered even years PREREQUISITE: ARTH 201IA. This course offers students an in-depth understanding of painting and sculpture in France and Britain in the 18th century. Through focused lectures, readings and discussions and writing assignments students will learn about the 18th century cultural, philosophical and scientific developments in their original contexts as well as their bearing on the present day.

ARTH 435. Art in the United States. 3 Credits. (3 Lec) F alternate even years PREREQUISITES: ARTH 200 or ARTH 201. This course will examine American painting and sculpture from the time of Europe settlement to 1918 with special emphasis on political, social and cultural contexts.

ARTH 438. Beginnings of Modern Art. 3 Credits. (3 Lec) F alternate years to be offered even years PREREQUISITE: ARTH 201IA. From Post-Impressionism to World War I. Major artists include Gauguin, Van Gogh, Cezanne, Matisse, Picasso, and the German Expressionists.

ARTH 440. 20th Century Art. 3 Credits. (3 Lec) S PREREQUISITE: ARTH 201IA. Art from World War I to the present.

ARTH 441. Art Now. 3 Credits. (Lec 3) F Alternate Even Years PREREQUISITES: ARTH 200 or ARTH 201 Art Now is designed as a discussion-based course surveying the most recent trends in contemporary art, focusing in particular on developments that have occurred within the art world of the last fifteen years.

ARTH 451. Contemporary Art. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: ARTH 440. This course will focus on issues in contemporary painting, sculpture, and related radical art forms. Students are responsible for discussions of assigned readings and presentations of research projects.
ARTH 555. Critical Terms in Art History. 3 Credits. (3 Sem) F alternate years
This is a seminar designed for candidates for the master's degree in art history to expose them to a gamut of issues and approaches to research in the history of art, with particular emphasis on recent concepts and theories pertaining to modern and contemporary art.

ARTH 575. Professional Paper and Project. 1-4 Credits. (1-4 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

ARTH 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand
PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. Courses offered on a one-time basis to fulfill professional development needs of in-service educators. A specific focus is given to each course which is appropriately subdivided.

ARTH 590. Master's Thesis. 1-10 Credits. (1-10 Ind; 15 cr max) F,S,Su
PREREQUISITE: Master’s standing.

ARTH 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ARTH 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, and Dean of Graduate Studies. Directed research and study on an individual basis.

ARTZ - Art: Visual Arts

ARTZ 105RA. Visual Language - Drawing. 3 Credits. (6 Stu)
PREREQUISITES: Consent of department. The development of basic drawing skills and concepts through an emphasis on observation and visual problem-solving. Representation and expression are explored through black and white drawing media. Critiques develop student’s ability to formulate and verbalize knowledgeable responses to visual production.

ARTZ 109RA. Visual Language: Comprehensive Foundation. 4 Credits. (1 Lec; 3 Std)
PREREQUISITE: Consent of department. The development of basic two-dimensional and three-dimensional technical and aesthetic concepts through an emphasis on design elements and principles. Visual problem-solving in 2D pictorial construction, 3D form and space, and color theory. Critiques develop student’s ability to formulate and verbalize knowledgeable responses to visual production. Required weekly lecture on various aspects of visual arts practice. Art Department.

ARTZ 110RA. Visual Language: Ideation and Creativity. 4 Credits. (1 Lec; 3 Std)
PREREQUISITE: Consent of department. Development and understanding of processes for idea generation and creative thinking to generate questions and solutions. Develop basic abilities to interpret, recognize, construct, appreciate and negotiate information presented in the form of visible actions, images, objects, symbols, natural or human-made.

ARTZ 131. Ceramics for Non Majors. 3 Credits. (1 Lec. 2 Studio) F,S
Ceramics for non majors will offer an overview of the history, development, and aesthetics of ceramic vessels and sculpture, the technical aspects of clay, glazes, and the firing of ceramic objects. The course will focus on problem solving and the development of ideas.

ARTZ 210. Professional Practices: Careers in Art. 3 Credits. (1 Lec. 2 Seminar) S
PREREQUISITES: ARTZ 105RA and ARTZ 109RA, Consent of department. This course covers the initial development of visual portfolio, photographing and exhibiting artwork, artist statement, and other preparation for a career in the visual arts. Students will also be prepared for exhibition opportunities as well as for entry into other areas in professional creative fields.

ARTZ 211RA. Drawing I. 4 Credits. (2 Lec; 4 Studio) F,S,Su
Introduction to the basic vocabulary of drawing, observation, problem solving, and personal expression. Critiques develop student’s ability to formulate and verbalize informed analysis of the completed projects.

ARTZ 221. Painting I. 4 Credits. (2 Lec; 2 Lab) F,S
Introduction to oil and/or acrylic painting. Exploration of basic aesthetic and technical concepts in painting. Primarily representational subject matter. Understanding and developing individual stylistic tendencies. Individual and group critiques.

ARTZ 231RA. Ceramics I. 4 Credits. (2 Lec; 2 Lab) F,S

ARTZ 251. Sculpture I. 4 Credits. (2 Lec; 2 Lab) F,S
PREREQUISITE: ARTZ 109RA and Consent of Department. Introduction to three-dimensional form through projects involving plaster, woodworking, welding, and non-traditional materials. Introduction to tools, materials, processes, and safety procedures with a conceptual approach to problem solving.

ARTZ 261. Metals I. 4 Credits. (2 Lec; 2 Lab) F,S
PREREQUISITE: ARTZ 109RA and Consent of Department. A beginning course in basic metalsmithing techniques and three-dimensional design skills. Design concepts, small metal fabrication methods and practical demonstrations.

ARTZ 271. Printmaking I. 4 Credits. (1 Lec; 3 Studio) F,S
PREREQUISITES: ARTZ 109RA, ARTZ 110RA, Consent of department. This course will introduce students not only on how to make digital photographs and output them, but also to understand how to read photography, the image and its underlying conceptual construction, with particular reference to photography and fine art practices.

ARTZ 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 6 cr max) F,S
Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research.

ARTZ 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ARTZ 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of the director. Directed research and study on an individual basis.

ARTZ 312. Intermediate Drawing. 5 Credits. (5 Std; 15 cr max) F,S,Su
PREREQUISITE: ARTZ 211RA and Consent of Department. Advanced technical and aesthetic concepts in drawing with emphasis on the development of a personal artistic style. Use of traditional and non-traditional subject matter. Individual and group critiques.

ARTZ 322. Intermediate Painting. 5 Credits. (3 Std; 2 Rec; 15 cr max)

ARTZ 332. Intermediate Ceramics. 5 Credits. (2 Lec; 3 Std; 15 cr max)
PREREQUISITE: ARTZ 231RA and Consent of Department. Advanced problems in ceramics.

ARTZ 352. Intermediate Sculpture. 5 Credits. (3 Std; 2 Rec; 15 cr max)

ARTZ 357. Functional Design-Strategies for Fabricating Practical Objects. 5 Credits. (3 Lec; 2 Lab) Su
PREREQUISITES: ARTZ-251 or by instructor approval. During the course students will have the opportunity to work on their level of craftsmanship, technique and skill set involving the creation of practical and functional objects. The course allows students to step back from conceptual concerns and focus on the necessary skills involved in making “clean” cuts, joints and design. The course is intended to help students develop their overall skill set in the shop environment thus giving them a solid introduction to advanced processes in the wood shop.

ARTZ 361. Metals II. 5 Credits. (2 Lec; 3 Std; 15 cr max)
PREREQUISITE: ARTZ 261 and Consent of department. Advanced course designed around a set of specific problems and demonstrations for advanced jewelry and metal forming concepts. Emphasis will be placed on technical development and personal imagery.
ARTZ 373. Intermediate Printmaking - Lithography. 5 Credits. (2 Lec; 3 Std; 15 cr max)
PREREQUISITE: ARTZ 271 and ARTZ 211RA and Consent of department. An intermediate course in which multiple original prints are made from hand-drawn images on lithographic limestone. Editioning in black and multicolor using crayon, tusche, transfer, and photo methods.

ARTZ 374. Intermediate Printmaking - Serigraphy. 5 Credits. (2 Lec; 3 Std; 15 cr max)
PREREQUISITE: ARTZ 271 and Consent of department. An intermediate course in which multiple original, multi-colored prints are made using various water-based silk-screen processes. Stencil techniques include paper, screen filler, drawing fluid, and photo.

ARTZ 375. Intermediate Printmaking - Intaglio. 5 Credits. (3 Std, 2 Rct; 15 cr max)
PREREQUISITE: ARTZ 271 and Consent of department. Advanced course in which multiple original prints are made using plaster and end grain wood and plastic / rubber relief plates. Methods include reductive and multi-plate color, shaped and found object (collagraph), color overlay, split fountain, roller and brush inking, and various hand and press printing methods.

ARTZ 376. Intermediate Printmaking - Relief. 5 Credits. (3 Std, 2 Rct; 15 cr max)
PREREQUISITE: ARTZ 271 and Consent of department. An advanced course in which students are offered a wide range of printing processes. These may include monotype, photo techniques, experimental lithography, large format printing, multimedia, and digital printmaking. The structure of the course is based on technical demonstrations, studio assignments, and critiques.

ARTZ 399. Studio Arts Pre-Thesis. 2 Credits. (2 Ind) F,S
PREREQUISITE: Students must have completed a minimum of 15 credits in their major area of study (i.e. Painting, Metalsmithing, Sculpture, Ceramics, Drawing, Printmaking) before being eligible for enrollment in Pre-Thesis. COREQUISITE: ARTZ 494 Undergraduate Seminar (2nd enrollment) The Studio Arts Pre-Thesis are credits in guided research with the goal of developing a robust plan of work for the Thesis project. This facilitates success in creating a Thesis project of high quality.

ARTZ 400. Careers in Art. 1 Credit. (1 Lec) F
PREREQUISITE: Junior, Senior, or Graduate standing, or consent of instructor. Senior capstone course for Liberal Arts Studio majors. Presentations by professional artists about important career elements such as resume writing, photographing and marketing your work, making presentations to galleries and design firms, starting a business, researching graduate schools, teaching as a career, and applying for grants and fellowships.

ARTZ 411. Guided Research- Drawing. 1-5 Credits. (1-5 Ind; 15 cr max) F,S,Su
PREREQUISITE: ARTZ 312. Course in which student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of drawing. Written, signed contract required prior to registering for this course.

ARTZ 421. Guided Research- Painting. 1-5 Credits. (1-5 Ind; 15 cr max) F,S,Su
PREREQUISITE: ARTZ 322. Course in which student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of painting. Written, signed contract required prior to registering for this course.

ARTZ 431. Guided Research- Ceramics. 1-5 Credits. (1-5 Ind; 15 cr max) F,S
PREREQUISITE: ARTZ 332. Course in which student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of ceramics. Written, signed contract required prior to registering for this course. Department of Art.

ARTZ 432. kiln Building Intensive. 3-6 Credits. (1 Lec, 2 Lab) Su, On Demand PREREQUISITE: ARTZ 231 RA, or consent of the instructor. This course is for those interested in pursuing a career in the ceramic arts. The class will offer students the opportunity to learn the design, cost estimates, and construction process for building an essential tool for their work, a kiln.

ARTZ 453. Guided Research- Sculpture. 1-5 Credits. (1-5 Ind; 15 cr max) F,S,Su
PREREQUISITE: ARTZ 352. Course in which student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of sculpture. Written, signed contract required prior to registering for this course.

ARTZ 461. Guided Research-Metalsmithing. 1-5 Credits. (1-5 Ind; 15 cr max) F,S,Su
PREREQUISITE: ARTZ 361. Course in which student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of metalsmithing. Written, signed contract required prior to registering for this course.

ARTZ 472. Guided Research- Printmaking. 1-5 Credits. (1-5 Ind; 15 cr max) PREREQUISITE: ARTZ 373, ARTZ 374, ARTZ 376, ARTZ 375, or ARTZ 379. Course in which student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of printmaking. Written, signed contract required prior to registering for this course.

ARTZ 490R. Undergraduate Research. 1-5 Credits. (1 Ind; 12 cr max) On Demand Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research.

ARTZ 491. Special Topics. 1-5 Credits. (1-5 Lec; 12 cr max) On Demand PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ARTZ 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor, and approval of the director. Directed research and study on an individual basis.

ARTZ 494. Undergraduate Seminar. 3 Credits. (3 Seminar) F,S
PREREQUISITE: If studio arts majors, students must be of junior standing, and have successfully passed the BFA portfolio review. If liberal arts студии option majors, students must be of senior standing and Consent of department. A weekly platform for critical and creative discussion in which students will study selected critical and/or philosophical readings while engaging in the production of studio work independently, in the media and formal framework that is appropriate to their work.

ARTZ 498. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor, and approval of the director. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

ARTZ 499R. Senior Thesis: Studio. 1-5 Credits. (1 Ind; 12 cr max) F,S,Su
Senior capstone course. Directed undergraduate research/creative activity which may culminate in a research paper, undergraduate thesis paper, or undergraduate thesis exhibition. Graphic design students must take this course in the spring. Course will address responsible conduct of research.

ARTZ 500. MFA Caucus. 1-3 Credits. (1-3 Sem) F,S
PREREQUISITE: MUST BE ENROLLED AS A STUDENT WITHIN THE SCHOOL OF ART MFA PROGRAM. COREQUISITES: MUST BE ENROLLED AS A STUDENT WITHIN THE SCHOOL OF ART MFA PROGRAM. Caucus is a seminar style course involving reading, writing analytical responses to, and constructive discussion around a selection of critical essays of topics including but not limited to: Philosophy, Art Historical, Aesthetic Theory, Cognitive Theoretical texts hereafter referred to as the Caucus Reader. Additional course content include addressing business related to the program when necessary, providing feedback to fellow graduate student’s as it pertains to pre-thesis and thesis drafts, orientations, and research as it pertains to bringing writing regarding your own practice to the table for discussion. Faculty and third year graduate students will alternate Wednesday nights as Caucus .

ARTZ 505. Painting. 1-5 Credits. (1-5 Ind) F,S,Su
Maximum 15 cr PREREQUISITE: ARTZ 421, graduate standing. Course in which the student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of painting.

ARTZ 515. Ceramics. 1-5 Credits. (1-5 Ind) F,S,Su
Maximum 15 cr PREREQUISITE: ARTZ 431, graduate standing. Course in which the student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of ceramics.

ARTZ 524. Metalsmithing. 1-5 Credits. (1-5 Ind) F,S,Su
Maximum 15 cr PREREQUISITE: ARTZ 461, graduate standing. Course in which the student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of metalsmithing.

ARTZ 526. Drawing. 1-5 Credits. (1-5 Ind) F,S,Su
Maximum 15 cr PREREQUISITE: ARTZ 411, graduate standing. Course in which the student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of drawing.
ARTZ 527. Printmaking. 1-5 Credits. (1-5 Ind) F,S,Su
Maximum 15 cr PREREQUISITE: ARTZ 472, graduate standing. Course in which the student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of printmaking.

ARTZ 529. Sculpture. 1-5 Credits. (1-5 Ind) F,S,Su
Maximum 15 cr PREREQUISITE: ARTZ 453, graduate standing. Course in which the student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of sculpture.

ARTZ 530. Intermedia. 1-5 Credits. (1-5 Ind) F,S,Su
Maximum 15 cr PREREQUISITE: ARTZ 352, ARTZ 312, ARTZ 322 and graduate standing. Course in which the student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of intermedia.

ARTZ 575. Professional Paper and Project. 1-4 Credits. (1-4 Ind; 6 cr max) F,S,Su PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major adviser and graduate committee.

ARTZ 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. Courses offered on a one-time basis to fulfill professional development needs of in-service educators. A specific focus is given to each course which is appropriately subtitled.

ARTZ 589. Graduate Consultation. 3 Credits. (3 Ind) F,S,Su PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

ARTZ 590. Master’s Thesis. 1-10 Credits. (1-10 Ind) F,S,Su Maximum 15 cr PREREQUISITE: Master’s standing.

ARTZ 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor, and Dean of Graduate Studies. Directed research and study on an individual basis.

ARTZ 594. Seminar. 1 Credit. (1 Sem; 5 cr max) On Demand PREREQUISITE: Graduate standing or seniory by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

ASTR - Physics-Astronomy
ASTR 1101N. Introduction to Astronomy: Mysteries of the Sky. 3 Credits. (3 Lec) F,S,Su
An introduction to contemporary astronomy that explores the nature, methods, and limitations of scientific inquiry within the context of our struggle to understand the structure and evolution of the Universe. Topics include the history of astronomy, motions of the night sky, the solar system, stellar evolution, galaxies, and cosmology. Common Exams.

ASTR 371. Solar System Astronomy. 4 Credits. (3 Lec, 1 Lab) PREREQUISITE: PHYS 205, PHYS 220, or PHYS 240. COREQUISITE: PHYS 207, PHYS 222, or PHYS 242. Covers the origin and development of our solar system, including detailed examinations of the sun, earth, moon, other planets, and satellites. Exciting new discoveries and emerging research results will be integrated into the course. The laboratory operates in a "project mode" and includes experiments with models that can be done indoors as well as with the use of telescopes.

ASTR 373. Stars, Galaxies, and the Universe. 4 Credits. (3 Lec, 1 Lab) PREREQUISITE: PHYS 205, PHYS 220, or PHYS 240. COURSEREQUISITE: PHYS 207, PHYS 222, or PHYS 240. After reviewing basic classical astronomy on the properties, structure and evolution of stars and galaxies, the course will introduce some hot topics in frontiers of astronomy, such as pulsars, quasars, black holes, and fate of the universe.

AVFT - Aviation Flight Training
AVFT 121. Aviation Fundamentals. 5 Credits. (5 Lec) F,S,Su
Introduction to basic flight principles. Course includes the principles of flight (basic aerodynamics), aircraft systems, performance, weight and balance, aviation physiology, federal air regulations, and flight publications.

AVFT 122. Private Pilot - Flight. 2 Credits. (2 Lab) F
Students must enroll in this course while pursuing a private pilot’s certificate from an approved flight school. Course credits will be awarded upon receipt of a copy of the student’s private pilot certificate.

AVFT 123. Private Pilot - Basic Air Nav. 3 Credits. F
Students must be co-enrolled in both AST-141 and AST-143. An introduction to air navigation procedures. Course includes basic meteorology, interpreting weather data, piloting and dead reckoning navigation, radio navigation, and cross-country flight planning.

AVFT 130. Meteorology for Aviation. 3 Credits. (3 Lec) F
COREQUISITE: Generally students will be concurrently enrolled in AST 141 and AST 143. Provides a detailed introduction to the environmental factors that are critical to safe flight operations. Includes the following: thermal patterns, horizontal and vertical motion, moisture clouds, precipitation, air masses, fronts, cyclones, thunderstorms and aviation hazards. Will also include meteorological flight planning, use of weather information systems, and reports and charts used for aviation weather reporting and forecasting.

AVFT 141. Advanced Navigation Systems. 3 Credits. (3 Lec) S
PREREQUISITE: AVFT 143 Advanced navigation systems includes HSI, RMI, Loran, Doppler, VOR, NDB and GPS. Will include navigation theory, in-flight emergencies, electronic instrumentation, and advanced flight computing problems. Extensive use of in-class computer flight simulation will be exercised. Provides the radio navigation skills necessary for the instrument pilot.

AVFT 142. Instrument Flight. 2 Credits. (2 Lab) S,F,S
PREREQUISITE: AST 142 Students must enroll in this course while pursuing the Instrument certificate at an approved flight school. Credits will be awarded upon receipt of a copy of the student’s instrument rating.

AVFT 143. Instrument Ground. 3 Credits. (3 Lec) S
PREREQUISITE: AVFT 122. An introduction to flight under IFR conditions. Course includes basic instrument flying, flight instruments, IFR charts and approach plate, IFR regulations and procedures, ATC clearances and IFR flight planning. Completion of the course will prepare the student for the Instrument Knowledge Exam.

AVFT 150. Aviation Operations. 3 Credits. (3 Lec) S
An overview of general aviation operations, specifically the operation and management of the Fixed Base Operation (FBO). This course also covers current events and trends affecting the general aviation industry as a whole.

AVFT 171. Aircraft Systems for Pilots. 3 Credits. (3 Lec) S
Introduction to basic aircraft systems found on modern single and multi-engine reciprocating aircraft. Topics will include piston engines, electrical systems, hydraulic and pneumatic systems, radios and instruments, propellers, pressurization, maintenance requirements and documentation, and trouble shooting from the cockpit.

This course will be introduced to the systems commonly found in the training aircraft you are now flying.

AVFT 191. UAS Fundamentals. 1 Credit. (1 Lec) F
COREQUISITES: AVFT 121. This course is an introduction to UAS (Unmanned Aerial Systems) systems and will provide students with the basic knowledge of UAS specific systems, regulations, performance, and a range of imaging technologies. Course includes flight planning, waiver application process, situational performance analysis, and imaging techniques/methodologies. Upon completion, the student will be prepared for the FAA Remote Pilot knowledge exam.

AVFT 245. Commercial Ground. 3 Credits. (3 Lec) F
PREREQUISITE: AVFT 145. Commercial Flight Maneuvers, Airplane Aerodynamics, Advanced Performance, Power plants (including fuel injection and turbo-charging), Environmental Control Systems and Retractable Landing Gear Systems will be taught. Also, airports (marking and lighting) will be reviewed. Advanced Weight and Balance, and Part 61, 91, 125, and 135 and NTBS 830 Commercial Pilot Regulations will build on the private pilot regulations learned earlier. High Altitude Physiology, and High Performance and Turbine-Aircraft Flight Operations will be emphasized.

AVFT 250. Commercial Flight 1 Single Eng. 2 Credits. (2 Lab) F,S
Students must enroll in this course while pursuing the Single engine commercial certificate at an approved flight school. Course credits will be awarded upon completion of 57.5 hours of commercial flight training.

AVFT 251. Commercial Flight 2 Single Eng. 2 Credits. (2 Lab) F,S
Students must enroll in this course while pursuing the single-engine commercial certificate at an approved flight school. Credits will be awarded upon completion of the FAA Commercial Pilot Certificate.

AVFT 252. Commercial Flight 1 2 Credits. (2 Lab) F,S,Su
PREREQUISITE: AVFT 122. Students must enroll in this course while pursuing the Multi-Engine commercial certificate at an approved flight school. Credits will be awarded upon completion of 57.5 flight hours of Commercial flight training.
AVFT 253. Commercial Flight 2. 2 Credits. (2 Lab) F,S
PREREQUISITES: AVFT 142, Instrument Flight. Students must enroll in this course while pursuing the Multi-engine commercial certificate at an approved flight school. Credits will be awarded upon completion of the FAA Commercial Pilot Certificate.

AVFT 260. Aviation Safety. 3 Credits. (3 Lec) F,S
This course will concentrate primarily on the organizations and processes that govern commercial and general aviation safety in the United States. This course will also provide an overview of modern techniques used in accident investigation. Also covered are descriptions of major factors and the causation of aviation accidents.

AVFT 261. Flight Instructor Theory. 4 Credits. (4 Lec) F,S
Students must enroll in this course while pursuing their Commercial certificate at an approved flight school. Credits will be awarded upon receipt of a copy of the student’s commercial certificate.

AVFT 262. Advanced Aircraft Theory. 3 Credits. (3 Lec) F
Prerequisite: Private Pilot Certificate and Instrument rating, or consent of instructor. Introduction to high performance, multi engine, aerobatic, and tailwheel aircraft; their systems, performance, weight and balance computations, flight procedures, characteristics, and emergencies. Unusual attitude recoveries, IFR and VFR.

AVFT 263. Aviation Regulations and Professional Conduct. 3 Credits. (3 Lec) S
Provides a detailed study of the regulations and procedures common to the aviation industry as well as a survey of the legal environment and the standards of conduct required of professional pilots.

AVFT 282. Certified Flight Instructor. 1 Credit. (1 Lec) S
Students must be enrolled in this course while pursuing their Certified Flight Instructor certificate. Credit for the course will be awarded upon completion of the FAA Certified Flight Instructor Practical Test.

BCH - Biochemistry

BCH 104RN. The Biochemistry of Health for Non-Science Majors. 4 Credits. (3 Lec, 1 Lab) S
Introduction for non-science majors to the biochemical basis of nutrition, health, DNA, and the human genome. The class and laboratory includes training for in depth searching of Internet and library information resources, evaluating and presenting the information found, and an introduction to DNA fingerprinting.

BCH 194. Seminar/Workshop. 1 Credit. (1 Sem) F
For the new student. Integration into the department and its research and educational program. Scientific communication and chemical literature searching skills. Cross-listed with CHMY 194.

BCH 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 6 cr max) F,S
PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

BCH 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S
On Demand. Consent of instructor and approval of department head. Directed research and study on an individual basis.

BCH 294. Seminar/Workshop. 1 Credit. (1 Sem; 4 cr max) F,S
PREREQUISITE: CHMY 194 or BCH 194. Introduction to faculty research through faculty mini seminars. Departmental research facilities. Research groups. Research planning decisions (MSU laboratory, summer internship, student exchange, REU, USP, etc.). Cross-listed with CHMY 294.

BCH 380. Biochemistry. 5 Credits. (4 Lec, 1 Lab) F,S,Su
PREREQUISITE: BIOB 160 or BIOL 260, and CHMY 211 or CHMY 323 or CHMY 333. Carbohydrate, lipid, protein, and nucleic acid structure and function; enzyme kinetics; energetics; major metabolic pathways for carbohydrates, lipids, and amino acids; photosynthesis; regulation of gene function. Students who have already taken this course and scored an 80% or better in the lab are eligible to be lab exempt. Contact department to register 994-4884.

BCH 394. Seminar/Workshop. 1 Credit. (1 Sem) F
PREREQUISITE: CHMY 294 or BCH 294. Research techniques, procedures, and reports. Seminar reporting and presentation skills. Career planning and resume preparation. May be repeated once. Cross-listed with CHMY 394.

BCH 441. Biochemistry of Macromolecules. 3 Credits. (3 Lec) F
PREREQUISITE: BIOB 160 or BIOL 260 and CHMY 323 or CHMY 333. Biochemical basis of modern molecular biology; structure and function of proteins, nucleic acids, and membranes; replication; transcription; translation; regulation of gene expression; and recombinant DNA.

BCH 442. Metabolic Regulation. 3 Credits. (3 Lec) S
PREREQUISITE: BCH 441 or consent of instructor. In-depth biochemical treatment of metabolism and its regulation in cellular processes.

BCH 444R. Biochemistry & Molecular Biology Methods. 3 Credits. (1 Lec, 2 Lab)
PREREQUISITE: BCH 441 or consent of instructor. This course focuses on molecular biology/biochemistry procedures integral to current research. Methods include PCR; gene cloning; DNA sequencing; and expression, isolation, purification, and characterization of the gene-encoded protein.

BCH 450. X-Ray Crystallography. 3 Credits. (3 Lec) S
PREREQUISITES: M 172 COREQUISITES: CHMY 323 or BCH 380 or BCH 441 or PHSX 224 or instructor’s approval. This course focuses on the theory of small and macromolecular structure determination by x-ray crystallography. Topics include crystallization of small and macromolecules, and molecular structure determination from single crystal X-ray diffraction data, including model building, refinement and validation. Co-Convened with BCH 550.

BCH 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S
PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

BCH 491. Special Topics. 1-4 Credits. (1-4 Ind; 12 or max)
On Demand. Consent of instructor as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BCH 492. Independent Study. 1-6 Credits. (1-6 Ind; 6 cr max)
On Demand. Consent of instructor, and approval of department head. Directed research and study on an individual basis.

BCH 494. Seminar/Workshop. 1 Credit. (1 Sem) F,S
PREREQUISITE or COREQUISITE: CHMY 394 or BCH 394. Senior capstone course. Taught in collaboration with departmental Honors Thesis, CHMY 499. The chemistry/biochemistry research undergraduate experience constitutes a synthesis of our (bio)chemistry class room and laboratory education. The projects are orally presented in seminar form, discussed on the basis of acquired knowledge, and analyzed using stringent scientific methods and criteria. A complete personal resume is prepared. May be repeated once. Cross-listed with CHMY 494.

BCH 499. Senior Thesis/Capstone. 1 Credit. (1 Lec) F,S
PREREQUISITE: CHMY 490R AND (BCH 394 OR CHMY 394). Senior capstone course. Taught in collaboration with departmental Honors Thesis, CHMY 499. The chemistry/biochemistry research undergraduate experience constitutes a synthesis of our (bio)chemistry class room and laboratory education. The projects are orally presented in seminar form, discussed on the basis of acquired knowledge, and analyzed using stringent scientific methods and criteria. A complete personal resume is prepared. May be repeated once. Cross-listed with CHMY 499.

BCH 524. Mass Spectrometry. 3 Credits. (3 Lec) F
Alternate years, to be offered odd years.
BCH 526. Adv Protein NMR Spectroscopy. 3 Credits. (3 Lec) F
Alternate years, to be offered even years.
PREREQUISITE: CHMY 323, This lecture-based course is designed to teach the fundamental principles of nuclear magnetic resonance (NMR) spectroscopy as it applies to the structural elucidations of proteins in solution. Pre-requisites include familiarity with linear algebra and basic trigonometric functions and CHMY 323. Cross-referenced with CHMY 526.

BCH 543. Proteins. 3 Credits. (3 Lec) F
Alternate years, to be offered odd years.

BCH 544. Seminar/Workshop. 1 Credit. (1 Sem) F
Alternate years, to be offered even years.
PREREQUISITE: CHMY 323, This lecture-based course is designed to teach the fundamental principles of nuclear magnetic resonance (NMR) spectroscopy as it applies to the structural elucidations of proteins in solution. Pre-requisites include familiarity with linear algebra and basic trigonometric functions and CHMY 323. Cross-referenced with CHMY 526.

BCH 545. Advanced Physical Biochemistry. 3 Credits. (3 Lec) S
Alternate years, to be offered even years.
PREREQUISITE: CHMY 324 AND BCH 441. Theoretical presentation of the molecular structures and interactions occurring in proteins and nucleic acids. Discussion of spectroscopy techniques used to study bio molecular structures and function. Includes concepts in: Nuclear Magnetic Resonance, X-ray Diffraction, Ultraviolet Absorption, Fluorescence, Circular Dichroism, Vibrational Spectroscopy, molecular motion and transport properties including diffusion, sedimentation, and viscosity.
BCH 547. Bioinorganic Chemistry. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: CHMY 401 AND BCH 441. This course provides an introduction and overview of the field of bioinorganic chemistry, the chemistry of metals in biological systems, with a particular emphasis on metal trafficking, metal center assembly and metal clusters in biology.

BCH 550. X-ray Crystallography. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: BCH 441 and BCH 442 or the equivalent and M 182M. This course focuses on theory and practice of molecular structure determined by x-ray crystallography. Topics include crystallization of macromolecules, molecular structure determination from x-ray data, and evaluation of the quality of the resulting macromolecular models. Co-Convened with BCH 450.

BCH 575. Professional Paper. 1-6 Credits. (1-6 Ind; 6 cr max) F,S
PREREQUISITE: Consent of instructor. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee. Cross-listed with CHMY 575.

BCH 590. Master's Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Master's standing.

BCH 591. Special Topics. 1-4 Credits. (1-4 Ind; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BCH 592. Independent Study. 1-3 Credits. (1 Ind; 3 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

BCH 594. Seminar. 1 Credit. (1 Sem; max unlimited) F
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material. May be repeated. Cross-listed with CHMY 594.

BCH 689. Grad Research/Instruction. 1-3 Credits. (1-3 Lec; 3 cr max) F,S,Su
PREREQUISITE: Graduate standing. COREQUISITE: BCH 590 or BCH 690.
Course instruction associated with directed graduate research/creative activity projects.

BCH 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: PhD standing.

BFIN - Business Finance

BFIN 205. Personal Finance. 3 Credits. (3 Lec) F On Demand
PREREQUISITE: Completion of University Core mathematics course. Financial concepts as they apply to daily life. Basics of consumer credit, personal investment, insurance, and personal financial planning. This course may not substitute for any required business course.

BFIN 290B. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F
Directed undergraduate research/creative activity which may culminate in a written work or other creative projects. Course will address responsible conduct of research. May be repeated.

BFIN 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BFIN 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of Associate Dean. Directed research and study on an individual basis. Not to be used as a substitute for a required course.

BFIN 322. Business Finance. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: Junior standing, ACTG 201, ECNS 204IS, and either M 161Q or STAT 216Q. Study of the principles of finance with emphasis on the application and integration of financial concepts in decision making.

BFIN 357. Financial Markets & Institutions. 3 Credits. (3 Lec) F,S
PREREQUISITE: Junior standing, ACTG 201, ECNS 204IS, and either M 161Q or STAT 216Q. Develops a sound understanding of why financial markets and institutions exist, their roles in a capitalist society, and how financial risk is managed most effectively. Focuses on applied analysis of financial institution risk, market operation, and products.

BFIN 409. Intro to Applied Investing. 1 Credit. (1 Rct) On Demand
PREREQUISITE: Junior standing. For business majors: formal admission to the College of Business. COREQUISITE: BFIN 322. Students gain hands-on experience by managing a real portfolio, thereby learning how to transact in securities, how the securities business operates, and how to apply various techniques and theories of finance.

BFIN 420R. Investments I. 3 Credits. (3 Lec) F
PREREQUISITE: BFIN 322 and BFIN 357; For business majors: formal admission to the College of Business. Course provides the foundation for students to comprehend the objectives, policies, concepts, analyses, techniques, practices, and theories in investments, both within the U.S. financial markets and globally.

BFIN 421. Real Estate and Investment Analysis. 3 Credits. (3 Lec) On Demand
PREREQUISITE: BFIN 322 or permission of instructor. For business majors: formal admission to the College of Business. To prepare students for careers in real estate, construction lending, real estate valuation, acquisition and asset management, and market and investment analysis. Much of the course material is also applicable to personal financial planning.

BFIN 435. Corporate Finance. 3 Credits. (3 Lec) F
PREREQUISITE: BFIN 322 and BFIN 357; For business majors: formal admission to the College of Business. In-depth extension of financial management topics introduced in BFIN 322. Topics include: risk, valuation, cost of capital, capital budgeting, capital structure, and payout policy.

BFIN 441. Advanced Analysis of Financial Statements. 3 Credits. (3 Lec) F,S
PREREQUISITE: ACTG 327; For business majors: formal admission to the College of Business; cross-listed with ACTG 441. Analysis with emphasis on how managers' investing and financing decisions have financial statement implications. Coverage includes: revenue recognition methods, cash flow analysis, ratios, inventory analysis, capitalization vs. expensing, depreciation, leasing vs. buying, and overall financial health and earnings quality of the firm.

BFIN 452. International Finance. 3 Credits. (1 Lec) On Demand
PREREQUISITE: BFIN 322. For business majors: formal admission to the College of Business. Focuses on the risks associated with financial management of a multinational company. Topics include: financial problems of multinational businesses, international financial environments, long-term capital commitments to international ventures, financial techniques for firm operation, and international investing.

BFIN 456. Financial Management for the Entrepreneur. 3 Credits. (3 Lec) F
PREREQUISITE: BFIN 322; for business majors: formal admission to the College of Business. Study of corporate finance issues confronting entrepreneurial firms. Focus is on financial forecasting and assessing financial needs. Students utilize fundamental financial principles to make small-business decisions. Topics include: strategic financing, financing alternatives, financial contracting, venture valuation, real options, and risk-sharing.

BFIN 458. Commercial Bank Management. 3 Credits. (3 Lec) S
PREREQUISITE: BFIN 322 or ECNS 313. For business majors: formal admission to the College of Business. Management of commercial banks, with emphasis on community banking issues. Course emphasizes measurement and control of key banking risks, methods of credit and collateral analysis, and overview of bank regulatory environment. Course includes issues in contemporary banking.

BFIN 459. Current Topics. 3 Credits. (3 Sem; 6 cr max) On Demand
PREREQUISITE: BFIN 435, BFIN 441, BFIN 420, BFIN 357, and senior standing. For business majors: Formal admission to the College of Business. Investigation of key issues which will determine future practices in finance.

BFIN 460. Derivative Securities and Risk Management. 3 Credits. (3 Lec) S
PREREQUISITE: BFIN 322 and BFIN 357; for business majors: formal admission to the College of Business. Introduction to derivative securities, their markets and their relation to the markets for real and financial assets. Focuses on the trading and valuation of derivative securities (futures, options, etc.), and their role in financial risk management for financial institutions and corporations.

BFIN 461. Portfolio Management. 3 Credits. (3 Sem, Max 6 cr) F
PREREQUISITE: BFIN 322. Students learn how to analyze a company from an investment standpoint and manage the DA Davidson Student Investment Program portfolio. Students apply portfolio theory to create an optimized version of the portfolio and compare its performance to the actual portfolio.
BFIN 466. Investments II. 3 Credits. (3 Lec) On Demand
PREREQUISITE: BFIN 420; for business majors: formal admission to the College of Business. Security and portfolio analyses, using fundamental and technical indicators, with evaluation of financial and economic environments. In-depth study of stocks, bonds, and derivatives. Risk hedging for both individual investors and portfolio managers, using analyses of embedded risk and returns.

BFIN 400R. Undergrad Research. 1-6 Credits. (1 Ind; 12 cr max) On Demand
PREREQUISITE: Senior standing and consent of instructor. For business majors: formal admission to the College of Business. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research.

BFIN 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) F,S
PREREQUISITE: Formal admission to the College of Business, consent of instructor and course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BFIN 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, formal admission to the College of Business, consent of instructor, and approval of Associate Dean. Directed research and study on an individual basis. Not to be used as a substitute for a required course.

BFIN 494. Seminar/Workshop. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper-division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

BFIN 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) F,S,Su
PREREQUISITE: Formal admission to the College of Business, and consent of instructor. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field. Directed research and study on an individual basis.

BFIN 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Upper-division courses and others as determined for each offering. For business majors: formal admission to the College of Business. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BFIN 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Graduate standing consent of instructor, approval of Associate Dean and Dean of Graduate Studies. Directed research and study on an individual basis.

BGEN - Business: General

BGEN 104US. Business & Entrepreneurship Fundamentals Seminar. 3 Credits. (3 Sem) F,S
University Seminar Core objectives are integrated into an interactive course that focuses on improving critical thinking, writing, and oral presentation skills while developing an entrepreneurial mindset and an understanding of fundamental business concepts in management, marketing, accounting, and finance. Intended for first semester freshmen.

BGEN 204. Business & Entrepreneurship Fundamentals. 3 Credits. (3 Lec) F,S
This interactive course focuses on developing an entrepreneurial mindset and understanding fundamental business concepts in management, marketing, accounting, and finance. Intended for transfers into the College of Business & Entrepreneurship, non-business majors, and those who have not taken BGEN 194US.

BGEN 210. Accounting & Finance Basics. 3 Credits. (3 Lec) F
PREREQUISITES: M 105Q (formerly M 145Q), M 121Q, STAT 216Q, or level 4 or 5 math course. Basics of accounting and finance for non-business students. Topics include fundamentals of accounting, financial statement and budget preparation/analysis, financial analysis/control, working capital management, time value of money, capital investment & financing decisions. May not be substituted for a course required for the business major.

BGEN 235. Business Law. 3 Credits. (3 Lec) F
Offered by Gallatin College. The course will emphasize business ethics, contracts, and employment obligations, including sales, agency, and tort law. The course content will help business leaders make informed decisions based on the philosophical, legal, and historical aspects of the regulatory environment.

BGEN 242D. Intro to Int'l Business. 3 Credits. (3 Lec) F
Introduces topics of globalization: differences in political economies, culture, legal systems, and ethical standards; international trade laws; issues in foreign direct investment trade alliances; global economic, financial, marketing, and human resource challenges; and organizational and strategic issues for international business.

BGEN 245D. Cultural Dimensions of International Business. 3 Credits. (3 Lec) F
On Demand
The course will help students recognize the importance cultural differences play in conducting international business transactions. They will analyze the nature and impact of some common problems resulting from not understanding how to deal appropriately with cultural differences.

BGEN 302. Career Perspectives. 1 Credit. (1 Lec) F,S
PREREQUISITE: Business major and BMGT 205. This highly interactive course helps students manage their career planning for business-related fields with an emphasis on life-long career exploration and planning. Topics include self-assessment, researching career information, understanding the job search process, interviewing skills, and professionalism.

BGEN 303. Professional Coaching Clinic. 1 Credit. (1 Sem) F,S
PREREQUISITES: Business major, BMGT 205 and consent of instructor. The mission of this course is to create in business students a passion for achieving professional excellence in career pursuits. Students work one-on-one with a coach to identify their strengths, weaknesses, competencies, interests, and personal and professional aspirations. May be taken instead of BGEN 302.

BGEN 361. Principles of Business Law. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: Junior standing. Survey of the U.S. legal system, business ethics, and the following areas of law: civil procedure, torts, contracts, UCC Article 2, intellectual property, employment, agency, and organizational forms. Emphasis on written and oral communication skills, critical thinking, and collaborative learning.

BGEN 365. International Practicum. 3 Credits. (3 Lec) F
PREREQUISITES: Consent of instructor; junior standing; admission to College preferred. Non-majors will be considered if space is available. Intensive study of culture, customs, politics, history, and business practices of another country. Program culminates with extended visit to location for lectures, and other relevant activities.

BGEN 468. Contemporary Issues in Business Ethics. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Senior standing or permission of the instructor. For business majors: formal admission to the College of Business. The relationship between business and society in the social, ethical, and natural environment. A focus on issues of business responsibility and ethics with emphasis on practical business problems of leadership and accountability.

BGEN 472. Legal and Social Framework of Business Regulation. 3 Credits. (3 Lec) On Demand
PREREQUISITE: BGEN 361 or consent of instructor. For business majors: formal admission to the College of Business. Study of legal and social basis for government regulation of business. Topics include environmental regulation, employment and labor law, securities regulation, antitrust, and international trade. Students research and make class presentation on regulatory issues.

BIOB - Biology-General

BIOB 1001N. Organism Function. 3 Credits. (3 Lec) F,S
This course examines biological origins and diversity of life on Earth, emphasizing biodiversity of principal biomes, origins of biodiversity, and exploring form, function, and adaptation of relevant biological systems, including photosynthesis, nutrition and immunity. The course also explores relevant ecological relationships among organisms with an emphasis on animals and plants.

BIOB 105CS. Introduction to Biotechnology. 3 Credits. (3 Lec) F
Introduction to an ever-growing industry. Course is designed to demonstrate the significance of biotechnology in today's world. Lecture series presented by research professors, social scientists, and industrial experts.

BIOB 110CS. Introduction to Plant Biology. 3 Credits. (3 Lec) S
Provides an understanding of basic plant science principles and the related environmental components that impact society. Current questions in plant biology, agriculture, and ecology are used to develop problem-solving skills and integrative thinking.
### BIOB 140R. Honors Molecular Biology, 4 Credits.

- Prerequisite: Restricted entry through the Honors Program. An introduction to molecular biology research with an emphasis on how gene expression is regulated in cells and organisms. Hands-on learning of basic techniques in cell and molecular biology will culminate in an independent research project.

### BIOB 160. Principles of Living Systems, 4 Credits.

- Prerequisite: CHMY 121N, or CHMY 154, or consent of instructor. Introduction to cellular organization and function. Topics covered include synthesis and function of macromolecules, cell organelles and structure, energy transformations in living systems, respiration, photosynthesis, the cell cycle, classical genetics, molecular genetics, and biotechnology. Common final.

### BIOB 170N. Principles of Biological Diversity, 4 Credits.

- Prerequisite: BIOB 100, 110, 170 or BIOM 103. This course examines the biology, ecology, and evolutionary relationships among living organisms. All forms of life will be considered, from single celled prokaryotes to multicellular eukaryotic plants and animals.

### BIOB 205. Methods in Biotechnology, 4 Credits.

- Prerequisite: CHMY 105C. This course will challenge students in the biotech major to learn a series of essential molecular techniques focusing on research and faculty interaction. The techniques learned will be highly applicable to the biotech industry, giving students a post-graduation competitive edge.

### BIOB 260. Cellular and Molecular Biology, 4 Credits.

- Prerequisite: CHMY 141 or CHMY 151, and STAT 216Q or M 171Q or M 181Q, with a grade of "C" or better. Corequisite: CHMY 143 or 153. Introduction to biological macromolecules, cell structures and function, and gene structure and expression. The laboratory portion will include both wet labs and computer-based modules.

### BIOB 280. Miracle molds, magic mushrooms: Fungi in our world, 3 Credits.

- Prerequisite: BIOB 100, 110, 170 or BIOM 103. A presentation of the fungi and their roles in nature and in shaping past and present civilizations. The historical and practical significance of fungi as decayers, as pathogens, as food, and as sources of mind-altering chemicals will be emphasized.

### BIOB 290R. Undergraduate Research. 1-6 Credits.

- Prerequisite: Sophomore standing and consent of instructor. Directed undergraduate research. Course will address responsible conduct of research.

### BIOB 291. Special Topics. 1-4 Credits.

- Prerequisite: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

### BIOB 318. Biometry. 3 Credits.

- Prerequisite: C- or better in any 100 level or above Math course. Analysis and interpretation of biological data. Topics include: measures of center and spread, probability, analysis of frequency data and proportions, comparing numerical values, comparing means of two or more groups, linear regression, correlation and modern statistical methods.

### BIOB 375. General Genetics. 3 Credits.

- Prerequisite: BIOM 160, BIOM 170N, BIOB 260, or BIOM 360. Introduction to classical and molecular genetics of eukaryotes, with emphasis on transmission genetics, the structure and regulation of genes, and mechanisms of genetic change.

### BIOB 377. Practical Genetics. 3 Credits.

- Prerequisite: BIOM 160 or BIOM 260 or consent of instructor. Examination of the modes of inheritance, gene expression and genetic manipulation of eukaryotic organisms, particularly those of flowering plants and mammals. Population genetics, genetic diversity and quantitative genetics are also discussed.

### BIOB 410. Immunology. 3 Credits.

- Prerequisite: CHMY 211 or CHMY 321. Fundamentals of cellular and molecular immunology including consideration of structure, genetics and function of immunoglobulin, T-cell receptors and major histocompatibility antigens; regulation of the immune response; transplantation and immunological diseases.

### BIOB 414. Advanced Microscopy. 1 Credit.

- Prerequisite: BIOM 360, BIOM 375, or consent of instructor. Introduction to instrument design, operation and applications, and to modern techniques in preparing specimens for microscopic analyses, including computer-assisted microscopic imaging technology and microinjection.

### BIOB 415. Adv Immunology Methods. 1 Credit.

- Prerequisite: BIOM 360, BIOM 375, or consent of instructor. This course provides hands-on experience on assays commonly used in immunology for the detection of an immune response.

### BIOB 420. Evolution. 3 Credits.

- Prerequisite: BIOM 375, BIOM 377, or BIOM 320. For seniors in biology. Evolutionary theory is presented and takes two principle directions, the study of evolutionary history, and the study of natural selection.

### BIOB 424. Ethical Practice of Science. 3 Credits.

- Prerequisite: BIOM 312, BIOM 321, or at least one three-hundred level series of any science course. Examines the evolution of the scientific process with specific focus on the ethical responsibilities of scientists and to examine policies and procedures developed by the scientific community to ensure integrity in the research process. Co-convened with BIOM 524.

### BIOB 425. Adv Cell & Molecular Biology. 3 Credits.

- Prerequisite: BIOM 260, BIOM 320, and BCH 380. In-depth study of cell structure and function. This course is co-convened with BIOM 525.

### BIOB 428. Molecular Evolution. 3 Credits.

- Prerequisite: BIOM 375, BIOM 377, or BIOM 320. For seniors in biology. Evolutionary theory is presented and takes two principle directions, the study of evolutionary history, and the study of natural selection.

### BIOB 429R. Undergraduate Research. 1-4 Credits.

- Prerequisite: Sophomore standing and consent of instructor. Directed undergraduate research. Course will address responsible conduct of research.

### BIOB 435. Advanced Molecular Biology. 3 Credits.

- Prerequisite: BIOM 360, BIOM 375, or consent of instructor. Theory and practice of molecular biology with an emphasis on the analysis of mammalian cells.

### BIOB 437. Introduction to Genomics. 3 Credits.

- Prerequisite: BIOM 360, BIOM 375, or consent of instructor. This course focuses on the techniques involved in the production of monoclonal antibodies.

### BIOB 438. Developmental Mechanisms. 3 Credits.

- Prerequisite: BIOM 375, BIOM 377, or BIOM 320. For seniors in biology. Evolutionary theory is presented and takes two principle directions, the study of evolutionary history, and the study of natural selection.

### BIOB 470R. Undergraduate Research. 1-4 Credits.

- Prerequisite: BIOM 375 or BIOM 377 or BIOM 320, and BIOM 420, and STAT 216Q completed (no concurrent registration). Introduces the theory and practice of conservation genetics, focusing primarily on animals. Case studies will be used liberally, and emphasis will be placed on interpreting genetic data. Readings will include primary literature. Co-convened with BIOM 548.

### BIOB 484. Population Genetics. 3 Credits.

- Prerequisite: BIOM 375, or consent of instructor. This course focuses on the techniques involved in the production of monoclonal antibodies.

### BIOB 490R. Undergraduate Research. 1-4 Credits.

- Prerequisite: BIOM 375, or consent of instructor. This course focuses on the techniques involved in the production of monoclonal antibodies.
and animal phenology, and disease outbreaks. Students explore how ecosystems are responding to climate changes at a range of scales.

**PREREQUISITE:** BIOB 160, and BIOB 170, and BIOE 370 or NRSM 240.

**BIOE 497. Educational Methods: Biology, 2 Credits.** (2 Lab; 4 cr max) F,S,Su

PREREQUISITE: Senior or junior standing, consent of instructor and department head. Provides deeper contact with a subject for those considering an academic career. This course experiences in a teaching laboratory under detailed academic supervision in recognition that teaching enhances learning. Includes the preparation, organization, presentation of materials, and student evaluation.

**BIOE 498. Internship/Cooperative Edu, 1-6 Credits.** (1-6 Ind; 6 cr max) F,S

PREREQUISITE: Junior standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

**BIOE 499. Senior Thesis/Capstone, 2 Credits.** (2 Sem) F,S

PREREQUISITE: Senior standing in the Cell Biology & Neuroscience Department or in the Plant Sciences & Plant Pathology Department and consent of instructor. Senior capstone course. Students are expected both to present and to discuss advanced topics from the current biomedical literature. These topics will expand upon material presented in regular courses in the biomedical science curriculum. Students will write at least one major paper.

**BIOE 524. Ethical Practice of Science, 3 Credits.** (3 Sem) S

This course exposes students to the ethical issues and federal requirements they will likely encounter throughout their careers and helps develop skills for resolving ethical issues encountered in scientific research. Co-convened with BIOB 425.

**BIOE 525. Adv. Cell & Molecular Biology, 3 Credits.** (2 Lec 1 Rec) S

PREREQUISITE: BIOE 260 and BCH 380 or BCH 441, and BIOE 375 or BIOH 320 In-depth study of cell signaling, structure and function. This course is co-convened with BIOB 425.

**BIO E - Biology-Ecological**

**BIOE 103CS. Environmental Science and Society, 3 Credits.** (3 Lec) F,S

Annually. The relationship between people and the environment using the earth as an ecosystem to show the effects of people’s activities on natural ecosystems. Environmental issues such as wilderness, wolf reintroduction, global warming, fire ecology, whirling disease, and grizzlies are covered.

**BIOE 290R. Undergraduate Research, 1-6 Credits.** (1-3 Ind; max unlimited) F,S

Demand

PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

**BIOE 291. Special Topics, 1-4 Credits.** (1-4 Lec 12 cr max) F,S

Max 12 credit PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

**BIOE 292. Independent Study, 1-3 Credits.** (1-3 Ind 6 cr max) F,S

Demand

PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

**BIOE 298. Internship, 1-4 Credits.** (1-4 Ind. Study. Max 8 credits) F,S, Su

PREREQUISITE: Approval of internship program by consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience. May be repeated.

**BIOE 370. General Ecology (equiv to 270), 3 Credits.** (3 Lec) F,S

PREREQUISITE: BIOE 170IN; M 121Q or M 161Q or M 171Q. Recommended: STAT 216Q or BIOE 318. Relation of organisms to their environment. The composition, structure, function and distribution of populations, communities, and ecosystems. Emphasis on population ecology, including demography, population dynamics and evolutionary ecology.

**BIOE 375. Ecological Responses to Climate Change, 3 Credits.** (3 Lec) S

PREREQUISITE: BIOE 160, and BIOE 170IN, and BIOE 370 or NRSM 240. Students explore how ecosystems are responding to climate changes at a range of spatial and temporal scales. Case studies include changes in vegetation and soils, plant and animal phenology, and disease outbreaks.

**BIOE 405. Behavioral and Evolutionary Ecology, 3 Credits.** (3 Lec) S

PREREQUISITE: BIOE 370 and at least Junior standing. Abundance and distribution of organisms in relation to their evolution, behavior, population biology and interactions with other organisms.

**BIOE 408. Rocky Mountain Vegetation, 3 Credits.** (2 Lec, 1 Lab) F

PREREQUISITE: Senior Class Standing in Biological Sciences major, or consent of instructor. Rocky Mountain Vegetation is an integrative, place-based course in vegetation ecology. Topics include: Geographic distribution and ecological characteristics of the component ranges of the Rockies, interaction of geology and soils with climate to produce the extreme environmental gradients typical of the Rockies, the basic autecology of dominant and widespread species that characterize the vegetation of the Rockies, the principles of disturbance and succession and how the vegetation of the Rockies exhibits those principles, the distribution and dynamics of the common plant communities of the Rockies in response to the variable environment.

**BIOE 416. Alpine Ecology, 3 Credits.** (1 Lec, 2 Lab) Su

PREREQUISITE: Junior standing, BIOE 170IN. The ecology characteristics of alpine areas. A three-day field trip will confirm and reinforce material presented in class and is a course requirement.

**BIOE 420. Field Ornithology. 3 Credits.** (3 Lec) Su

PREREQUISITE: Junior standing, and either BIOE 100IN or BIOE 170IN. Field identification, habitat affinities and life histories of birds of the northern Rockies. Includes early morning field trips.

**BIOE 421. Yellowstone Wildlife Ecology, 3 Credits.** (2 Lec 1 Lab) Su

PREREQUISITE: Junior standing, and BIOE 100IN or BIOE 170IN, and BIOE 370. Basic ecology of the major animal species of the Yellowstone area and the ecological controversies surrounding their management.

**BIOE 422. Insect Ecology. 3 Credits.** (3 Lec) S


**BIOE 424. Ecology of Fungi, 3 Credits.** (2 Lec, 1 Lab) F

Alternate years, to be offered odd years.

PREREQUISITE: BIOE 170IN, BIOE 256, a comparable course in introductory biology, or consent of instructor. COREQUISITE: None, but an upper division biology course is recommended. This course emphasizes the important and varied roles of the higher fleshy fungi in natural and managed systems, focusing on forest habitats. Fungi are the ecological backbone of many terrestrial systems, yet their ecological roles as saprophytes, symbionts, and mycorrhizal mutualists are often minimized. Both traditional techniques and more recent molecular methods will be presented at the individual, population, community, landscape, and biome levels, along with topics on fungal conservation and global change. This course consists of over weekly sessions of two hours each for lecture, discussions, and demonstrations. One or two afternoon or morning field trips to nearby forests are required to initiate a final project.

**BIOE 427RN. Research in Freshwater Ecology, 3 Credits.** (1 Lec, 2 Lab) F

PREREQUISITE: Junior standing; BIOE 370; Prior or concurrent registration in BIOE 428. This course is designed to expose students to the full process of designing and conducting research in freshwater ecosystems. Students will develop a research question, propose a study design, conduct field and laboratory research, and present their research in oral and written form. This course will also include a stream invertebrate collection and identification assignment.

**BIOE 428. Freshwater Ecology, 3 Credits.** (3 Lec) F

PREREQUISITE: BIOE 370 and Junior standing; or consent of instructor. This course examines relationships between freshwater organisms and their environment. Students learn about the ecology of rivers, lakes, reservoirs, and wetlands, with exposure to a wide diversity of organisms and processes. Emphasis is placed on linking basic concepts and real-world applications.

**BIOE 439. Stream Ecology, 3 Credits.** (2 Lec, 1 Lab) F

PREREQUISITE: BIOE 170IN, CHMY 121IN or CHMY 141, and PHSX 205. Examination of the structure and function of stream ecosystems emphasizing connections among stream organisms, the aquatic chemical and physical environment, and the surrounding terrestrial landscape.
BIOE 440R. Conservation Biology. 3 Credits. (3 Lec) F
PREREQUISITE: BIOE 370 and STAT 216Q and STAT 217Q, or equivalents, and Junior standing. RECOMMENDED: STAT 411. Examines issues relevant to conservation of wild populations, focusing primarily on animals. Emphasis is on approaches that use demography, population biology and genetics to address conservation questions. Approaches include empirical field studies, mathematical models, and the use of R programming for modeling and empirical analysis. Readings are from the primary literature and a textbook, including case studies. Cross-listed with BIOE 521.

BIOE 445. Macrosystems Ecology: Linking Plants, Animals, and Ecosystems Across Scales. 3 Credits. (3 Lec) S
PREREQUISITE: BIOE 370 and Junior standing. Advanced ecology designed to help students "put the pieces together" and understand how plants, animals, and ecosystems interact. These interactions are examined across biomes of the world to better understand general principles and to derive effective local management strategies.

BIOE 455. Plant Ecology. 3 Credits. (3 Lec) S

BIOE 490R. Undergraduate Research. 1-6 Credits. (1-6 Lec; 12 cr max)
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. Maximum of 6 credits as electives in Organismal Biology Option.

BIOE 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Max 12 credits PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

BIOE 492. Independent Study. 1-3 Credits. (1-3 Ind; 3 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor and approval of department head. Maximum of 6 as electives in Organismal Biology Option. Directed research and study on an individual basis.

BIOE 494. Seminar/Workshop. 1 Credit. (1 Sem; 4 cr max)F
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students attend and discuss seminar presentations by professional biologists.

BIOE 498. Internship. 1-4 Credits. (1-4 Internship) On Demand PREREQUISITE: Approval of intern program by instructor and the department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience.

BIOE 499. Senior Thesis/Capstone. 2 Credits. (2 Sem) F,S
PREREQUISITE: Senior standing in Ecology Department, and prior or concurrent registration in BIOE 420. Senior capstone course. Discussion of topics that integrate evolutionary theory with ecology, genetics, medicine, behavior, or other subjects that are part of the biology curriculum.

BIOE 513. Terrestrial Ecology of Plains and Prairies. 1 Credit. (1 Rec) Su PREREQUISITE: Either BIOE 408 or BIOL 516, graduate standing, secondary teacher certification, two years teaching experience, and computer access. COREQUISITE: Suggested: ESCI 513. Students will develop plant keys for classroom use, quantitatively analyze two grassland communities, and develop classroom activities on ecology of grasslands. Distance learning, class offered by internet connection. This course is designed for secondary school teachers enrolled in the MSSE program and cannot be used in graduate programs in Biological Sciences.

BIOE 514. Ecological Modeling. 3 Credits. (3 Lec)F alternate even years PREREQUISITE: BIOE 370. Interactions and feedbacks between vegetation, disturbance, and climate will be explored using biogeochemistry and biogeochemical models. Theory and computational techniques in ecological modeling.

BIOE 515. Landscape Ecol & Mgmt. 4 Credits. (2 Lec, 2 Lab) F alternate years, to be offered odd years.
PREREQUISITE: Graduate standing or consent of instructor. Principles on landscape pattern, change, and function. Application of theory to conservation including population viability, reserve design, multiple-use landscapes. Lab introduces GIS, GPS, and simulation models. For graduate students and motivated undergraduates.

BIOE 517. Advances in Ecological Modeling. 3 Credits. (3 Lec)S PREREQUISITE: BIOE 370. Advances in numerical modelling of disturbance, demography, and ecophysiology will be introduced with lectures and applied computational examples.
BIOE 542. Community Ecology. 3 Credits. (3 Lec/S) Alternate Odd Years. PREREQUISITE: At least one upper division or graduate course in each of the following: ecology and statistics, or consent of instructor. Focuses on the origin, maintenance, and consequences of biological diversity within local communities by examining studies of natural patterns, explorations of mathematical models and direct experimentation. The complexities of species interactions are explored in multi species assemblages.

BIOE 548. Conservation Genetics. 3 Credits. (3 Lec) PREREQUISITES: BIOB 375 or BIOB 377 or BIOH 320 and BIOB 420, and STAT 216Q. Introduction to the application of genetics for the conservation of plant and animal populations. Emphasis will be placed on case studies from the primary literature and analyzing genetic data using mathematical models developed in class. Cross-listed with BIOB 480.

BIOE 554. Foundations of Ecology & Mgmt. 1 Credit. (1 Rec) F This course explores the origin, maturation, and application of core principles in ecology. Students gain an appreciation for the scope of ecology, how theory and application are linked, and how big ideas in ecology have matured (or not) over time.

BIOE 555. Communication in Ecol Sciences. 1 Credit. (1 Sem) S PREREQUISITES: Graduate standing, consent of instructor. This course will require students to gain experience presenting scientific information in a variety of communication methods.

BIOE 575. Professional Paper and Project. 1-4 Credits. (1 Ind; 4 cr max) F,S Su Graduate standing and committee approval and consent of instructor. A research or professional paper or project dealing with a topic in the field. The topic must be mutually agreed upon by the student and his or her major advisor and graduate committee.

BIOE 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su PREREQUISITE: Master’s standing.

BIOE 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: Upper division courses and others as determined for each offering. Consent of instructor required. Taught to any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BIOE 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

BIOE 593. Alpine Ecology for Teachers. 2 Credits. (1 Lec. 1 Lab) Su PREREQUISITES: A minimum of two years science teaching experience. The primary goals in this course will be to understand how altitude affects the structure, function and evolution of alpine and sub-alpine plants and animals, and to create ways to bring this understanding into the grade 6-12 classroom. We will explore and gather information about alpine plants and animals, and discover how to design and implement classroom activities related to these topics.

BIOE 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand PREREQUISITE: Graduate standing or seniors by petition and course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

BIOE 595. Ecology and Conservation of the World’s Marine Ecosystems for Teachers. 3 Credits. (1 Lec. 1 Lab. 1 Rec) F PREREQUISITES: A minimum of two years science teaching experience. This course is designed for teachers to gain a broad understanding of structure and function of the world’s marine ecosystems and a broad knowledge of the major conservation issues in the oceans including climate change, overfishing, coral reef loss, and ocean acidification. The course will integrate in-depth study of each of the major marine ecosystems with reading and discussion of major conservation issues.

BIOE 596. Land Use Issues in GYE for Teachers. 2 Credits. (1 Lec. 1 Rec) Su PREREQUISITES: Teacher of science with two years minimum teaching experience. This course will lay the groundwork for an understanding the legal and political basis for scientific management of natural resources. Readings, field visits and skill-building exercises will equip science educators with the social context of complex ecological issues.

BIOE 597. Ecology of Trout Steams for Teachers. 2 Credits. (1 Lec. 1 Lab) Su PREREQUISITES: A minimum of 2 years science teaching experience. Montana is home to world-renowned trout streams, and this course is designed to delve into how trout and trout streams function and some of the current issues surrounding their management. The course content will include principles and techniques for studying trout and trout streams in the laboratory and the field. This course will combine laboratory lectures and exercises with day-long field visits to area streams to collect aquatic insects, conduct habitat analyses, and view various types of stream management practices. On one field trip, students will don wets suits and directly observe trout behavior.

BIOE 598. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

BIOE 599. Advanced Ecology for Teachers. 2 Credits. (1 Lec. 1 Lab) S PREREQUISITES: A minimum of two years science teaching experience. Our primary goals in this course will be to understand the theoretical underpinnings of ecological interactions and link these theories to the real world study of ecology. Through a mix of class and field work, students will move rapidly from foundational theory, to hands-on field work and data collection, to the basics of analyses. The course capitalizes on the ecology of Yellowstone in winter.

BIOE 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su PREREQUISITE: Doctoral standing.

BIOH 112. Human Form & Function I. 3 Credits. (3 Lec. 1 Lab) F Offered by Gallatin College. Human anatomy, physiology, and pathology; including etiology, prognosis, medical treatment, signs and symptoms of diseases of respiratory, endocrine, excretory, and reproductive systems. Proper diet and nutrition guidelines are also addressed. This course will focus on the key elements of anatomy and physiology necessary for students in allied health professions, specifically those who will work the areas of community health, health enhancement education, health promotion, and kinesiology. The aim of this course is for students to demonstrate working knowledge of the muscular, skeletal, nervous, cardiovascular, and respiratory systems, and to demonstrate an understanding of the endocrine and digestive systems and body metabolism.

BIOH 113. Human Form and Function II. 3 Credits. (3 Lec) S Offered by Gallatin College. Human anatomy, physiology, and pathology; including etiology, prognosis, medical treatment, signs and symptoms of diseases of muscular, skeletal, nervous, cardiovascular, and lymphatic systems.

BIOH 185. Integrated Physiology I & 4 Credits. (3 Lec. 1 Lab) F COREQUISITES: CHMY 141 or CHMY 151. How the human body works. For students planning to be health professionals. Includes basic cellular mechanisms, physiological control and communications. Major topics include muscle, nerve, respiratory, renal and cardiovascular systems. Cadaver laboratory will cover related human anatomy.

BIOH 201. Human Anatomy and Physiology I & 5 Credits. (3 Lec. 1 Lab) F,S,Su PREREQUISITES: CHMY 121H, CHMY 141, or CHMY 151, with a grade of "C-" or better; priority given to majors requiring this course. General principles of cell and tissue biology that apply to all living systems. Structure and function of skeletal, muscular, nervous, and endocrine systems. Homeostasis, control, and integration of the human body will be emphasized. Laboratory will cover related systems. This course is not repeatable without prior consent of instructor.

BIOH 211. Human Anatomy and Physiology II & 4 Credits. (3 Lec. 1 Lab. 1 Rec) S,F,F,S,Su PREREQUISITE: BIOH 201 with grades of "C-" or better. Function of the human digestive, cardiovascular, respiratory, reproductive, and urinary systems. Principles of integration, metabolism, energy flow and homeostasis will be emphasized.
BIOH 291. Special Topics. 3 Credits. (2 Lec, 1 Rct) S
Spring 2016 Topic: Global Health. Survey the historical and emerging trends in health issues around the world. Develop a fluency in what health issues are occurring in the various regions around the globe. Establish a basic knowledge of the culture, environment, politics and geography of key global regions.

BIOH 303. Global Diseases and Health Disparities. 3 Credits. (3 Lec) F
Survey the historical and emerging trends in health issues around the world. Develop a fluency in what health issues are occurring in the various regions around the globe. Establish a basic knowledge of the culture, environment, politics and geography of key global regions.

BIOH 309. Human Neuroanatomy. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: BIOH 185 or BIOH 201 and Junior standing or consent from instructor. Covering the organization and function of the human nervous system. The course will emphasize theories of its normal functioning and its responses to environmental change, as it is learning and structural modification. Homeostasis will be emphasized.

BIOH 313. Neurophysiology. 3 Credits. (3 Lec) F
PREREQUISITE: BIOB 260. Physiology of integrative mechanisms in nervous systems. Topics range from the mechanisms of synaptic transmission and action potential generation to the neural basis of learning and memory.

BIOH 320. Biomedical Genetics. 3 Credits. (3 Lec) S
PREREQUISITE: BIOB 260. Introduction to fundamental principles of eukaryotic molecular genetics. Emphasis on the genetics of the major model organisms of biomedical research and how they are exploited to understand human biology and disease.

BIOH 323. Human Developmental Biology. 4 Credits. (4 Lec) S
PREREQUISITE: BIOB 260. Developmental Biology: Introduction to the cell signaling pathways and morphogenetic processes that establish the basic vertebrate body plan. Includes hands-on study of chicken and frog embryos.

BIOH 395. Human Pathophysiology. 3 Credits. (3 Lec) S
PREREQUISITE: BCH 380 or consent of instructor. Students will research two diseases of their own choosing and give a class presentation of their findings. The presentation normally includes diagnosis, pathophysiology, and treatment.

BIOH 405. Hematology. 3 Credits. (3 Lec) F
PREREQUISITE: BIOB 410 or BCH 380 are recommended. A study of the function, biochemistry, cell biology, and pathology of blood and its constituents.

BIOH 406. Hematology Laboratory. 1 Credit. (1 Lab) F
COREQUISITE: BIOH 405. Methods of examining white blood cells, red blood cells, and platelets. Also included is the examination of abnormal blood cells, hemostasis, and fluorescent antibody cell sorting analysis.

BIOH 409. Advanced Human Torso Anatomy. 4 Credits. (2 Lec, 2 Lab) F
PREREQUISITES: Junior standing and 2 upper division biology courses and consent of instructor. Covers thorax and abdomen anatomy, emphasizing topography and three dimensional relations. Instruction will be based on student dissections of human cadavers, with lectures covering structure and function, as well as pathology typically encountered in the dissection laboratory. Co-convened with BIOH 509.

BIOH 411. Adv Human Anatomy. 4 Credits. (2 Lec, 2 Lab) S
PREREQUISITE: Senior standing, completion of at least two upper division courses in the biological sciences and consent of instructor. Covers back, extremities and joint anatomy, emphasizing topography and three dimensional relations. Instruction will be based on student dissections of human cadavers, with lectures covering structure and function, as well as pathology typically encountered in the dissection laboratory. Class can fulfill 4 upper division honor credits, if prerequisites are satisfied.

BIOH 420. Molecular Genetics. 3 Credits. (3 Lec) S
PREREQUISITE: BIOH 320. This course will focus on the use of current molecular genetic methods in biomedical research for editing and functionally analyzing eukaryotic genomes.

BIOH 422. Genes and Cancer. 3 Credits. (3 Lec) F
PREREQUISITE: BIOH 320. This course will focus on the molecular and cellular mechanism of human cancer. The role of oncogenes and tumor suppressor genes in normal and cancerous cells will be examined, with an emphasis on how mutations in certain genes result in altered cell-cell signaling and cell proliferation. The role of genetic mutation in breast, colorectal and lymphoma cancers will be discussed, along with new technologies to detect and treat these cancers.

BIOH 425. Sensory Neurophysiology. 3 Credits. (3 Lec) S
PREREQUISITE: BIOH 313. Neurophysiology of sensory cells and systems. Topics range from the mechanisms underlying sensory reception to the processing of sensory information at higher stages. The major focus will be on human sensory systems. Pathologies that effect sensory perception will be considered.

BIOH 428R. Molecular Neurological Disease. 3 Credits. (1 Lec, 2 Rec) F
PREREQUISITES: BIOH 313 CO REQUISITES: BIOB 425 This course will give an in-depth view of the molecular aspects of neuroscience. Student projects will then use that knowledge to research the current state of molecular understanding of a chosen neurological disease.

BIOH 430. Neuroethology. 3 Credits. (Lec) S
PREREQUISITE: BIOH 313 Introduction to the study of neuroethology based on a review of historically significant and modern primary research materials. In this class we will explore a number of ‘model systems’ that have been used extensively to develop our current understanding of the neural bases of animal and human behavior. This includes sound localization in owls, echolocation in bats, electrolocation in various fish and number of varied sensory systems used for species-specific communication in both vertebrates and invertebrates.

BIOH 435. Cognitive Neuroscience. 3 Credits. (3 Lec) F
PREREQUISITE: BIOH 313. This course will survey our present knowledge of the neural basis of normal and abnormal cognitive function in humans and non-human primates. Topics will range from perception and action to attention, consciousness and mental illness.

BIOH 440. Neuroscience of Mental Illness. 3 Credits. (3 Lec) S
PREREQUISITE: BIOH 313. Survey of the major categories of human mental illness and their underlying neural mechanisms and treatments.

BIOH 444. Modeling Brain Disorders. 3 Credits. (3 Lec) F
PREREQUISITES: BIOB 425 and BIOH 313. In this course, students will delve into the primary research literature in the field of behavioral neuroscience. We will study a variety of model systems and paradigms used to study neurological and psychiatric disorders. In addition, students will learn to effectively communicate about science orally and in writing.

BIOH 445. Intro Pharmacology. 3 Credits. (3 Lec) F
PREREQUISITE: BIOH 185 or BIOH 201 and BIOB 260. An introduction to the pharmacodynamics of drug action. Major classes of pharmaceutical drugs will be studied to understand their mechanism of action at the cellular and organ levels. Clinical trials for new drugs will also be considered.

BIOH 454. Microanatomy (Histology). 4 Credits. (2 Lec, 1 Lab) On Demand
PREREQUISITE: Consent of instructor. Covers an introductory microscopic study of cells, tissues and selected mammalian organs. Emphasizing normal structure and function relating to disease processes in specific organ systems. Class discussion will relate the normal microanatomy to human pathophysiology.

BIOH 455. Molecular Medicine. 3 Credits. (1 Lec) F
PREREQUISITE: BIOH 320 and BCH 380. Lecture and seminar courses based on recent, original papers. Moves from human disease to molecular explanations. Intended for upper level students with a strong background in biology.

BIOH 464. Clinical Hematology and Body Fluids. 2 Credits. (1 Lec, 1 Lab) Su
PREREQUISITE: Acceptance in professional training program. Topics include a review of normal hematopoiesis; red blood cell, white blood cell, and platelet disorders; body fluid overview; and an introduction to hematology instrumentation.

BIOH 465R. Gene Expression Lab: From Genes to Proteins to Cells. 3 Credits. (3 Lab) On Demand
PREREQUISITE: BIOB 425 and BCH 380 This course will give students the opportunity to design a unique research project, then learn and use the appropriate methods to pursue their research question. The course will expose students to the research process used in most basic science labs.

BIOH 466. Clin Microbiology 1. 3 Credits. (2 Lec, 1 Lab) Su
PREREQUISITE: Acceptance in professional training program. Topics include a review of medical microbiology, virology, mycology, parasitology, and clinical laboratory testing procedures.

BIOH 467. Clinical Chemistry 1. 3 Credits. (2 Lec, 1 Lab) Su
PREREQUISITE: Acceptance in professional training program. Topics include an introduction to theories and principles with emphasis on all body systems, and the role of instrumentation in the clinical chemistry laboratory.

BIOH 468. Clinical Immunohematology 1. 3 Credits. (2 Lec, 1 Lab) Su
PREREQUISITE: Acceptance in professional training program. Basic techniques in blood banking. Topics to be included are: ABO/Rh typing, antibody identification, transfusion therapy and reactions, donor collection and component preparation.

BIOH 469. Essentials of Clinical Lab Practice. 1 Credit. (1 Lab) Su
PREREQUISITE: Acceptance in professional training program. Provides an orientation to the program, safety information, phlebotomy training, and an overview of management practices. Also includes instruction in hemostasis, molecular diagnostics and urinalysis.
PREREQUISITE: Students must be accepted to the MMLS training program.

BIOH 470. Summer Clinical Laboratory. 12-13 Credits. Su

PREREQUISITE: To take this course, students must be accepted into a professional training program. This is a clinical laboratory science course, which will be conducted at affiliate training programs during the summer of a student’s senior year. It includes student lecture and laboratory instruction in clinical immunohematology, clinical chemistry, phlebotomy, clinical hemostasis, clinical microscopy and urinalysis, clinical body fluids, transfusion techniques, and clinical microbiology.

BIOH 471. Professional Training I. 12-13 Credits. (12-13 Lec; 13 cr max) F

PREREQUISITE: To take this course, students must be accepted into a professional training program. BIOH 470. Students will review basic and advanced information in immunohematology, clinical chemistry, clinical hematology, clinical microbiology, clinical immunology, medical mycology, and phlebotomy techniques. Students will perform patient laboratory testing under the guidance of trained professionals.

BIOH 472. Professional Training II. 12-13 Credits. (12-13 Lec; 13 cr max) S

PREREQUISITE: To take this course, students must be accepted into a professional training program. BIOH 471. Students will learn financial and quality management information of the clinical laboratory and study advanced immunohematology, clinical chemistry, clinical microbiology, and clinical hematology. During this course, students will perform actual patient laboratory testing under the guidance of trained professionals.

BIOH 473. Laboratory Practice II. 1 Credit. (1 Lab) F

PREREQUISITE: Students must be accepted to the MMLS training program. Essential skills for performing phlebotomy, laboratory specimen collection, handling and preparing samples for laboratory analysis and interpersonal communication skills will be emphasized.

BIOH 474. Clinical Hematology II. 2 Credits. (2 Lab) F

PREREQUISITE: Students must be accepted to the MMLS training program. Blood cell identification, manual and automated procedures for the assessment of hemolytic disease will be emphasized. Students will begin to learn to assess, interpret and correlate hematologic data with disease.

BIOH 475. Clinical Hemostasis. 1 Credit. (1 Lab) F

PREREQUISITE: Students must be accepted to the MMLS training program. Laboratory skills using manual and automated procedures will be emphasized. Students will assess, interpret and correlate data as it relates to normal and abnormal hemostasis and anticoagulant therapy.

BIOH 476. Clinical Microbiology II. 3 Credits. (3 Lab) F

PREREQUISITE: Students must be accepted to the MMLS training program. The ability to differentiate pathogens from commensals and perform identification procedures and antimicrobial susceptibility testing are emphasized along with an introduction to specialized and automated testing.

BIOH 477. Clinical Chemistry and Urinalysis II. 3 Credits. (3 Lab) F

PREREQUISITE: Students must be accepted to the MMLS training program. Manual and automated procedures for determining chemical analytes in blood and body fluids and the associated disease conditions will be emphasized along with an introduction to specialized testing.

BIOH 478. Clinic Immunohematology II. 2 Credits. (2 Lab) F

PREREQUISITE: Students must be accepted to the MMLS training program. Maintenance of blood components and performing routine and basic problem solving procedures in the blood bank will be emphasized. Correlation of immunohematology theory and disease with testing and transfusion practices and patient care will be covered.

BIOH 479. Clinical Immunology/Serology. 1 Credit. (1 Lab) F

PREREQUISITE: Students must be accepted to the MMLS training program. Assessment, interpretation and clinical significance of immunology principles and techniques and their correlation to laboratory data and patient disease will be emphasized.

BIOH 482. Laboratory Practice III. 2 Credits. (2 Lab) S

PREREQUISITE: Students must be accepted to the MMLS training program. A two week rotation in a small hospital laboratory provides an opportunity to experience a different work environment and practice laboratory skills.

BIOH 484. Clinical Hematology III. 2 Credits. (2 Lab) S

PREREQUISITE: Students must be accepted to the MMLS training program. Competence in performing testing and the ability to assess, interpret, and correlate hematologic data with other patient information to recommended additional testing, diagnosis, and probable treatment option for the patient will be emphasized.

BIOH 485. Clinical Microbiology III and Molecular Diagnostics. 2 Credits. (2 Lab) S

PREREQUISITE: Students must be accepted to the MMLS training program. Competently identify and provide susceptibility data for microorganisms isolated from human specimens including clinically significant yeasts, molds, parasites, viruses and mycobacterium. Perform molecular diagnostic techniques available.

BIOH 487. Clinical Chemistry III. 2 Credits. (2 Lab) S

PREREQUISITE: Students must be accepted to the MMLS training program. Achieve entry level knowledge of disease processes, and exhibit professional competencies in clinical chemistry laboratory procedures and the operation of laboratory instrumentation.

BIOH 488. Clinical Immunohematology. 3 Credits. (3 Lab) S

PREREQUISITE: Students must be accepted to the MMLS training program. Attain competency and the ability to correlate testing data to theory and initiate advanced techniques where appropriate. Students will demonstrate entry level competency by managing the daily aspects of blood bank operation.

BIOH 489. Laboratory Management. 1 Credit. (1 Lab) S

PREREQUISITE: Students must be accepted to the MMLS training program. General management policies, principles, and procedures necessary for efficient operation of a clinical laboratory will be emphasized along with federal and state regulations which govern the clinical laboratory.

BIOH 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su

PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

BIOH 491. Special Topics. 1-4 Credits. (1-4 Lab; 12 cr max) On Demand P

PREREQUISITE: BIOH 260. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

BIOH 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand P

PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

BIOH 509. Advanced Human Torsos Anatomy. 4 Credits. (2 Lec; 2 Lab) F

PREREQUISITE: Degree-seeking graduate student, undergraduate A & P coursework Covers thoracic, abdominal and pelvic anatomy, emphasizing anatomical landmarks and relationships. Instruction will be based on student dissections of human cadavers, and lectures covering structure, function, and common pathology. Co-ordinated with BIOI 409.

BIOH 510. Topics in Neurobiology. 3 Credits. (2 Lec. 1 Lab) S

PREREQUISITE: Graduate standing and at least one upper division or graduate course in neurobiology. Recent advances in topics in neurobiology with emphasis in different years on either neurocytology, neuroendocrinology/neuroimmunology, or developmental neurobiology.

BIOH 511. Advanced Human Anatomy. 4 Credits. (2 Lec. 2 Lab) S

PREREQUISITE: Degree-seeking graduate student, undergraduate anatomy and physiology work covers the musculoskeletal system of the back and upper and lower extremity and arthrology, emphasizing anatomical landmarks and relationships. Integrating of vascular and nervous supply along with the understanding of kinesiology will also be a major focus. Instruction will be based on student dissections of human cadavers, and lectures covering structure, function, and common pathology. Cross-Listed with BIOH 411.

BIOH 520. Molecular Genetics. 3 Credits. (3 Lec) S

PREREQUISITE: BIOH 320. This course will focus on the use of current molecular genetic techniques in biomedical research for editing and functionally analyzing eukaryotic genomes.

BIOH 528. Molecular Basis of Neurological Diseases. 3 Credits. (1 Lec, 1 Ind, 1 Ret) F

PREREQUISITE: BIOH 313 and BIOH 525 or consent of instructor. This course will give an in-depth view of the molecular aspects to neuroscience. Student projects will then use that knowledge to do their own research into the current molecular understanding of a chosen neurological disease and writing up an NIH research proposal.

BIOH 542. Survey of Current Cell Signaling. 2 Credits. (2 Sem.; max 12) S

This course will be in a journal club style where peer reviewed articles will be presented and discussed in a critical fashion. The goal is to learn how to synthesize information, develop critical thinking, keep up with the literature, learn about new topics and foster interdisciplinary interactions. Topics will be student driven with the restriction that they fall under the broad umbrella of cell signaling.
**BIOL 565. Gene Expression Lab: From Genes to Proteins to Cells.** 3 Credits. (3 Lec) S
PREREQUISITES: BIOL 425 and BCH 380. This course is intended to develop a specific research question and to learn the appropriate techniques necessary to address the chosen research question. The primary focus will be experience with a wide breadth of laboratory techniques including tissue culture, heterologous expression, microscopy, RNA extraction, RT-PCR, gene expression analysis, protein extraction, protein expression analysis, and data quantification.

**BIOL 590. Master’s Thesis.** 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing.

**BIOL 592. Independent Study.** 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

**BIOL 594. Seminar.** 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Graduate standing or seniors by petition and course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

**BIOL 595. Anatomy & Physiology for Tchrns.** 3 Credits. (1 Lec. 1 Lab. 1 Rec) Su
PREREQUISITE: Teacher of science with a minimum of two years teaching experience. Must have solid background in life science. This course is designed for high-school and post-secondary instructors who are either currently teaching an anatomy and physiology course or are interested in developing one. The goal of the course is to help instructors develop an A&P curriculum that integrates Next Generation Science Standards. Participants from all A&P instructional backgrounds are welcome and should expect to work in a collaborative environment.

**BIOL 690. Doctoral Thesis.** 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral standing.

**BIOL - Biology**

**BIOL 409. Advanced Human Torso Anatomy.** 4 Credits. (2 Lec, 2 Lab) S
PREREQUISITE: Junior standing and 2 upper division biology courses and consent of instructor. Covers thorax and abdomen anatomy, emphasizing topography and three dimensional relations. Instruction will be based on student dissections of human cadavers, with lectures covering structure and function, as well as pathology typically encountered in the dissection laboratory.

**BIOL 490R. Undergraduate Research.** 1-6 Credits. (1 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

**BIOL 492. Independent Study.** 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

**BIOL 510. Topics in Neurobiology.** 3 Credits. (2 Lec, 5 Lab; 9 cr max) S
PREREQUISITE: Graduate standing and at least one upper division or graduate course in neurobiology. Recent advances in topics in neurobiology with emphasis in different years on either neurocognition, neuroendocrinology/neuroimmunology, or developmental neurobiology.

**BIOL 588. Professional Development.** 1-3 Credits. (1-3 Lec; 3 cr max) On Demand
PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. Courses offered on a one time basis to fulfill professional development needs of in service educators. A specific focus is given to each course which is appropriately subtitled. May be repeated.

**BIOL 591. Special Topics.** 1-4 Credits. (1-4 Lec) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

**BIOL 592. Independent Study.** 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

**BIOL 690. Doctoral Thesis.** 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral standing.

**BIOM - Biology-Micro**

**BIOM 101. Careers in Microbiology.** 1 Credit. (1 Lec) F
The course introduces students to educational and career opportunities in the fields of medical, molecular, ecological, and environmental microbiology. The course introduces students to the various options in the microbiology degree program. It will emphasize the differences in the options and the employment opportunities in each once a degree has been obtained.

**BIOM 103IN. Unseen Universe: Microbes.** 3 Credits. (2 Lec, 1 Lab) F,S
Beneficial and harmful effects of microorganisms on individual health, public health, food and water quality; are relevant to an informed citizen of the 21st century. Current news topics and historical perspectives are emphasized. Laboratory exercises investigate microbial activity in our everyday world.

**BIOM 107CS. Molecules of Life.** 3 Credits. (3 Lec) S
Introduction to uses of biological molecules for improving health and agriculture. Gene therapy and DNA fingerprinting are discussed in relation to social/moral issues. Intent of course is to help students develop a rational approach to evaluate cost/benefits of biotechnology to society.

**BIOM 210RN. Environmental Health Science.** 3 Credits. (3 Lec) S
PREREQUISITES: WRT 101W or exempt from course based on ACT or SAT scores. High school chemistry or one semester of college level chemistry. M096 or M121Q. Environmental health science emphasizes how human health is linked to the health of the environment. This course combines classroom instruction with current events discussions, training activities and field trips to explore physical, chemical and biological factors that impact human health, including water pollution and treatment, air pollution, food safety, vectorborne diseases, hazardous waste disposal, community sanitation, emergency preparedness and hazard control in institutional and occupational environments.

**BIOM 250. Microbiology for Health Sciences: Infectious Diseases.** 3 Credits. (3 Lec) F,S
Introduction to the world of microorganisms and the role of viral, bacterial, fungal and parasitic infectious agents in human health. Emphasis is on public health aspects of transmission, epidemiology, treatment and control of these diseases. Also host-pathogen interactions with regards to pathogenesis and host immune responses are considered.

**BIOM 290R. Undergraduate Research.** 1-6 Credits. (1 Ind; 12 cr max) F,S,S
Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

**BIOM 291. Special Topics.** 3 Credits. (1 Lab; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

**BIOM 292. Independent Study.** 1-4 Credits. (1-4 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of instructor. Directed research and study on an individual basis.

**BIOM 360. General Microbiology.** 5 Credits. (3 Lec, 2 Lab) F,S
PREREQUISITE: BIOL 160 or BIOL 260. An introduction to major topics and subdisciplines in microbiology including microbial diversity and classification, microbial anatomy and physiology, microbial genetics, microbial ecology, medical microbiology and immunology, epidemiology and public health, and biotechnology.

**BIOM 400. Medical Microbiology.** 3 Credits. (3 Lec) S
PREREQUISITE: BIOM 360; Recommended BIOL 410 and BIOM 435. Selected viral, bacterial and protozoan infections of man and domestic animals will be covered with an emphasis on disease process and immune responses.

**BIOM 405. Host-Associated Microorganisms.** 3 Credits. (3 Lec) F,S
PREREQUISITE: BIOM 360 or BIOL 160 and CHMY 123 or BCH 380 This course will introduce students to the microbial ecosystems that colonize human and animal hosts, detailing their essential roles in host nutrition, health and development. Students will also be exposed to modern molecular techniques used to study these systems.

**BIOM 410. Microbial Genetics.** 3 Credits. (3 Lec)
PREREQUISITE: BIOM 360, BCH 380. The students will become familiar with concepts in microbial genetics, including DNA replication, RNA, and protein biosynthesis. Other concepts covered in the course include bacteriophage and plasmid biology, gene regulation, mobilome elements, and the fundamentals of genetic engineering.
BIOM 415. Microbial Diversity, Ecology, and Evolution. 3 Credits. (3 Lec) S Alternate even years, to be offered even years.
PREREQUISITE: BIOM 360, BCH 380, or consent of instructor. The diversity of prokaryotic and eukaryotic microorganisms will be explored from both classical phenotypic and contemporary genotypic perspectives. The linkage between microbial diversity, its evolutionary origins, and its ecological value will be emphasized.

BIOM 421. Concepts of Plant Pathology. 3 Credits. (2 Lec, 1 Lab) S PREREQUISITE: BIOC 170IN. An introductory course in the study of plant diseases. Includes plant pathogens, etiology of disease, and various control strategies.

BIOM 423. Mycology. 3 Credits. (2 Lec, 1 Lab) S Alternate Even Years. PREREQUISITE: BIOC 100IN or BIOC 110CS or BIOC 160 or BIOC 170IN or BIOM 103IN. This course surveys the immense diversity of fungi, including all major groups with emphasis on structures, life cycles, identification, and ecology. It provides a basis of knowledge for the rapidly expanding relevance of fungi in research, medicine, agriculture, biotechnology, and industry. This course is co-convened with BIOM 523.

BIOM 425. Toxicology: Science of Poisons. 3 Credits. (3 Lec) S PREREQUISITES: CHMY 141. CHMY 143, BIOM 160 This course is appropriate for pre-med, health professional, and environmental science majors. Topics include history principles, and mechanisms of toxicology, disposition of toxicants, chemical carcinogens, target organ toxicity, clinical and environmental toxicology. Co-convened with MB 527.

BIOM 427. General Parasitology. 4 Credits. (3 Lec, 1 Lab) F Study of the life cycles, biochemistry, molecular parasitology, pathogenesis, identification and treatment of the major parasitic groups, including parasitic protozoa, monogeneans, digeneans, cestodes, nematodes, acanthocephalans, and parasitic arthropods.

BIOM 430. Applied and Environmental Microbiology. 4 Credits. (3 Lec, 1 Lab) S PREREQUISITE: BIOM 360. The course introduces students to complex concepts in water microbiology, food microbiology, sterility and disinfection, the use of microorganisms in manufacturing processes and in the degradation of contaminants in the environment.

BIOM 431. Medical Bacteriology. 3 Credits. (3 Lec) S PREREQUISITE: BIOM 360; recommend BIOC 410. This course considers the nature of the agents of bacterial infectious disease; the etiology, signs, symptoms, pathogenesis, diagnosis, therapy, epidemiology, and prevention of specific diseases. The major objective is for students to gain an understanding of bacteria that cause disease in humans.

BIOM 432. Med Bacteriology Lab. 2 Credits. (2 Lab) S PREREQUISITE: BIOM 360. Corequisite: BIOM 431. Laboratory methods designed to teach techniques used in culturing and identifying bacterial pathogens and normal flora from clinical specimens. Procedures used to test the antibiotic susceptibility of pathogenic bacteria.

BIOM 435. Virology. 3 Credits. (3 Lec) F PREREQUISITE: BIOM 360 or BIOC 375 or BIOC 320 or BCH 380 or BIOC 442 or BCH 444R. Fundamentals of virology with emphasis on animal viruses of medical importance. Molecular aspects of structure, replication transmission and host response to viral infection will be covered.

BIOM 441. Eukaryotic Pathogens. 4 Credits. (3 Lec, 1 Lab) S PREREQUISITE: BIOM 360; recommend BCH 380; credit cannot be applied toward major requirements for both BIOM 427 and BIOM 441. The study of medically important parasite and fungal pathogens. Covers the biology, taxonomy, host-parasite relationships, pathogenesis, diagnosis and treatment of protozoan and helminth parasites; as well as of pathogenic fungi; with laboratory procedures in fungal isolation and identification.

BIOM 450. Microbial Physiology. 3 Credits. (3 Lec) F PREREQUISITE: BCH 380, BIOM 360. An in-depth examination of microbial cell structure and function, bioenergetics, intermediary metabolism and its control, and the orchestration and regulation of cellular functions that enable microbes to adapt to and survive in their environment.

BIOM 452. Soil & Environmental Microbiology. 3 Credits. (3 Lec) S PREREQUISITE: CHMY 143, ENSC 245IN. Microorganisms in soil environments: Focuses on soil microbial ecology, emphasizing relevant aspects of: i) microbial metabolism, physiology and genetics; ii) plant-microbe interactions; and iii) biotransformations of inorganic or organic contaminants.

BIOM 455R. Research Mthds in Microbiology. 4 Credits. (3 Lec, 1 Lab) F PREREQUISITE: BIOM 360 and BIOC 380. Fundamentals of research methodology for undergraduate and graduate students in microbiology and related disciplines. Theory and application of techniques, reagents, and instrumentation will be emphasized in the lecture and laboratory. The emphasis in the course will be on recombinant DNA methodology, and the safe and effective use of radioisotopes.

BIOM 460. Infectious Diseases Ecology and Spillover. 3 Credits. (3 Lec) F PREREQUISITES: BIOM 360 or BIOC 370 or consent of instructor. Disease Ecology is highly interdisciplinary and mergers concepts from microbiology, immunology, evolution, mathematics, epidemiology, medicine, veterinary medicine, ecology, and geography. Thus this discipline is positioned to address major global health issues. Students will study questions such as: What factors, across molecular to landscape scales, must align to allow pathogens to jump from animals to humans? Why is monkeypox spillover increasing in West Africa as immunity to smallpox wanes? Why do wolves experience periodic outbreaks of distemper in Yellowstone? Why did Ebola recently spread through multiple West African countries, whereas previous outbreaks were restricted to small regions in Central Africa?

BIOM 465. Plant-Pathogen Interactions. 3 Credits. (3 Lec) S Alternate Even Years PREREQUISITE: BIOC 160. This course is to teach students the molecular mechanisms by which plants and pathogens/insects interact during the progress of pathogenesis or resistance, the understandings of how plants recognize relatively conserved microbial patterns to active defense. Co-convened with PISP 565.

BIOM 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

BIOM 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

BIOM 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

BIOM 494. Seminar/Workshop. 1 Credit. (1 Sem; 4 cr max) F,S,Su PREREQUISITE: BIOM 360 and junior standing. Senior capstone course. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material. When taken in the senior year, this course fulfills the senior capstone course requirement.

BIOM 497. Educational Methods: Microbiology. 2 Credits. (2 Lec) F,S,Su PREREQUISITE: BIOM 431 and BIOM 432. Instruction and practice in effective teaching methods; practice in preparing laboratory materials, assisting a class and grading.

BIOM 523. Mycology for Graduates. 3 Credits. (2 Lec, 1 Lab) F Alternate even years PREREQUISITE: Basic Biology Course or equivalent. This course is co-convened with BIOM 423. The course surveys the incredible diversity of fungi, including major groups with emphasis on structures and identification. The recent explosion of knowledge on fungi in research, medicine, agriculture, biotechnology begins with basic mycology.

BIOO - Biology-Organismal

BIOO 162CS. Insects and Human Society. 3 Credits. (2 Lec, 1 Lab) S Ways in which research and advances in technology in the areas of insect biology and management have influenced people’s lives throughout the world. Focus will be on insects as major factors affecting the areas of the world where humans live, crops and animals humans produce, and general quality of life on the planet. Interactions of insects and human cultures, technologically oriented and indigenous, non-technology based cultures, and concepts of pest management will also be explored. Students generate and test hypothesis and evaluate sources of scientific information on these topics.

BIOO 220. General Botany. 3 Credits. (3 Lec) PREREQUISITE: BIOC 170IN. This course focuses on organisms that possess plastid organelles in all their cells, and investigates their function (physiology, biochemistry), diversity, life cycles, and environmental adaptations.

BIOO 230. Identification of Seed Plants. 4 Credits. (2 Lec, 2 Lab) S PREREQUISITE: BIOC 170IN. Identification of conifers, trees and shrubs, and herbaceous seed plants; determination by use of manuals; vocabulary, classification and nomenclature; and preparation and collection of seed plant specimens.
BIOO 262IN. Introduction to Entomology. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: One of the following: BIOO 100IN, or BIOO 170IN. General biology of insects including principles of morphology, physiology, behavior, ecology, and control. Includes identification of major orders and common families.

BIOO 310. Comparative Vertebrate Anatomy. 4 Credits. (2 Lec, 2 Lab) F
PREREQUISITE: BIOO 170IN or BIOB 258. A comparative study of organ systems of vertebrates. Laboratory utilizes representative vertebrate types.

BIOO 412. Animal Physiology. 3 Credits. (3 Lec) F
PREREQUISITE: Junior or Senior standing, BIOB 160 or BIOO 268; and one of the following: CHMY 211, CHMY 321, or CHMY 123. General homeostatic physiology of animals with emphasis on mammals. Selected body systems are covered with major emphasis on the integration of body processes.

BIOO 415. Ichthyology. 3 Credits. (2 Lec, 1 Lab) S

BIOO 433. Plant Physiology. 3 Credits. (3 Lec) S
PREREQUISITE: Junior standing, BIOO 160 and one of the following: CHMY 211, CHMY 321, or CHMY 123. Physiological processes of higher plants, including photosynthesis, water relations, mineral nutrition, and development.

BIOO 435. Plant Systematics. 3 Credits. (1 Lec, 2 Lab) F even years
PREREQUISITE: BIOO 170IN and BIOO 230. Introduction to the local vascular plant flora emphasizing characteristics of the common families and genera. Lab concentrates on plant identification of common angiosperm plant families in Montana; preparation of about 120 reference specimens taken from the local flora.

BIOO 437. Plant Development. 3 Credits. (3 Lec) S
Alternate Even Years PREREQUISITE: BIOO 220 or BCH 380 or consent of instructor. This course studies the specific plant functions allowing a zygote to develop into an embryo. It further analyzes development of the embryo into a vegetatively growing plant, then a process known as ‘floral transition’ allowing the plant to ‘switch’ from vegetative to reproductive growth, and finally investigates the formation of floral organs allowing completion of the plant’s life cycle.

BIOO 458. Plant Cell Physiology. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: BIOO 375, BCH 380. The features of plant cells that differentiate them from animal cells are the chief topics covered. These include cell walls, plastids and vacuoles. Other cellular organelles will also be briefly covered, including intra- and inter-cellular communication mechanisms.

BIOO 460. Plant Metabolism. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: BIOO 220 or BCH 380 or consent of instructor. In-depth overview of plant metabolism: photosynthesis including C4 and CAM pathways; intermediary carbon metabolism (sucrose and starch synthesis and degradation); lipid; nitrogen and sulfur assimilation and metabolism; amino acid biosynthesis; secondary metabolism (terpenoids, alkaloids, phenolic compounds).

BIOO 465. Insect Identification. 4 Credits. (2 Lec, 2 Lab) S alternate years, to be offered odd years.
PREREQUISITE: BIOO 262IN and one of the following: BIOO 100IN, BIOO 160 or BIOO 170IN. The identification of insects and related terrestrial arthropods. Evolutionary patterns reflected in modern insect diversity will be used to illustrate classification methods. Taxonomic methods will be used as an access to information retrieval.

BIOO 470. Ornithology. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: BIOO 310 and at least Junior standing. Evolution, functional biology, distribution, and classification of birds. Montana species recognition is developed through laboratory use of a representative skin collection.

BIOO 475. Mammalogy. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: BIOO 310 and at least Junior standing. Evolution, functional biology, distribution, and classification of mammals. Labs cover taxonomy and identification of representative forms with a focus on Montana species.

BMGT 205. Prof Business Communication. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: Completion of University Seminar and Writing University Core Requirement. Recognizing and creating effective approaches and styles for written, oral, and nonverbal communications appropriate to organizational situation, nature of message, and co-communicators. Course addresses professional document and presentation designs, choices of media, and tones for individual and organizational communications.

BMGT 210. Small Business Entrepreneurship. 3 Credits. (Lec 3) S
Offered by Gallatin College. This course will provide an entrepreneurial learning experience that is grounded in collaborations and dynamic problem-solving opportunities. Through student-driven projects, participants will move through the basic building blocks of conceptualizing and starting a business.

BMGT 215. Human Resource Management. 3 Credits. (3 Lec) S
For Gallatin College Business Management Professional Certificate students only. This course provides a vast overview of the essential functions in Human Resource Management. Ideal for entrepreneurs and management/executives or those interested in learning more about the Human Resource profession. This course focuses on subject areas of the Human Resource function within a business for strategic planning, ethical and legal responsibilities, recruitment and staffing plans, employee development, compensation and benefits, safety and health, and employee and labor relations. Once complete, this course will provide comprehensive, best-practice techniques for managing Human Resource within real-world environments and situations.

BMGT 235. Management. 3 Credits. (3 Lec) F
This course is an introduction to critical management skills involved in directing the operations of an organization. Emphasis is placed on effectively working with others to achieve entity objectives. Course topics include the basic management functions of planning, organizing, leading and controlling as well as staffing, appraising performance, motivating employees, handling disciplinary problems, and stress and time management. Students will develop leadership, teamwork, and communication skills.

BMGT 240IS. Business Research Methods. 3 Credits. (3 Lec) F,S
PREREQUISITE: STAT 216Q, and BMIS 211 as pre- or co-requisite. Introduction to the methods of knowledge and knowing regarding business activities and business organizations. Focused on disciplined inquiry using statistics and quantitative analysis; providing the intellectual foundation for further exploration of the business discipline.

BMGT 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by offering department. Courses not required in any curriculum for which there is a particular student need, or given on a trial basis to determine acceptability and demand before requiring a regular course number.

BMGT 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of Associate Dean. Directed research and study on an individual basis. Not to be used as a substitute for a required course.

BMGT 322. Operations Management. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: Junior standing. For business majors: BMIS 211, M 161Q, and STAT 216Q. For non-business majors: M 161Q and consent of instructor. Introduction to the topics and methods of production and operations management. Emphasis is given to critical thinking, business analyses and computer modeling. Application areas include accounting, finance, marketing, and management.

BMGT 329. Human Resource Management. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: BMGT 335 and BGED 361; for business majors: formal admission to the College of Business. The functions and tools used in procurement, development, compensation, integration, and maintenance of human resources and their impact on the effective attainment of organizational goals.

BMGT 335. Management and Organization. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: Junior standing. A survey of contemporary research-based concepts relevant to management and organization including topics such as motivation, leadership, teamwork, organizational design, communication, decision making, entrepreneurship, diversity, and ethics.

BMGT 366. Supervisory Management Skills. 3 Credits. (3 Lec) F,S
PREREQUISITE: Junior Standing and BMGT 335; for business majors: formal admission to the College of Business. An applied management course that will build the foundational knowledge and skills required by first line supervisors and newly appointed managers. The course deals with issues including personality, communication, creative problem solving and motivation. The course emphasizes analysis that informs value-adding actions in response to typical challenges confronting first-line supervisors.

BMGT 405. Supply Chain Analytics. 3 Credits. (3 Lec) F
PREREQUISITE: BMGT 322 or EIND 458; For business students: formal admission to the College of Business. Includes important concepts, methodologies, and tools related to supply chain management and business analytics (i.e., descriptive, predictive, and prescriptive analytics) from a managerial perspective.
BMGT 406. Negotiation/Dispute Resolution. 3 Credits. (3 Lec) S
PREREQUISITE: BMGT 335 or consent of instructor; for business majors: formal admission to the College of Business. Introduction to negotiation theories and skills to help students practice and improve their essential area of business and personal competence. Taught primarily through discussion and in-class exercises that allow students to gain experience and confidence as negotiators.

BMGT 410. Sustainable Business Practices. 3 Credits. (3 Lec) S
PREREQUISITES: Junior standing; for business majors: BMGT 335, BMKT 325, and formal admission to the College of Business; for non-business majors: consent of instructor. Explores sustainability from a business perspective focusing on the decision making process both economically and ecologically. Decision making tools will be introduced for use in assessing and evaluating information considering ecological sustainability, strategic human resource management, organizational change, corporate social responsibility, leadership and community renewal. A unified approach to corporate sustainability is identified and used by students to evaluate the sustainability of various businesses.

BMGT 420. Leadership and Motivation. 3 Credits. (3 Sem) F
PREREQUISITE: BMGT 335 or consent of instructor; for business majors: formal admission to the College of Business. Theories, issues, and current topics related to the emergence and effectiveness of leaders, with focus on leadership behaviors and processes in business organizations. Emphasis placed on examination of how individual and organizational leadership capacity is developed.

BMGT 433. Managing Quality and Productivity. 3 Credits. (3 Lec) On Demand
PREREQUISITE: BMGT 322; for business majors: formal admission to the College of Business. A study of the theoretical foundations of quality management along with applications of the quantitative and qualitative tools used in improving organizational quality and productivity. Coverage will include the principles promoted by major quality experts and a review of the requirements for corporate quality certification.

BMGT 448. Entrepreneurship. 3 Credits. (3 Lec) F
PREREQUISITE: For business majors: BMGT 335, BMKT 322, senior standing, and formal admission to the College of Business; for non-business majors: senior standing and consent of instructor. Introduction to entrepreneurship and launching new ventures. Students learn how to develop creativity skills and an entrepreneurial mindset; identify and evaluate start-up opportunities; analyze the demand for new products/services; and finance, promote, manage, and plan for a new venture. Course simulates the activities of start-up entrepreneurs.

BMGT 458. Adv Entrepreneurship Sem. 3 Credits. (3 Sem) On Demand
PREREQUISITE: For business majors: senior standing, BMGT 448, and formal admission to the College of Business; for non-business majors: senior standing and consent of instructor. Teaches the process and the key steps for preparing a business plan for a new (or existing) business venture. A business plan is an essential tool in planning an entrepreneurial venture and integrates an analysis of potential demand for the product or service.

BMGT 460. Practical Management Perspectives. 3 Credits. (3 Sem.) F
PREREQUISITE: By application, and formal admission to the College of Business (all options encouraged to apply) or declaration of a business minor. Students are partnered with faculty to co-teach BGEN 194US. This personalized learning experience improves communication, mentoring, feedback, and presentation skills while providing new perspectives on the application of leadership and management principles.

BMGT 461. Small Business Management. 3 Credits. (3 Lec) S
PREREQUISITE: For business majors: BMGT 335, BMKT 325, BFIN 322, senior standing and formal admission to the College of Business; for non-business majors: senior standing and consent of instructor. Focus on the process of starting and managing a small business, with an emphasis on businesses owned and operated by one individual or family. Topics covered will include typical funding sources and all phases of small business management from start-up to exit.

BMGT 463. Entrepreneurial Experience. 3 Credits. (3 Lec) F,S
PREREQUISITE: For business majors: BMGT 335, BMKT 325, BFIN 322, formal admission to the College of Business and BMGT 448 as a pre- or co-requisite; for non-business majors: senior standing and consent of instructor. Real-world experience in projects that assist area entrepreneurs. Students will work with these new ventures to solve their management, marketing, finance and other business problems. The content of the problems will depend on the needs of the client businesses.

BMGT 464. International Management. 3 Credits. (3 Lec) F
PREREQUISITE: BGEN 242D, BMGT 335, and senior standing; for business majors: formal admission to the College of Business. Description of the challenges which the global context poses to business managers. Examination of the elements of international environments and illustration of their effects on management practices and how management deals with such forces.

BMGT 465. International Practicum. 1-12 Credits. (1 Ind) On Demand
PREREQUISITE: By application; for business majors: formal admission to the College of Business. An introduction to culture, customs, politics, history, and business practices of another country. Program culminates with extended visit to location for lectures, and other relevant activities.

BMGT 466. Middle Management Skills. 3 Credits. (3 Lec) F,S
PREREQUISITE: BMGT 335, BMGT 366, and junior standing; for business majors: formal admission to the College of Business. An applied management course that will build the knowledge and skills required by middle managers. The course deals with issues including the use of teams, interpersonal skills, employee empowerment, conflict, negotiation and ethics. The course emphasizes analysis that informs value-adding actions in response to typical challenges confronting middle managers.

BMGT 469. Community Entrepreneurship & Nonprofit Management. 3 Credits. (3 Lec) S
PREREQUISITE: Junior standing. For business majors: formal admission to the College of Business. For non-business majors: consent of instructor. Engages students in entrepreneurial thinking and the application of business strategies to address community and societal issues. Students develop and strengthen their practical understanding of business concepts, leadership skills and management capacities as they relate to effective nonprofit management.

BMGT 475R. Management Experience. 3 Credits. (3 Lec) F,S
PREREQUISITE: BMGT 335, senior standing and formal admission to the College of Business. Teams do major project such as substantive community service project, research paper, small business experience case, business plan, or strategic analysis. Practical study of the theoretical foundations of quality management where performance is measured by delivered product. No credit for previous experience.

BMGT 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) On Demand
PREREQUISITE: Senior standing and consent of instructor; for business majors: formal admission to the College of Business. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

BMGT 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) F,S
Max 12 cr PREREQUISITES: Formal admission to the College of Business, consent of instructor and course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BMGT 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Formal admission to the College of Business, consent of instructor, and approval of Associate Dean. Directed research and study on an individual basis. Not to be used as a substitute for a required course.

BMGT 494. Seminar. 1-3 Credits. (1-3 Sem; 6 cr max) On Demand
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper-division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

BMGT 498. Internship. 1-12 Credits. (1-12 Ind) F,S
Prerequisite: BMGT 335, Junior standing, formal admission to the College of Business, and consent of instructor. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

BMGT 591. Special Topics. 1-4 Credits. (1 Sem; 12 cr max) On Demand
Max 12 cr PREREQUISITES: Upper-division courses and others as determined for each offering. Students not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BMGT 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of Associate Dean and Dean of Graduate Studies. Directed research and study on an individual basis.

BMIS - Business: Mgmt Info Systems

BMIS 211. Intro to Bus Decision Support. 3 Credits. (3 Lec) F,S
PREREQUISITE: M 121Q. Focuses on best business practices with word-processing, presentation, spreadsheet, and database software. Emphasis on producing and evaluating effective and efficient information designs with applications in finance, accounting, marketing, and management.

BMIS 215. Mgmt Info Systems
BMIS 311. Management Information Systems. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: Junior standing, BMIS 211, and ACTG 201. A survey of the uses of information in organizational management, with emphasis on strategic systems and systems to support managerial decision making. Students apply concepts in practical application projects using currently available software.

BMIS 314. Business Web Site Design. 3 Credits. (3 Lec) F
PREREQUISITE: For business majors: formal admission to the College of Business. Students acquire skills necessary to create and implement effective business web sites. Best practices in web site design, HTML, CSS, host site selection and introductory programming are covered. Project-based course includes creating web sites for businesses or non-profit organizations.

BMIS 315. Telecommunications Management. 3 Credits. (3 Lec) On Demand
PREREQUISITE: BMIS 311. For business majors: formal admission to the College of Business. Students acquire skills necessary to understand the role that telecommunications play in organizations, how networks facilitate competitive advantage, and how to integrate technology into a corporate culture. Students create business cases for value-adding networks and telecommunications systems.

BMIS 405. Business App Development. 3 Credits. (3 Lec) On Demand
PREREQUISITE: ACTG 321R or BMIS 311. For business majors: formal admission to the College of Business. Business applications for computers. Accounting inventory, planning, and financial analysis are among the topics covered. End-user programming and prototyping will be emphasized.

BMIS 412. Design of E-Commerce Sites. 3 Credits. (3 Lec) On Demand
PREREQUISITE: BMIS 311. For business majors: formal admission to the College of Business. Study of methods and tools a system analyst uses in development of e-commerce web sites including best practices and performance metrics. Design done on networked microcomputers. Final solutions presented orally, in writing, and on the web.

BMIS 413. Contemporary Support Systems. 3 Credits. (3 Lec) On Demand
PREREQUISITE: BMIS 311. For business majors: formal admission to the College of Business. Integrates theory, application and development of information systems to support managerial decision making in semi-structured and unstructured situations. Considers spreadsheet, expert system, and/or web-based software applications to support decision making. Uses cases and project-based assignments.

BMIS 414. Data-driven Business Web Serv. 3 Credits. (3 Lec) On Demand
PREREQUISITE: BMIS 314. For business majors: formal admission to the College of Business. Design and create data-driven, web-based applications commonly found in electronic-commerce applications by combining database design and use with interactive web site creation.

BMIS 415. Mgmt of Information Technology. 3 Credits. (3 Lec) On Demand
PREREQUISITE: BMIS 405, BMIS 412, and BMGT 335. For business majors: formal admission to the College of Business. Course integrates content from the courses in the Management of Information Technology minor. The course will unite the technical knowledge and skills acquired by students with behavioral knowledge and skills necessary to effectively manage business applications of information technology.

BMKT - Business: Marketing

BMKT 112. Applied Sales. 3 Credits. (3 Lec) F
Offered by Gallatin College. This course will provide the foundation for understanding sales. Students will understand the tactics for researching prospects, identifying and qualifying leads, and methods for successful negotiation with customers. Particular attention will be paid to understanding mindset and habits to succeed in sales situations in a small business setting.

BMKT 225. Marketing. 3 Credits. (3 Lec) F,S
Students will learn and understand marketing, the process through which organizations analyze, plan, implement, and control programs to develop and maintain beneficial exchanges with target buyers. This course covers fundamental marketing terminology, concepts and strategies including product development, consumer behavior, research, target markets, pricing, channels of distribution, promotion and marketing plans.

BMKT 240. Advertising. 3 Credits. (3 Lec) S
Offered by Gallatin College. In this course students will examine how advertising contributes to the overall success of marketing a product, service or organization. Professionals in advertising need to understand how communication goals are achieved through understanding the target audience and ensuring appropriate messages are delivered through strategically selected media channels. Students will display an understanding of the strengths and weaknesses of each communication channel and why it is critical to developing an effective advertising plan. Participants will apply readings to be able to critically evaluate the advertising channels and develop a plan based on a hypothetical budget and target audience.

BMKT 241. Sales. 3 Credits. (3 Lec) On Demand
Principles of sales for non-business majors. Focus is on selling in retail and service environments. This course may not substitute for any required business course.

BMKT 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BMKT 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Consent of instructor and approval of Associate Dean. Directed research and study on an individual basis. Not to be used as a substitute for a required course.

BMKT 325. Principles of Marketing. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: Junior standing and ECNS 101BS. Marketing management decision-making in the product, price, promotion, and distribution areas. The behavioral, legal, ethical, competitive, technological, and economic environments as they affect decisions in the domestic and international organization.

BMKT 337. Consumer Behavior. 3 Credits. (3 Lec) F,S
PREREQUISITE: BMKT 325. For business majors: formal admission to the College of Business. Application of behavioral sciences to understanding human behavior in the market place. Emphasis on culture and subculture, social class, reference group, family, attitudes, perception, motivation, personality, and learning theory on consumer and marketing management decisions.

BMKT 342R. Marketing Research. 3 Credits. (3 Lec) F,S
PREREQUISITE: STAT 217Q or BMGT 2401S, and BMKT 325. For business majors: formal admission to the College of Business. The application of scientific research methods to marketing problems. The emphasis is on survey design and data analysis for market segmentation studies.

BMKT 343. Integrated Marketing Communication. 3 Credits. (3 Lec) F,S
PREREQUISITE: BMKT 325. For business majors: formal admission to the College of Business. Explores the use of advertising, sales promotion, Internet, electronic media, and personal selling as methods for promoting goods and services. Taught from the perspective of the marketing manager, with emphasis on the theory, strategy, and tactics of promotion. College of Business.

BMKT 406. Advertising Campaign Development. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: Students junior or senior standing with consent of instructor. Design, develop and implement advertising campaigns for specific markets. Students will work in teams and create detailed advertising plans for various target markets.

BMKT 420. Integrated Online Marketing. 3 Credits. (2 Lec) F,S
PREREQUISITE: BMKT 325 and formal admission to the College of Business; for non-business majors: consent of instructor. Through readings, case studies and hands-on projects, students will come away with an understanding of the basics of digital marketing and analytics. Students will be exposed to such topics as email marketing, user experience design, social and paid media, search engine optimization (SEO), basic website design and maintenance, mobile marketing and online analytics. Technology platforms may include WordPress, UserTesting.com, Google Analytics + Data Studio, AdWords, Facebook Audience Insights, and a variety of specialized tools employed in industry.

BMKT 436. Sales and Sales Management. 3 Credits. (3 Lec) F,S
PREREQUISITE: BMKT 325. For business majors: formal admission to the College of Business. Focus on sales and sales management in a business-to-business and business-to-consumer setting. Students will develop personal, technical, and management skills as they learn selling techniques, practice and develop personal selling skills, and use Customer Relationship Management (CRM) software. College of Business.

BMKT 441. International Marketing. 3 Credits. (3 Lec) S
PREREQUISITE: BMKT 325 and RGEN 242D. For business majors: formal admission to the College of Business. International economic, financial, cultural, political, and legal environment; marketing research, market segmentation and positioning issues analyzed primarily from a global perspective. Global strategies and organizational designs described and analyzed as related to foreign market entry, sourcing, product development, pricing, promotion, logistics and distribution, and export-import management.
**BREN - Bio-Resources Engineering**

**BMKT 444. Retail Management. 3 Credits.** (3 Lec) S
PREREQUISITE: Senior standing and BMKT 325. For business majors: formal admission to the College of Business. Focuses on retail management. Topics include design of retail environments; market positioning; consumer behavior; pricing, promotion, and operations; and e-commerce. Students will work in teams to design, develop, and present plans for a retail project.

**BMKT 446. Marketing for Entrepreneurs. 3 Credits.** (3 Lec) F
PREREQUISITE: BMKT 325. For business majors: formal admission to the College of Business. Examines the unique marketing challenges faced by start-up organizations. New firms are often resource constrained. As a result, penetrating markets dominated by larger competitors with new and innovative products and services requires different marketing tactics. Markets are underserved and establishing primary demand for a new product category may be required.

**BMKT 447. Marketing Mix and Design. 3 Credits.** (3 Lec) On Demand
PREREQUISITE: Senior standing, BMKT 325 and approval of instructor. For business majors: formal admission to the College of Business. Students design and implement marketing strategies for a new product or service. Emphasis is placed on developing creative marketing plans, research, product development, and promotional campaigns.

**BMKT 490R. Undergraduate Research. 1-6 Credits.** (1-6 Ind; 12 cr max) On Demand
PREREQUISITE: Senior standing and consent of instructor. For business majors: formal admission to the College of Business, consent of instructor and course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

**BMKT 491. Special Topics. 1-4 Credits.** (1 Lec; 12 cr max) F,S
Max 12 cr. PREREQUISITE: Formal admission to the College of Business, consent of instructor and course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

**BMKT 492. Independent Study. 1-3 Credits.** (1 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Junior standing, formal admission to the College of Business, consent of instructor and approval of Associate Dean. Directed research and study on an individual basis. Not to be used as a substitute for a required course.

**BMKT 494. Seminar. 1 Credit.** (1 Seminar) On Demand
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper-division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

**BMKT 498. Internship. 1-12 Credits.** (1-12 Ind; 12 cr max) F,S,Su
PREREQUISITE: BMKT 325, formal admission to the College of Business, and consent of instructor. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

**BMKT 499. Senior Capstone Marketing Management. 3 Credits.** (3 Lec) F,S
PREREQUISITE: Senior standing, BMKT 337, BMKT 342R, BMKT 343, and BMKT 436. For business majors: formal admission to the College of Business. BMKT 436 may be taken as a co-requisite. The content of previous marketing courses is applied using the case method to solve marketing problems. Emphasis is on marketing strategy and implementation.

**BMKT 591. Special Topics. 1-4 Credits.** (1 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Upper-division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

**BMKT 592. Independent Study. 1-3 Credits.** (1 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of Associate Dean and Dean of Graduate Studies. Directed research and study on an individual basis.

**BREN - Bio-Resources Engineering**

**BREN 570. Independent Study. 1-3 Credits.** (1-3 Ind; 8 cr max) On Demand
Max 8 cr. PREREQUISITE: Admission to graduate program. Directed graduate research and study of architectural, urban design or historic preservation issues on an individual basis.

**BREN 580. Special Topics. 1-4 Credits.** (1-4 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

**BSI - Big Sky Institute**

**BSI 591. Special Topics. 1-4 Credits.** (1-4 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Graduate status or seniors by petition. Explores interactions between the natural (i.e., nonhuman) and human processes that drive mountain ecosystems. Weekly lectures present current research on relevant topics. Required of all graduate students enrolling for multidisciplinary study in the Big Sky Institute.

**CAA - College of Arts & Arch**

**CAA 290R. Collaborative Rsch/Creative. 1-4 Credits.** (1 Ind; 8 cr max) F,S,Su
Max 8 cr. COREQUISITE: Freshman or sophomore standing and consent of instructor. Intended for lower division undergraduate research and creative projects undertaken in an interdisciplinary team format. The student will work closely with students and faculty colleagues creating collaborative and creative projects. Course will address responsible conduct of research. May be repeated. Department Undeclared.

**CAA 291. Special Topics. 1-4 Credits.** (1-4 Sem; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number. Undeclared.

**CAA 310. The Art of Mental Healing: Collaboration in Scholarship and Creativity. 3 Credits.** (3 Sem)F
Alternate Odd Years PREREQUISITE: Sophomore standing and WRIT 101W. Working collaboratively, students in this course will foster developing solutions for mental healing and for educating the community through scholarship and creativity.

**CAA 481. CAA Ambassador Seminar. 1 Credit.** (1 Seminar) F,S
PREREQUISITES: Students must be accepted (through the specific gate) within a degree program in the College of Arts & Architecture, meaning they must be accepted, sophomore, junior, or senior to take this class. Further they must apply to take the class. The CAA Ambassador Seminar provides students from the four schools within the College of Arts and Architecture opportunities to experience and demonstrate leadership, peer mentoring and advocacy. Participants will gain experience as mentors and advocates within their school and the college, as well as working knowledge about all of the areas of study within the college and the values of those areas.

**CAA 490R. Collaborative Rsch/Creative. 1-4 Credits.** (1 Ind; 8 cr max) F,S,Su
Max 8 cr. COREQUISITE: Junior or higher standing and approval of instructor. Intended for upper division undergraduate research and creative projects undertaken in an interdisciplinary team format. The student will work closely with students and faculty colleagues creating collaborative and creative projects while exploring innovative methods of collaborative problem solving. Course will address responsible conduct of research. May be repeated. Department Undeclared.

**CAA 491. Special Topics-Farm to Market: An Interdisciplinary Design Lab. 3 Credits.** (3 Lab) F
Alternate Odd Years PREREQUISITE: Sophomore standing and WRIT 101W. Working collaboratively, students in this course will foster developing solutions for mental healing and for educating the community through scholarship and creativity.

**CAA 310. The Art of Mental Healing: Collaboration in Scholarship and Creativity. 3 Credits.** (3 Sem)F
Alternate Odd Years PREREQUISITE: Sophomore standing and WRIT 101W. Working collaboratively, students in this course will foster developing solutions for mental healing and for educating the community through scholarship and creativity.

**CAA 481. CAA Ambassador Seminar. 1 Credit.** (1 Seminar) F,S
PREREQUISITES: Students must be accepted (through the specific gate) within a degree program in the College of Arts & Architecture, meaning they must be accepted, sophomore, junior, or senior to take this class. Further they must apply to take the class. The CAA Ambassador Seminar provides students from the four schools within the College of Arts and Architecture opportunities to experience and demonstrate leadership, peer mentoring and advocacy. Participants will gain experience as mentors and advocates within their school and the college, as well as working knowledge about all of the areas of study within the college and the values of those areas.

**CAA 490R. Collaborative Rsch/Creative. 1-4 Credits.** (1 Ind; 8 cr max) F,S,Su
Max 8 cr. COREQUISITE: Junior or higher standing and approval of instructor. Intended for upper division undergraduate research and creative projects undertaken in an interdisciplinary team format. The student will work closely with students and faculty colleagues creating collaborative and creative projects while exploring innovative methods of collaborative problem solving. Course will address responsible conduct of research. May be repeated. Department Undeclared.

**CAA 491. Special Topics-Farm to Market: An Interdisciplinary Design Lab. 3 Credits.** (3 Lab) F
Alternate Odd Years PREREQUISITE: Sophomore standing and WRIT 101W. Working collaboratively, students in this course will foster developing solutions for mental healing and for educating the community through scholarship and creativity.

**CAPP - Computer Applications**

**CAPP 120. Introduction to Computers. 3 Credits.** (3 Lec) F,S,Su
Offered by Gallatin College. Computer hardware and software concepts as they apply to all computers. Exposure to software packages such as Windows, word processors, spreadsheets, and Internet applications. Laboratory projects reflect practical usage in resolving real world problems/situations.

**CAPP 120. Introduction to Computers. 3 Credits.** (3 Lec) F,S,Su
Offered by Gallatin College. Computer hardware and software concepts as they apply to all computers. Exposure to software packages such as Windows, word processors, spreadsheets, and Internet applications. Laboratory projects reflect practical usage in resolving real world problems/situations.
CAPP 156. Microsoft Excel. 3 Credits. (3 Lec) F,Su
For Gallatin College students. Introduces business applications using spreadsheets. Emphasis placed on the essential functions of spreadsheet operation, as well as an introduction to some advanced spreadsheet features such as lookup functions and list management. Covers expert level skills for the Microsoft Certified Application Specialist (MCAS) certification in Microsoft Excel.

CHIN - Chinese

CHIN 101. Elementary Chinese I. 4 Credits. (4 Lec) Elementary course designed to help students acquire basic language skills in Mandarin: reading, writing, listening, speaking, Introduction to Chinese writing systems. Emphasis on establishing correct pronunciation and grasp of grammar. Cultural perspectives such as greetings, simple dialogues re introduced.

CHIN 102D. Elementary Chinese II. 4 Credits. (4 Lec) PREREQUISITE: CHIN 101 or equivalent, or placement interview with instructor. Continuation of CHIN 101. Builds upon the foundation established in 101. Greater emphasis is placed upon oral and written expression. Reading and discussions are designed to increase comprehension of more linguistically complex texts and more conceptually complex cultural issues.

CHIN 130D. Historical and Literary Journey into Modern China. 3 Credits. (3 Lec) The focus of this course will be on twentieth-century Chinese short stories and novels in English translation. We will look at modern Chinese literature in its historical setting as well as from the point of view of literary critical theory.

CHIN 193. Study Abroad. 12 Credits.

CHIN 201D. Intermediate Chinese I. 4 Credits. (4 Lec) PREREQUISITE: CHIN 102D. The second year college-level Chinese course that emphasizes four language skills: listening, speaking, reading and writing. The overall goal is to help students develop their Chinese communication skills, and provide students a broader perspective on Chinese culture.

CHIN 202D. Intermediate Chinese II. 4 Credits. (4 Lec) PREREQUISITE: CHIN 201D. Continuation of CHIN 201. Throughout the entire course, the more up-to-date language ingredients and authentic linguistic materials are introduced with a view towards reflecting cultural life in the dynamic and rapidly changing contemporary China.

CHIN 211D. Chinese Culture & Civilization. 3 Credits. (3 Lec) COREQUISITE: WRIT 101W or equivalent. Chinese cultural, social and political history. Confucianism, Buddhism, and such elements of high culture as the arts of poetry and prose, while providing a sense of dynastic chronology. Course is taught in English.

CHIN 293. Study Abroad. 12 Credits.

CHIN 320IH. History of Chinese Cinema. 3 Credits. (3 Lec) PREREQUISITE: Junior standing or permission of instructor. This course reviews the history of Chinese cinema. Provides students opportunities to interrogate cinematic representations of China, to participate in critical thinking discussions and dialogues, and to understand the methods that Chinese filmmakers use to explore those questions. In English.

CHIN 393. Study Abroad. 12 Credits.

CHIN 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) PREREQUISITE: Junior standing and consent of instructor. Directed research and study on an individual basis.

CHIN 493. Study Abroad. 12 Credits.

CHMY - Chemistry

CHMY 102CS. Applying Chemistry to Society. 3 Credits. (3 Lec) S
An introduction to contemporary chemistry in the contextual framework of current issues including the effect of human impact on the air, water, and earth. This course will examine the scientific basis for current scientific and societal issues such as depletion of the ozone layer, water pollution, acid rain, genetic engineering and nuclear fusion among other issues. Topics will be addressed from a scientific viewpoint to develop knowledge and understanding of the chemical concepts that underlie these contemporary issues. The goal is to inform non-science majors of chemical and scientific issues in order to help them to become well-informed, inquiring citizens.

CHMY 121IN. Introduction to General Chemistry. 4 Credits. (3 Lec, 1 Lab) F,S,Su
PREREQUISITE: C- or above in M 090 or M 097 or placement in a Math Level 3 via MPLEX/ACT/SAT (ACT 23 or SAT 540). Introductory general chemistry. Measurement systems, atomic structure, chemical periodicity, bonding, chemical reactions, acid-base chemistry, electrochemistry, nuclear chemistry. Common Exams. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 123. Introduction to Organic Chemistry and Biochemistry. 4 Credits. (3 Lec, 1 Lab) F,S,Su
PREREQUISITE: C- or above in CHMY 121IN or CHMY 143. An introduction into functional group organic chemistry and important biochemical structures, concepts, and processes. The laboratory is closely integrated with lecture coverage. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 141. College Chemistry I. 4 Credits. (3 Lec, 1 Lab) F,S
PREREQUISITE: C- or above in M 121Q or placement in a Math Level 4 (ACT 25 or SAT 580). The first of a two-semester course sequence about the general principles of modern chemistry with emphasis on atomic structure, the periodic table, equilibria, chemical reactivity, and kinetics. It is recommended that students registering for this course have taken high school chemistry. Common Exams. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 143. College Chemistry II. 4 Credits. (3 Lec, 1 Lab) F,S,Su
PREREQUISITE: C- or above in CHMY 141. The second semester of the two-semester general chemistry sequence. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 151. Honors College Chemistry I. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: Placement in a level 5 Math (Math ACT score of 27 or SAT of 620). Recommended that students registering for this course either have taken calculus or are concurrently enrolled. Also recommended that students registering in this course have taken high school chemistry and/or physics, preferably AP Chemistry and/or Physics. Topic coverage parallels CHMY 141, with emphasis on critical and analytical thought and with a greater reliance on math skills. For departmental honors program and the University honors program. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 153. Honors College Chemistry II. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: A grade better than a C in CHMY 141 or CHMY 151. Topic coverage parallels CHMY 143, with emphasis on critical and analytical thought and with a greater reliance on math skills. For departmental honors program.

CHMY 194. Seminar/Workshop. 1 Credit. (1 Sem) F
For the new student. Integration into the department and its research and educational program. Scientific communication and chemical literature searching skills. Cross-listed with BCH 194.

CHMY 211. Elements of Organic Chemistry. 5 Credits. (4 Lec, 1 Lab) F,S
PREREQUISITE: C- or above in CHMY 121IN, CHMY 143, or CHMY 153. A one-semester introduction to organic chemistry. The unique character of carbon: bonding, structure, nomenclature, and common reactions of hydrocarbons and functional organic compounds. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

CHMY 291. Special Topics/Expmnul Crse. 1-4 Credits. (1-4 Ind; 6 cr max) On Demand
Max 12 cr. PREREQUISITE: None required, but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

CHMY 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

CHMY 294. Seminar/Workshop. 1 Credit. (1 Sem) S
PREREQUISITE: CHMY 194 or BCH 194. Introduction to faculty research through faculty mini seminars. Research groups. Research planning decisions (MSU laboratory, summer internship, student exchange, REU, USP, etc.). Cross-listed with BCH 294.
CHMY 311. Fundamental Analytical Chem. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: CHMY 143 or CHMY 153. Introduction to wet analytical chemistry with an emphasis on the systematic treatment of equilibria, acid-base chemistry, redox equilibria and titrations, complexometric equilibria and titrations, Beer's law, fundamental lab skills and chromatography.

CHMY 321. Organic Chemistry I. 4 Credits. (3 Lec, 1 Lab) F,Su
PREREQUISITE: CHMY 143 or CHMY 153. The first of a two-semester professional sequence in organic chemistry. In-depth coverage of stereochemistry, synthetic organic chemistry, physical organic chemistry, spectroscopy, and nomenclature. Students should register for both semesters. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 323. Organic Chemistry II. 4 Credits. (3 Lec, 1 Lab) S,Su
PREREQUISITE: CHMY 321. The second semester of the two-semester professional sequence in organic chemistry. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 331. Honors Organic Chemistry I. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: CHMY 151 and CHMY 153 or consent of instructor. CHMY 331 is the first of a two-semester honors sequence in organic chemistry. Topic coverage parallels CHMY 321, but at an accelerated pace with in-depth coverage of physical organic chemistry, stereochemistry, synthetic organic chemistry, spectroscopy, and nomenclature. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 333. Honors Organic Chemistry II. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: A grade of better than a C in CHMY 331. CHMY 333 is the second semester of the two-semester honors sequence in organic chemistry. Topic coverage parallels CHMY 323, with more in-depth coverage of mechanisms and more emphasis on retrosynthetic analysis and on solving multi step synthesis problems. Students who have already taken this course and scored an 80% or better in lab are eligible to be lab exempt. Contact the department to register 994-4884.

CHMY 350. Astrobiology. 3 Credits. (3 Lec) F
PREREQUISITE: BIOB 170N, CHMY 121N, and ASTR 110N (or equivalent) and junior standing. This course examines the science of Astrobiology focused on the origin, evolution, and distribution of life in the universe. Topics that will be discussed include planetary evolution, origin of life, habitability, evolution, intelligence, and the search for life beyond Earth.

CHMY 351. Astrobiology Recitation. 1 Credit. (1 Rct) F
PREREQUISITE: BIOB 170N, CHMY 121N, and ASTR 110N (or equivalent) and junior standing. COREQUISITE: CHMY 350 These interactive sessions will complement the study of astrobiology as students become both better consumers of and practitioners of science communications. We’ll discuss trends, challenges and opportunities in science communications; analyze and critique current communications campaigns; and strategize how to best convey the diverse aspects of astrophysics through strategies such as science writing; working with the media; social media and Websites; and more. Students will create and present press communications pieces, and will be encouraged to disseminate their work to the public. This recitation recommended, but not required.

CHMY 361. Elements of Physical Chemistry. 4 Credits. (4 Lec) F
PREREQUISITE: M 1610Q or M 1720Q and PHSX 207, and CHMY 211 or CHMY 323 or CHMY 333. A physical chemistry course directed toward the life sciences, health professions, and agricultural sciences.

CHMY 362. Elements of Physical Chemistry Lab. 1 Credit. (1 Lab) F
PREREQUISITE: CHMY 361. CHMY 361 can be a prerequisite or corequisite. The laboratory to accompany CHMY 361.

CHMY 371. Physical Chemistry-Quantum Chemistry and Spectroscopy I. 3 Credits. (3 Lec) F
PREREQUISITE: CHMY 143 or CHMY 153 and M 1720Q and PHSX 222. COREQUISITE: M 273Q. The first semester of a two-semester sequence for science and engineering majors on quantum chemistry, statistical thermodynamics, spectroscopy, classical thermodynamics and kinetics.

CHMY 372. Physical Chemistry Laboratory I. 1 Credit. (1 Lab) F
PREREQUISITE: CHMY 311 COREQUISITE: CHMY 371 or CHMY 373 (Prerequisite or Corequisite). Laboratory to accompany CHMY 371 or 373. Fundamental experiments in thermodynamics and kinetics.

CHMY 373. Physical Chemistry - Kinetics and Thermodynamics. 3 Credits. (3 Lec) S
The second semester of a two-semester physical chemistry sequence for science/engineering majors. Students should take both semesters of the sequence.
Molecules and spin systems.

PREREQUISITE: CHMY 373 or equivalent. Applications of quantum mechanics to chemical systems.

CHMY 558. Classical & Stat Thermodynamic. 3 Credits. (3 Lec) F alternate years, to be offered odd years. PREREQUISITE: CHMY 573 or equivalent. Classical & statistical thermodynamics applied to chemical systems.

CHMY 559. Kinetics & Dynamics. 3 Credits. (3 Lec) S alternate years, to be offered even years. PREREQUISITE: CHMY 573 or equivalent. Chemical kinetics, theories of reaction rates, molecular reaction dynamics, with applications to Chemical reactions in the gas phase, on surfaces, and in solution.

CHMY 560. Symmetry, Orbitals, and Spectroscopy. 3 Credits. (3 Lec) F alternate years, to be offered odd years. PREREQUISITE: CHMY 573. Group theory with applications, semi-empirical and ab initio calculations, vibrational and electronic spectroscopy, and their interrelationship will be covered.

CHMY 564. Adv Quantum Chemistry. 3 Credits. (3 Lec) S alternate years, to be offered odd years. PREREQUISITE: CHMY 557 or equivalent. Time independent and time dependent quantum mechanics with application to chemical bonding and molecular spectroscopy.

CHMY 575. Professional Paper. 1-6 Credits. (1-6 Ind; 6 cr max) F.S Maximum 6 credits. PREREQUISITE: Consent of instructor. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee. Cross-Listed with BCH 575.

CHMY 587. Exploring Chemistry for Teachers. 3 Credits. (3 Lec) Su PREREQUISITES: Teacher of science with a minimum of two years teaching experience. The course will lead to a greater understanding of chemical concepts, provide resources and ideas for class activities, and advice from fellow teachers with the ultimate goal of enhancing your teaching abilities—and giving you confidence in your understanding of the material. The level of content is appropriate for either a stand-alone class in high school or as a section in an integrated science class. Students of this course will gain insight to how topics in chemistry are linked together and how they can all be applied to explain other areas of science and topics of public concern.

CHMY 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand Max 3 cr. PREREQUISITE: Graduate standing; teaching experience and/or current employment in a school or organization; and consent of instructor and Dean of Graduate Studies. Courses offered on a one-time basis to fulfill professional development needs of in-service educators. A specific focus is given to each course which is appropriately subdivided. May be repeated.

CHMY 589. Graduate Consultation. 1-3 Credits. (3 Ind) F,S,Su PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

CHMY 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su IND Maximum credits unlimited. PREREQUISITE: Master’s standing.

CHMY 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

CHMY 592. Independent Study. 1-3 Credits. (1-3 Ind; 3 cr max) On Demand Max 3 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

CHMY 593. Kinetics, Equilibrium & Thermodynamics for Teachers. 3 Credits. (2 Lec; 3 Lab) Sp PREREQUISITES: A minimum of 2 years teaching experience. Equilibrium, Thermodynamics, and Kinetics explain why reactions stop where they do, why they get hot or cold, and how fast they occur. This course is designed to help teachers of science bolster their background in equilibrium, thermodynamics, kinetics as well as provide assistance in the teaching of these topics. A classroom population represents a distribution of learning styles and a goal of this course is to provide a variety of instructional tools for teachers to utilize in their classrooms.

CHMY 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand Max 4 cr. PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material. Cross-Listed with BCH 594.
CHMY 595. Chemistry of the Environment for Teachers. 3 Credits. (2 Lec. 1 Lab) Su
PREREQUISITES: Teacher of science with 2 years minimum teaching experience and undergraduate chemistry course. This course is designed to familiarize existing secondary teacher (ideally 8th and 9th grade) with basic general science and chemistry concepts of the environment, including water, air and Earth - as well as to provide opportunities to enrich these chemistry concepts through applications and examples. Since this course will be building upon basic chemistry concepts, teachers taking this course should have taken general chemistry at the undergraduate level, or the equivalent.

CHMY 596. Exploring Organic Chemistry for Teachers. 3 Credits. (1 Lec. 1 Lab, 1 Rec) F
PREREQUISITES: CHMY 599 Atoms-First Primer for AP/IB Chemistry Teachers & CHMY 593 Kinetics, Equilibrium, Thermodynamics for Teachers. College organic chemistry at the sophomore level is highly recommended. This course is for teachers of science interested in refreshing and/or increasing organic chemistry knowledge for application in the high school classroom. Weekly discussion topics cover course content and teaching ideas specific to organic chemistry. Exams include a Teaching Organic Chemistry Problem. An optional teaching project resulting in an organic chemistry unit of study is available.

CHMY 597. Exploring Biochemistry I for Teachers. 3 Credits. (3 Lec) Su
Alternate Odd Years PREREQUISITES: Teacher of science with a minimum of 2 years teaching experience. Background in general chemistry, organic chemistry, and biology. This course will consider the reactions of the principle biochemical molecules (carbohydrates, lipids, proteins, and nucleic acids) with additional emphasis on biomedical topics. The primary goal of this course is to promote critical thinking about important, current health issues and to examine the role of laboratory modules in teaching these concepts. General biochemistry principles will be presented to understand the diseases under review. Written material will be provided on advanced topics.

CHMY 598. Exploring Biochemistry: Metabolism for Teachers. 3 Credits. (2 Lec. 1 Lab) Su
Alternate Even Years PREREQUISITES: Teacher of science with a minimum of 2 years teaching experience. Background in general chemistry, organic chemistry, and biology. This course is designed to serve as the second semester of a two-semester sequence of biochemical principles. The course will build on topics covered in CHMY 597 (Exploring Biochemistry I for Teachers) such as carbohydrates, lipids, proteins and nucleic acids. The proposed course will investigate the metabolism of each of these biological molecules while exploring applications of these topics to a classroom setting. The textbook will be used as a basis for the course but students will be required to utilize materials from various resources including chapter summaries, related internet websites, scientific journals, and material compiled on the students part.

CHMY 599. An Atoms-First Primer for AP/IB Chemistry Teachers. 3 Credits. (1 Lec. 1 Lab. 1 Rec) F
PREREQUISITES: A minimum of two teachers teaching high school chemistry. The course is specific to teachers of Advanced Placement (AP) and/or International Baccalaureate (IB) chemistry. This course is designed to introduce teachers of Advanced Placement (AP) or International Baccalaureate (IB) Chemistry courses to an Atoms-First pedagogy in the teaching of their courses. Teachers will be exposed to the AP chemistry unit of study is available.

CHTH 205. Drugs and Society. 3 Credits. (3 Lec) F,S
Su On Demand Individual and social implications of psychoactive drug use. Basic pharmacological concepts, legal issues, common pharmaceutical preparations, and over-the-counter products are studied.
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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>CTHH 490R.</td>
<td>Undergraduate Research. 1-6 Credits.</td>
<td>(1 Ind; 12 cr max) F,S,Su</td>
<td>Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.</td>
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<tr>
<td>CTHH 491.</td>
<td>Special Topics. 1-4 Credits.</td>
<td>(1-4 Lec; 12 cr max) On Demand Max 12 cr.</td>
<td>PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.</td>
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<tr>
<td>CTHH 492.</td>
<td>Independent Study. 1-3 Credits.</td>
<td>(1-3 Ind; 6 cr max) F,S,Su</td>
<td>PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.</td>
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<tr>
<td>CTHH 494.</td>
<td>Seminar. 1 Credit.</td>
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<tr>
<td>CTHH 495.</td>
<td>Practical Experience in Aging. 3 Credits.</td>
<td>(3 Ind) F,S,Su</td>
<td>PREREQUISITE: Completion of 12-credits of coursework in the online gerontology certificate program. This class will provide students the opportunity to gain practical experience in working with older adults as well as provide students the opportunity to develop as professionals in the field of aging.</td>
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<tr>
<td>CTHH 498.</td>
<td>Internship. 1-12 Credits.</td>
<td>(1-12 Ind; 12 cr max) On Demand PREREQUISITE: Consent of internship director in academic area. An individualized professional assignment arranged for specific discipline. Some academic areas will offer specific sections in sequence for their students. All students must receive department permission prior to registration, and register for a senior seminar in their major area.</td>
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<tr>
<td>CTHH 502.</td>
<td>Theories and Models in Health. 3 Credits.</td>
<td>(3 Lec) F</td>
<td>PREREQUISITE: Graduate standing or permission of instructor. Understanding and application of theory and models in the family and community health fields. The course will focus on applications at the individual, family, community, and environmental levels.</td>
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<tr>
<td>CTHH 503.</td>
<td>Community-Based Participatory Research. 3 Credits.</td>
<td>(3 Lec) F</td>
<td>PREREQUISITE: Graduate student standing. Community-based participatory research is an orientation to research with community. Research is situated within a context relevant to both community and academic partners. Suggests an enrichment of the research results because of integration of the knowledge of community and noncommunity partners.</td>
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<tr>
<td>CTHH 575.</td>
<td>Professional Paper and Project. 1-6 Credits.</td>
<td>(1-6 Ind; 15 cr max) F,S,Su</td>
<td>PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.</td>
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<tr>
<td>CTHH 588.</td>
<td>Professional Development. 1-3 Credits.</td>
<td>(1-3 Ind; 3 cr max) On Demand PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, and consent of instructor. Courses offered on a one-time basis to fulfill professional development needs of in service educators. A specific focus is given to each course which is appropriately subtitled. May be repeated.</td>
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<tr>
<td>CTHH 589.</td>
<td>Graduate Consultation. 1-3 Credits.</td>
<td>(1-3 Ind; 3 cr max) F,S,Su</td>
<td>PREREQUISITE: Graduate standing in health major and approval of committee chair. This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty or staff time or help. May be repeated.</td>
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</tr>
<tr>
<td>CTHH 590.</td>
<td>Master’s Thesis. 1-10 Credits.</td>
<td>(1-10 Ind; max unlimited) F,S,Su</td>
<td>PREREQUISITE: Master's standing. Directed graduate research/creative activity.</td>
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<tr>
<td>CTHH 591.</td>
<td>Special Topics. 1-4 Credits.</td>
<td>(1-4 Lec; 12 cr max) On Demand Max 12 cr.</td>
<td>PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.</td>
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<tr>
<td>CTHH 592.</td>
<td>Independent Study. 1-3 Credits.</td>
<td>(1-3 Ind; 6 cr max) F,S,Su</td>
<td>Max 6 cr.</td>
<td>PREREQUISITE: Graduate standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.</td>
</tr>
<tr>
<td>CTHH 594.</td>
<td>Seminar. 1 Credit.</td>
<td>(1 Sem; 4 cr max) On Demand Maximum 4 cr.</td>
<td>PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.</td>
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<tr>
<td>CTHH 598.</td>
<td>Internship. 2-12 Credits.</td>
<td>(2-12 Ind; 12 cr max) F,S,Su</td>
<td>Maximum 12 cr.</td>
<td>PREREQUISITE: Graduate standing and consent of instructor. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.</td>
</tr>
</tbody>
</table>

**CLS - College of Letters & Science**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Offered</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTHH 101US.</td>
<td>Knowledge and Community. 3 Credits.</td>
<td>(3 Sem) F,S</td>
<td>PREREQUISITE: First year students (less than 30 credits) only. Small seminar-style classes. Introduction to university study and the excitement of intellectual inquiry. Participation in a community of learners. Readings in the humanities, social sciences, and natural sciences. Emphasis on critical thinking, effective communication, and active learning. Open only to first year students- Not repeatable.</td>
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</tr>
<tr>
<td>CTHH 102US.</td>
<td>Engaged Knowledge &amp; Community. 4 Credits.</td>
<td>(3 Sem, 1 Lab) F,S</td>
<td>Small seminar-style classes. Introduction to university study and the excitement of intellectual inquiry with additional engaged community component. Readings in humanities, social securities, and natural sciences. Emphasis on critical thinking, effective communication, and active learning.</td>
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<tr>
<td>CTHH 201US.</td>
<td>Knowledge and Community. 3 Credits.</td>
<td>(3 Sem) F,S</td>
<td>PREREQUISITE: Class is similar to CTHH 101 but is designed for students beyond their freshman year. CTHH 201 is open to students who have completed at least 30 credits; students will not receive credit if they have passed CTHH 101 with a grade of C- or better. Small seminar-style classes.</td>
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<tr>
<td>CTHH 209R.</td>
<td>Undergrad Rech/Instruction. 1-3 Credits.</td>
<td>(1-3 Rct; max unlimited) F,S</td>
<td>PREREQUISITE: Classroom instruction associated with directed undergraduate research/creative activity projects. May be repeated.</td>
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<tr>
<td>CTHH 290R.</td>
<td>Undergraduate Research. 1-6 Credits.</td>
<td>(1-6 Ind; max unlimited) F,S,Su</td>
<td>PREREQUISITE: Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.</td>
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</tr>
<tr>
<td>CTHH 460.</td>
<td>Teaching Internship. 2-3 Credits.</td>
<td>(2 Sem; 6 cr max) F,S</td>
<td>As co-facilitators of a section of CTHH 101US or CTHH 201US, students will learn and have the opportunity to practice classroom teaching strategies and mentoring skills.</td>
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<tr>
<td>CTHH 489R.</td>
<td>Undergrad Rech/Instruction. 1-3 Credits.</td>
<td>(1 Rct; 4 cr max) F,S,Su</td>
<td>Max 4 cr.</td>
<td>COREQUISITE: CTHH 490. Classroom instruction associated with directed undergraduate research/creative activity projects. May be repeated.</td>
</tr>
<tr>
<td>CTHH 490R.</td>
<td>Undergraduate Research. 1-6 Credits.</td>
<td>(1 Ind; 12 cr max) F,S,Su</td>
<td>PREREQUISITE: Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.</td>
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</tr>
<tr>
<td>CTHH 492.</td>
<td>Independent Study. 1 Credit.</td>
<td>(1 Ind; 2 cr max) F,S</td>
<td>Maximum 2 cr.</td>
<td>COREQUISITE: CTHH 460. Directed research and study on an individual basis.</td>
</tr>
</tbody>
</table>

**COA - Coaching**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Offered</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>COA 205.</td>
<td>Introduction to Coaching. 3 Credits.</td>
<td>(3 Ind) F,S</td>
<td>PREREQUISITE: Introductory course which will cover basic information from the beginning level in the American Coach Effectiveness Program.</td>
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<tr>
<td>COA 256.</td>
<td>Coaching Track and Field. 2 Credits.</td>
<td>(2 Lec) F</td>
<td>PREREQUISITE: COA 205 with a grade of at least a “C” and declared Coaching minor. The technique of all track and field events. Emphasis on teaching progressions in all events. Classroom sessions include development of training schedules, tactics, strategy, philosophy, meet organization, and officiating.</td>
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<tr>
<td>COA 316.</td>
<td>Football Coaching Theory. 1 Credit.</td>
<td>(1 Lec) S</td>
<td>PREREQUISITE: COA 205 with a grade of at least a “C” and declared Coaching minor. Basic fundamentals and techniques used in coaching football.</td>
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<tr>
<td>COA 317.</td>
<td>Basketball Coaching Theory. 1 Credit.</td>
<td>(1 Lec) F</td>
<td>PREREQUISITE: COA 205 with a grade of at least a “C” and declared Coaching minor. This course is set up to provide the student a working knowledge of basketball coaching techniques and philosophies. The course should assist the student in developing his/her own basketball coaching philosophy.</td>
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<tr>
<td>COA 318.</td>
<td>Soccer Coaching Theory. 1 Credit.</td>
<td>(1 Lec) F</td>
<td>PREREQUISITE: COA 205 with a grade of at least a “C” and declared Coaching minor. A working knowledge of soccer coaching tactics and techniques.</td>
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<tr>
<td>COA 319.</td>
<td>Volleyball Coaching Theory. 1 Credit.</td>
<td>(1 Lec) S</td>
<td>PREREQUISITE: COA 205 with a grade of at least a “C” and declared Coaching minor. A working knowledge of volleyball coaching tactics and techniques.</td>
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<tr>
<td>COA 395.</td>
<td>Practicum: Coaching Application. 1-2 Credits.</td>
<td>(1-2 Lec; 3 cr max) F,S,Su</td>
<td>PREREQUISITE: COA 205 with a grade of at least a “C”, declared Coaching minor, and consent of instructor. Assignment of prospective coaches to specific sports. Discussion and feedback on planning and implementation in practical setting.</td>
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</tbody>
</table>
COA 405. Advanced Concepts in Coaching. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: COA 205 with a grade of at least a "C" or consent of instructor.
The class is intended for the student in the MSU coaching minor and/or experienced coaches who wish to examine current issues in coaching such as dealing with athletics with concussions, coaching the female athlete, emphasizing sportsmanship and ethics in sport, or coach/parent relationships in detail.

COA 567. Prof Issues in Coaching. 3 Credits. (3 Lec)
On demand PREREQUISITE: COA 205, COA 395 or 3 years of successful coaching in public schools. In depth examination of at least one sub-topic from the Montana High School Coach Certification curriculum that is, prevention, care and rehabilitation of injuries, risk management in sport; sociological and psychological aspects of coaching; coaching the female athlete.

COLS - College Studies
COLS 100. Effective Academic Practices. 3 Credits. (3 Lec) F,S
The course is designed to help students maximize their potential in all courses, specifically: to define one's purpose in pursuing a college education; utilize components that students need to be successful learners-motivation, methods of learning, time management, physical and social environment, and performance; develop practical study techniques that can be applied to daily college course work; set short- and long-term academic and career goals; and become acquainted with professors, MSU resources, and how to seek academic assistance. Offered by Gallatin College.

COLS 101US. First Year Seminar. 3 Credits. (3 Sem) F,S
PREREQUISITE: For Gallatin College students only. This multi-disciplinary course, presented in seminar format, draws from the disciplines of psychology, sociology, history, and philosophy, and encourages students to explore issues critical to their academic goals and objectives. The course emphasizes verbal communication, critical thinking, intellectual development, and academic choices. Fulfills university seminar requirement of the core curriculum. This course may not be repeated. Offered by Gallatin College.

COLS 103. College Learning Strategies. 1 Credit. (1 Lec) F,S
This survey course introduces to the effective use of college resources and methods of increasing success in other courses. It acquaints students with study skills and prepares them to integrate traditional study skills with college content areas. Student will develop learning and study strategies to become efficient students. Also, students will become familiar with professors, academic advisors, and college resources.

COLS 191. Special Topics. 1 Credit. (1 Lec) F,S
This survey course introduces students to the effective use of college resources and methods of increasing success in other courses. It acquaints students with study skills and prepares them to integrate traditional study skills with college content areas. Students will develop learning and study strategies to become efficient students. Also, students will become familiar with professors, academic advisors, and college resources.

COLS 260RS. Studying Human Behavior. 3 Credits. (3 Lec) S
PREREQUISITES: WRIT 101 W The purpose of this course is to learn methods and principles used to study human behavior, how to ask meaningful questions that address a topic of study, find out what is already known about the possible answers to those questions, learn the process of collecting and analyzing data, and to generate new knowledge about how or why we behave in the ways we do. Gallatin College Developmental Courses.

COLS 291. Special Topics. 1-4 Credits.
COLS 292. Independent Study. 3 Credits. (3 Ind.) S
PREREQUISITE: Consent of Instructor.

COM - Communications
COM 000. COM" COURSES ARE NOW "COMX. 0 Credits.
-- All "COM" courses are now listed under the "COMX" subject code. COM 110US Public Communication, last offered in Spring 2015, was replaced with COMX 111US, beginning Summer 2015.

COMX - Communication
COMX 102. Interpersonal Skills in the Workplace. 1 Credit. (1 Lec) F,S,Su
Offered by Gallatin College. This course covers the basic elements of communication in the business environment, including listening, speaking, and reading. It also looks at the importance of nonverbal communication, ethics, and professional courtesy. It discusses the importance of internal skills like teamwork and external skills with customers such as reflective listening. Successful interview skills are discussed in class and demonstrated in final student project.

COMX 106. Communicating in a Dynamic Workplace. 3 Credits. (3 Lec) F,S,Su
This course prepares students to seek and maintain a professional position. The course covers many elements of communication in the workplace, including listening, nonverbal behavior, salary negotiation, personality, customer service, and decision making. Students will prepare job application documents and practice interviewing skills.

COMX 111US. Introduction to Public Speaking. 3 Credits. (1 Lec, 2 Rec) F,S,Su
Overview of the theories, concepts, and principles of public speaking, to include audience analysis, evidence, sensory aids, small group communication, ethics and listening. Application of concepts and principles through preparation and delivery of impromptu, informative, persuasive, and group presentations.

COMX 115. Introduction to Interpersonal Communication. 3 Credits. (3 Lec) F,S,Su
This course will examine the importance of personal and small group communication. The emphasis will be on how individuals perceive information and transmit messages based on aspects such as the context in which we interact, the perceptions we hold, our cultural background, and nonverbal and verbal behavior. Students will explore the factors that affect both individual and group dynamics in our personal and professional lives.

COMX 222. Professional Communication. 3 Credits. (3 Lec) F,S,Su
This class focuses on developing skills for interpersonal and group communication in a professional environment. Students will develop a professional resume and cover letter, conduct an interview, and learn how to communicate professionally with co-workers, supervisors, and customers. The class explores diversity in the workplace, nonverbal communication, influence, technical communication, and managing workplace conflict.

CRWR - Creative Writing
CRWR 240RA. Introduction to Creative Writing. 3 Credits. (3 Rec) F,S,Su
PREREQUISITE: WRIT 101 W Introduction to the principles and techniques of creative writing, aimed at developing literary craft and the creative process. Includes lectures, readings, and writing exercises in genres that may include fiction, poetry, and creative nonfiction.

CRWR 340. Intermediate Creative Writing Workshop. 3 Credits. (3 Ret) F,S,Su
PREREQUISITE: WRIT 101 W and CRWR 240RA Beginning exploration, through workshops, discussions, and readings, of creative writing techniques in genres that might include fiction, poetry, play writing, autobiographical writing, or creative nonfiction.

CRWR 437. Topics in Craft and Genre. 3 Credits. (3 Ret) S
PREREQUISITE: CRWR 240RA or CRWR 340. Students will read and analyze historical and contemporary literary texts to study how writers have responded to particular challenges in a genre that involves issues of craft and rhetoric. Students will simultaneously write and revise their own texts in that genre, applying what they have learned from the reading.

CRWR 440. Advanced Creative Writing Workshop. 3 Credits. (3 Lec; 6 cr max) F,S
Max 6 cr. PREREQUISITE: CRWR 340 or consent of instructor. Continuing exploration of creative writing in which experienced writers act as an audience for each other through workshops, discussions, and readings. Emphasis on techniques in a particular genre, such as fiction, poetry, play writing, autobiographical writing, or creative nonfiction.

CS - Computer Science
CS 140CS. Spinning Webs. 3 Credits. (3 Lec) S
The World Wide Web. What it is. How it works. Where it’s headed. Societal implications. Examination of currently popular Web ventures, such as Google, Facebook, YouTube, Twitter, and Drupal. Construction of individual Web portfolios and a hosted website. Prepares students from all majors to participate in Web ventures and to become Web-informed citizens. No previous Web or programming experience required.

CS 145RA. Web Design. 3 Credits. (2 Lec, 1 Lab) F,S
Basic design principles and how these principles apply to website construction. HTML, HTML editors and Cascading Style Sheets. Laboratory projects reflect practical usage of course concepts. Cross-listed with MART 145RA.

CS 204. Multimedia Dev Methods. 3 Credits. (2 Lec, 1 Lab) S odd years.
The design and development of multimedia presentations using computerized studio techniques. Methods for combining video, audio, photography, studio techniques, and computer-generated art forms. Computer-assisted studio control and editing. Project-oriented course organization with interdisciplinary project teams.
CSCI - Computer Science/Programming

CSCI 107. Joy and Beauty of Computing. 3 Credits. (3 Lec) F
Examines the computing field and how it impacts the human condition. Introduces exciting ideas and influential people. Provides a gentle introduction to computational thinking using the Python programming language.

CSCI 111. Programming with Java I. 4 Credits. (3 Lec, 1 Lab) F,S
COREQUISITE: M 151Q. Introduction to programming: program design, analysis, and implementation in Java, including I/O, assignment, decision, iteration, scalar types, arrays, control structures, methods, classes, and common data types. No previous programming experience required.

CSCI 112. Programming with C I. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: CSCI 111 or CSCI 127 or EELE 101. C Programming knowledge. Introduces imperative programming and the C standard library. Course covers pointers, memory management and structures.

CSCI 127. Joy and Beauty of Data. 4 Credits. (3 Lec, 1 Lab) F,S
COREQUISITE: M 151Q Provides a gentle introduction to the exciting world of big data and data science. Students expand their ability to solve problems with Python by learning to deploy lists, files, dictionaries and object-oriented programming. Data science libraries are introduced that enable data to be manipulated and displayed. To succeed in this course, either basic computer literacy or CSCI 107 is recommended.

CSCI 132. Basic Data Structures and Algorithms. 4 Credits. (3 Lec, 1 Lab) PREREQUISITE: CSCI 111 or CSCI 127 and M 151Q. An examination of advanced Java and basic data structures and their application in problem solving. Data structures include stacks, queues and lists. An introduction to algorithms employing the data structures to solve various problems including searching and sorting, and recursion. Understanding and using Java class libraries. The laboratory uses Java. Introduces Big-O Notation.

CSCI 215CS. Social & Ethical Issues in CS. 3 Credits. (2 Lec, 1 Rec) F
PREREQUISITE: W core and US core. Social and ethical issues as they relate to computing, including privacy, risks, computer abuse, commerce, professionalism, free speech, intellectual property, social justice, and current issues. History of computing.

CSCI 232. Data Structures and Algorithms. 4 Credits. (3 Lec, 1 Lab) S PREREQUISITE: CSCI 132. Advanced data structures and programming techniques and their application. Topics include: trees, balanced trees, graphs, dictionaries, hash tables, heaps. Examines the efficiency and correctness of algorithms. The laboratory uses Java. CSCI 246 is recommended as a prerequisite.

CSCI 246. Discrete Structures. 3 Credits. (3 Lec) PREREQUISITE: M 171Q, COREQUISITE: CSCI 132. This course covers logic, discrete probability, recurrence relations, Boolean algebra, sets, relations, counting, functions, maps, Big-O notation, proof techniques including induction, and proof by contradiction.

CSCI 290B. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

CSCI 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Max 12 cr. PREREQUISITE: To be determined based on actual topic offered. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

CSCI 292. Independent Study. 1-3 Credits. (1-3 Ind; 3 cr max) On Demand Max 3 cr. PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

CSCI 305. Concepts/Programming Languages. 3 Credits. (3 Lec) S
PREREQUISITE: CSCI 132 and CSCI 246. An examination of several programming paradigms, and languages, as well as their application and underlying execution model. Paradigms examined include imperative, object-oriented, functional, logic and string based. Students will gain exposure to a variety of languages such as C, C++, Scheme, Prolog and Perl.

CSCI 338. Computer Science Theory. 3 Credits. (3 Lec) S
PREREQUISITE: CSCI 246 and M 171Q. Formal languages, theory, automata, Turing Machines, computability, the Church-Turing thesis, computational complexity, and NP-completeness.

CSCI 351. Systems Administration. 3 Credits. (3 Lec) S
PREREQUISITE: CSCI 112 and CSCI 232. The administration and management of Linux computer systems. Includes installation, user/process management, configuration of services and device handling. A thorough knowledge of Linux/Unix command structure is required.

CSCI 361. Computer Architecture. 3 Credits. (3 Lec) F
PREREQUISITE: CSCI 112 and CSCI 232. The structure and function of computer systems: CPU, memory, I/O. Includes digital logic, data type, instruction set design, pipelining, RISC, parallel processing, and assembly language programming.

CSCI 432. Advanced Algorithm Topics. 3 Credits. (3 Lec) F
PREREQUISITE: CSCI 246 and CSCI 232. A rigorous examination of advanced algorithms and data structures. Topics include average case analysis, probabilistic algorithms, advanced graph problems and theory, distributed and parallel programming. CSCI 358 is recommended as a prerequisite.

CSCI 440. Database Systems. 3 Credits. (3 Lec) F
PREREQUISITE: CSCI 232, DBMS architecture; major database models; relational algebra fundamentals; SQL query language; index file structures, data modeling and management, entity relationship diagrams.

CSCI 441. Computer Graphics. 3 Credits. (3 Lec) S odd years.

CSCI 442. Comp Vision: Robot Vision. 3 Credits. (3 Lec) S odd years.
PREREQUISITE: CSCI 232. Image processing techniques are used to quantify and manipulate visual information in diverse applications such as satellite imagery, robotic vision, and animation. Topics include enhancement, representation, restoration, segmentation, and digitization techniques.

CSCI 446. Artificial Intelligence. 3 Credits. (3 Lec).

CSCI 447. Machine Learning: Soft Computing. 3 Credits. (3 Lec)
PREREQUISITE: CSCI 232. An exploration of biologically inspired machine learning models and algorithms, including evolutionary algorithms, neural networks, swarm intelligence, and fuzzy systems. An emphasis is placed on results from current research in computational intelligence. Students engage in class discussions and team projects.

CSCI 451. Computational Biology. 3 Credits. (3 Lec) F odd years.
PREREQUISITE: CSCI 232 and CSCI 246. This course surveys classic and recent problems from computational biology. Topics covered include algorithms for genomic sequencing and searching, protein structure prediction, and regulatory network discovery. Co-convened with CSCI 551.

CSCI 455. Embedded Systems: Robotics. 3 Credits. (3 Lec) S even years.
PREREQUISITE: CSCI 232 and CSCI 361 or EELE 371. The basic tools and techniques of embedded systems using robotics as a platform. Student teams will build an autonomous mobile robot, and learn to program it to perform increasingly sophisticated behaviors. Besides providing an introduction to autonomous mobile robot technologies, the students also learn key concepts of mechanics, electronics, programming techniques, and systems design and integration.

CSCI 460. Operating Systems. 3 Credits. (3 Lec) F

CSCI 466. Networks. 3 Credits. (3 Lec) F
PREREQUISITE: CSCI 232 and CSCI 112. How computer systems are organized into networks and how communication over networks is organized. Communication protocols and their design with an emphasis on current technology and implementation of software.

CSCI 468. Compilers. 4 Credits. (3 Lec, 1 Lab) S

CSCI 476. Computer Security. 3 Credits. (3 Lec) S
PREREQUISITE: CSCI 232. Introductory to computer security. Covers security issues in software design and development from technical, social and legal viewpoints. Topics include cryptography, security models, software security, authentication, authorization, and system security. CSCI 466 is recommended as a prerequisite.
CSCI 477. Simulation. 3 Credits. (3 Lec) F
PREREQUISITE: CSCI 112, consent of instructor, and a probability or statistics course. Discrete and continuous simulation modeling methodology using a computer simulation language; random number generation, output analysis, validation, and verification; application to varied system design and analysis problems. Cross-listed with EIND 422.

CSCI 481. Program Assessment. 0 Credits. (0 Ind) F,S
PREREQUISITE: Graduating Senior. Student participation in Computer Science program assessment activities such as taking the Computer Science Major Field Test.

CSCI 482R. Interdisciplinary Project Instruction. 1 Credit. (1 Rct) F
PREREQUISITE: Senior standing. COREQUISITE: ESOF 522 First part of a senior capstone sequence for the interdisciplinary option. Classroom instruction that prepares a student to undertake an interdisciplinary project that relates computing to the student’s minor.

CSCI 483R. Interdisciplinary Project. 3 Credits. (3 Ind) S
PREREQUISITE: CSCI 482R. Second part of a senior capstone sequence for the interdisciplinary option. Students undertake an interdisciplinary project and present their results through a written paper, a poster and an oral presentation.

CSCI 490R. Undergraduate Research. 1-6 Credits. (1-3 Ind; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Consent of instructor. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

CSCI 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: To be determined based on actual topic offered. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number. Co-convened with CSCI 591.

CSCI 492. Independent Study. 1-4 Credits. (1-3 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Junior standing, consent of instructor and approval of director of the School of Computing. Directed research and study on an individual basis.

CSCI 494. Seminar. 1-4 Credits. (1-4 Sem; 4 cr max) On Demand
Max 4 cr. PREREQUISITE: Junior standing and as determined by each offering. Topics offered at the upper divisional level that are not covered in regular courses. Students participate in preparing and presenting discussion material.

CSCI 495. Field Work/Practicum. 1 Credit. (1 Ind; 2 cr max) F,S
Max 2 cr. PREREQUISITE: Junior standing and CSCI 232. Directed assistance to, and involvement in labs, with lower division CS students. Can only complete once.

CSCI 498. Internship. 1-6 Credits. (1-6 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor and approval of director of the School of Computing. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

CSCI 520. Distributed Systems. 3 Credits. (3 Lec) S
PREREQUISITE: CSCI 432 and CSCI 466. The design and implementation of software systems that utilize multiple host computer networks as a foundation. Concurrent control, homogenous and heterogeneous systems, interprocess communication, protocols and application design.

CSCI 532. Algorithms. 3 Credits. (3 Lec) S
PREREQUISITE: CSCI 232. Concrete time and space complexity; combinatorial algorithms; greedy algorithms; dynamic programming; probabilistic and randomized algorithms; branch-and-bound algorithms. CSCI 432 is recommended as a prerequisite.

CSCI 535. Computational Topology. 3 Credits. (3 Lec) S
COREQUISITES: CSCI 532 or M 461 or M 511 or consent of the instructor. Provides an introduction to topological data analysis (TDA). This course will cover the topological, geometric, and algebraic tools used in TDA. Specific topics covered include persistent homology, Reeb graphs, and minimum homotopy area. Students will explore a data set of their choice in a course project, and learn how to apply the tools discussed in lecture.

CSCI 538. Computability. 3 Credits. (3 Lec) F
PREREQUISITE: CSCI 338. Turing machine computability and decidability; abstract time and space complexity; intractability.

CSCI 540. Advanced Database Systems. 3 Credits. (3 Lec) F odd years
PREREQUISITE: CSCI 440 or consent of instructor. Advanced database models including spatial, temporal, and object-oriented; advanced data indexing techniques, data warehousing and query optimization.

CSCI 541. Computer Graphics. 3 Credits. (3 Lec) S odd years.

CSCI 547. Machine Learning. 3 Credits. (3 Lec)
An exposure to advanced topics from the field of artificial intelligence with an emphasis on machine learning. Example topics include Bayesian learning, evolutionary computation, and cognitive science. CSCI 446 is a recommended prerequisite.

CSCI 548. Reasoning Uncertainty. 3 Credits. (3 Lec)
An exploration of problem solving using structured probabilistic models. Topics in probabilistic representations, inference algorithms, and learning such models from data will be explored. CSCI 446 is a recommended prerequisite. Background in probability recommended.

CSCI 550. Data Mining. 3 Credits. (3 Lec) F even years.
PREREQUISITE: A probability or statistics course. Clustering, classification and pattern recognition; performing automated discovery of knowledge from a data set.

CSCI 551. Adv Computational Biol. 3 Credits. (3 Lec) F odd years
PREREQUISITE: CSCI 432. This course examines a variety of algorithmic computational biology topics with an emphasis on elucidating new research problems. Co-convened with CSCI 451.

CSCI 565. Wireless Networks and Mobile Computing. 3 Credits. (3 Lec) F even years
PREREQUISITES: CSCI 466 or (EELE 445 and EELE 447). This course introduces the topics of wireless networks and mobile computing. Students will be exposed to different technologies of mobile computing, both software and hardware, and be able to use them to perform wireless networking analysis.

CSCI 566. Advanced Networking. 3 Credits. (3 Lec) S odd years
PREREQUISITE: CSCI 466. This graduate-level course covers advanced topics in networking, with emphasis on IP and wireless networks. After taking this course, the students are expected to know the state-of-the-art in networking algorithms, protocols and architectures, and to understand how networking research is done.

CSCI 581. Computational Thinking Tchrn. 2 Credits. (1 Lec. 1 Lab) Su
PREREQUISITES: A minimum of 2 years high school teaching experience. The course examines the computing field and how it impacts the human condition. Exciting ideas and influential people are introduced. A gentle introduction to computational thinking using the Python programming language is provided. The course also introduces participants to robotic platforms.

CSCI 582. Joy Beauty Data for Teachers. 2 Credits. (1 Lec. 1 Lab) Su
PREREQUISITES: A minimum of 2 years teaching experience at the 7-12 grade level, and CSCI 581. Computer Science in the Classroom. Computational Thinking for Teachers or prior computer science experience, is a pre-requisite. Teachers who enroll in this course will extend their knowledge of the Python programming language and be gently introduced to the world of data science. The course builds upon the prerequisite course that is the 2-credit, MSSE course entitled Computer Science in the Classroom: An Introduction to Computational Thinking. Teachers who complete this course will be better prepared to teach material covered in CSCI 127, The Joy and Beauty of Computing.

CSCI 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing.

CSCI 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number. Co-convened with CSCI 491.

CSCI 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Graduate standing, consent of instructor and approval of director of the School of Computing. Directed research and study on an individual basis.

CSCI 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
Max 4 cr. PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

CSCI 598. Internship. 1-6 Credits. (1-6 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Graduate standing, consent of instructor and approval of director of the School of Computing. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.
CSCI 399. Graduate Consultation. 1-3 Credits. (1-3 Ind; 3 cr max) On Demand
PREREQUISITE: Master's standing, consent of instructor and approval of director of the School of Computing. This course may be used only by students who have completed all of their course work, and thesis, if on a thesis plan but who need additional faculty or staff time or help.

CSCI 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral standing.

CSTN - Construction Trades

CSTN 148. Blueprints, Codes, and Estimating. 3 Credits. (3 Lec) F
This course will introduce blueprints and emphasize reading, scaling, analyzing and bidding from plans. Topics covered will include: line weights, styles and types; title block information, dimensions, structural shapes, auxiliary views, section views, detail symbols, symbols, scaling, acronyms found in different industries, and other various blueprint information. Students will also be taught how to use plans to bid and price materials, visit the Fall Parade of Homes, and compare what's on the page to what really gets built. Typically Taken – 1st Semester (Fall).

CSTN 173. Arch Construct and Material. 3 Credits. (3 Lec) F
Upon successful completion of this course, the student will be able to identify the origins of materials and the extraction, properties, processing, and assemblies of the basic materials of construction. Thorough working knowledge of materials can enhance a construction project and enlighten the client, designer, drafts-person or end user. A complete understanding of materials, methods, techniques, sequences, and procedures can unify a design and create timeless, contemporary elements.

CSTN 248. Plans Examining II - IBC - Commercial Codes, Blueprint Reading, and Estimating. 3 Credits. (3 Lec) S
PREREQUISITE: CSTN 148, or consent of instructor, or approval of program director. This course will introduce blueprints and emphasize blueprint reading, scaling, analyzing, and estimating plan components for commercial and multiple-residence projects. Topics covered will include: building use and occupancy, special occupancy requirements, height and area limitations based on construction type, fire resistance and protection requirements, requirements for evacuation, accessibility for persons with disabilities, building systems (lighting, HVAC, plumbing, electrical and elevators), and structural components. Commercial building code criteria in the design process will be emphasized. Students will also be taught how to use plans to bid and price materials.

DANC - Dance

DANC 150. Social Dance. 1 Credit. (1 Lab; 3 cr max) F,S
Traditional and popular styles of ballroom dancing, including jitterbug, polka, waltz, cha-cha, western dance, and foxtrot.

DDSN - Drafting Design

DDSN 101. CAD 1-A. 2 Credits. (2 Lec) F,S
This course starts with basic software recognition and user interface concepts, introduces basic computer drafting principles and commands, including some intermediate concepts including 3D visualization and drafting and document publishing. Students will learn blocks, fields, CAD tips and shortcuts, and also create their own template and title block. The featured software is AutoCAD Architecture. There is no prerequisite. This course, when followed by DDSN 102 – CAD 1-B, is equivalent to DDSN 118 CAD-1.

DDSN 102. CAD 1-B. 2 Credits. (2 Lec) F,S
PREREQUISITE: DDSN 101 This course is a follow-up to DDSN 101 CAD-1. A: the two courses together, completed successfully, are equivalent to DDSN 118 CAD 1. In this course, students will focus on using AEC objects to create construction documents of designs created by others.

DDSN 112. Professional Practices. 3 Credits. (3 Lec) S
Students in this course will learn how to create a professional looking and effective résumé, understand their strengths and weaknesses, talents, and aptitudes, know how to properly seek employment in their chosen field, present themselves well in interviews and elevator pitches, know the basics of setting up their own business, understand the basic principles of the business of the Design Drafting field and learn how to continue to improve in all of these areas.

DDSN 113. Technical Drafting. 3 Credits. (3 Lec) F
This course is divided into two parts. The first half of the semester is devoted to free hand sketching. The second half of the semester is hand drafting with an emphasis on learning the components of residential construction. Traditional drafting tools will be used such as T Squares, triangles, scales, eraser shields, and mechanical pencils.

DDSN 114. Introduction to CAD. 3 Credits. (1 Lec, 2 Lab) S
Provides the learner with an understanding of two-dimensional computer-aided drafting. Students explore and create two dimensional drawings with the aid of AutoCAD software (made by Auto desk). Drawings focus on architecture, mechanical and civil engineering applications.

DDSN 118. CAD I. 4 Credits. (4 Lec) F,S
PREREQUISITE: DRFT 131 or instructor approval. This course starts with basic software recognition and user interface concepts, introduces basic Computer Drafting principles and commands, navigates CADs steep learning curve, and progresses to intermediate concepts including 3D Visualization and Drafting, AEC Objects, and Document Publishing. Students will learn Blocks, Fields, CAD Tips and Shortcuts, and also Create their own Template and Title Block. Featured software: AutoCAD Architecture. There is no prerequisite. Typically Taken – 1st Semester.

DDSN 124. Descriptive Geometry. 4 Credits. (4 Lec) S
PREREQUISITE: DRFT 131. Advanced theory and practices in descriptive geometry construction and pattern development are covered in this course in preparation for advanced courses in Design Drafting. Descriptive Geometry teaches 3D-visualization and how to solve geometric problems by drawing them in CAD. Typically Taken – 2nd Semester (Spring).

DDSN 131. Introduction to Drafting and Design. 3 Credits. (3 Lec) F,S
Introductory course, teaching hand and CAD drafting as it relates to Architecture, Engineering, Construction, and Industrial Design.

DDSN 135. SolidWorks I. 3 Credits. (3 Lec) F,S
PREREQUISITE: M 111 or consent Program Director/Instructor. This course is a study and application of standards used for producing working drawings, including the fundamentals of geometric dimensioning and tolerances. Both detail and assembly drawings will be produced. Typically Taken – 2nd Semester (Spring).

DDSN 166. Revit I. 3 Credits. (3 Lec) S
PREREQUISITE: CSTN 173, DDSN 118, DDSN 131. Students will be introduced to Parametric Design and Building Information Modeling (BIM) that make up the base platform of this software as they work through a variety of drafting projects.

DDSN 186. Intermediate Drafting & Design. 3 Credits. (3 Lec) S
PREREQUISITE: DDSN 101 and 102 or DDSN 118 or DDSN 131. Explores advanced concepts, techniques, and customizability of AutoCAD. Create templates, set up and modify printers, generate shortcuts and subroutines, and increase drafting speed and efficiency. Transition from an AutoCAD user into a competent CAD manager. Typically Taken – 2nd Semester (Spring).

DDSN 235. SolidWorks II. 3 Credits. (3 Lec) S
PREREQUISITES: DDSN 135 or consent of Instructor, or approval by Program Director. This course presents the advanced use of new designing techniques and capabilities of solid modeling using the SolidWorks software, including the integration of the advanced parametric modeling and drawing tools for SolidWorks.

DDSN 236. Product Design Challenges. 3 Credits. (3 Lec) F
PREREQUISITES: MFTG 205, DDSN 135 This course takes students through a series of design assignments & a semester-long project exploring the design processes used by companies in the prototyping and product design industry.

DDSN 244. GIS and Mapping. 3 Credits. (3 Lec) S
Fundamentals of reading, interpreting, analyzing and designing maps. Topics of emphasis include 1.) the nature of geographic information, 2.) how geographic information systems (GIS) facilitates data analysis, and 3.) how cartographic design principles can be used to create maps that excel at effective visual thinking and communication. Students will create design effective reference and thematic maps for specific users. Typically Taken – 4th Semester (Spring).

DDSN 245. Civil Drafting. 3 Credits. (3 Lec) S
PREREQUISITE: DDSN 118 or DDSN 101 or Program Director Approval. This course builds upon previous CAD experience and applies those skills to creating drawings specifically for the Civil Engineering industry. Instruction will be given relating to basic engineering principles like: survey data, acquisition, contour/break line creation, azimuth/bearing calculations, coordinate systems, latitude/longitude, and slope/grade calculations. Projects will primarily use AutoCAD Civil 3D software.

DDSN 265. Architectural Drafting. 3 Credits. (3 Lec) F
PREREQUISITES: CSTN 173, DDSN 118, DDSN 124, and DDSN 186. The students in this course will create, from scratch, an entire two story home, and draw the plans in CAD to the level where it is ready to be submitted for permit to the City of Bozeman or other municipality. Plans will include: Site Plan, Four Exterior Elevations, Foundation Plan, Main Floor Plan, Second Floor Plan, Electrical Plans, Sections and Details as required. All drawings must follow current codes including: International Residential Code, International Mechanical Code, Fuel Gas Code, International Energy Conservation Code, Uniform Plumbing Code, and National Electrical Code. Historical US Home Styles and Space Planning Problems will also be explored.
EBIO 216. Elem Princ of Biological Engineering. 3 Credits. (3 Lec) S
PREREQUISITE: ECHM 201, M 172Q. Fundamentals of energy balances in biological engineering applications.

EBIO 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a written work or other creative project. May be repeated.

EBIO 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EBIO 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of the Associate Dean. Directed research and study on an individual basis.

EBIO 324. Bioengineering Transport. 3 Credits. (3 Lec) F
PREREQUISITE: EBO 216, ECHM 321. Fundamentals of the phenomena governing the transport of momentum, energy, and mass in biological systems.

EBIO 393. Turkish Bioingen Electives. 3 Credits.

EBIO 396. Turkish Bioingen Electives. 3 Credits.

EBIO 407. Biological Engineering Thermodynamics. 3 Credits. (3 Lec) F
PREREQUISITE: M 274 and CHMY 211 and EBO 216. Principles of thermodynamics, conservation of energy and phase equilibria applied to living systems and biological processes.

EBIO 411R. Biological Engineer Design I. 3 Credits. (2 Lec) F
PREREQUISITE:ECHM 321, EBO 324, EBO 438. COREQUISITE: EGEN 310R. Senior capstone course. Design and simulation of chemical engineering equipment, processes and plants.

EBIO 412R. Biological Engineer Design II. 3 Credits. (2 Lec) F
PREREQUISITE: EBO 411R. Senior capstone course. Design and simulation of chemical engineering equipment, processes and plants.

EBIO 438. Bioprocess Engin. 3 Credits. (3 Lec) S
PREREQUISITE: ECHM 201. Biotechnology process engineering - microbial processing fundamentals, enzyme catalysis, bioreactor design and analysis, separation of biomaterials.

EBIO 439. Downstream Processing. 3 Credits. (3 Lec)

EBIO 442. Bioengineering Lab I. 3 Credits. (1 Lec, 2 Lab) F
PREREQUISITE: EBO 324, EBO 438, EGEN 350. Students will develop an experimental objective and experimental design to meet a particular objective. Independently investigate the relevant theory for a proposed experiment, analyze data for statistical significance, draw conclusions from the experimental data. They will then effectively communicate the technical information through written reports. Cross-listed with ECHM 442.

EBIO 443. Bioengineering Lab II. 3 Credits. (1 Lec, 2 Lab) S
PREREQUISITE: EBO 442. Students will develop an experimental objective and experimental design to meet a particular objective. Independently investigate the relevant theory for a proposed experiment, analyze data for statistical significance, draw conclusions from the experimental data. They will then effectively communicate the technical information through written reports.

EBIO 461. Principles of Biomedical Engineering. 3 Credits. (3 Lec) S
PREREQUISITE: ECHM 321 or consent of instructor. An overview of biomedical engineering including the application of engineering principles to the design of products and processes in the health industries. Topics include ethics, biomechanics, biomaterials, bioinstrumentation, biosensors, pharmacokinetics, and tissue engineering.

EBIO 490R. Undergraduate Research. 1-8 Credits. (1-8 Ind; 12 cr max) F,S
PREREQUISITE: Senior Standing and consent of instructor. Directed undergraduate research/creative activity which may culminate in research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.
ECHM 216. Elementary Principles of Chemical and Biological Engineering II. 3 Credits. (3 Lec) F
3 cr. LEC 3 PREREQUISITE: ECHM 215, M 172Q, consent of instructor. Energy balances and combined energy-material balances. Discussion of contemporary issues in engineering and the impact of engineering solutions in a global, economic, environmental and societal context.
ECHM 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) FS
PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a written work or other creative project. May be repeated.
ECHM 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
ECHM 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
Maximum 6 cr. PREREQUISITE: Consent of instructor and approval of the Associate Dean. Directed research and study on an individual basis.
ECHM 307. Chem Engin Thermodynamics I. 3 Credits. (3 Lec) F
ECHM 321. Chemical Engineering Fluid Mechanics Operations. 3 Credits. (3 Lec) F
ECHM 322. Chemical Engineering Heat Transfer Operations. 3 Credits. (3 Lec) F
ECHM 323. Chemical Engineering Mass Transfer Operations. 3 Credits. (3 Lec) S
PREREQUISITE: ECHM 307, ECHM 322. Theory and equipment for fundamental chemical engineering operations involving mass transfer. Equipment design and computations of operational rates.
ECHM 328. Chemical Engineering Reactor Design. 3 Credits. (3 Lec) S
3 cr. LEC 3 PREREQUISITE: ECHM 201, M 274. Application of the chemical kinetics of homogeneous and heterogeneous reactions to the design of chemical processing equipment.
ECHM 405. Sustainable Energy. 3 Credits. (3 Lec) F
PREREQUISITE: EMAT 251 and either ECHM 307 or EMEC 320, or consent of instructor. Review of energy sources, their extraction, conversion and end-use, focusing on modern technology and materials. Investigate the design, construction and operation of combustion-based energy conversion systems including boilers, engines and gas turbines, in addition to non-combustion-based energy conversion systems including solar-thermal, photovoltaics, wind turbines, fuel cells and batteries.
ECHM 407. Chem Engin Thermodynamics II. 2 Credits. (2 Lec) F
ECHM 411R. Chemical Engineering Design I. 3 Credits. (2 Lec) F
PREREQUISITE: ECHM 321, ECHM 322, ECHM 323, ECHM 328, COREQUISITE: EGEN 310R. Senior capstone course. Design and simulation of chemical engineering equipment, processes and plants.
ECHM 412R. Chemical Engineering Design II. 3 Credits. (2 Lec) S
PREREQUISITE: ECHM 411R. Senior capstone course. Design and economic analysis of chemical engineering equipment, processes and plants.
ECHM 424. Transport Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: ECHM 323, M 273Q, M 274. Deterministic modeling techniques are applied to processes for the transport of momentum, energy and mass. Analytical and numerical solution techniques for the differential equations commonly encountered in the transport processes.
ECHM 428. Reaction Engineering and Reaction Modeling. 3 Credits. (3 Lec) S
PREREQUISITE: ECHM 323 and ECHM 328. Advanced engineering aspects of chemical reactor design. Analysis of coupled mass and energy transport processes and chemical reaction in application to realistic design and scale-up of various types of chemical reactors. Optimization problems in reactor design and operation.
ECHM 442. Chem Engin Laboratory I. 3 Credits. (1 Lec, 2 Lab) F

ECHM 443. Chem Engin Laboratory II. 3 Credits. (1 Lec, 2 Lab) S
PREREQUISITE: ECHM 442. Experimental studies of unit operations and transport phenomena. Design of chemical processes and equipment from experimental studies.

ECHM 451. Chemical Engineering Process Dynamics and Control. 3 Credits. (3 Lec) S
PREREQUISITE: ECHM 328, ECHM 332, M 274. Transient response analysis of controllers and instruments. Design of chemical process control systems.

ECHM 452. Advanced Engineering Materials. 3 Credits. (3 Lec) On Demand
PREREQUISITE: EMEC 250 or EMAT 251, M 274. Micro and macro properties of electronic materials and material processing.

ECHM 490R. Undergraduate Research. 1-8 Credits. (1-8 Ind; 12 cr max) F,S,Su
PREREQUISITE: Senior Standing and consent of instructor. Directed undergraduate research/creative activity which may culminate in research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

ECHM 491. Special Topics. 1-3 Credits. (1-3 Ind; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ECHM 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

ECHM 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor and approval of associate dean. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

ECHM 503. Thermodynamics. 3 Credits. (3 Lec) F

ECHM 510. Reaction Engineering/Modeling. 3 Credits. (3 Lec) S alternate years, to be offered odd years

ECHM 533. Transport Phenomena. 3 Credits. (3 Lec) S

ECHM 534. Mass Transfer. 3 Credits. (3 Lec) On Demand
PREREQUISITE: ECHM 424. Mass transfer theory, transport in liquids, porous solids, interfacial effects, related mathematical techniques and application.

ECHM 535. Viscous Fluid Dynamics. 3 Credits. (3 Lec) On Demand

ECHM 575. Research or Prof/Paper/Project. 1-4 Credits. (1-4 Ind; 6 cr max) On Demand
Maximum 6 cr. PREREQUISITE: Graduate standing. A research or professional dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee. Directed research and study on an individual basis.

ECHM 590. Master's Thesis. 1-10 Credits. (1-10 Ind; 10 cr max) F,S,Su
PREREQUISITE: Master's standing.

ECHM 591. Special Topics. 1-3 Credits. (1-3 Lec; 12 cr max) On Demand
Maximum 12 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ECHM 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
Maximum 6 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

ECHM 594. Seminar. 1 Credit. (1 Sem; 4 cr max) F
Maximum 4 cr. PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material. Cross-listed with EBO 594.

ECHM 598. CHBE Grad Internship. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
Maximum 6 cr. PREREQUISITE: Graduate standing, consent of advisor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

ECHM 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; 10 cr max) F,S,Su
PREREQUISITE: Doctoral standing.

ECIV 101. Intro To Civil Engineering. 1 Credit. (1 Lec) F
PREREQUISITE: Must be taken within your freshman year. This course is optional for students entering civil engineering but is encouraged for freshmen wanting to learn about the breadth of the discipline. Students choosing to take the course will be introduced to civil engineering, including department programs and areas of specialty, civil engineering career options, professionalism, history, and ethics.

ECIV 202. Applied Analysis. 1 Credit. (1 Lab) F,S
PREREQUISITE: M 165Q or M 171Q or M 181Q. Civil Engineering or CE/Bio-Resources Engineering majors only. Computer applications in civil engineering using M-based software and a programming language.

ECIV 220CS. Civil Engineering and Construction - from the Ancient to the Modern. 3 Credits. (3 Lec) Su On Demand
Through the lenses of civil engineering and construction, follow the advancement of civilizations. Assess and evaluate decisions that we must make as a society with respect to protecting the health of the public and the environment with our finite resources.

ECIV 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F
Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

ECIV 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ECIV 307. Construction Estimating and Bidding. 3 Credits. (2 Lec, 1 Lab) F,S,Su
PREREQUISITE: BMGT 205 or WRIT 201 or WRIT 221 and EGEN 116 or DDDS 101 or DDDS 131. Contract documents, insurance, bonding, specifications, drawings, labor and labor law, estimating, bidding and scheduling, business organizations, leadership, and ethics. Significant technical and business writing required.

ECIV 309. Building Information Modeling in Construction. 3 Credits. (2 Lec; 1 Lab) F,S
PREREQUISITE: EGEN 115, DDDS 101 or EGEN 116 or DDDS 131. CO-REQUISITE: ECIV 308 and ARCH 241. Introduction to the use of Building Information Modeling (BIM) in the Construction Industry. Instruction in BIM basics using contemporary software, with hands-on exercises in typical construction applications.

ECIV 311. Construction Project Documentation. 2 Credits. (2 Lec) F,S
PREREQUISITE: ECIV 308. Review and development of various administrative instruments required for project management, including plans and specifications, business communications, submittals, contracts, financial reports, contract risk and pass through clauses, labor issues and legislation, submittals, claims and disputes, change orders, quality control plans and reports, project close outs and productivity analyses.

ECIV 312. Structures I. 3 Credits. (3 Lec) F,S

ECIV 315. Structures II. 3 Credits. (2 Lec; 1 Lab) F,S
ECIV 320. Geotechnical Engineering. 3 Credits. (2 Lec, 1 Lab) F,S

ECIV 331. Engineering Hydrology. 2 Credits. (2 Lec) On Demand
PREREQUISITE: EGEN 350 or STAT 332. Descriptive and quantitative hydrology with applications in water resources engineering.

ECIV 332. Engineering Hydraulics. 2 Credits. (1 Lec, 1 Lab) On Demand.
PREREQUISITE: EGEN 335. Pipe flow, open channel flow, and hydraulic machines with applications in water resources engineering.

ECIV 333. Water Resources Engineering. 4 Credits. (3 Lec. 1 Lab) F,S
PREREQUISITE: EGEN 350 or STAT 332. Descriptive and quantitative hydrology with applications in water resources engineering. Pipe flow, open channel flow, and hydraulic machines with applications in water resources engineering.

ECIV 350. Transportation Engineering. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: Junior standing. Introduction to vehicle operating characteristics, geometric and pavement design, traffic flow theory, signal design and analysis, capacity analysis and planning. Laboratory work will introduce various in-practice software packages.

ECIV 401. Civil Eng Practice and Ethics. 1 Credit. (1 Rct) F,S
PREREQUISITE: Concurrent registration with ECIV 489R required. Professional ethics, social responsibility, public policy, and leadership.

ECIV 404. Heavy Const Equip and Methods. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: STAT 216Q, EGEN 325 or EGEN 330, and ETCC 302 or ECIV 320. COREQUISITE: ECIV 307. Construction equipment operating characteristics, economics, and production rate estimation. Heavy construction methods associated with tunneling, aggregate production, and mass earthwork operations.

ECIV 405. Construction Project Planning and Scheduling. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: ECIV 307. Project planning and scheduling procedures involving both network (CPM) and non-network techniques. Introduction to computer scheduling software.

ECIV 406. Sustainability Issues in Construction. 3 Credits. (3 Lec) S
PREREQUISITE: ECIV 308. Review sustainability issues in the construction industry, including LEED; green practices; energy systems and renewable energy; water resources; storm and waste water; life cycle assessment; building health issues.

ECIV 414. Steel Design. 3 Credits. (5 Lec) F alternate years to be offered odd years PREREQUISITE: ECIV 315. Design of structural steel members and systems.

ECIV 415. Design of Masonry Structures. 3 Credits. (3 Lec) S
Alternate Even Years. PREREQUISITE: ECIV 315. Introduction to masonry design. Integrated building design from the roof to the foundation. Including load calculations, structural roof and floor elements and connections. Emphasis on low-rise buildings.

ECIV 416. Design of Wood and Timber Structures. 3 Credits. (3 Lec) S
Alternate Odd Years. PREREQUISITE: ECIV 315. Introduction to the basic behavior of wood and timber structures. Design of wood and timber components and structures using contemporary building codes.

ECIV 420. Earth and Foundation Engr. 3 Credits. (3 Lec) S
PREREQUISITE: ECIV 320. Application of soil mechanics principles to the analysis and design of conventional shallow foundations, mat foundations, and deep foundation systems.

ECIV 425. Geotechnical Structures. 3 Credits. (3 Lec) F

ECIV 431. Open Channel Hydraulics. 3 Credits. (3 Lec) F
PREREQUISITE: ECIV 332 or ECIV 333. Principles of open channel flow; hydraulic design of open channel structures.

ECIV 435. Closed-Conduit Hydraulics. 3 Credits. (3 Lec) S
PREREQUISITE: ECIV 332 or ECIV 333. Advanced topics in hydraulic engineering, with emphasis on analysis and design of pipe transmission lines, pumps, and pipe distribution networks.

ECIV 450. Public Transit System Design. 3 Credits. (3 Lec) On Demand
PREREQUISITE: ECIV 350, and EGEN 350 or STAT 332. Design, implementation and management of public transit systems including paratransit, bus and light rail; including an overview of funding sources, legislation, public relations and other issues with coverage or route optimization strategies and demand estimation techniques.

ECIV 451. Highway Pavements. 3 Credits. (2 Lec, 1 Lab) S
Alternate Even Years. PREREQUISITE: ECIV 350 and ECIV 320. Design of highway pavements including drainage and base/subbase/subgrade preparation. Laboratory in bituminous materials.

ECIV 452. Traffic Engineering and ITS. 3 Credits. (2 Lec, 1 Lab) F,S
Alternate Odd Years. PREREQUISITE: ECIV 350. Application of driver, vehicle, and roadway characteristics to principles of traffic control, operations, and safety. Traditional and advanced technology solutions will be explored.

ECIV 454. Transportation Planning. 3 Credits. (2 Lec, 1 Lab) S
Alternate Odd Years. PREREQUISITE: ECIV 350 and EGEN 350 or STAT 332. Transportation planning process and travel demand forecasting including trip generation, trip distribution, mode split and traffic assignment. Laboratory work will introduce TranCADtm software.

ECIV 455. Survey Data Collection & Analysis for Transportation Engineering. 3 Credits. (2 Lec, 1 Lab) F,S
Alternate Even Years PREREQUISITE: EGEN 350 or EIDN 354 or consent of instructor. Course introduces students to the principles and practice of survey and data analysis for transportation engineering and elevates students’ ability to design and apply scalable approaches to analyze transportation-related data. Transportation survey design, implementation and analysis are covered. Methods and techniques for anticipating traffic events (crashes, congestion, etc.) are studied. Co-convened w/ ECIV 555.

ECIV 456. Highway Geometric Design. 3 Credits. (3 Lec) F
PREREQUISITE: ECIV 350. Advanced geometric design of highway systems including two-lane, interstate roadways, roundabouts, and intersection design elements.

ECIV 461. Cold Regions Infrastructure Engineering. 3 Credits. (3 Lec) S
PREREQUISITE(S): ECIV 320 or ETCC 302, EGEN 331 or EGEN 335. COREQUISITE: ECIV 308. This course explores the challenges of cold regions infrastructure engineering. Design, construction and performance issues specific to cold climates are identified, and methods to overcome them are developed and demonstrated.

ECIV 484. Reinforced Concrete Design. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: ECIV 315. Design of reinforced concrete members and systems.

ECIV 489R. Civil Engineering Design I. 2 Credits. (1 Lec, 1 Lab) F,S
PREREQUISITE: EGEN 310R and a student must be within two semesters of graduation. COREQUISITE: EGEN 325 or EGEN 330 and ECIV 308. Concurrent registration with ECIV 401 is required. Senior capstone course. Discussion of the design process from conceptual/preliminary design to final design, plans, specifications, Develop proposal for engineering services, including scope of work, data acquisition, and organization of design team.

ECIV 490R. Undergraduate Research. 1-4 Credits. (1 Ind; 12 cr max) F,S,Su
Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

ECIV 491. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ECIV 492. Independent Study. 1-3 Credits. (1-3 Ind; 4 cr max) F,S,Su,F
PREREQUISITE: Junior standing, consent of instructor, and approval of Department Head. Directed research and study on an individual basis.

ECIV 498. Internship. 2-3 Credits. (2-3 Ind; 12 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor and approval of Department Head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field. Students may not take this course the semester they graduate.

ECIV 499R. Capstone: Civil Eng Design II. 2 Credits. (1 Lec, 1 Lab) F,S

Montana State University
ECIV 504. Construction Productivity. 3 Credits. (Lec) On Demand PREREQUISITE: Two years of construction field experience required. PMSEM-CEM option requirement. ONLINE ONLY. Management concepts will include human factors as well as enlightened leadership and advanced management concepts. Productivity improvement data collection, analysis, and solutions to include the construction work force and cost.

ECIV 505. Quality Assurance/Risk Management. 3 Credits. (Lec) On Demand PREREQUISITE: Either EGEN 350, EIND 354 or STAT 322 and ECIV 308 or equivalent plus one year of industrial experience or one internship (ECIV 498 or ETCC 498). PMSEM-CEM option requirement. ONLINE ONLY. Quality assurance and control concepts to include utilization of statistical analysis. Application of risk analysis principles to the construction process to minimize liability and project costs.

ECIV 506. Ad Construction Management. 3 Credits. (Lec) On Demand PREREQUISITE: One year of industrial experience or one internship (ECIV 498 or ETCC 498). PMSEM-CEM option requirement. ONLINE ONLY. Broad issues of construction sustainability (LEED, Lean Construction, Environmental requirements, etc.) and how the construction industry needs to manage this process.

ECIV 507. Law of the Construction Industry. 3 Credits. (Lec) On Demand PREREQUISITE: BGEN 361. PMSEM-CEM option requirement. ONLINE ONLY. This class exposes engineers to the effect of law, rules and regulations on their work both from a practical perspective, for example, what engineers should know about basic concepts of contract law, to more abstract concepts like whether, and in what manner, governments mandates green construction. This course emphasizes the importance of understanding how the construction industry works within a framework of rules and regulations, critically considering whether the rules help or hinder the construction process and most importantly, how you as future leaders in the engineering profession are going to make the process better.

ECIV 511. Building Structural Systems. 2 Credits. (2 Lec) F alternate even years PREREQUISITE: ECIV 484 or ECIV 414 or ECIV 415 or ECIV 416. COREQUISITE: ECIV 512. Analysis of multistory structural systems. Emphasis on lateral force resisting systems in steel framed buildings.

ECIV 512. Structural Dynamics. 2 Credits. (2 Lec) F alternate even years. PREREQUISITE: ECIV 312. Response of structures to dynamic loads, including seismic loads.

ECIV 513. Behavior of Concrete Structures. 3 Credits. (3 Lec) S alternate odd years. PREREQUISITE: ECIV 484. Behavior of reinforced concrete members, frames, and shear wall systems. Significance of behavior in design of reinforced concrete structures.

ECIV 514. Behavior of Steel Structures. 3 Credits. (3 Lec) S alternate even years. PREREQUISITE: ECIV 414. Behavior of steel members and frames. Significance of behavior in design of steel structures.

ECIV 515. Adv Structural Analysis. 2 Credits. (2 Lec) S alternate odd years. PREREQUISITE: EGEN 415. This course presents the theoretical background behind common finite elements used by structural engineers. Elasticity, energy methods, dynamics, buckling, nonlinear materials and large rotation topics are addressed. These topics will help students understand the finite element structural engineering software in an informed manner.

ECIV 519. Bridge and Prestressed Concrete Design. 3 Credits. (3 Lec) F alternate even years PREREQUISITE: ECIV 320. Principles of geotechnical site investigations and advanced laboratory testing for the purpose of characterizing soils and the determination of engineering soil properties used in the design of soil structures.

ECIV 524. Advanced Soil Mechanics. 3 Credits. (3 Lec) F alternate odd years. PREREQUISITE: ECIV 320. Topics leading to an advanced understanding of the engineering behavior of soils with an emphasis on settlement and shear strength.

ECIV 529. Groundwater Contamination. 3 Credits. (3 Lec) S. PREREQUISITE: EGEN 335. Contemporary groundwater topics including water supply, contaminant transport, and remediation technologies. Subsurface mass transport and microbial processes and their effect on fate and transport of organic and inorganic contaminants in the context of bioremediation and other remediation technologies will be emphasized.

ECIV 530. Adv Hydraulic Investigations. 3 Credits. (3 Lec) S alternate even years. Advanced topics in hydraulics and fluid mechanics.

ECIV 554. Transportation Safety. 3 Credits. (3 Lec) S alternate odd years. PREREQUISITE: ECIV 350. This course addresses safety of the highway system as related to design, construction, and operations. The course provides an overview of the various elements of the highway system namely, road users, vehicles, roadways, and environment as related to safety. Apart from the introduction, the course is structured in three distinct components that represent the sequential stages in highway life; i.e. design, construction, and operations.

ECIV 555. Survey Data Collection & Analysis. 3 Credits. (2 Lec, 1 Lab) S Alternate Even Year PREREQUISITES: EGEN 350 or EIND 354. This course introduces students to the principles and practice of survey data collection and analysis for transportation engineering and raises students’ ability to design and apply scalable approaches to analyze transportation-related data. Transportation survey design, implementation and analysis are covered. Methods and techniques for anticipating traffic events (crashes, congestion, etc.) are studied. Co-convened with ECIV 455.

ECIV 556. Traffic Flow Fundamentals. 3 Credits. (3 Lec) S alternate even years. PREREQUISITE: ECIV 350, EGEN 335 or STAT 322. This course covers traffic stream parameters, their relationships, and important analytical techniques in traffic engineering such as capacity analysis, queueing analysis, shockwave analysis, and traffic simulation. Topics covered are essential in understanding the behavior of vehicular traffic as a complex system.

ECIV 562. Snow and Avalanche Physics for Teachers. 3 Credits. (1 Lec. 1 Lab. 1 Rec) S PREREQUISITES: A minimum of 2 years science teaching experience. Snow and Avalanche Engineering for Teachers provides students with the knowledge necessary to implement snow and avalanche related lessons into their respective math and science lessons.

ECIV 575. Research or Prof Paper/Project. 1-4 Credits. (1-4 Ind; 6 cr max) F,S,Su PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major adviser and graduate committee.

ECIV 589. Graduate Consultation. 1-3 Credits. (1 Ind; 3 cr max) F,S,Su PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

ECIV 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su PREREQUISITE: Master’s standing.

ECIV 591. Special Topics. 1-4 Credits. (1-4 Ind; 12 cr max) On Demand PREREQUISITE: Upper division courses and others as determined for each offering. Courses not included in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ECIV 592. Independent Study. 1-6 Credits. (1-6 Ind; 6 cr max) F,S,Su PREREQUISITE: Graduate standing, consent of instructor, approval of Department Head and Dean of Graduate Studies. Directed research and study on an individual basis.

ECIV 594. Seminar. 1 Credit. (1 Sem) F S PREREQUISITE: Final semester of MS program. Students participate in preparing and presenting discussion material.

ECIV 598. Internship. 2 Credits. (2 Ind; 12 cr max) On Demand Graduate standing, consent of instructor and approval of Department Head. An individual assignment arranged with an agency, business or other organizations to provide guided experience in the field.

ECIV 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su PREREQUISITE: Doctoral standing.

ECNS - Economics

ECNS 100IS. Personal Economics. 3 Credits. (3 Lec) F PREREQUISITE: Gallatin College degree-seeking student. This course will demonstrate the basic tools of personal finance and economics. The financial lessons will be put into economic perspective by evaluating them at the micro and macro levels helping students understand the fabric of the overall economy. This course does not fulfill the requirement of ECNS 101IS - Economic Ways of Thinking.

ECNS 101IS. Economic Way of Thinking. 3 Credits. (3 Lec) F,S Introduces important tools and methods of economics, including the core reasoning that underlies decision-making, analytical thinking and problem solving, demand and supply analysis, and indicators of economic performance. Emphasis is on application of the tools of economics to current issues of social and personal importance. LEVEI II MATH SUGGESTED.
ECNS 101. Study Econ Way of Thinking. 1 Credit. (1 Lec) F,S
Corequisite: ECNS 101IS. Optional directed study in a small group setting for ECNS 101 students. Students meet weekly in small groups to review ECNS 101 concepts, gain additional practice with economic problems, and complete in-class problem sets.

ECNS 132. Econ & the Environment. 3 Credits. (3 Lec) On demand PREREQUISITE: ECNS 101IS. This course includes topics on renewable (fisheries, wildlife, surface water use) and non-renewable (oil, natural gas, minerals) natural resource issues, environmental resources (public lands, resource preservation), pollution control issues, and the global environment (including climate change, biodiversity and population).

ECNS 202. Principles of Macroeconomics. 3 Credits. (3 Lec) F,S,Su PREREQUISITE: ECNS 101IS. Corequisite: M 121Q. Topics include inflation, unemployment, interest rates, money, and the impact of government surpluses or deficits. Government policies of growth, employment, income distribution, and international trade are examined.

ECNS 204IS. Microeconomics. 3 Credits. (3 Lec) PREREQUISITE: ECNS 101IS or ECNS 251IS, M 121Q. Consumer theory and the theory of the firm are utilized to show how independent decisions by consumers and firms interact in markets to determine the price and output of goods and services.

ECNS 206. Study Principles of Macroeconomics. 1 Credit. (1 Lec) F,S Corequisite: ECNS 202. Optional directed study in a small group setting for ECNS 202 students. Students meet weekly in small groups to review ECNS 202 concepts, gain additional practice with economic problems, and complete in-class problem sets.

ECNS 251IS. Honors Economics. 4 Credits. (4 Sem) F,S PREREQUISITE: Consent of Instructor. Economic principles are introduced and applied to a wide range of contemporary and historical problems including legal, environmental, resource, health, taxation, poverty, economic development, and macroeconomic policy issues.

ECNS 290R. Undergraduate Research. 1-8 Credits. (1-8 Ind; 8 cr max) F,S,Su PREREQUISITE: ECNS 101IS and approval of instructor. Intended for lower division undergraduate research/undergraduate scholars program. The student will work closely with the supervising faculty. Course will address responsible conduct of research.

ECNS 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: Dependent on the offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting regular course number.

ECNS 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

ECNS 301. Intermediate Micro with Calc. 3 Credits. (3 Lec) F,S PREREQUISITE: ECNS 204IS or ECNS 251IS, M 161Q or M 171Q. A study of microeconomic theory and selected applications with emphasis on theory of consumer behavior and theory of the firm. A major objective of the course is to prepare students for additional upper-division courses in economics.

ECNS 303. Intermediate Macro with Calc. 3 Credits. (3 Lec) F,S PREREQUISITE: ECNS 202 and ECNS 204 or ECNS 251; M 161 or M 171. The economic theory of economy-wide aggregates such as national income, levels of employment, income distribution, the determinants of the performance of entire economies: nations, groups of nations, and the world.

ECNS 305R. Peer Leadership in Economics. 3 Credits. (3 Lec) F PREREQUISITE: ECNS 301 and by consent of instructor. Teaches leadership through peer interaction of ECNS 101 students. Students lead economics study labs, study and implement effective economics pedagogical techniques analyze and communicate to others regarding economic problem solving, and conduct research on economics pedagogy.

ECNS 309. Managerial Economics. 3 Credits. (3 Lec) F PREREQUISITE: ECNS 204 or ECNS 251, M 161 or M 171. An integration of various principles and concepts from different areas of economics. These are combined with several tools of analysis and related to problems of economic decision making and policy formulation at the firm level.

ECNS 311. Intermediate Microeconomics with Economics Education Applications. 3 Credits. (3 Lec) On Demand PREREQUISITE: ECNS 204 or ECNS 251 or consent of instructor. A study of microeconomic theory with selected applications in the area of the economics of education and emphases on the theory of the behavior of consumers, firms, nonprofit organizations and government agencies, and welfare economics. Applications will address issues such as the labor market for primary and secondary school teachers, the effects of voucher programs on the quality of public and private education, and the returns to primary and secondary education.

ECNS 312. Labor Economics. 3 Credits. (3 Lec) F,S,Su PREREQUISITE: ECNS 204 or ECNS 251. Economics of labor markets, wage determination, and human capital. The theoretical framework of labor market analysis is presented, along with empirical research results and descriptive aspects of current labor issues.

ECNS 313. Money and Banking. 3 Credits. (3 Lec) F,S,S Su PREREQUISITE: ECNS 202 or ECNS 251. Principles and problems of money, banking, and credit. Monetary and banking history; monetary theory and policy; structure and operation of our financial system.

ECNS 314. International Economics. 3 Credits. (3 Lec) F PREREQUISITE: ECNS 204IS or ECNS 251IS. A survey of international economic theory and policy. Major concepts explored are comparative advantage, impacts of tariffs, exchange rates, and international payments.

ECNS 317. Economic Development. 3 Credits. (3 Lec) S PREREQUISITE: ECNS 204IS or ECNS 251IS. The plight of the world's low income countries, and the many national and international programs devoted to its alleviation. Primary emphasis directed to economic factors, but attention given to political and social characteristics vital to economic development.

ECNS 320. Public Finance. 3 Credits. (3 Lec) S PREREQUISITE: ECNS 204IS or ECNS 251IS. Analysis of public expenditure programs, government behavior, and public decision making. Topics such as health care and welfare programs, and principles of taxation will be covered.

ECNS 332. Econ of Natural Resources. 3 Credits. (3 Lec) S PREREQUISITE: ECNS 204IS or ECNS 251IS. Economic principles regarding the allocation and use of natural resources and the impact of institutional factors within which these decisions are implemented. Emphasis on property rights, economic rent, and impact of regulations on resources such as forests, fisheries, land, and water.

ECNS 345. Econ Org, Finance & Credit. 3 Credits. (3 Lec) F,S,S PREREQUISITE: ECNS 204IS or ECNS 251IS. Alternatives available to business owners for acquiring and maintaining control over resources used in production. Emphasis is on the management of cash, credit, debt, taxes, and interest in relation to price levels and general economic conditions. Primary focus is the agriculture industry. Cross-listed with AGBE 345.

ECNS 372. Economic History of U.S. 3 Credits. (3 Lec) On Demand PREREQUISITE: ECNS 101IS or ECNS 251IS. Interpretation of American economic growth in the context of economic theory. Examines specific issues in U.S. history while focusing on the question of how the U.S. has been able to sustain increases in per capita income.

ECNS 394. Seminar. 1 Credit. (1 Sem; max unlimited) F,S,Su PREREQUISITE: ECNS 204IS or ECNS 251IS consent of instructor. Current economic problems and current writings of people in the profession. Topics vary each semester; students should check with the department before registering.

ECNS 401. Microeconomic Theory. 3 Credits. (3 Lec) F PREREQUISITE: ECNS 301 or consent of instructor. Current economic problems and current writings of people in the profession. Topics vary each semester; students should check with the department before registering.

ECNS 403R. Intro to Econometrics. 3 Credits. (3 Lec) F,S,S PREREQUISITE: ECNS 301 and STAT 216Q or M 161Q or M 171Q. Senior capstone course. Statistical analysis and interpretation of quantitative data in economics. Focus on estimating economic relationships and conducting hypothesis testing in economics. Utilizes curating-edge statistical software packages and real data to apply economic methods to problems in business, economics, and public policy.

ECNS 406. Industrial Organization. 3 Credits. (3 Lec) F PREREQUISITE: ECNS 301. Offers students the opportunity to use training in price theory by focusing on issues concerned with public policy toward business. The subject matter should appeal to students in pre-law and business as well as economics majors.

ECNS 432R. Benefit-Cost Analysis. 3 Credits. (3 Lec) F,S,S PREREQUISITE: ECNS 301. Senior capstone course. Applied welfare economics and methods and criteria for evaluating benefits and costs of public policies and investment. Applications include environmental and natural resource issues.
ECNS 461. Financial Econometrics. 3 Credits. (3 Lec) F
PREREQUISITE: ECNS 251IS, EIND 394. Introduce important concepts in econometrics with an emphasis on probability theory, mathematical statistics, matrix algebra, and application of these concepts to developing econometric analyses. The SAS statistical software will be to develop empirical analyses of financial markets data.

ECNS 490R. Undergraduate Research. 1-8 Credits. (1-8 Ind; 8 cr max) F,S,Su
PREREQUISITE: ECNS 204IS, junior standing, and approval of instructor. Intended for upper division undergraduate research/undergraduate scholars program. The student will work closely with the supervising faculty. Course will address responsible conduct of research.

ECNS 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Determined by each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ECNS 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

ECNS 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material. Course is co-convened with ECNS 594.

ECNS 501. Microeconomic Theory. 3 Credits. (3 Lec) S
PREREQUISITE: ECNS 401 and Consent of Instructor. Economic models of optimization as they apply to consumer and firm decision making. Topics covered include comparative statics, theory of the firm and consumer, and consumer and producer surplus.

ECNS 502. Macroeconomic Theory. 3 Credits. (3 Lec) S

ECNS 561. Econometrics I. 3 Credits. (3 Lec) F
PREREQUISITE: ECNS 301, STAT 216, M 221. The use of regression analysis in the estimation of economic relationships, with emphasis on development of the least squares technique, the properties of estimators, and hypothesis testing in the context of the regression model.

ECNS 562. Econometrics II. 3 Credits. (3 Lec) S
PREREQUISITE: ECNS 561 and Consent of Instructor. Course consists of theoretical and applied econometrics of static and dynamic structural models, primarily using time-series data. Single equations and system of equations are evaluated. Estimation properties specific to statistical problems, dynamic adjustments to economic behavior, and model forecasting are emphasized.

ECNS 569. Research Methodology. 1 Credit. (1 Lec) F
PREREQUISITE: Graduate standing, ECNS 301, ECNS 303. The research process as a means of acquiring knowledge which is reliable and relevant to problems.

ECNS 575. Professional Paper and Project. 1-4 Credits. (1-4 Ind; 6 cr max) F,S,Su
Max 6 cr. PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

ECNS 589. Graduate Consultation. 3 Credits. (3 Ind) F,S
PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

ECNS 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing. May be repeated.

ECNS 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ECNS 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, and approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

ECNS 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ECDS 501. Educational Statistics I. 3 Credits. (3 Lec) F,S
PREREQUISITE: STAT 216, graduate standing or consent of instructor. The application of statistical processes to the analysis of educational data. Educational problems that require hypothesis testing, regression, estimation and the T-distribution, analysis of frequencies, and ANOVA in their solution will be included.

ECDS 504. Assessment and Evaluation in Education. 3 Credits. (3 Lec) F,S
PREREQUISITE: Graduate standing. This course will engage students in a discussion regarding the construction, selection and use of formative assessment methods specific, but not limited to, the science classroom. In addition, students will be involved in special projects which allow them to explore evaluation at the classroom and program levels.

ECDS 505. Foundations of Action Research in Teaching and Learning. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing. This course presents an overview of action research for practicing teachers and informal science educators. Students will explore the conceptual underpinnings of action research in science education as they relate specifically to curriculum, teaching and learning of science. Students will gain experience in data collection and analysis, and will prepare an action research proposal based on their individual teaching situations.

ECDS 506. Applied Educational Research. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: Graduate standing. Students are introduced to systematic scientific inquiry, its purpose in an educational environment, the different approaches to conducting educational research, and the major components of an educational research study. Providing a foundation for further study of research methodologies, students will identify and evaluate existing literature on a topic and conduct an educational research study. Course will address responsible conduct of research.

ECDS 509. Implementing Action Research in Teaching and Learning. 3 Credits. (3 Lec) F
PREREQUISITE: ECDS 505 or another foundational course in action research. In this course, students will complete the action research proposal created in ECDS 505. This will include developing and refining techniques for gathering classroom data, using multiple strategies for data analysis, and communicating the research results in a professional report and in presentation to more than one audience (e.g. other educators, community members).

ECDS 510. Issues and Trends in Social Studies Instruction. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing. Treats current issues & trends in social studies teaching and learning, with special focus on the social and political forces driving change in social studies education and the responses from the research and practice communities.

ECDS 512. Writing and Its Improvement. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Graduate standing. Advanced study in language arts pedagogy. Special attention is given to the writing process.

ECDS 514. Mentoring New Teachers. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate Standing. This course examines research relevant to the process of mentoring new teachers and supporting their professional development. Course content explores skills necessary for successful mentoring, the professional development needs of new teachers, and development of tools for monitoring and evaluation.

ECDS 518. Master Teaching Strategies for Science Educators. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing. A professional development class for practicing science educators to learn master teaching strategies to engage grade 6 - 12 students learning science. Intended as a "gateway" online class for teachers interested in exploring an online course in consideration of the MSSE degree. Course is elective for the MSSE degree.
EDCI 520. Visual Arts and Learning. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Graduate standing. Explores the importance of art in the lives of children and adolescents while finding ways to include art experiences in an integrated curriculum. Emphasizes philosophical and cultural groundings for teaching art, studio experiences and research potentials.

EDCI 522. Info Resources & Services. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing. A course in the use of information resources in research, reference, integration, and online learning. Topics include the use and evaluation of traditional and electronic information resources, design and selection of information resources for classrooms and libraries. Restricted to Library Media Certificate students.

EDCI 525. Improvement of Instruction in Science. 3 Credits. (3 Lec) S
PREREQUISITE: EDU 495 OR EDU 497. This course focuses on theoretical and practical concerns in science education. Research, conceptual frameworks and policy issues will be introduced, as well as teaching and learning activities for elementary and secondary science classrooms.

EDCI 530. Improvement of Math Instruction. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate Standing. This course will focus on developing mathematical knowledge for teaching through the study of mathematics education literature, designing and testing mathematics lessons, diagnosing student errors, and using those errors as a bridge to better understanding.

EDCI 531. Contemporary Issues in Education. 3 Credits. (3 Lec) Su
This course is designed to establish the necessary social, technical, and research, foundations for cohort groups in the Master's degree program. This course will examine critical issues in education including advanced pedagogy, Indian Education for All, and school law.

EDCI 532. General School Curriculum. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Graduate standing. A survey of developments in curriculum theory and the role of curriculum reform in school improvement initiatives. Also treated is the relationship between curriculum reform and implementation.

EDCI 533. Middle Years School. 3 Credits. (3 Lec) On Demand
PREREQUISITE: EDU 495, graduate standing. History, philosophy and organization of Junior High and Middle schools, emphasizing curriculum and instruction based on the characteristics and needs of 10 to 13 year olds.

EDCI 534. Literacy Assessment and Instruction. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Graduate standing. Current theory and techniques in assessment of reading. Emphasis on instructional strategies and assessment tools developing the literacy of all students. A practicum is included.

EDCI 536. Construction of Curriculum. 3 Credits. (3 Lec) Su
PREREQUISITE: Graduate standing. The development and evaluation of curriculum based on psychological and social foundations of curriculum, curriculum theory, developmental models, design issues, purposes, implementation plans and techniques for assessing the impact of curriculum change.

EDCI 537. Contemporary Issues in Science Education. 2 Credits. (2 Lec) Su
PREREQUISITE: Graduate standing. This seminar style course focuses on current problems and controversial issues in science education. Emphasis is placed on those issues which relate directly to science teaching, learning and curriculum. Students investigate a variety of issues especially as they relate to their own teaching practices and student learning in their classroom.

EDCI 540. American Indian Studies for Ed. 3 Credits. (3 Lec) On Demand
This course serves to equip teachers with the skills, knowledge, and dispositions to meet Indian Education for All requirements for the state of Montana, and fulfills similar expectations in surrounding states. Instruction pertains to the history, traditions, customs, values, beliefs, and contemporary affairs of American Indians, particularly tribal groups in the Northern Plains Region.

EDCI 541. History & Philosophy of Education. 3 Credits. (2 Lec) On Demand
PREREQUISITE: Graduate standing. In its classical obligation, philosophy means "a love of learning," This course traces the growth of cultural and intellectual awareness in human civilizations and examines how we humans learned to create tools for the mind. Teachers learn to see the nature of formal cultural systems in the way they developed, and to recognize the central concepts that are the key to learning any subject.

EDCI 542. Creative Processes in Education. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Graduate standing. Reviews historical and current issues in art education, aesthetic education and related areas which inform how we know our world and construct meaningful ways to pursue creative endeavors. Emphasizes documentation and research while acknowledging growth as teachers and artists.

EDCI 544. Philosophical Issues in Education. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Graduate standing. An examination of contemporary educational issues using the perspectives of traditional and contemporary philosophical documents.
EDCI 556. The Legal, Social, and Practical Basis of Schooling. 3 Credits. (3 Lec) S
This is a course on the history of American educational traditions, institutions, practices, policies, and legal rulings as configured within the framework of democratic institutions. This course informs the judgment of teachers by helping them understand schools as integral with the social, political, ideological, economic, and cultural contexts of the societies they serve. Includes practical information on governance structures, unions, school law, ethics, and the culture of the school as a professional workplace.

EDCI 557. Brain Science, Educational Research, and Teaching. 3 Credits. (3 Lec) S
This course examines key theories and concepts on the psychology of learning, from behaviorism through gestalt psychology to current variations of constructivism and cognitive science. Topics include brain imaging, cognitive science, a taxonomy of knowledge types, the power of narrative in learning, and a practical study in establishing curricular coherence through the use of foundational perspectives of the subject matter.

EDCI 558. Internship: Methods of Teaching. 3 Credits. (3 Lec) F
This course provides a research and classroom based study of general teaching methods and covers topics such as culturally responsive teaching, differentiated instruction, and data-driven decision making. Topics also include strategies to promote student understanding, meeting the needs of ESL students, lesson delivery, motivational techniques for instruction and assessment, and effective work with families and colleagues.

EDCI 559. Internship: Equity, Special Needs, and Diversity. 3 Credits. (3 Lec) F
This course focuses on the practical implementation of professional knowledge, skills, and dispositions in the social dimensions of teaching, knowing how to manage a classroom and develop an effective learning community. It provides a research and classroom based study of equity; special education laws, theory and practice; diversity, directing theory into practice; and meeting national, state and local standards.

EDCI 564. The Comprehensive Portfolio. 3 Credits. (3 Lec) S
This course guides the process of creating the capstone Comprehensive Portfolio in which students summarize all of their learning from the NPTT program and demonstrate how that learning has manifested in the success of the K-12 learners they teach. We study the use of portfolios as a mechanism for authentic assessment of professional practice by various professional organizations. Students engage in self-critique, peer evaluations, and the professional evaluation of your portfolio by faculty and other professional evaluators, and model the habits of self-study, reflection, and critique expected of teachers as life-long learners.

EDCI 571. In-Service Education. 1-4 Credits. (1-4 Lec; 4 cr max) On Demand
PREREQUISITE: Graduate standing and employment by sponsoring school organization. An approved supervised study group of an educational problem within a local school supervised by an MSU faculty member which culminates in a special report to be filed with the local district and the.

EDCI 575. Professional Paper/Project. 3 Credits. (3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing. MSSE 501, EDCI 504, EDCI 505, EDCI 509 or equivalent. This is the culminating research course in which students implement and report their research findings. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

EDCI 577. Internship: OPI Teacher Certification. 1 Credit. (1 Ind) F,S,Su
PREREQUISITE: Consent of instructor and approval of department head. An internship course restricted to OPI teacher certification students.

EDCI 578. Internship: BPE Teacher Certification-Library Media. 1-2 Credits. (1-2 Ind; 7 max) F,S,Su
PREREQUISITE: Must be in the An internship course restricted to BPE teacher certification students enrolled in the Library Media Certificate program.

EDCI 588. Professional Development. 1-3 Credits. (1-3 Lab; 3 cr max) On Demand
Courses offered on a one-time basis to fulfill professional development needs of in service educators. A specific focus is given to each course which is appropriately subtitled.

EDCI 589. Graduate Consultation. 1-3 Credits. (1-3 Ind) F,S,Su
PREREQUISITE: Master’s standing and approval of the department head. This course may be used only by students who have completed all of their coursework (and thesis if on a thesis plan) but who need additional faculty or staff time or help.

EDCI 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing. Restricted Entry: Requires contract with major advisor. May be repeated.

EDCI 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EDCI 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

EDCI 598. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with a school, agency, business or other organization to provide guided experience in the field.

EDCI 604. Advanced Educational Psychology. 3 Credits. (3 Lec) S
PREREQUISITES: Graduate standing or permission of the instructor. An examination of theory and research related to the diverse learning and motivation needs of K-12 students. Practical implications for effective teaching will be identified throughout the course.

EDCI 690. Doctoral Thesis. 1-12 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral standing. Restricted Entry: Requires contract with major advisor. Course will address responsible conduct of research.

EDEC - Early Childhood Education

EDCI 160. Early Childhood Development. 3 Credits. (3 Lec) F,S,Su
Development of children birth-8 years old. Cognitive, language, physical, social, and emotional domains are examined in addition to contexts of development that influence children’s well-being, such as family, school, and community. Theory, research, and application for professionals are emphasized.

EDCI 253. Health and Movement in Early Childhood. 3 Credits. (2 Lec, 1 Lab) F,S,Su
PREREQUISITE: EDEC 271. Criminal background check required. Developmentally appropriate movement and health-related activities in early childhood education. Designing physical activity and nutrition programs in early childhood settings, implementing appropriate teaching practices, understanding movement concepts, and helping guide children in becoming physically active and healthy for a lifetime.

EDCI 271. Paraprofessional Experience in Early Childhood. 2 Credits. (1 Lec, 1 Lab) F,S,Su
on demand PREREQUISITE: EDEC 160. Work directly with young children, learn and use strategies of positive and supportive interactions with teachers, families, and children. Form foundational understanding of the complex roles of early childhood professionals.

EDCI 288. Signing for Early Childhood Educators. 3 Credits. (3 Lec) F,S,Su
Provides foundational expressive and receptive skill acquisition in American Sign Language to meet federal demand for inclusionary practices in early childhood education and public school settings for deaf and hard of hearing, cognitive and language disorders, pervasive developmental disorders, etc.

EDCI 292. EC Independent Study. 1-4 Credits. (1-4 Ind, 1-2 Lab; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EDCI 350. Play and Learning in Early Childhood. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: EDEC 271 and junior standing. Current issues, research, theory, and practice related to young children’s play, learning, and development in educational contexts. Planning and preparing developmentally appropriate learning environments and developing dispositions that promote teacher-child and family-school relationships, diversity and social justice, ethics and professionalism.

EDCI 362. Development, Education, and Well-Being of Children at Risk. 3 Credits. (3 Lec) Su, On Demand
PREREQUISITE: EDEC 160 and junior standing. The course emphasizes well-being indicators in children from a development, educational, and community perspective. Exploration and understanding of deficit models and strength models of well-being are examined within the context of tribal communities and other at-risk populations.
EDC 385. Integrated Curriculum Early Childhood Education. 3 Credits. (3 Lec)
S
PREREQUISITE: EDC 350. COREQUISITE: EDC 498 for child development option students; EDU 395 for P-3 option students. Observation, reflection, and analysis of various early childhood education curricula including Montessori, Reggio Emilia, and Waldorf. Curriculum planning, implementation, and evaluation. Laboratory experience in an early childhood classroom is required.

EDC 430. Social and Emotional Development in the Young Child. 3 Credits. (3 Lec)
S
COREQUISITE: EDC 385. Social and emotional development in children birth to age eight in relation to young children’s familial, social, and cultural contexts. This course also addresses effective strategies for promoting development and learning. Some observation of young children is required.

EDC 450. Literacy in the EC Classroom. 3 Credits. (3 Lec) F
PREREQUISITES: EDC 380. Development of language and literacy from birth to age 8 utilizing an integrated approach to family, school, and community literacy. Theoretical and foundational perspectives of language development, literacy environments, and emergent literacy skills among young children.

EDC 453. P-3 Steam. 3 Credits. (3 Lec) F
PREREQUISITE: EDC 385. Admiration to the Teacher Education Program.
COREQUISITES: EDC 395. This course focuses on the integration of science, technology, engineering, art, and mathematics in early childhood (pre-kindergarten, kindergarten, grades 1 through 3) classrooms using an inquiry and project-based approach to support young children’s learning. Emphasis is placed on content methods and curriculum standards in the STEAM disciplines to promote P-3 student creativity, problem solving, and critical thinking.

EDC 455. P-3 English Language Arts and Social Studies. 3 Credits. (3 Lec) S
PREREQUISITES: EDC 450 and Admiration to the Teacher Education Program.
COREQUISITES: EDC 395 and EDU 330. This course focuses on methods and strategies to support children’s language, listening, speaking, reading, and writing skills in the context of P-3 classrooms. Developmentally appropriate practices and early learning standards are used to foster the child’s sense of self, family, and community as related to social studies concepts.

EDC 490R. Undergraduate Research ECE. 1-6 Credits. (1-6 Ind; 12 cr max) F,S
Research methods in Early Childhood Education, including survey, ethnography, case studies, and action research. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

EDC 491. Special Topics. 3 Credits. (3 Lec) Su
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EDC 492. EC Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

EDC 494. EC Seminar/Workshop. 1 Credit. (1 Sem; 4 cr max) On Demand Max 4 cr. PREREQUISITE: Senior standing. Topics offered at the upper division level that are not covered in regular courses. Students participate in preparing and presenting class materials.

EDC 496. Early Childhood Advanced Practicum. 4 Credits. (1 Lec, 3 Lab) S,Su
PREREQUISITE: Senior standing in major and student teaching applicant screening required. Criminal background check required. Senior capstone course. Supervised experience in programs for young children and collaboration with early childhood professionals in the community. Students will be responsible for lesson planning and teaching, as well as supervision and evaluation of young children in an NAECYC-accredited classroom.

EDC 498. EC Internship. 1-12 Credits. (1-12 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor. An individualized assignment with a professional agency to provide a guided field experience. All students must receive department permission prior to registration.

EDEL - Elementary Education

EDEL 503. Contemp Iss in Child Literature. 3 Credits. (3 Lec) On Demand
PREREQUISITE: EDU 330 and EDU 301 and EDU 495. Examination and interpretation of the themes of current, award-winning children’s literature and their relevance to today’s children. Inquiry projects will focus on topics of critical literacy. Emphasis will be on classroom application.
EDLD 532. School Law. 3 Credits. (3 Lec)F
PREREQUISITE: Graduate standing. A general examination of law and court decisions relative to the administration of K-12 schools. Specific attention is given to Montana school law.

EDLD 533. Law and Policy in Higher Education. 3 Credits. (3 Lec) On Demand PREREQUISITE: Graduate standing. This course analyzes and interprets landmark legislation affecting American higher education since 1960 and considers the resulting policies that govern the management of universities and colleges. Topics include separation of church and state, access, collective bargaining, intercollegiate athletics, affirmative action, Title IX, and the legal relationships with state and federal governments to include various institutional types.

EDLD 534. Data Driven Decisions. 3 Credits. (3 Lec)S
PREREQUISITE: Graduate standing. The course focuses on instructional leadership actions and behaviors which guide school personnel in sound decision making practices for continuous school improvement. Students will be required to collect, analyze (using statistical methods) and utilize classroom, school and district level data from local contexts as a means of increasing student achievement across all contexts.

EDLD 535. Student Services. 3 Credits. (3 Lec) On Demand PREREQUISITE: Graduate standing. In this course, students are introduced to the philosophy, values, norms, and practice of the student affairs profession. The course outlines the various functional areas and professional competencies that comprise student services, and engages students in critical thinking on current issues in the field through ethical and legal frameworks employed in student affairs practice.

EDLD 538. College Curriculum. 3 Credits. (3 Lec) On Demand PREREQUISITE: Graduate standing. This course considers the definition, philosophical and historical roots, disciplinary organization, current issues, design, administration, and evaluation of the college curriculum.

EDLD 543. Social Justice in Educ. 3 Credits. (3 Lec) On Demand PREREQUISITE: Graduate standing. Consideration of social equity issues in education to include disabilities, gender, ethnic, social, and economic issues.

EDLD 555. School Finance. 3 Credits. (3 Lec)S
PREREQUISITE: Graduate standing. This course prepares school leaders to identify and analyze sources of fiscal and non-fiscal revenue and resources for schools and school districts, to manage financial and material assets, to develop an efficient budget planning process, and to perform a variety of management functions. Course emphasis is on Montana school finance.

EDLD 564. The Comprehensive Portfolio. 3 Credits. (3 Lec) Su, On Demand PREREQUISITE: Consent of Instructor. Students create a professional portfolio to evidence their vision of learning, the culture of teaching and learning, community/school relationships, and the social, cultural, ethical, legal, political, and economic context of schooling.

EDLD 565. K-12 Instructional Leadership. 3 Credits. (3 Lec) Su PREREQUISITE: EDLD 508 and EDLD 534. Students will examine issues, challenges, and processes in K-12 curriculum and instruction in elementary and secondary schools. The course prepares school leaders for the role of instructional leader at the building level and the specific leadership behaviors demonstrated to improve student achievement.

EDLD 566. Administration and Supervision of Special Education Programs. 3 Credits. (3 Lec)Su PREREQUISITE: EDLD 532. Administration and Supervision of Special Education Programs is a master’s level course designed to provide school principals and special education supervisors with the knowledge and skills to effectively and ethically plan, organize and manage special education and related services in their schools. This is a required course for K-12 Principal licensure in Montana.

EDLD 571. In-Service Education. 1-4 Credits. (1-4 Lec, 1-4 Lab; 6 cr max) On Demand PREREQUISITE: Graduate standing and employment by sponsoring school organization. A carefully supervised group study of an educational problem. The study will culminate in a special report, syllabus, blueprint, course of study or guide book or report to be filed with the local administrator and with the.

EDLD 574. Field Experience in Educational Leadership. 1-6 Credits. (1-6 Lab; 6 cr max) F,S
PREREQUISITE: 18 credits of EDLD course work at Montana State University. This is a course that offers students the opportunity for guided field experience as a principal or superintendent in K-12 schools.

EDLD 575. Professional Paper & Project. 3 Credits. (1 Ind; 6 cr max)F,S,Su PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major adviser and graduate committee.

EDLD 588. Professional Development. 1-3 Credits. (1 Lec; 3 cr max) On Demand PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. Courses offered on a one-time basis to fulfill professional development needs of in service educators. A specific focus is given to each course which is appropriately subtitled.

EDLD 589. Graduate Consultation. 1-3 Credits. (3 Ind; 3 cr max) F,S,Su
PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

EDLD 590. Master’s Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing. This course will address responsible conduct of research.

EDLD 591. Special Topics. 1-4 Credits. (1-4 Lec, 1-4 Lab; 12 cr max) On Demand
COREQUISITE: Student must be enrolled in a graduate program. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EDLD 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor, approval of the Dean of Graduate Studies. Directed research and study on an individual basis.

EDLD 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Consent of instructor. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

EDLD 598. Internship. 2-12 Credits. (2 Ind; 12 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor and approval of advisor. Interns are those students already hired into an administrative position who have been approved by the Board of Public Education. The internship course is designed for those required to include practical experience as part of their degree. Course content is informed by bridging theory with practice and the on-the-job expectations and responsibilities.

EDLD 605. Higher Education History and Philosophy. 3 Credits. (3 Lec) On Demand PREREQUISITE: Graduate standing. This course is an in-depth past-to-present tour of the historical and philosophical development of American higher education set against the dynamic backgrounds of political, social, economic, cultural, and intellectual landscapes.

EDLD 610. Leadership and Organizational Theory. 3 Credits. (3 Lec) F, On Demand PREREQUISITE: Master’s degree in Education. The course will provide existing school leaders with theories, concepts, and behaviors of effective leadership that addresses the challenges of schools today. The course encourages a deeper understanding of personal beliefs, style, values, and ethics required of school leaders.

EDLD 616. Organization and Administration of Higher Education. 3 Credits. (3 Lec) On Demand PREREQUISITE: Graduate standing. In this course students will examine the different organizational structures that characterize and govern American higher education. In this introduction to the field of higher education governance, organization and change structures and influences will be examined.

EDLD 620. The School Superintendent. 3 Credits. (3 Lec) Su PREREQUISITE: Master’s degree, Principal licensure, or consent of instructor. This course focuses on the leadership skills necessary for the school superintendent. There is emphasis on superintendent relations with the school board and the school community, and on working with stakeholders to identify school priorities. The development of effective and appropriate communication strategies and interpersonal skills that promote public confidence for schools is stressed.

EDLD 628. College Students. 3 Credits. (3 Lec) On Demand PREREQUISITE: Graduate standing. This foundations course reviews theory and research on undergraduate college students’ learning, development, culture, demographics, and sub-populations, which inform current educational practice.

EDLD 630. Supervision & Instructional Leadership. 3 Credits. (3 Lec)
S. PREREQUISITE: Master’s degree or consent of instructor. The course focuses on increasing the knowledge and skills of supervising and leading instruction on a district or school systems basis. Emphasis is given to dimensions of leadership at the district level including supervision of the leadership team, aligning the vision, mission, and strategic plan with student needs, professional growth, and maximizing resources to support teaching and learning.
EDLD 635. College Teaching. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing. This course is designed to explore the learning-teaching nexus; special attention is given to effective teaching practices, learning and assessment theories and perspectives, and effective course design. We approach and frame these topics through the scholarship of teaching and learning and with attention to traditional and diverse learners.

EDLD 643. Leading Social Justice. 3 Credits. (3 Lec) PREREQUISITE: Master’s degree or consent of instructor. This course provides a framework for inclusive leadership. Students evaluate the relationship among privilege, power, and educational equity from a variety of perspectives. Critical theory will be stressed in examining the complexities of diversity and its impact on organizational leadership.

EDLD 645. Personnel and Collective Bargaining in MT. 3 Credits. (3 Lec) Su PREREQUISITE: Master’s degree in Educational Leadership and principal licensure. This course is designed to prepare educational leaders to apply effective job analysis procedures, to understand performance appraisal for instructional and non-instructional staff, formulate professional growth plans, negotiate union agreements, and apply appropriate policies, criteria, processes for recognition, induction, and compensation of personnel with an emphasis on equity and diversity.

EDLD 650. MT Finance & Facilities. 3 Credits. (3 Lec) Su PREREQUISITE: Master’s degree in Educational Leadership and principal licensure. This course is designed to facilitate a more in depth understanding of the efficient and effective use of finances, facilities, and other tangible and intangible resources at the school district level. An emphasis will be placed on Montana school finance structures, equitable distribution of resources and the alignment of resources to strategic plans and district vision. This course fulfills the Montana Chapter 57 licensure requirements for superintendents educated in out of state preparation programs.

EDLD 655. MT Legal & Policy Studies. 3 Credits. (3 Lec) Su PREREQUISITE: Master’s degree in Educational Leadership and principal licensure. This course is designed to facilitate a more in-depth understanding of legal issues relative to education in Montana and their policy implications. Students will increase their understanding of how legal decisions impact their school. They will explore policy analysis and implementation, and develop an understanding of how laws, policies, and systemic organizational life are intertwined. This course fulfills the Montana Chapter 57 licensure requirements for superintendents educated in out of state preparation programs.

EDLD 657. Education Policy & Politics. 3 Credits. (2 Lec) S Alternate odd years PREREQUISITE: Graduate standing. This course provides existing school leaders with an understanding of the goals of the U.S. and State level political systems, the governmental structures designed to achieve these goals, and the interest groups that influence the goals and their implementation.

EDLD 690. Doctoral Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S,Su PREREQUISITE: Doctoral standing. Restricted Entry. This course will address responsible conduct of research.

EDSP - Secondary Education

EDSP 306. Exceptional Learners. 3 Credits. (3 Lec) F,S,Su PREREQUISITE: EDEC 160 or EDU 222IS or EDU 223IS, and junior standing. Categories of exceptionality and implications for educators. Historical, societal, familial and educational attitudes; legal requirements of Preschool Amendments, IDEA and ADA including IEPs, IFSPs, 504s, FBAs, and IEPs. Identification, intervention, and best practices including multi-tiered systems of support (MTSS) and RtI.

EDSP 307. Exceptional Learners Lab. 1 Credit. (1 Lab) F,S PREREQUISITE: EDSP 306; may be taken concurrently. Criminal background check required. Direct experience and engagement with children and adolescents with special needs in infant-preschool settings, public schools, and community-based settings.

EDSP 458. Assessment and Intervention. 4 Credits. (3 Lec, 1 Lab) PREREQUISITE: EDSP 306. Knowledge, application and interpretation of data in formal and informal assessment instruments; formal report writing; psychometrics; CST, IEP, IFSP, 504, FBA parent and professional roles. Linking assessment data with intervention techniques. Direct experience with children and families required.

EDU - Education

EDU 101US. Teaching and Learning. 3 Credits. (3 Sem) F,S,Su PREREQUISITE: First year students (less than 30 credits) only. This course is an introduction to the profession of public school teaching. Topics treated include the nature of knowledge, the development of public education, the training of teachers, the nature of schools today, education policy, and society’s expectations of schools.

EDU 202. Early Field Experience. 1 Credit. (1 Lab) F,S,Su Students will explore the profession of teaching by attending an orientation, conducting in-school observations and interviews, recording personal reflections in a portfolio, and participating in two seminar sessions to debrief/discuss their experiences.

EDU 2041A. Arts & Lifelong Learning. 3 Credits. (3 Lec) F,S,Su This course explores how dance, drama, music and the visual arts offer students expressive ways to learn and inquire about themselves, their social and physical worlds. Students engage in creative arts by exploring content, practicing critical inquiry skills and reviewing aesthetic perspectives.

EDU 211D. Multicultural Education. 3 Credits. (3 Lec) Alternate PREREQUISITE: EDU 222IS or EDU 223IS and Sophomore Standing. Examination of the school-society relationship in the United States and of the many issues and variables embedded in this relationship, including equal opportunity, human diversity, ideology, politics and social change. Foundational perspectives (historical, political, social, and policy) will be explored.

EDU 222IS. Educ Psych & Child Development. 3 Credits. (3 Lec) F,S,Su PREREQUISITE: Graduate standing. Human growth and psychological development of school age students, to include physical, cognitive, and psychosocial development within an educational, familial, and societal context. An examination of theory and research related to the development, learning and motivation of school age students. Implications for effective classroom teaching will be identified throughout the course.

EDU 223IS. Educ Psych and Adolescent Dev. 3 Credits. (3 Lec) F,S,Su Human growth and psychological development of middle and high school students, to include physical, cognitive, and psychosocial development within an educational, familial, and social context. An examination of theory and research related to the development, learning and motivation of middle and high school students. Implications for effective classroom teaching will be identified throughout the course.

EDU 263. Teaching Grammar Through Writing. 3 Credits. (3 Lec) F,S,Su This course explores the structure and function of the English language. In particular, study of grammar including the eight parts of speech, types of phrases and clauses, sentence structure and fluency, word usage, and other language conventions will be addressed.

EDU 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S,Su Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research.

EDU 291. Special Topics/Expmdnl Course. 1-4 Credits. (1-4 Lab; 12 cr max) F,S,Su On Demand Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EDU 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su On Demand PREREQUISITE: Good standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

EDU 294R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S,Su Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research.

EDU 330. Emergent Literacy. 3 Credits. (3 Lec) Even years PREREQUISITE: EDU 222IS or 223IS. Current theory concerning emergent literacy and developmentally appropriate classroom practices. Emphasis is on a balanced approach which includes phonics and other cue systems, use of authentic children’s literature, and use of programmed reading materials.
EDU 332. Lit and Arts in Context. 9 Credits. (3 Lec, 6 Lab) Su Study of British and French literature for children is integrated with experiences in the arts. The course includes a three-week trip to England and France where participants will visit historical sites and see performances that bring stories to life.

EDU 342. Managing the Learning Envir. 3 Credits. (3 Lec) PREREQUISITE: Good standing in the Teacher Education Program. This course examines key factors in establishing a healthy learning environment for K-12 students. The course will explore factors that contribute to student success such as school law and policy and their relationship to the establishment of effective and respectful management, engaging classroom instruction, and meaningful learning for all students.

EDU 370. Integrating Tech into Educ. 2 Credits. (1 Lec, 1 Lab) PREREQUISITE: EDU 222IS or EDU 223IS. Exploration of technology use in society and effects on teaching and learning. Includes strategies for developing technology-rich curriculum and techniques for enhancing learning through integration of technology and 21st century skills.

EDU 382. Assessmt, Curric, Instruct. 3 Credits. (3 Lec) F,S PREREQUISITE: EDU 202 (For K-12 and 5-12 teaching majors) and 222IS or EDU 221IS or EDU 223IS. Fundamental concepts of differentiated educational assessment for classroom teachers including the alignment of assessment to curriculum standards and essential understandings, quality of assessment, principles of item construction, evaluation of student responses, interpretation of results, and improvement of techniques.

EDU 395. Practicum. 1-3 Credits. (3 Lec; 12 cr max) F,S,Su PREREQUISITE: M 133Q (elementary education majors only), EDU 382, and good standing in Teacher Education Program. Students will be assigned to school classrooms to observe children, teachers, and teaching strategies and to co-teach lessons in classrooms. Sections will be specific to grade level 5-12, K-8, or K-12. See advisor for appropriate section and information on term offerings.

EDU 397. Methods. 3 Credits. (1-3 Lec, 0-2 Lab; 25 cr max) PREREQUISITE: EDU 382 and good standing in Teacher Education Program. This course is divided into multiple sections that cover specific elementary content areas. Sections include K-5 Art, K-8 Creative Arts, K-4 and K-8 Health Enhancement, K-8 Language Arts, K-8 Math, and K-8 Science. Students explore the methods of teaching content, skills, and attitudes in the elementary classroom and learn best practices for teaching in each content area.

EDU 397R. Methods:K-8 Social Studies. 3 Credits. (3 Lec) F,S,Su odd years PREREQUISITE: EDU 382, completion of 3 required social science courses, and good standing in the Teacher Education Program. Identification of goals, objectives, and instructional strategies for elementary social studies.

EDU 401. Intro Lit Leadership Ed. 3 Credits. (3 Lec) PREREQUISITE: EDU 382 or EDU 397 (K-8 Methods: Language Arts), and good standing in Teacher Education Program, or consent of instructor. This course will introduce students to the role and responsibilities of reading specialists in the professional school setting. Topics include collaborating with colleagues, parents, and the community, current practice in literacy professional development, and reading policy.

EDU 408. Professional Issues: K-12. 2 Credits. (2 Lec) PREREQUISITE: Senior standing, completion of all coursework, and good standing in Teacher Education Program. Overview of salient issues to include applied evaluation, classroom management and discipline, cooperative learning, law, contracts, certification, professional organizations, ethics, resume, job seeking, and professionalism.

EDU 409. Professional Issues: K-8. 2 Credits. (2 Lec) PREREQUISITE: Senior standing, completion of all required EDEL methods courses, and good standing in Teacher Education Program. Senior capstone course. Review the role of teachers and elementary school; school law; teacher contracts; certification; professional organizations; ethics; job seeking; job success; cooperative learning; and other critical issues for elementary education majors.

EDU 411. ESL/Teaching Culturally/Linguistically Diverse K-12 Students. 3 Credits. (3 Sem) F,S PREREQUISITE: EDU 211D and EDU 222IS or EDU 223IS, or consent of instructor. This course provides an overview of linguistically/culturally appropriate instructional strategies for K-12 teachers to implement with English Language Learners in the regular classroom. This course examines current research, controversial issues, and best practices surrounding second language acquisition and language learning.

EDU 422. Ed Computing Mgmt/App. 1-3 Credits. (1-3 Ind; 3 cr max) On Demand PREREQUISITE: EDU 370. A flexible format that allows the student to select hands-on learning modules based on student need and interest in educational technology and 21st century skills.

EDU 431. Teaching Reading: 4-8. 4 Credits. (4 Lec) F,S,Su alternate years to be offered odd years PREREQUISITE: EDU 382, EDU 331, and good standing in Teacher Education Program. Current theory and practice addressing literacy instruction in grades 4-8, with special emphasis on middle school. Topics include reading strategies, the writing process, and workshop approaches to literacy.

EDU 432. Lit and Literacy for Yng Adlts. 3 Credits. (3 Lec) F,S,Su odd years PREREQUISITE: EDU 331 Survey of materials for young adult readers. Includes literary analysis, pedagogy, electronic resources, and motivational strategies.

EDU 438. Ltrcy Asmnt, Diagnos and Instr. 3 Credits. (2 Lec) PREREQUISITE: EDU 382, and good standing in Teacher Education Program. Current theory and techniques in literacy assessment and individualization. Emphasis will be on specific instructional strategies that focus on independence in reading and writing. A practicum is included.

EDU 470. Advanced Educ Technology. 3 Credits. (2 Lec, 1 Lab) F,S,Su Hands on experiences in the production of advanced instructional media materials. Emphasis on exploration of techniques using current and cutting edge technologies. Appropriate for media specialists, teachers, trainers and communicators interested in using the new technology tools.

EDU 481. Literacy Across the Curriculum. 2 Credits. (2 Lec) PREREQUISITE: EDU 330 or EDU 397 (Methods: K-8 Language Arts), and good standing in the Teacher Education Program. Techniques, materials, and theories in teaching effective reading skills in all content fields, grades 5-12.

EDU 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su Max 12 cr. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

EDU 491. Special Topics. 1-4 Credits. (1-4 Ind; 12 cr max) On Demand PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EDU 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

EDU 493. Study Abroad. 1 Credit. (1 Sem; 4 cr max) On Demand PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

EDU 494. Seminar: Lab Safety. 1 Credit. (1 Sem; 4 cr max) F,S,Su PREREQUISITE: Junior standing. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

EDU 495. Student Teaching. 5-16 Credits. (5-16 Ind; 16 cr max) F,S,Su PREREQUISITE: Senior standing, completion of all coursework, and good standing in Teacher Education Program. Observation and teaching in a classroom setting; preparation and delivery of lesson plans, and teacher work sample. The student teaching experience will occur under the supervision of experience teachers and MSU field supervisors.

EDU 495R. Student Teaching. 5-16 Credits. (5-16 Ind; 16 cr max) F,S,Su PREREQUISITE: Senior standing, completion of all coursework, and good standing in Teacher Education Program. Observation and teaching in a classroom setting; preparation and delivery of lesson plans, and teacher work sample. The student teaching experience will occur under the supervision of experience teachers and MSU field supervisors.

EDU 496. Methods: K-12 Modern Languages. 4 Credits. (3 Lec, 1 Lab) PREREQUISITE: EDU 382, 20 or more credits in subject area, and good standing in Teacher Education Program. Provides prospective foreign language instructors with a practical and theoretical foundation for planning (including lesson/unit), implementing teaching, and evaluating programs and learning for levels K-12. Content reading skills are also addressed. Includes practicum experience for majors only.
PREREQUISITE: EDU 382 and consent of instructor. An individualized assignment with a professional agency to provide a guided field experience.

EDU 511. Teaching Culturally and Linguistically Diverse K-12 Students. 3 Credits. (3 Lec) Su
PREREQUISITES: A student needs to be a current K-12 teacher, licensed in Montana with at least two years of teaching experience. In-service K-12 teachers will learn how they will be able to enhance their instruction and adapt their materials to make their content comprehensible to English Language Learners (ELLs) in various classroom settings. An examination of the impact of language development on ELLs’ academic performance will be conducted. American Indian ELLs, who make up the majority of ELLs in Montana, will be the focus. Best practices for helping ELLs develop academic language and literacy skills will be addressed. The SIOP (Sheltered Instruction Observation Protocol) Model, a comprehensive, research-validated approach to make content comprehensible for ELLs, will be reviewed.

EDU 512. Literacy Development for Culturally & Linguistically Diverse K-12 Students. 3 Credits. (3 Lec) Su
PREREQUISITES: A student needs to be a current K-12 teacher, licensed in Montana with at least two years of teaching experience. Instructor approval. COREQUISITES: EDU 511. Literacy Development for Culturally and Linguistically Diverse K-12 Students is a 3-credit graduate course designed to extend teachers’ knowledge of literacy instruction to secondary ELLs. Participants will analyze and apply linguistic instructional approaches specific to orthography, phonology, morphology, vocabulary, syntax, semantics, and pragmatics applied to English language development. They will also develop reading strategies to facilitate the learning and literacy development of ELLs in secondary core content classrooms, applying these strategies to modify lesson plans and adapting textbooks to help ELLs succeed academically.

EDU 513. Assessment of English Language Learners. 3 Credits. (3 Lec) Su
PREREQUISITES: EDU 511, EDU 512. Co-Requisites: EDU 514 (in this course participants will explore formative and summative assessments for K-12 English Language Learners (ELLs)). They will critically examine English Language Development Standards and how these standards support and drive authentic assessment. Participants will create assessment tools targeting the unique needs of ELLs and determine how different types of assessments guide instruction.

EDU 514. Culturally Responsive Pedagogy. 3 Credits. (3 Lec) Su
PREREQUISITES: EDU 511, EDU 512. Co-Requisites: EDU 513 This course is an in-depth analysis of the theory and practice of cultural diversity in educational contexts with an emphasis on linguistic diversity and how best to meet the needs of culturally and linguistically diverse students in the regular classroom. Techniques to create an IEEFA sheltered lesson plan by familiarizing yourself with a variety of activities that cover the components and features of the Sheltered Instruction Observation Protocol (SIOP) methodology will be explored.

EDU 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EDU 600. Doctoral Seminar. 3 Credits. (3 Sem) F
PREREQUISITE: Doctoral standing and instructor approval. This course introduces and orient new students to the expectations and culture of doctoral study.

EDU 602. Educational Statistics II. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Graduate standing and EDCI 501. The application of statistical processes to the analysis of educational data. Educational problems that apply multi-factor ANOVA, multiple comparison techniques, ANCOVA, multiple regression, and factor analysis in their solution are included.

EDU 606. Mixed Methods Research Design in Education. 3 Credits. (3 Lec)S
PREREQUISITES: The prerequisites for this course include: EDIC 507 – Qualitative Research Methods with a grade of C or better and EDCI 501 – Educational Statistics I with a grade of C or better. This course provides graduate students an advanced mixed methods research knowledge and concepts, including research designs, strategies for data collection, analysis, and integration of both qualitative and quantitative findings of a research, and its applications in education research.

EDU 607. Quantitative Educational Research. 3 Credits. (3 Lec) On Demand
PREREQUISITES: EDIC 602, EDCI 506, and graduate standing. This course explores the implications of and application of the quantitative research paradigm to systematic inquiry within the field of education. The course includes quantitative designs, design-related data collection and management methodologies, appropriate data analysis and writing strategies, and the role of quantitative research in decision-support. Students will plan and complete a quantitative research project. Course will address responsible conduct of research.

EDU 608. Advanced Quantitative Research. 3 Credits. (3 Lec) On Demand
PREREQUISITES: Graduate standing and EDU 607. Doctoral Students will operationalize a research plan proposed in EDU 607. Specifically, they will refine their research proposals to produce a dissertation proposal that is defensible by piloting research procedures, data collection methods, data analysis techniques, and presentation of results in written and oral formats.

EDU 610. Qualitative Educational Research. 3 Credits. (3 Lec) F
PREREQUISITES: Graduate standing and EDCI 506. This course explores the implications and application of the qualitative research paradigm to systematic inquiry within the field of education. Methods used in qualitative research including techniques of data collection, analysis, and reporting will be reviewed. Students will plan and complete a qualitative research project. Course will address responsible conduct of research.

EDU 611. Advanced Qualitative Research. 3 Credits. (3 Lec)F,S
PREREQUISITES: EDU 610. This course will expose advanced graduate students to a variety of sophisticated qualitative approaches common to the fields in the social sciences. Students will consider the philosophical, ethical, and social-cultural contexts that underpin that major qualitative traditions such as phenomenology, grounded theory, narrative, and case study methodologies. Students are expected to analyze the conceptual differences of these approaches with an emphasis of critique and application to extant research and an original research project. Students will apply philosophical, epistemological, and methodological foundations commonly associated with the qualitative paradigm to design and carry out a sound and rigorous independent research study.

EDU 612. Critical Race Theory. 3 Credits. (3 Lec) On Demand
PREREQUISITES: Graduate standing, Critical Race Theory (CRT) is an analytical framework that provides a raced-based epistemological and methodological approach to study racial inequality in education. This seminar focuses on the application of CRT to educational leadership, policy, and practice.

EDU 613. Indigenous Methodologies in Educational Research. 3 Credits. (3 Sem) On Demand
PREREQUISITES: Graduate standing. An examination of interdisciplinary methodologies demonstrated in a sociocultural context highlighting ethical practices when researching Indigenous peoples. Students get guidance in framing a culturally attuned methodology for their research and examine critiques of Indigenous methodologies.

EDU 614. Planning Program Assessment. 3 Credits. (3 Lec) On Demand
PREREQUISITES: Graduate standing. This course exposes students to the accepted literature, evaluation models, standards, strategies, and skills to plan and carry out an assessment or program evaluation of post-secondary educational programs or other administration settings. These assessments are aimed at various internal and external clients including accrediting agencies, national funding organizations, and other governing bodies of higher education.

EDU 617. Participatory Research in Education. 3 Credits. (3 Sem) S
Alternate Odd Years PREREQUISITES: Acceptance into a doctoral program (EdD or PhD). In this seminar, students will learn (a) the roles of institutional research and assessment in higher education; (b) appropriate measures of academic and administrative assessment, internal and external data sources, and analytic strategies; and (c) the communication of information to academic and administrative decision makers.
EDU 650. Dissertation Seminar. 3 Credits. (3 Sem) F
PREREQUISITES: Doctoral standing and instructor approval. This course is designed to help students prepare their dissertation proposal. Course will address responsible conduct of research.

EDU 690. Doctoral Thesis. 1-12 Credits. (1-12 Ind Study) F,S,Su
PREREQUISITE: Doctoral Standing Restricted Entry. Requires contract with major advisor. Course will address responsible conduct of research.

EELE - Electrical Engineering

EELE 101. Intro Electrical Fundamentals. 3 Credits. (1 Lec, 1 Lab) F,S
PREREQUISITE: M 151Q or equivalent. Lecture/laboratory introduction to electrical fundamentals including Kirchhoff's and Ohm's Laws, using meters and oscilloscopes, time-varying signals in electric circuits, inductors and capacitors, series and parallel circuits, introduction to digital circuits, problem solving including computer applications, technical communications, team work.

EELE 201. Circuits I for Engineering. 4 Credits. (3 Lec, 1 Lab) F,S
PREREQUISITE: EELE 101, M 172Q. COREQUISITE: PHSX 222. Introduction to circuit analysis, Ohm's and Kirchhoff's Laws, nodal and mesh methods, network theorems; resistors, capacitors, inductors, dependent sources, ideal op-amps; the complete response of first order circuits; complex frequency and phasors; steady-state AC circuits, coupled inductors and ideal transformers.

EELE 203. Circuits II for Engineering. 4 Credits. (3 Lec, 1 Lab) S

EELE 217. The Science of Sound. 2 Credits. (2 Lec) F
PREREQUISITE: M 121Q, M 132, or M 105Q, or the equivalent. Introduction to the principles of musical acoustics, sound systems, and audio technology for non-engineering students. This course is particularly geared toward students in the College of Arts and Architecture and in the Music Technology program.

EELE 250. Circuits, Devices and Motors. 4 Credits. (3 Lec, 1 Lab) F,S
PREREQUISITE: M 166Q or M 172Q and PHSX 207 or PHSX 222. Introduction for non-majors to electrical circuit principles, voltage and current laws, frequency response; introduction to electronic circuits including operational amplifiers, and power electronics; introduction to electromechanical energy conversion devices, DC and AC machines.

EELE 261. Intro To Logic Circuits. 4 Credits. (3 Lec, 1 Lab) F,S
An introductory course in the fundamental concepts of classical digital design. Course covers design and implementation of combinational logic circuits, synchronous sequential circuits and information storage circuits. Basic concepts of Hardware Description Languages (HDLs), design and simulation of digital systems using HDLs, and digital system implementation with programmable logic devices are presented.

EELE 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

EELE 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) F
On Demand PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EELE 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F
On Demand PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

EELE 308. Signals and Systems Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: EELE 203, M 273Q. Discrete and continuous time signals and systems. Properties, application, synthesis and analysis for the CT and DT Fourier Series, the Fourier transform, the DTFT, z and Laplace transform. Applications in differential and difference equations, sampling, feedback, and communications. Introduction to the DFT.

EELE 317. Electronics. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: EELE 203. This is an introductory course in electronics. It introduces diodes, bipolar junction transistors, field effect transistors and bipolar and MOS analog and digital circuits.

EELE 321. Intro To Feedback Controls. 3 Credits. (3 Lec) S
PREREQUISITE: EELE 308 or EMEC 303 or consent of instructor. Classical continuous-time, transfer function approach to control systems engineering. Approximations, linearization, and time response. Design and analysis via root-locus, Nyquist, and Bode methods. Proportional, dominant pole, lead, lag, PID, and minor loop compensation. Describing functions. Lab exercises incorporate a variety of hands-on control systems.

EELE 334. Electromagnetic Theory I. 3 Credits. (3 Lec) F
PREREQUISITE: PHSX 222, M 273Q. Basic electric and magnetic fields including transmission lines. The materials covered will include both static and dynamic fields, traveling waves, and transmission line concepts such as impedance, reflection coefficient, and transient response.

EELE 354. Electric Power Applications. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: M 166Q or M 171Q and PHSX 207 or PHSX 222. An applied study of electricity and electrical power circuits, with laboratory experience, for that person not expected to deal with electronics or advanced circuit techniques. Topics covered include electrical circuit laws, power and energy, alternating current circuits; residential, commercial and industrial wiring; wire sizing, three-phase circuits; and application of transformers and electric motors.

EELE 355. Energy Conversion Devices. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: EELE 203. Three-phase power; electromechanical energy conversion devices and motor drives; introduction of power electronic converters for power control and motor drive applications. Laboratory experience includes power measurements; experience with transformers and motor-generator operational characteristics and DC and AC motor drives operation.

EELE 367. Logic Design. 4 Credits. (3 Lec, 1 Lab)
PREREQUISITE: EELE 261 Advanced combinational and sequential logic design. Hardware descriptive language (HDL) programming knowledge. Laboratory experience implementing advanced logic designs using FPGAs.

EELE 371. Microprocess HW and SW Systems. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: EELE 261 and knowledge of a programming language or consent of instructor. Introduction to the structure of microprocessors, arithmetic and logic units, processor control, interrupts, memories, and input/output. Laboratory experience in assembly level programming of microprocessor applications.

EELE 394. Multidisciplinary Seminars. 1 Credit. (1 Sem) F,S
PREREQUISITE: Junior standing. Students attend seminars presented by a variety of departments and disciplines to gain an appreciation of multidisciplinary environments leading to a greater understanding of the impact of engineering solutions in a global and societal context.

EELE 407. Intro To Microfabrication. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: Junior standing and PHSX 222 or PHSX 207. Provide an introduction to clean room safety protocol and micro fabrication. Lectures will introduce micro fabrication methods, models and equipment. Laboratories will perform the steps to produce and characterize a metal-oxide-semiconductor transistor.

EELE 408. Photovoltaic Systems. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: PHSX 222. Provide a basic understanding of the design, fabrication and operating principles of solar cells and how they are integrated into photovoltaic systems. Laboratories will perform the steps required to produce and characterize silicon solar cells.

EELE 409. EE Material Science. 3 Credits. (3 Lec) F
PREREQUISITE: EELE 317. Basic material properties of dielectrics, magnetic materials, conductors, and semiconductors. Practical applications of materials to semiconductor devices.

EELE 411. Advanced Analog Electronics. 3 Credits. (3 Lec) S
PREREQUISITE: EELE 317. This course covers differential and multistage amplifiers, frequency response, feedback, analog integrated circuits, filters, and tuned circuits, analog to digital and digital to analog conversion, noise in electronics, current topics.

EELE 414. Intro to VLSI Design. 3 Credits. (3 Lec) F
PREREQUISITE: EELE 261, EELE 317. Introduction to the fundamentals of CMOS VLSI circuit design. This course covers CMOS device characteristics and timing, CMOS fabrication, CAD tools, design rules, simulation and layout, CMOS combinational and sequential logic, SRAM and DRAM memory, and dynamic logic design.

EELE 417. Acoustics/Audio Engineering. 3 Credits. (3 Lec) F
Alternate years to be offered even years PREREQUISITE: PHSX 222. Introduction to the principles of acoustics, audio engineering, and audio signal processing. Propagation of sound in enclosures. Engineering analysis of loudspeakers, microphones, and recording devices. Human psychoacoustics.
EELE 422. Intro to Modern Control. 3 Credits. (3 Lec) F

EELE 432. Applied Electromagnetics. 3 Credits. (3 Lec) S
PREREQUISITE: EELE 334 or PHSX 423. Advanced study of electromagnetic wave propagation, including polarization, reflection and refraction at interfaces, and cavities and multilayer structures, to investigate a number of practical devices with applications related to electrical engineering and optics, such as waveguides, fiber optics, and antennas.

EELE 445. Telecommunication Systems. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: EELE 308, 317. Introduction to analog and digital communication systems with lab. Topics include signals in communications; noise characteristics; bandwidth considerations; probability of error; analog and digital modulation; frequency domain analysis; matched filter applications. Experiments involve modulation, demodulation, A/Ds, sampling theory, and aliasing.

EELE 447. Mobile Wireless Communications. 3 Credits. (3 Lec) F
PREREQUISITE: EELE 445. Characteristics of the radio environment, propagation, cellular concepts, channel allocation, modulation techniques, multiple access techniques, Shannon's Capacity Theorem, error-correcting codes, data compression, spread spectrum modulation, current wireless communication systems.

EELE 451. Power Electronics. 3 Credits. (2 Lec, 1 Lab) S alternate years to be offered even years PREREQUISITE: EELE 317, 321, EELE 355. Introduction to solid-state power devices; topologies, operating principles, modeling and control, and design of basic power converters; magnetic design; applications of power converters in renewable energy sources power systems, electric and hybrid electric vehicles, and other residential, commercial, and industrial systems; laboratory experience with basic power converters.

EELE 454. Power Systems Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: EELE 355. Power system components, transmission system design, power flow studies, automatic generation control, symmetrical components, faulted power systems, protection, introduction to transient stability.

EELE 455. Alternative Energy Power Gen. 3 Credits. (3 Lec) S, alternate years to be offered even years PREREQUISITE: EELE 355 or equivalent. Exploration and analysis of alternative power generation sources and systems such as wind, solar, microturbine, and fuel cells, combined sources and their design, power electronic interfacing, and energy storage systems. Co-convened with EELE 555.

EELE 456. Power Sys Protection & Ctrl. 3 Credits. (3 Lec) S, alternate years to be offered even years PREREQUISITE: EELE 454 or equivalent. Continuation of EELE 454. Symmetrical and unsymmetrical fault analysis, system protection, introduction to load frequency control, voltage control, economic dispatch, and introduction to power system stability.

EELE 461. Digital System Design. 3 Credits. (3 Lec) S, alternate years to be offered even years PREREQUISITE: EELE 454 or equivalent. Design of high speed digital systems including chip-to-chip signal propagation, transmission lines, IC package interconnect, printed circuit board design, state-of-the-art simulation tools, and measurement techniques using Time Domain Reflectometry (TDR).

EELE 465. Microcontroller Applications. 4 Credits. (2 Lec, 2 Lab) S
PREREQUISITE: EELE 371. Lecture/laboratory exposure to micro controller hardware and software applications, serial and parallel I/O, timing, interrupts LCDs, keypads, A to D conversion, and a project realizing a real time control problem.

EELE 466. Comp Computer Architecture. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: EELE 475. Design of custom CPU's and embedded systems using FPGAs, emphasizing computational tasks such as audio and video processing, design and development of custom instruction sets. Engineering tradeoffs among fixed-point, floating point, and compressed representations of numerical data.

EELE 467. SoC FPGAs 1: Hardware-Software CoDesign. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITES: EELE 367 and CSCI 112. Design of advanced digital systems using System-on-Chip (SoC) Field Programmable Gate Arrays (FPGAs). Design of custom hardware components for the FPGA fabric using VHDL. Implementation of custom hardware-software interfaces. Writing programs and Linux device drivers in C to interact with custom hardware. Laboratory experience developing custom systems using SoC FPGAs.

EELE 468. SoC FPGAs II: Application Specific Computing. 4 Credits. (3 Lec. 1 Lab) B
PREREQUISITES: EELE 467 Design of custom digital systems using SoC FPGAs, emphasizing computational tasks such as digital signal processing, audio, or video processing.

EELE 475. Hardwr/Softwr Eng Embedded Sys. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: EELE 367 and CSCI 112. Topics in embedded system design, real-time operating systems, high level language programming of embedded systems, software and hardware tradeoffs, and laboratory experience with embedded systems.

EELE 477. Digital Signal Processing. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: EELE 308. Analysis and design of discrete-time systems, including frequency response. Sampling and reconstruction of continuous signals. Analysis, design, and applications of FIR and IIR digital filters. Properties and applications of the discrete Fourier transform. Laboratory experience implementing off-line and real time digital signal processing algorithms.

EELE 481. Optical Design. 3 Credits. (3 Lec) S alternate years PREREQUISITE: EELE 482 or PHSX 327 Optical design using geometric optics and computer ray-tracing software. Introduces ray and wave front aberrations, control of aberrations in optical systems, designing for system requirements, and analytic tools including the modulation transfer function.

EELE 482. Electro-Optical Systems. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: EELE 334 or PHSX 423 or equivalent. Provides an overview of electro-optic systems and components. Lectures cover ray optics, scalar wave optics, laser and Gaussian beam optics, optical polarization and polarization devices, light sources, detectors, and electro-optic and acoustic-optic photonic devices. Laboratory experiments introduce basic photonic instrumentation and measurement techniques.

EELE 484. Laser Engineering. 3 Credits. (3 Lec) S alternate years to be offered even years PREREQUISITE: PHSX 222. The laser engineering course provides a basic understanding of the design and operational principles of lasers. Discussions of design and operation of several types of lasers will be covered including solid state lasers, gas lasers, and semiconductor lasers.

EELE 487. Prof, Ethics & Engr Practices. 1 Credit. (1 Lec) S
PREREQUISITE: Junior standing. Engineers from industry and others give presentations on professionalism, ethics, and engineering practices. Included are specific well-known, historical engineering ethics cases and professional practices of engineering, intellectual property issues, and new developments.

EELE 488R. Electric Engineering Design I. 2 Credits. (2 Sem) F
PREREQUISITE: EELE 317 and EGEN 310R. Part I of a two consecutive semester senior capstone design sequence in Electrical Engineering. Students, under the guidance of a faculty supervisor, formulate a solution to a real-world design problem culminating in a critical design review. Co-convened with EELE 489R.

EELE 489R. Electrical Engr Design II. 3 Credits. (3 Sem) S
PREREQUISITE: EELE 488R. The second of a two consecutive semester senior capstone design sequence in Electrical Engineering. Students, under the guidance of a faculty supervisor, realize, assess and document the performance of their solution to a real-world design problem. Co-convened with EELE 489R.

EELE 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 6 cr max) F,S,Su
Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

EELE 491. Special Topics. 1-4 Credits. (1-4 Lab; 12 cr max) On Demand PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EELE 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

EELE 498. Internship. 1-2 Credits. (1 Ind; 12 cr max) F,S,Su PREREQUISITE: Sophomore standing and consent of instructor. On-site, one semester practicum under guidance of employer designated mentor.

EELE 499R. Capstone: Electrical Engr Dsgn. 3 Credits. (2 Lab) F,S
PREREQUISITE: EGEN 310R. Senior capstone course. A design project culminates with the actual construction and demonstration of the results. Design teams report progress to the design supervisor periodically. Students are required to write a technical paper, participate in a Design Fair, and generate complete technical documentation for the project.
EELE 503. Advanced Analog Circuit Design. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: EELE 417. Solid state device models, p-spice and other computer simulations, single and multiple state amplifier design, current sources, operation amplification design, frequency response, feedback and feedback forward amplifier analysis, noise and distortion in electronics.

EELE 505. MEMS Sensors and Actuators. 3 Credits. (2 Lec, 1 Lab) S alternate years to be offered odd years PREREQUISITE: EELE 409. Micro fabrication of electrical and mechanical devices. Theory of various mechanical transducers and physical sensors including optical MEMS, RF MEMS, and Bio/Chemical MEMS.

EELE 508. Solar Cell Basics for Teachers. 2 Credits. (1 Lec. 1 Lab) Su PREREQUISITES: Graduate students enrolled in EELE 508 must be graduate students admitted to the MSSE degree program or have the permission of the instructor to take the course. There are no prerequisite courses for EELE 508. This graduate course introduces the concepts of the design, fabrication and operating principles of solar cells and how they are integrated into photovoltaics systems. The course contains a laboratory experience where the graduate students perform the steps required to produce and characterize silicon solar cells.

EELE 517. Acoustics/Audio Engineering. 3 Credits. (3 Lec) F alternate years to be offered even years PREREQUISITE: PHSX 222. Introduction to the principles of acoustics and audio engineering. Propagation of sound in enclosures. Engineering analysis of loudspeakers, microphones, and recording devices. Human psychoacoustics.

EELE 522. Adaptive Control. 3 Credits. (3 Lec) S alternate years to be offered even years PREREQUISITE: EELE 422. On-line parameter estimation, self-tuning regulators, model reference adaptive controls. Robust control.

EELE 525. System Identification. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: EELE 422. System identification with emphasis on off-line techniques. Stability of matrix decompositions used for identification. Recursive least squares, auto regressive techniques, hypothesis testing. Geometrical and statistical interpretations of least squares, maximum likelihood, and Bayesian estimation. Derivative and derivative-free iterative solutions. Modeling and model order selection. Analytical techniques including Lagrange multipliers.

EELE 526. Sequential State Estimation. 3 Credits. (3 Lec) F alternate years to be offered even years PREREQUISITE: EELE 422. Sequential state estimation, with emphasis on Kalman filtering and smoothing. Continuous and discrete time.

EELE 528. Advanced Controls and Signals. 3 Credits. (3 Lec; 6 cr max) On Demand Max 6 cr. PREREQUISITE: EELE 422 or equivalent. Reading, discussion and exploration of original source material on advanced control systems and signal processing. Topics selected to complement current interest and existing courses; for example, computational statistical methods, estimation, modeling, compression, advanced analytical techniques, multi-dimensional systems, spectral analysis, and implementation.

EELE 533. Antenna Engineering. 3 Credits. (3 Lec) F alternate years to be offered even years PREREQUISITE: EELE 334 or equivalent. Introduction to the electromagnetic theory and practice of antenna design and analysis. Common antenna structures are studied, including dipoles, arrays, horns, and reflectors. Applications will be explored in wireless communication, remote sensing, and related fields. Numerical electromagnetic simulation techniques are used for antenna modeling.

EELE 538. Ad Top Electromagnet & Optics. 3 Credits. (3 Lec; 6 cr max) -- Advanced topics in applied electromagnetics and optics, chosen to represent current research in this field.

EELE 541. Advanced Communication Theory. 3 Credits. (3 Lec) F alternate years to be offered even years PREREQUISITE: EELE 445. Signal spectrum analysis, random processes, correlation functions, functional transformations of random variables, optimal linear filtering and estimation, statistical analysis of digital and analog modulation systems, orthogonality and related signals: time, bandwidth, and dimensionality.

EELE 543. Advanced Telecom Systems. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: EELE 445. Digital and analog switching systems, packet and circuit telecommunication transmission networking and media selection (fiber optics, cable, microwave and satellite), network configuration, network technologies, equipment selection, system design examples and project.

EELE 547. Ad Hoc Wireless Sensor Network. 3 Credits. (3 Lec) S alternate years to be offered even years PREREQUISITE: EELE 447 and EELE 543. Stationary and mobile sensor network topologies, RF technologies, frequency selection, link layer and media access protocols, energy management techniques, mobility management, standards and applications.

EELE 548. Advanced Communication Systems. 3 Credits. (3 Sem; 6 cr max) S alternate years to be offered odd years Max 6 cr. PREREQUISITE: EELE 543 or equivalent. Reading and discussion of original source material on advanced communications systems topics including digital communications systems, optical technologies and systems, packet networks, IP networking, wireless systems, ad hoc networks.

EELE 552. Power System Analysis/Control. 3 Credits. (3 Lec) On Demand PREREQUISITE: EELE 454. Representation of power system elements, fast-decoupled power flow, optimal power flow, voltage control, load-frequency control, load flow, active and reactive power flow, application of FACTS devices in power flow control, electrical faults and contingency calculations, transient stability, dynamic stability.

EELE 555. Alt Energy Dist Gen Systems. 3 Credits. (3 Lec) S alternate years to be offered even years PREREQUISITE: EELE 355. Exploration and analysis of alternative power generation sources and systems such as wind, solar, microturbin, and fuel cells, combined sources and their design, power electronic interfacing, and energy storage systems. Co-convened with EELE 455.

EELE 556. Advanced Power Electronics. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: EELE 451. Mathematical modeling of switching power converters, advanced power converter topologies, design constraints and control methods, design-oriented analysis techniques for applications in electro-mechanical systems, power systems, transportation systems, etc.

EELE 558. Advanced - Electrical Power. 3 Credits. (3 Lec; 6 cr max) On Demand Max 6 cr. PREREQUISITE: EELE 454 or equivalent. Reading, discussion and exploration of advanced electrical power topics including power system operation and control, power dynamics, power markets, protection, electric drives, or power electronics.

EELE 561. Digital System Design. 3 Credits. (3 Lec) S, alternate years to be offered even years PREREQUISITE: EELE 368 and EELE 334 and EELE 371. Analysis and design of high speed digital systems including chip-to-chip signal propagation, transmission lines, IC package interconnect, printed circuit board design, state-of-the-art simulation tools, and measurement techniques using Time Domain Reflectometry (TDR) and Vector Network Analyzers. Research of modern topics.

EELE 565. Parallel Processing. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: EELE 466. Architecture and applications of parallel processors, major design issues, fault tolerant computing, performance measures of parallel systems, and issues in concurrent programming.

EELE 575. Research/Proj/Paper/Project. 3-6 Credits. (3-6 Ind; 6 cr max) F,S,Su IND Maximum 6 cr. PREREQUISITE: Graduate standing. A research or professional paper dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee. This course is required for students in the Electrical Engineering non-thesis (plan B) master's degree program.

EELE 577. Adv Digital Signal Processing. 3 Credits. (3 Lec) S alternate years to be offered odd years PREREQUISITE: EELE 477. Advanced topics in digital signal processing. Review of LT1 discrete-time systems; signal and coefficient quantization; sample rate conversion and multirate filter structures; time-varying and adaptive systems; fast algorithms; system implementation alternatives; DSP applications in current research.

EELE 578. Speech Signal Processing. 3 Credits. (3 Lec) F alternate years to be offered even years PREREQUISITE: EELE 477. Digital signal processing techniques that are used to analyze, code, and manipulate speech signals will be covered. Topics include modification, coding, enhancement, and recognition of speech signals.

EELE 581. Fourier Optics/Imaging Theory. 3 Credits. (3 Lec) F alternate years to be offered odd years PREREQUISITE: EELE 334 or consent of instructor. Optical propagation and diffraction using scalar wave approach and Fourier Theory of imaging. Introduces concepts of pupil function, point and line spread function and optical transfer function, image formation with coherent and incoherent light, holography and diffractive optical elements.

EELE 582. Optical Design. 3 Credits. (3 Lec) S alternate years to be offered odd years PREREQUISITE: EELE 482 or PHSX 327. Optical design using geometric optics and computer ray-tracing software. Introduces ray and wave front aberrations, control of aberrations in optical systems, designing for system requirements, and analytic tools including the modulation transfer function for describing the imaging and beam-conditioning properties of typical optical systems, including lenses, mirrors, cameras, and telescopes.
EENV 583. Remote Sensing Systems. 3 Credits. (3 Lec) S alternate years to be offered even years. PREREQUISITE: EENV 334 or PHSX 423 or equivalent. Design, analysis, and calibration of electromagnetic remote sensing systems. Combines an introduction to atmospheric radiative transfer and wave propagation principles with detailed coverage of radiometry and optical detectors to analyze remote sensing systems. The course considers the full electromagnetic spectrum, but emphasizes optical systems at ultraviolet, visible, and infrared wavelengths, including cameras, spectrometers, radiometers, polarimeters, multispectral and hyperspectral imagers, laser radars, etc.

EENV 584. Laser Engineering. 3 Credits. (3 Lec) S Alternate Years. PREREQUISITE: PHSX 222. The laser engineering course provides a basic understanding of the design and operational principles of lasers. Discussions of design and operation of several types of lasers will be covered including solid state lasers, gas lasers, and semiconductor lasers.

EENV 589. Graduate Consultation. 1-3 Credits. (1-3 Ind; 3 cr max) F,S,Su TUT Maximum 3 cr. PREREQUISITE: Master's standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty or staff time or help.

EENV 590. Masters' Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su PREREQUISITE: Master's standing.

EENV 591. Special Topics. 1-4 Credits. (1-4 Lab; 12 cr max) -- Special Topics.

EENV 592. Independent Study. 1-6 Credits. (1-6 Ind; 6 cr max) -- Independent study for electrical engineering students.

EENV 598. Internship. 1-12 Credits. (1-2 Ind) On Demand PREREQUISITE: Graduate standing, consent of instructor and approval of Department Head. An individual assignment arranged with an agency, business or other organizations to provide guided experience in the field.

EENV 600. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su PREREQUISITE: Doctoral standing.

EENV - Environmental Engineering

EENV 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

EENV 340. Princ of Envir Engineering. 3 Credits. (3 Lec) F,S Lec 3 PREREQUISITE: CHMY 143 or CHMY 153. COREQUISITE: EGEN 335 or ECHM 321. Fundamentals of environmental engineering with emphasis on water and wastewater.

EENV 432. Advanced Engineering Hydrology. 3 Credits. (3 Lec) S Lec 3 PREREQUISITE: EECI 331 and EECI 332 or EECI 333. Hydrology emphasizing engineering design. Topics include modern techniques for flow estimation, flood routing and sediment yield; design of conveyance structures; and water project development.

EENV 434. Groundwater Supply/Remediation. 3 Credits. (3 Lec) S Lec 3 PREREQUISITE: EGEN 335. Contemporary groundwater topics including water supply, contaminant transport, and remediation technologies.

EENV 440. Water Chemistry for Envr Engr. 3 Credits. (3 Lec) F PREREQUISITE: EENV 340. Fundamentals of aquatic chemistry and principles of water technology for environmental engineers. Based on chemical thermodynamics. Students learn to quantify water quality and control parameters characterizing water quality. Co-convened with EENV 540. Students enrolled in this course will not be able to take EENV 540 and have it count toward degree requirements.

EENV 441. Natural Treatment Systems. 3 Credits. (3 Lec) F PREREQUISITE: EENV 340. Planning, design, and operation of remediation facilities emphasizing natural versus mechanical elements. Specific topics include stabilization ponds, constructed wetlands, land treatment, and on-site domestic systems.

EENV 443. Air Pollution Control. 3 Credits. (3 Lec) F alternate even years. PREREQUISITE: EGEN 335; CHMY 141 and EGEN 324. Fundamentals of air quality management with emphasis on the design of processes and equipment for controlling gaseous and particulate emissions.


EENV 447. Hazardous Waste Management. 3 Credits. (3 Lec) S PREREQUISITE: Junior standing and either CHMY 211 or EGEN 335. Introduction to the technologies, regulations, political and social issues, and environmental impacts of hazardous wastes. Management approaches are developed through fundamental studies and review of case histories.

EENV 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind) F,S,Su Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

EENV 491. Special Topics. 1-3 Credits. (1-3 Ind; 4 cr max) On Demand PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EENV 492. Independent Study. 1-3 Credits. (1-3 Ind; 4 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor, and approval of Department Head. Directed research and study on an individual basis.

EENV 534. Environ Eng Investigation. 3 Credits. (3 Lec) F PREREQUISITE: EENV 340 and EECI 431 or EENV 431 or ECIV 435. Laboratory and field investigations for design and analysis of environmental engineering systems with focus on site investigations, remediation and incorporation of modeling studies.

EENV 540. Water Chemistry for Envr Engr. 3 Credits. (3 Lec) F PREREQUISITE: EENV 340. Fundamentals of aquatic chemistry and principles of water technology for environmental engineers. Based on chemical thermodynamics. Students learn to quantify water quality and control parameters characterizing water quality. Co-convened with EENV 440. Students enrolled in this course will not be able to take EENV 440 and have it count toward degree requirements.


EENV 562. Water Treatment Process/Design. 3 Credits. (3 Lec) S Principles, theory, and practice of water treatment plant design.


EENV 565. Chem Sens/Instr Envir Biotech. 2 Credits. (2 Lec) S alternate even years. PREREQUISITE: EENV 340. The course provides the knowledge necessary to design, manufacture, and use chemical sensors in the area of environmental biotechnology. Principles of manufacture and examples of application of chemical sensors along with the principles of measurement, signal conditioning, and data acquisition are presented to an extent that is necessary for the operation of sensors. The measurement techniques are preceded with an adequate theoretical introduction. Demonstrations of the sensors are organized in the Microsystems Laboratory located at the Center for Biofilm Engineering.

EENV 575. Research or Prof Paper/Project. 1-4 Credits. (1-4 Ind; 6 cr max) F,S,Su Max 6 cr. PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

EENV 589. Graduate Consultation. 1-3 Credits. (3 Lec) F,S,Su PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

EENV 590. Master's Thesis. 1-10 Credits. (1 Ind; max unlimited) On Demand PREREQUISITE: Master's standing. May be repeated.

EENV 591. Special Topics. 1-3 Credits. (1-3 Ind; 12 cr max) On Demand PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EENV 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su PREREQUISITE: Graduate standing, consent of instructor, approval of Department Head and Dean of Graduate Studies. Directed research and study on an individual basis.

EENV 598. Internship. 2 Credits. (2 Ind) On Demand PREREQUISITE: Graduate standing, consent of instructor and approval of Department Head. An individual assignment arranged with an agency, business or other organizations to provide guided experience in the field.
EGEN 415. Advanced Mechanics of Solids. 3 Credits. (3 Lec) F
PREREQUISITE: EGEN 205. Advanced topics in deformational mechanics of materials; application to contemporary engineering problems. Computer applications.

EGEN 435. Fluid Dynamics. 3 Credits. (3 Lec) S
PREREQUISITE: EGEN 335. Equations governing steady and unsteady fluid flow; applications to contemporary engineering problems. Computer applications.

EGEN 488. Fundamentals of Engineering Exam. 0 Credits. (0 Ind) F,S
PREREQUISITE: Must be in final semester of program. Student participation in engineering program assessment. Requirement to complete the Fundamentals of Engineering (FE) examination or the Major Field Test in Computer Science (CS majors only). Students register for the FE exam through the NCEES website (https://ncees.org/) and then schedule a time to take the exam online. Documentation must be submitted to the Engineering Dean’s Office prior to Finals Week.

EGEN 490R. Undergraduate Research. 1-4 Credits. (1 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. May be repeated.

EGEN 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EGEN 492. Independent Study. 1-3 Credits. (1-3 Ind; 4 cr max)
PREREQUISITE: Junior standing, consent of instructor, and approval of Department Head. Directed research and study on an individual basis.

EGEN 498. Internship. 1-3 Credits. (1-3 Ind; 12 cr max)
PREREQUISITE: Junior standing, consent of instructor and approval of Department Head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field. Students may not take this course the semester they graduate.

EGEN 498Z. Internship. 1-3 Credits. (1-3 Ind; 12 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor and approval of Department Head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field. Students may not take this course the semester they graduate.

EGEN 505. Advanced Engineering Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: One of the following: EMEC 425, EMEC 326, EGEN 335. Mathematical modeling of engineering systems, physical interpretation of ordinary and partial differential equations and methods of solution.

EGEN 506. Numerical Sol to Engr Problems. 3 Credits. (3 Lec) S
Numerical methods used to solve common engineering research problems. Solutions to nonlinear equations. Optimization methods.

EGEN 541. Thy Magnetic Resonance Imag I. 3 Credits. (3 Lec) F,S
PREREQUISITE: Graduate standing, or consent of instructor. Advanced topics in MRI phenomena including relaxation, diffusion, chemical shift, and magnetic susceptibility, as well as experimental aspects including phase cycling, magnetic field gradients, rf coil, tuning and matching and pulse sequence development will be covered.

EGEN 542. Thy Magnetic Resonance Imag II. 3 Credits. (3 Lec) F,S
PREREQUISITE: Graduate standing. Consent of Instructor. Advanced topics in nuclear magnetic resonance phenomena focusing on molecular dynamics and pulse sequence development for measuring complex dynamics will be covered.

EIND - Industrial Engineering

EIND 101. Introduction to Industrial & Management Systems Engineering. 1 Credit. (1 Lec) F
PREREQUISITE: Must be taken the first year enrolled in IE program. Overview of the industrial engineering profession. Lectures will concentrate on tools and methods of industrial and management system engineering, and their application in manufacturing and service industries.

EIND 142. Introduction to Systems Engineering. 2 Credits. (1 Lec, 1 Lab) S
Introduce students to the methods used by industrial engineers to improve efficiency and safety of human-based systems. Labs will include hands-on activities and plant tours. Contemporary industrial engineering topics will be introduced, such as designing for the environment and sustainability.

EIND 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

EIND 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EIND 300. Engineering Management & Ethics. 3 Credits. (3 Lec) F
PREREQUISITE: WRIT 101W, COMX 111US, and Junior standing. Introduction to management, leadership and organizational theory with applications to the engineering profession. Communication skills, social responsibility and ethical decision making for managers and engineers emphasized throughout. Cases and class exercises used to illustrate contemporary problems and environments.

EIND 313. Work Design and Analysis. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: WRIT 101W; EIND 142 for IE majors. Covers analysis and design methods for occupational tasks to improve productivity, workplace health, and safety. Topic areas include fundamental aspects of work standards development, ergonomics, and industrial safety. The labs demonstrate example applications of these topic areas.

EIND 354. Engineering Probability and Statistics I. 3 Credits. (3 Lec) F
PREREQUISITE: M 172Q, Senior standing, or consent of instructor. Understanding the statistical nature of engineering processes. Emphasis on proper data collection and classification, characteristics of variables and their distributions, joint probability distributions, and establishing hypotheses and statistical significance over engineering design specifications.

EIND 364. Principles of Operations Research 1. 3 Credits. (3 Lec) F
PREREQUISITE: M 221. Formulation of models and optimization techniques to facilitate engineering management decisions. Resource allocation, transportation and multiple goals via networks, linear, and integer programming with primal-dual emphasis.

EIND 371. Introduction to Computer Integrated Manufacturing. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: ETME 215 or consent of instructor. Introduces core concepts of computer controlled manufacturing systems and their applications. Topics include fundamentals of automation, programmable logic controllers, numerical control, industrial robotics, material handling and storage, and flexible manufacturing systems. Laboratories require students to apply core concepts in solving simulated industrial problems, and implement hardware-software solutions to meet stated objectives.

EIND 373. Production Inventory Cost Analysis. 3 Credits. (3 Lec) S
PREREQUISITE: M 161Q, M 165Q, or M 171Q. Industrial cost systems, accounting processes, and cost estimation; cost analysis of manufacturing processes, economic decision making and uses of cost information in making product design and product line decisions.

EIND 410. Interaction Design. 2 Credits. (2 Lec) S
PREREQUISITE: EIND 313 or EGEN 310R (or equivalent) for Engineering majors. This course demonstrates the process of integrating the psychology of the user into the design process as well as conducting usability testing to evaluate the design success. It emphasizes the need to understand the users, capabilities, and emotions of the user to produce usable and desirable designs. Emphasis is placed on innovation in design to create enjoyable (fun) user experiences.

EIND 411. Interaction Design Project. 1 Credit. (1 Rct) S
COREQUISITE: EIND 410. Applications of interaction design methods discussed in EIND 410 to an actual product or service concept (prototype), based on student project team guided by faculty.

EIND 413. Ergonomics & Human Factors Engineering. 3 Credits. (3 Lec) F
PREREQUISITE: Junior standing; EIND 313 for IMSE majors; or consent of instructor. Applications of ergonomics and human factors engineering. Topics include principles of anthropometrics, biomechanics, bioinstrumentation, physiology, design error, design for special populations (e.g., those with disabilities), mental stress/ workload, and risk assessment methods for work applied to common problems faced by engineers. Emphasis on design and analysis of occupational systems and consumer products which best “fit” job tasks or user requirements to human capabilities.

EIND 422. Introduction to Simulation. 3 Credits. (3 Lec) F
PREREQUISITE: CSI 127 or equivalent, and EIND 354 or equivalent. Discrete simulation modeling methodology; sampling, output analysis, validation, and verification; application to varied systems design and analysis problems. Cross-listed with CS/CSCI 477.

EIND 425. Technology Entrepreneurship. 3 Credits. (3 Lec) F
PREREQUISITE: EGEN 325 or EGEN 330 or equivalent. Introduction to principles of entrepreneurship and starting a business. Students learn how to formulate, plan, and implement a new venture, emphasizing the unique intellectual property, funding and marketing/selling concerns of technology startups. Includes extensive use of technology examples and case studies.
EIND 434. Project Management for Engineers. 3 Credits. (3 Lec) F
PREREQUISITE: Junior standing. Fundamental principles of planning and executing engineering and research projects, including estimating, budgeting, scheduling, controlling, software applications, and Agile project management approaches. Focus on management practices that drive success in domestic and international projects including team development and communication practiced through a term project.

EIND 442. Facility and Material Handling Systems Design. 3 Credits. (3 Lec) F
PREREQUISITE: IMSE seniors in their last full academic year, EIND 313, EMEC 103, ETME 215, COREQUISITE: EIND 300. Senior capstone course. The first course in the senior capstone sequence. Principles and techniques for planning and designing production facilities and material handling systems. Produce and process analysis, requirements, layout and support facilities. Computer-aided analysis and design.

EIND 454. Engr Probability and Stats II. 3 Credits. (3 Lec) On Demand
PREREQUISITE: EIND 354. Identification, characterization, and analysis of variation in engineering data. Includes inferential statistics, goodness of fit, applications of non-parametric statistics, curve fitting, regression, and the design of engineering experiments. A team design project is required.

EIND 455. DOE for Engineers. 3 Credits. (3 Lec) S, odd years
PREREQUISITE: EIND 354 or consent of instructor. Statistical analysis for managerial decision-making as applied to engineering problems. Single and multi-factor ANOVA, randomized complete, full-blown and fractional designs with blocking and confounding. Introductions to nested and split-plot designs, multiple regression and response surface designs.

EIND 457. Regres & Multivar Analysis. 3 Credits. (3 Lec) S, even years
PREREQUISITE: EIND 354 or consent of instructor. Advanced topics in applied statistical analysis for engineers. Topics include regression techniques: ANOVA, simple linear regression, multiple linear regression, and variable selection procedures; and multivariate analysis techniques: principal components, factor analysis, canonical correlation analysis, and clustering methods. Statistical analysis for managerial decision-making as applied to engineering problems. Co-convened with EIND 557.

EIND 458. Production & Engineering Mgmt. 3 Credits. (3 Lec) S
COREQUISITE: EIND 464 or consent of instructor. Design and management of efficient production/delivery systems for goods and services, emphasizing quantitative analysis and systems approaches. Topics include forecasting, inventory management, production planning, scheduling, material planning, and lean manufacturing systems.

EIND 464. PDM of Operations Research II. 3 Credits. (3 Lec) S
PREREQUISITE: EIND 354 and EIND 364. Advanced formulation of models, optimization techniques and application to engineering design and operations management decision making. Integer programming algorithms. Stochastic models including advanced queuing and general Markov processes.

EIND 468. Managerial Forecasting & Decision Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: EIND 354. Time series analysis through classical approaches; auto-regression, smoothing models, and advanced time series models. Technical applications emphasized. Includes investigations into financial and dependent data. Approaches designed for managers to test real applications for making decisions.

EIND 477. Quality Management Systems. 3 Credits. (3 Lec) S
PREREQUISITE: EIND 354 or EGEN 350 or consent of instructor. Introduction to industrial methods used to improve the quality of products and services and their application. Quality management approached from both qualitative and quantitative (statistical) tools. Emphasis on Six Sigma methods through case studies and projects.

EIND 490R. Undergrad Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head or director. Directed research and study on an individual basis.

EIND 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head or director. Directed research and study on an individual basis.

EIND 499R. Industrial Engineering Design Capstone. 3 Credits. (1 Lec, 2 Rct) S
PREREQUISITE: EGEN 310, EGEN 352, EIND 434 and EIND 442.
COREQUISITE: EIND 458. Second course in senior capstone sequence. An open-ended team design project emphasizing the application of industrial engineering tools and knowledge to create engineered solutions for real business needs or opportunities. Experiential learning, oral and written communication and project management emphasized. Co-convened with EFIN 499R.

EIND 506. Healthcare Delivery Systems. 3 Credits. (3 Lec) S
PREREQUISITE: NRSG 505 or EIND 458 or consent of instructor. This interdisciplinary course targets nursing students pursuing certification as a Clinical Nurse Leader and Industrial Engineering students who intend to work in the healthcare sector. Students will learn strategies for analyzing and improving processes, coordinating interdisciplinary healthcare teams, enhancing healthcare quality management, and reducing health risk through medical error elimination. This course is cross listed with NRSG 608.

EIND 509. Systems Simulation. 3 Credits. (3 Lec) F odd years
PREREQUISITE: CSCS 111 or CSCS 127, EIND 354, EIND 422; or consent of instructor. Systems exhibiting randomness are modeled and statistically analyzed using a state-of-the-art simulation language. Graphical model animation, and advanced output analysis are emphasized. Applications include improvement of existing and design of new production and service systems.

EIND 510. Design for Usability and Persuasion. 3 Credits. (3 Lec) F odd years
PREREQUISITE: EIND 410 or EGEN 310R or consent of instructor. Usability engineering is an iterative design process that applies human-centered design principles to ensure that usable, desirable, and sustainable products, services and systems. The goal is to meet the needs of the user. In contrast, methods of persuasive design seek to guide user behavior toward the needs of others who may benefit from the purchase and use of these products and systems. This project-based course will use a seminar format with industry guest speakers from various disciplines to examine the methods and ethics of usability and persuasive design.

EIND 511. Advanced Human Factors. 3 Credits. (3 Lec) S even years
PREREQUISITE: Basic knowledge of statistics (t-tests, ANOVA, regression, design of experiments) or consent of instructor. Advanced research methods applied to areas where ergonomics and human factors is playing a key role in increasing effectiveness, efficiency and safety of human-based systems. Example application areas include: (1) transportation systems; (2) health care systems; and (3) occupational work.

EIND 513. Human Factors in the Safety of Complex Systems. 3 Credits. (3 Lec) F, even years
PREREQUISITE: EIND 313 or EIND 413 (or equivalent); or consent of instructor. Analytical topics in human factors engineering applied to the understanding of human error in the failure of safety-critical systems. Emphasis is on understanding the system and human basis of failure in order to design systems with greater resilience. Basic and applied issues of human cognition, emotion, culture, and skill in relation to human error and system safety are explored through seminars, laboratory demonstrations and case studies.

EIND 514. Occupational biomechanics. 3 Credits. (3 Lec) S, odd years
PREREQUISITE: Basic knowledge of statistics (t-tests, ANOVA, regression, design of experiments); EIND 413 or consent of instructor. Topics relate to occupational biomechanics and bioinstrumentation application, focused on designing for the health and safety at work. Topics include the skeletal system, physiology, fatigue assessment, stress response, psychometrics, biomechanics, work design assessments and implementation of ergonomics programs.

EIND 525. Multi-Attribute Analysis. 3 Credits. (3 Lec) F, even years
PREREQUISITE: EIND 364. Theory, methods and applications pertinent to decision making with multiple attributes and/or multiple objectives. Special emphasis is given to multi-attribute utility theory, goal programming, and multiple criteria optimization decision-making in modern manufacturing and service systems and in decision-making to support competitive priorities of an enterprise.

EIND 554. DOE for Engineers. 3 Credits. (3 Lec) S, odd years
PREREQUISITE: EIND 354 or consent of instructor. Statistical analysis for managerial decision-making applied to engineering problems. Single and multi-factor ANOVA, randomized complete and fractional factorial designs with blocking and confounding. Introductions to nested and split-plot designs, multiple regression and response surface designs.

EIND 557. Regression & Multivar Analysis. 3 Credits. (3 Lec) S
PREREQUISITE: EIND 354 or consent of instructor. Advanced topics in applied statistics for engineers. Topics include regression techniques: ANOVA, simple linear regression, multiple linear regression, and variable selection procedures; and multivariate analysis techniques: principal components, factor analysis, canonical correlation analysis, and clustering methods. Statistical analysis for managerial decision-making as applied to engineering problems. This course is co-convened with EIND 457.
EIND 558. Manage Forecast & Dec Analysis. 3 Credits. (3 Lec) F, odd years
PREREQUISITE: EIND 394 or EIND 457. Time series analysis through classical approaches including regression, smoothing models, and advanced time series models. Technical applications emphasized in concepts, tools, and methods. Includes investigations into financial and dependent data. Approaches designed for managers to test real applications for making decisions.

EIND 574. Management Engineering Systems. 3 Credits. (3 Lec) S, odd years
PREREQUISITE: EIND 300 or consent of instructor. Students will explore various facets of designing effective organizational and management systems. Topics will include: classical and open system organization theory, socio-technical systems theory, congruence, technology and innovation management, knowledge management, and continuous improvement in organizations. Students will complete an independent research project in addition to course readings and in-class discussion.

EIND 575. Research or Prof Paper/Project. 1-4 Credits. (1-4 Ind) F, S, Su
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student, major advisor, and graduate committee.

EIND 589. Graduate Consultation. 1-3 Credits. (1-3 Ind) F, S, Su
PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their coursework (and thesis if on a thesis plan) but who need additional faculty or staff time or help.

EIND 590. Master’s Thesis. 1-10 Credits. (1-10 Ind) F, S, Su
PREREQUISITE: Master’s standing; consent of instructor.

EIND 591. Special Topics. 1-4 Credits. (1-4 cr.)
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EIND 592. Independent Study. 1-3 Credits. (1-3 Ind) F, S, Su
PREREQUISITE: Graduate standing, consent of instructor, approval of department head or director. Directed research and study on an individual basis.

EIND 598. Internship. 1-12 Credits. (1-3 Ind) F, S, Su
PREREQUISITE: Graduate standing, consent of instructor, and approval of graduate program coordinator. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

EIND 690. Doctoral Thesis. 1-10 credits. (1-10 Ind) F, S, Su
PREREQUISITE: Doctoral standing; consent of instructor.

EM - Engineering Mechanics

EM 506. Advanced Dynamics. 3 Credits. (3 Lec) On Demand
PREREQUISITE: EGEN 335. Kinematics of particles, rigid bodies, and mechanisms. Lagrange’s equations, constraints, applications, and numerical solutions.

EM 510. Elastic & Inelastic Analysis. 1-3 Credits. (3 Lec) S
Lec 3 PREREQUISITE: EM 525 or EGEN 415. Fundamentals of linear elasticity, linear viscoelasticity and plasticity. Correspondence principles for elastic and viscoelastic materials and analogy between elastic and inelastic materials will be presented. Constitutive theories of linear elasticity, linear viscoelasticity, and plasticity. Application to static structural theories for beams, torsion, plane stress, and plane strain will be covered for elastic and inelastic behavior.

EM 518. Theory Plates & Shells. 2 Credits. (2 Lec) S alternate years, to be offered even years.
Lec 2 PREREQUISITE: EGEN 415. Theory of small plate deformations, membrane shell theory, shell bending.

EM 525. Continuum Mechanics. 3 Credits. (3 Lec) F
Lec 3 PREREQUISITE: EGEN 415. Solid and fluid mechanics, laws of vector and tensor transformations, vector and tensor calculus using cartesian tensors, theory of deformation, principles of thermodynamics, constitutive equations for elastic solids and viscous fluids.

EM 560. Finite Elem Anal in Engr. 3 Credits. (2 Lec, 1 Lab) F
Lec 2, Lab 1 PREREQUISITE: EGEN 415 or EGEN 435. General finite element analysis. Application to the classical equations of fluid, solid, and thermal mechanics.

EM 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EM 592. Independent Study. 1-3 Credits. (1-3 Ind; 4 cr max) F, S, Su
PREREQUISITE: Graduate standing, consent of instructor, approval of Department Head and Dean of Graduate Studies. Directed research and study on an individual basis.

EMAT - Materials Engineering

EMAT 251. Materials Structures and Prop. 3 Credits. (3 Lec) F
PREREQUISITES: CHMY 141 or CHMY 121IN. COREQUISITE: M 165Q OR M 171Q. Chemistry and internal structure of solids and the relationship of structure to physical and mechanical properties of metals and nonmetallic solids.

EMAT 252. Materials Struct and Prop Lab. 1 Credit. (1 Lab) F
PREREQUISITE: WRIT 101W; CHMY 141 for ME Majors; CHMY 121IN for MET Majors. COREQUISITE: EMEC 250; M 172Q for ME majors; M 165Q for MET majors. This course is intended to supplement current materials lecture course offerings. Provides students with hands-on lab experience to identify and quantify physical, electrical, and mechanical properties of engineering materials via experimental measurements. Experimental procedures and reporting are emphasized.

EMAT 350. Engineering Materials. 3 Credits. (3 Lec) S

EMAT 460. Polymeric Materials. 3 Credits. (3 Lec) F
PREREQUISITE: EMAT 251 or EMEC 250. Interrelationships of molecular structure, morphology and mechanical behaviors of polymers. Topics will also include manufacture and application of polymeric materials.

EMAT 461. Friction and Wear of Materials. 3 Credits. (3 Lec) S
PREREQUISITE: EMEC 326 and EMEC 342 or instructor approval. Introduction to elastic and elasto-plastic deformation, microfracture, and surface interactions at the micro-and nano-scale. Application of fundamental knowledge to control friction and wear behavior through lubrication, selection of materials and coatings in practical situations.

EMAT 462. Manufacturing of Composites. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: EMAT 251 or EMEC 250. Manufacturing of Composites. 3 Credits. (2 Lec, 1 Lab) S
Alternate Even Years PREREQUISITE: EMAT 251 or EMEC 250. This course will examine the fundamentals of composite manufacturing, focusing on fiber reinforced plastics. Techniques such as open molding, resin transfer molding, pultrusion, and filament winding will be covered.

EMAT 463. Composite Materials. 3 Credits. (3 Lec) F
Alternate Even Years. PREREQUISITE: EMEC 341 or ETME 341. Structure and properties of composite materials and design procedures for composite structures.

EMAT 464. Biomedical Materials Engineering. 3 Credits. (3 Lec) F
PREREQUISITES: EGEN 351 or EGEN 353 or ECHM 321, and EMEC 250 or EMAT 251. This course will include materials engineering as related to the selection, fabrication, and design of biomaterials, largely for medical applications. Topics will include soft and hard materials, testing and characterization techniques. Emphasis will be placed on mechanics, design, and testing.

EMAT 511. Catalysis/Applied Surface Chem. 3 Credits. (3 Lec) On Demand
PREREQUISITE: CHBE 328. The fundamental principles of catalysis, surface chemistry, and reactor design at a working research level.

EMAT 550. Failure of Materials. 3 Credits. (3 Lec) S
Alternate Even Years PREREQUISITE: One of the following: EMAT 463, EGEN 415, or EMAT 452. Concepts of brittle and ductile fracture, fatigue, creep-rupture and environmentally assisted fracture. Applications to metals, polymers, ceramics and composite materials.

EMAT 551. Advanced Composite Materials. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: EMAT 463. Advanced treatment of composite materials, including constituent properties, interfaces, micromechanics, microscopic behavior, modes and mechanisms of failure.

EMAT 552. Advanced Ceramics. 3 Credits. (3 Lec) F
Alternate Odd Years PREREQUISITE: EMAT 463. Advanced treatment of composite materials, including constituent properties, interfaces, micromechanics, microscopic behavior, modes and mechanisms of failure.

EMAT 553. Advanced Composite Materials. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: EMAT 463. Advanced treatment of composite materials, including constituent properties, interfaces, micromechanics, microscopic behavior, modes and mechanisms of failure.
EMAT 560. Polymeric Materials. 3 Credits. (3 Lec) F
PREREQUISITES: Equivalent of EMAT 251 or EMEC 250 (undergraduate course in Materials Science, requiring an introductory chemistry class and lab as a prerequisite) or a sufficient related background in materials or chemistry, as evaluated by the instructor. Interrelationships of molecular structure, morphology and mechanical behaviors of polymers. Topics will also include manufacture and application of polymeric materials.

EMEC - Mechanical Engineering

EMEC 100. Introduction to Mechanical Engineering. 1 Credit. (1 Lec) F
COREQUISITE: M 151Q. The mechanical engineering profession, logical process of problem solving and design, professionalism, ethics.

EMEC 103. CAE I-Engineering Graphics Communications. 2 Credits. (2 Lab) F,S,Su
on demand PREREQUISITE: ME, MET, or IE majors only. COREQUISITE: M 171Q for ME and IE majors; M 151Q for MET majors. Communication through engineering graphics. The course topics include drawing utilizing sketching, 2-D CAD and 3-D solid modeling software, drawing standards, fits, and tolerances.

EMEC 203. CAE II-Mechanical Engineering Computations. 2 Credits. (1 Lec, 1 Lab) F,S
PREREQUISITE: EMEC majors only, EMEC 103. COREQUISITE: M 172Q. Computer methodology, use of various computer software packages in mechanical engineering applications.

EMEC 250. Mechanical Engineering Materials. 3 Credits. (3 Lec) F,S
PREREQUISITE: WRIT 101W. CHMY 141 for ME majors; CHMY 121IN for MET majors. COREQUISITE: EMEC 252; M 172Q for ME majors; M 165Q for MET majors. Properties of engineering materials and ceramics as related to their structures. Material selection for engineering applications.

EMEC 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind) F,S,Su
PREREQUISITE: Consent of instructor and approval of department head or director. Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

EMEC 291. Special Topics. 1-4 Credits. (1-4 cr.) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EMEC 292. Independent Study. 1-3 Credits. (1-3 Ind) F,S,Su
PREREQUISITE: Consent of instructor and approval of department head or director. Directed research and study on an individual basis.

EMEC 305. CAE III—Systems Analysis. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 203, M 273Q, M 274, COREQUISITE: EGEN 205. Course focuses on enhancing the appreciation of mathematics in ME and advancing the knowledge of mathematical methods in engineering analysis. Topics include introduction to mathematical modeling of engineering systems, linear algebra techniques, numerical methods, method of Laplace transformation, Fourier analysis, with classic and modern engineering applications.

EMEC 320. Thermodynamics I. 3 Credits. (3 Lec) F,S
PREREQUISITE: EGEN 201. Basic thermodynamic concepts, first and second laws, open and closed systems, properties of ideal and real substances, work, heat, irreversibility, and availability.

EMEC 321. Thermodynamics II. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 320. Vapor, gas power, and refrigeration cycles; mixtures and combustion.

EMEC 326. Fundamentals of Heat Transfer. 3 Credits. (3 Lec) F,S
PREREQUISITE: EGEN 335, EMEC 320. COREQUISITE: Concurrent enrollment in or prior completion of EMEC 303. Mechanisms of energy transport due to a temperature difference in materials. Conduction, convection, and radiation formulations.

EMEC 341. Adv Mechanics of Materials. 3 Credits. (3 Lec) F,S
PREREQUISITE: M 274 and EGEN 205. COREQUISITE: Concurrent enrollment in or prior completion of EGEN 350 and ETME 216 or ETME 217. Static, yield theories, introduction to fracture mechanics, analysis of fatigue, thick-walled pressure vessels, strain energy, Castigliano’s theorem, application to engineering design analysis problems. Evening exams required.

EMEC 342. Mech Component Design. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 341. Requires completion of all 100-200 level courses (except core). Analysis of components used in mechanisms and machines. Topics include bolts, welds, springs, bearings, gears, belts, chains, motors, and hydraulic elements.

EMEC 360. Measurement & Instrumentation. 3 Credits. (3 Lec) F,S
PREREQUISITE: ELE 250. COREQUISITE: EGEN 350; EMEC 320 or EGEN 324; EMEC 303 or ETME 202. Theory and application of engineering measurement concepts including: temperature, pressure, displacement and flow sensing; calibration; statistical and uncertainty analysis; sampling; signal conditioning; 1st and 2nd order dynamic response; emphasis of computerized data acquisition and feedback-based actuation and control.

EMEC 361. Measurement & Instrument Lab. 1 Credit. (1 Lab) F,S
COREQUISITE: EMEC 360. Application of engineering measurement concepts including: temperature, pressure, displacement and flow sensing; calibration; statistical and uncertainty analysis; sampling; signal conditioning; 1st and 2nd order dynamic response.

EMEC 368. Introduction to Aerospace. 3 Credits. (3 Lec) F
PREREQUISITE: M 172Q, PHSX 222. Introductory course on topics relevant to aerospace engineering and science. Required for the Aerospace Minor. Topics include history, atmospheric and space vehicles, propulsion, flight vehicle performance, materials and structures, and stability and control.

EMEC 403. CAE IV--Design Integration. 3 Credits. (1 Lec, 2 Lab) F,S
PREREQUISITE: EMEC 103 or EMEC 303; or instructor’s consent; junior standing. Develop the ability to use solid and parametric modeling to design and document machine parts. Geometric dimensioning and tolerancing, auxiliary views, analysis of models, advanced modeling techniques and customization are covered through hands-on experiences.

EMEC 405. Finite Element Analysis. 3 Credits. (3 Lec) F,S
COREQUISITE: Concurrent enrollment in or prior completion of EMEC 342. Introduction to the finite element method emphasizing the fundamental principles of FEA. Various finite element formulations for applications to structural analysis, thermal/fluids analysis, and design. Practical computational experience using a commercial finite element computer code.

EMEC 424. Cellular Mechanotransduction. 3 Credits. (3 Lec) F
PREREQUISITE: College of Engineering students—completion of all required mathematics courses in the major; other students—permission of the instructor. Solid and fluid mechanics and relationships to cell biology. This interdisciplinary course brings together topics from both engineering and molecular biology to understand the mechanisms by which cells respond to loading. Topics selected from: musculoskeletal, circulatory, lymphatic, chondrocyte, leukocyte, and cancer cell mechanotransduction.

EMEC 425. Advanced Thermal Systems. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 321, EGEN 335. Study of thermodynamics, heat transfer, and fluid mechanics analysis for applications to thermal systems.

EMEC 426. Thermodynamics of Propulsion Systems. 3 Credits. (3 Lec) S
PREREQUISITE: EMEC 425. An introduction to computer-aided thermodynamics calculations with applications to the mechanics and thermodynamics of aerospace propulsion systems. Includes computer-based chemical equilibrium applications and compressible fluid flow applications.

EMEC 430. Introduction to Combustion. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 321 or ECHM 407. COREQUISITE: EMEC 326 or ECHM 322. Study of combustion science based on chemistry, thermodynamics, fluid mechanics, and transport phenomenon. Stoichiometry, energetics of chemical reactions and flame temperature; combustion kinetics; momentum, heat and mass transport in combustion; combustion phenomena and applications.

EMEC 436. Computational Fluid Dynamics. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 303, EGEN 335, M 274. Introduction to computational methods used for the solution of advanced fluid dynamics problems. Emphasis on finite difference methods as applied to various ordinary and partial differential model equations in fluid mechanics, fundamentals of spatial discretization, numerical integration, and numerical linear algebra. A focus on the engineering and scientific computing environment. Other topics may include waves, advanced numerical methods (like spectral, finite element, finite volume), non-uniform grids, turbulence modeling, and methods for complex boundary conditions.
EMEC 444. Mech Behavior of Materials. 3 Credits. (3 Lec) F
Alternate Odd years PREREQUISITE: EMEC 341 or ETME 341. Theory, analysis, and application of mechanical behavior of materials. Constitutive behavior. Topics selected from: plasticity, fracture mechanics, visco elasticity, high temperature behavior, and material symmetry. Engineering behavior of materials such as metals, polymers, ceramics, composites, and biomaterials. Structure-function relationships such as stress-based growth, toughening mechanisms, fatigue, and damage-tolerant design with modern engineering materials are emphasized.

EMEC 445. Mechanical Vibrations. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 303. Requires completion of all 100-200 level courses (except Core). Vibration problems of single and multiple degree of freedom systems. Introduction to vibration of continuous bodies. Analysis of free and forced vibration problems. Effects of damping.

EMEC 447. Aircraft Structures. 4 Credits. (3 Lec, 1 Rct) S
PREREQUISITE: EMEC 341 or instructor approval. An introduction to the current practices in the design and analysis of aircraft metallic and composite structures. Overview of aircraft design, analysis, testing, and certification with examples. Static and dynamic load condition analysis.

EMEC 465. Bio-inspired Engineering. 3 Credits. (3 Lec) S
PREREQUISITE: EGEN 335, EMEC 320, EGEN 310R for ME majors; consent of instructor for non-majors. Addresses design in nature and resultant solutions as inspiration for solving engineering design problems. Structural, thermal, and fluid concepts in nature will be applied to engineering. Smart structures, self-healing materials, and robotics will be introduced.

EMEC 467. Micro-Electromechanical Systems. 3 Credits. (3 Lec) S
PREREQUISITE: ELE 250 and EGEN 205; Junior Standing. Introduction to sensors and actuators and their working principles. MEMS (microelectromechanical systems) fabrication procedures. MEMS materials and their mechanical properties. Mechanical behavior of microsystems. MEMS packaging and thermal-mechanical stresses in MEMS packages. Reliability issues in MEMS. MEMS case studies using FEM in Comsol in an extended project work.

EMEC 489R. Engineering Design Capstone I. 2 Credits. (1 Lec, 1 Rct) F
PREREQUISITE: EGEN 310R, ME majors only, COREQUISITE: Concurrent enrollment in or prior completion of EMEC 321, EMEC 326, EMEC 342, EMEC 360, EMEC 361, EMEC 445. Senior capstone design experience in Mechanical Engineering. Students, under the guidance of a faculty supervisor, solve real-world design problems.

EMEC 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head or director. Directed research and study on an individual basis. May be repeated.

EMEC 491. Special Topics. 1-4 Credits. (1-4 cr.)
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EMEC 492. Independent Study. 1-3 Credits. (1-3 Ind) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head or director. Directed research and study on an individual basis.

EMEC 495. Student Teaching ME Consult. 1-3 Credits. (1-3 Ind; 3 cr. max) F,S,Su
PREREQUISITE: Sophomore standing in ME/MET curriculum and consent of supervising faculty. Students enrolled in this class will provide technical support for selected ME/MET courses.

EMEC 498. Internship. 1-3 Credits. (1 Ind) F,S,Su
PREREQUISITE: Junior standing, EMEC 303, EMEC 320, EMEC 341, and consent of internship coordinator. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

EMEC 499R. Mech Eng Design Capstone II. 3 Credits. (1 Lec, 1 Rct, 1 Lab) F,S
PREREQUISITE: EMEC 489R or consent of instructor. ME majors only. Senior capstone design experience in Mechanical Engineering. Students implement and test the function of design prototypes, under the guidance of a faculty supervisor.

EMEC 524. Cellular Mechanotransduction. 3 Credits. (3 Lec) F
PREREQUISITE: College of Engineering students-completion of all required mathematics courses in the major; other students—permission of the instructor. Solid and fluid mechanics and relationships to cell biology. This interdisciplinary course brings together topics from both engineering and molecular biology to understand the mechanisms by which cells respond to loading. Topics selected from: musculoskeletal, circulatory, lymphatic, chondrocyte, leukocyte, and cancer cell mechanotransduction.

EMEC 525. Conduction Heat Transfer. 3 Credits. (3 Lc) F
PREREQUISITE: EMEC 326. COREQUISITE: EMEC 510. Advanced topics in conduction heat transfer with emphasis on analytical techniques including separation of variables, Duhamel’s theorem, two-phase problems, and numerical techniques.

EMEC 530. Advanced Fluid Mechanics I. 3 Credits. (3 Lec) S
Alternate odd years. PREREQUISITE: EGEN 335 or ECHM 321. COREQUISITE: EM 525 or consent of instructor. Review of conservation equations, laminar and turbulent internal flows, potential flows, and Stokes flow.

EMEC 531. Advanced Fluid Mechanics II. 3 Credits. (3 Lec) S
Alternate even years. PREREQUISITE: EGEN 335 or ECHM 321. COREQUISITE: EM 525. Laminar boundary layer and free shear flows, internal and external compressible flows.

EMEC 535. Transport Phenomena. 3 Credits. (3 Lec) On Demand PREREQUISITE: EMEC 531. Comprehensive treatment of mass, momentum, and energy transport. This course is cross-listed with ECHM 533.

EMEC 536. Computational Fluid Mechanics. 3 Credits. (3 Lec) F
PREREQUISITE: EGEN 335 or Instructor Approval. Numerical solutions of fluid flows, discretization methods, solution algorithms, aspects of turbulent flows.


EMEC 565. Smart Structures. 3 Credits. (3 Lec) On Demand PREREQUISITE: EMEC 303 and EMEC 342 and EMEC 445, or equivalent. Analysis and design of intelligent structures for aerospace, mechanical, and civil applications. Topics include piezoelectricity, shape memory effects, magnetorheology, and biomimicking.

EMEC 575. Research or Prof Paper/Project. 1-4 Credits. (1-4 Ind) F,S,Su
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee. This course can be used toward fulfilling the requirements for the Master of Science in Mechanical Engineering for non-thesis option students.

EMEC 589. Graduate Consultation. 1-3 Credits. (1-3 Ind) F,S,Su
PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their coursework (thesis, if on a thesis plan) but who need additional faculty or staff time.

EMEC 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; unlimited max) F,S,Su
PREREQUISITE: Master’s standing; consent of instructor. May be repeated.

EMEC 591. Special Topics. 1-4 Credits. (1-4 cr.)
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EMEC 592. Independent Study. 1-3 Credits. (1-3 Ind) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor, approval of department head or director. Directed research and study on an individual basis.

EMEC 594. Seminar. 1 Credit. (1 Sem) F
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Participants participate in preparing and presenting the discussion material.

EMEC 598. Internship. 1-12 Credits. (1-12 Ind) On Demand PREREQUISITE: Graduate standing, consent of instructor and approval of graduate program coordinator. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

EMEC 690. Doctoral Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S,Su
Max credits unlimited. PREREQUISITE: Doctoral standing; consent of instructor.
ENGL - English

ENGL 201. Introduction to English Education. 3 Credits. (3 Lec) S
This course will introduce students to the field of English Education and the profession of teaching secondary English. A main emphasis of the course will be on the history of the secondary subject English and critiquing contemporary pedagogical practices.

ENGL 237. Secondary English Curriculum. 3 Credits. (3 Lec) F
ENGL 236 is a special topics course, focusing on specialized content that undergirds secondary English curriculum. In addition to helping students develop deeper content knowledge, students will develop their research skills in English Education.

ENGL 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

ENGL 291. Special Topics. 1-4 Credits.

ENGL 339. Teaching Writing in Secondary School. 3 Credits. (3 Lec) S
PREREQUISITE: WRIT 101W and Junior Standing. Explores theoretical and practical issues related to teaching textual production within secondary English classrooms, including, but not limited to the following: creating assignments, assessing and evaluating student textual production, standardized writing assessments, and multi-modal and digital composing processes.

ENGL 445. Teaching Reading and Literature. 3 Credits. (3 Lec) S
PREREQUISITE: ENGL 339 Explorates theoretical and practical issues related to teaching textual consumption within secondary English classrooms, including, but not limited to the following: reading strategy instruction, applying literary theories to the teaching of literature, and linking literary and literature pedagogies.

ENGL 450. Rhetoric and Composition. 3 Credits. (3 Lec) F or S PREREQUISITE: Junior standing or consent of instructor. Intensive study in composition/rhetorical theory.

ENGL 461R. Issues in English Education. 3 Credits. (3 Lec) F
PREREQUISITE: EDU 407, senior standing. Senior capstone course for senior English teaching majors and minors. Explores current trends and issues within the field of English Education. At least one-third of this course will focus on students' original research related to English Education.

ENGL 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su
Max 12 cr. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

ENGL 505. Teaching College Composition. 3 Credits. (3 Sem) F
PREREQUISITE: Matriculation in the English M.A. or possession of an M.A. degree. COREQUISITE: A teaching assignment in a college composition course or equivalent writing instruction. Writing pedagogy applicable to teaching writing at the college level. Covers major problems and issues in writing instruction (e.g., assignment design, work-shopping writing, evaluating writing). Required for English graduate teaching assistants concurrent with their first semester of teaching.

ENGL 510. Studies in Critical Theory. 3 Credits. (3 Sem; 6 cr max)
PREREQUISITE: Graduate standing. Topics in critical theory and practice. Explores how historical and contemporary theories of literature have shaped the ways readers, teachers, and critics have thought about such fundamental questions as canon formation, pedagogical practice, and the goals and purposes of literary studies as a field.

ENGL 520. Pedagogy Theory and Practice. 3 Credits. (3 Sem) S
PREREQUISITE: Graduate standing. Topics in English/literacy education. Examines different theoretical and pedagogical approaches to teaching and learning secondary English Language Arts/literacy.

ENGL 530. Writing Theory and Practice. 3 Credits. (3 Sem; 6 cr max)
PREREQUISITE: Graduate standing. Topics in rhetoric and composition. Examines a variety of models that have historically governed composition theory and writing practice.

ENGL 550. Focused Research Seminar. 3 Credits. (3 Lec; 6 cr max) F,S
Max 6 cr. PREREQUISITE: Graduate standing. Course prerequisites as determined for each offering. Topics offered at the graduate level not covered in the required courses. Involves directed research resulting in paper, as well as participation in preparing and presenting discussion material. Topics will vary.

ENGL 575. Professional Paper. 1-6 Credits. (1-6 Ind; 6 cr max) F,S,Su
Max 6 cr. PREREQUISITE: Graduate standing. A research or professional paper project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

ENGR - Engineering

ENGR 610. Rsch & Mthds in Engineering. 3 Credits. (3 Lec) F
PREREQUISITE: Doctoral standing. Exploration of experimental design, statistical methods, models, and teaching issues. Methods of modern information access will also be covered.

ENGR 685. Mentored Student Teaching. 1 Credit. (1 Ind) F
PREREQUISITE: PhD student standing in the College of Engineering and ENGR 610. Students desiring a mentored teaching experience at the college level will have primary responsibility for a portion of a course and will be mentored and assisted by the instructor of the course. Students will develop assignments, deliver lectures, meet students in the practicum course, and receive intensive mentoring from the faculty.

ENGR 694. Seminar. 1-2 Credits. (1-2 Sem; 4 cr max) S
Required 2 cr. total. PREREQUISITE: Doctoral standing or consent of instructor. Seminar experience. For students enrolled before 8/07, initial enrollment immediately follows completion of ENGR 610. First time students will present and defend their thesis topics (1 credit). The second enrollment will be taken the semester prior to the student's comprehensive exam where they will prepare and defend a formal research proposal (1 credit). For students enrolling after 8/07, ENGR 694 will be taken once as a two credit class the semester prior to scheduling the comprehensive exam; the course is designed to help the student prepare their proposal.

ENSC - Environmental Science

ENSC 110. Land Resources and Environmental Sciences. 3 Credits. (3 Lec) Introduction to environmental science associated with managed and natural ecosystems. Students will learn how to identify scientific questions from issues, and how to develop scientifically-based objective information for answering environmental and land management questions. The class is a survey of the department's majors in agroecology, environmental biology, geospatial sciences, land rehabilitation, and soil and water science. Students must be proficient in basic algebra and have an understanding of biological principles. Participation in field trips is expected as part of the course.
ENSC 210. Role of Plants in the Environment. 3 Credits. (3 Lec) F
PREREQUISITE: BIOB 160 and Sophomore standing. Applying the fundamentals of the scientific method to gain a basic understanding of plant ecology and physiology with an emphasis on how plants respond and adapt to abiotic and biotic factors and the consequences for community dynamics and ecosystem feedbacks.

ENSC 245IN. Soils. 3 Credits. (2 Lec, 1 Lab)
PREREQUISITE: M 096 or M 097 or equivalent. Soils and their properties as components of landscapes and ecosystems. Application of soils knowledge to problems in environmental sciences and management of agricultural, wildland, and urban landscapes. COMMON FINAL ONLY.

ENSC 260. Evolution for Env Scientists. 3 Credits. (3 Lec)
ENSC 272CS. Water Resources. 3 Credits. (3 Lec) F
ENSC 290R. Undergraduate Research. 1-4 Credits. (1 Ind; 12 cr max) F,S,Su 1 - 4 cr. IND May be repeated. Maximum 12 cr. PREREQUISITE: Freshman or sophomore standing and approval of instructor. Course will address responsible conduct of research. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or other creative project.

ENSC 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand 1 - 4 cr. Maximum 12 cr. PREREQUISITE: None required, but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ENSC 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand 1 - 3 cr. IND Maximum 6 cr. PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

ENSC 298. Internship. 2-4 Credits. (2-4 Int; 12 cr max) On Demand 2 - 12 cr. IND Maximum 12 cr. PREREQUISITE: Consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience within the field.

ENSC 353. Environmental Biogeochemistry. 3 Credits. (3 Lec) F
PREREQUISITE: CHMY 143, ENSC 245IN. Foundational course will cover mechanisms controlling the behavior of inorganic and organic constituents in soil and water systems. Applications will focus on integrating biological and chemical processes to understand biogeochemical cycling, nutrient bioavailability, and the fate and transport of chemicals.

ENSC 407. Environmental Risk Assessment. 3 Credits. (3 Lec) F
Alternate Even Years. PREREQUISITE: BIOB 170IN. Principles of risk analysis, including risk assessment, perception, communication, and management. Emphasis on human toxicology, ecotoxicology, dose-response relationships, exposure analysis, environmental fate, and deterministic and probabilistic risk assessment.

ENSC 410R. Biodiversity Survey and Monitoring Methods. 3 Credits. (2 Lec, 1 Lab)
PREREQUISITE: NRSM 240 or BIOE 370; BIOB 318 or STAT 216Q. Biodiversity survey and monitoring designs, sampling methods, and data evaluation techniques are introduced. Emphasis is on plants but other taxa are addressed for agricultural, rehabilitation and wildland systems. One week of fieldwork required prior to semester; course completion 3rd week of October. Co-convened with LRES 510.

ENSC 443. Weed Ecology and Management. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: M 121Q, STAT 216Q or BIOB 318. The principles of weed ecology including plant population demographics, biotic and abiotic regulating mechanisms, and plant community temporal and spatial dynamics in managed ecosystems. Weed population model construction, spreadsheet calculations and thorough assessment of pest threshold theory. The study of ecologically-based weed management approaches including cultural, mechanical, biological, and chemical control practices.

ENSC 444. Watershed Hydrology. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITES: ENSC 245IN; M 151Q or M 161Q or M 165Q or M 166Q or M 171Q or M 181Q or M 182Q or PHSX 205 or PHSX 220 or PHSX 240; or consent of instructor (students who do not have these pre-reqs must see instructor); RECOMMENDED PREREQUISITE: STAT 216Q. This course provides a conceptual and quantitative introduction to the physical fundamentals of environmental and watershed hydrology. Focus is on the hydrologic processes that determine how rainfall and snowmelt ultimately become stream flow and evapotranspiration. Topics include the basics of: stream flow analysis, water balances, thermal energy balances, climate and weather, soil physics, ecohydrology, groundwater hydrology, groundwater-surface water interactions, stream flow generation, and water quality. Incoming students are advised to be proficient in algebraic and spreadsheet analyses and to be familiar with the basics of probability analysis and descriptive statistics.

ENSC 445. Watershed Analysis. 3 Credits. (3 Lec) S
PREREQUISITE: ENSC 444 and STAT 216Q or BIOB 318 or permission of instructor. Conceptual and quantitative analysis of watershed processes with an emphasis on modeling surface water hydrology and water resources management. Watershed modeling concepts including analysis of time series, spatially variable data, model calibration, and uncertainty analysis will be studied and demonstrated.

ENSC 448. Stream Restoration Ecology. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: BIOB 170IN, and either NRSM 240 or BIOE 370 or consent of instructor. Students will critically assess the definitions, assumptions, goals, appropriateness, and outcomes implicit in stream restoration projects in relation to ecosystem processes and dynamics in rivers and streams. Based on this information, students will critique an array of real-world stream restoration plans to identify implicit assumptions, goals, biases, and assess implementation strategies in the context of tenets of the conceptual underpinnings of stream ecology as a discipline.

ENSC 454. Landscape Pedology. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: ENSC 245IN. Processes leading to the formation and spatial distribution of soils on the landscape. Describing, classifying, and mapping soils. We explore classical approaches to evaluating soil development using concepts of soil age and residence time, and variation of soil properties with climate, geomorphic and hydrologic context, plant communities, and parent material. The course includes a substantial hands-on field component. Land use and soil management for agriculture/ rangelands are considered in the context of larger scale controls on soil development and distribution.

ENSC 458. Teaching Applications in LRES. 1-3 Credits. (1-2 Lab; 3 cr max) F,S,Su Application of teaching philosophies and methods through classroom, laboratory, and field teaching experiences.

ENSC 460. Soil Remediation. 3 Credits. (3 Lec) S
PREREQUISITE: ENSC 245IN. Principles of soil remediation in impacted landscapes. Soil reconstruction practices are presented for drastically disturbed lands. Treatment science is presented to repair soil systems contaminated by metals and salt as a result of resource extraction and landscape disturbance by humans. Protection of water resources are examined as related to sediment loss control, acid rock drainage science and treatment, and selective handling of geologic stratum. A field trip to a contaminated landscape will demonstrate on-going soil remediation practices.

ENSC 461. Restoration Ecology. 3 Credits. (3 Lec)
PREREQUISITE: BIOB 170IN, and either NRSM 240 or BIOE 370. Review of ecosystem structure and function, and community and population processes in intact systems, along with the effects of major disturbances on natural systems. Restoration amendments will be discussed in terms of their effects on ecosystem structure and function. The course includes case studies, and focuses on plant and soil systems. Co-convened with LRES 563.

ENSC 464. Computational Techniques Environmental Science. 1 Credit. S
1 cr. LAB 1 PREREQUISITE: BIOB 170IN. Computational skills are increasingly important in the Environmental Sciences. This course will focus on basic computer programming using R. No prior expertise is required and exercises will begin at a basic level.

ENSC 465. Environmental Biophysics. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: BIOB 170IN. The study of physical relationships between organisms, ecosystems, and their environment. Basic principles of Micrometeorology, Biometeorology, Ecological Climatology, and Biophysical Ecology as applied to contemporary ecological challenges. Laboratory sessions will focus on computer exercises using ecosystem models and field observations. Co-convened with LRES 565.
ENTO 401, ENTO 432, ENTO 510, ENTO 514, ENTO 516, or ENTO 520. The principles of insect morphology and the evolutionary principles behind the diversity of form and function of the major insect and arthropod groups.

ENTO 590. Master’s Thesis. 1-10 Credits. (1 Ind; max unlimited) F S, Su 1-10 cr. IND Maximum credits unlimited. PREREQUISITE: Master’s standing.

ENTO 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand 1 - 3 cr. IND Maximum 4 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of Department Head and Dean of Graduate Studies. Directed research and study on an individual basis.

ENTO 594. Seminar. 1 Credit. (1 Sem; 4 cr max) F S 1 cr. SEM 1 Maximum 4 cr. PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

ENVE - Environmental Engineering

ENVE 470. Independent Study. 1-3 Credits. (1 Ind; 4 cr max) On Demand Max 4 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of Department Head. Directed research and study on an individual basis.

EQUH - Equine Horsemanship

EQUH 110. Western Equitation. 2 Credits. (2 Lab) F Western equitation techniques including introductory training techniques. Students should allow 15 minutes to get to Miller Stock Pavillion. Transportation is student’s responsibility and not included in course fees.

EQUH 114. Beginning English Equitation. 2 Credits. (1 Lab) F S Beginning English equitation technique, including horse behavior, horse handling, equipment and basic horse anatomy. Students should allow 15 minutes to get to Miller Stock Pavillion. Transportation is student’s responsibility and not included in course fees.

EQUH 133. Horses: Ground Level. 2 Credits. (2 Lab) F S Designed to teach safe horsemanship, ground level. Students will learn handling skills to establish leadership and mutual respect. Skills taught will help students prepare horses for the vet, farrier, and outings. Students will gain awareness of body language to gage possible outcomes of situations.

EQUH 207. Intermed English Equitation. 2 Credits. (1 Lab) S PREREQUISITE: EQUH 114. Advanced English equitation techniques including collecting, lateral movements and beginning jumping. Students should allow 15 minutes to get to Miller Stock Pavillion. Transportation is student’s responsibility and not included in course fees.

EQUH 210. Intermed Western Equitation. 2 Credits. (2 Lab) F S PREREQUISITE: EQUH 110 or permission of instructor. Students will learn advanced movements and maneuvers such as collection, roll-backs, turn-arounds, and lead changes. Students must have secure seat and hands. Training methods for the green horse and tuning techniques for the older broke horse will be covered. Students should allow 15 minutes to get to Miller Stock Pavillion. Transportation is student’s responsibility and not included in course fees.

EQUH 253. Starring Colts. 2 Credits. (2 Lab) F PREREQUISITE: Full time student, sophomore standing or higher, in good academic standing and consent of instructor. Principles and techniques of breaking and training young horses.

EQUH 256. Developing The Young Horse. 2 Credits. (1 Lab) S PREREQUISITE: EQUH 253, full time student, sophomore standing or higher, in good academic standing and consent of instructor. Advanced techniques and training for reining, cutting, or working cow horses. For experienced riders.

EQUH 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

EQUH 314. Equine Instruction Methods. 2 Credits. (1 Lec, 1 Lab; 2 cr max) F S PREREQUISITE: EQUH 110, EQUH 210, or consent of instructor. The object of this course is to develop competent riding instructors who can communicate effectively and motivate students to higher riding skills. Students should allow 15 minutes to get to Miller Stock Pavillion. Transportation is student’s responsibility and not included in course fees.
EQUS 492. Independent Study. 1-3 Credits.

EQUS - Equine Sciences

EQUS 206. Equine Ethology: Understanding Horse Behavior. 3 Credits. (3 Lec) F
PREREQUISITE: ANSC 100. Equine Ethology is a course designed to teach students the science of horse behavior from an evolutionary, biologic, physiologic and genetic perspective. This course provides students a foundation for more sensitive and informed care, management and handling.

EQUS 233. Horse Science and Mgr Lab. 2 Credits. (2 Lab) F
PREREQUISITE: ANSC 100. Laboratory designed to familiarize students with approved management practices for horse enterprises.

EQUS 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F
PREREQUISITE: Consent of instructor and approval of department head. Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research.

EQUS 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand F
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EQUS 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand F
PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

EQUS 327. Equine Lameness. 3 Credits. (3 Lec) F
PREREQUISITE: ANSC 100, ANSC 265/266, and EQUS 347. This course is structured to familiarize students with the many types of lameness in the horse. Students will be instructed on the correlation between anatomy, conformation, locomotion and lameness. Selected diseases of the bones, joints, and soft tissue will be discussed. Significant time will also be spent on lameness diagnosis, treatment, prognosis, as well as: shoeing principles for sound and lame horses.

EQUS 346. Equine Reproductive Management. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: ANSC 100, ANSC 265/266, ANSC 321, ANSC 322, and EQUS 233. This course is designed to familiarize students with the reproduction in horses. Students will be instructed on the appropriate methods for management of the stallion, mare and foal. The curriculum will also include equipment and facilities use, as well as management of a breeding facility.

EQUS 347. Equine Form to Function. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: ANSC 265, ANSC 266, and Junior standing. Development of methods for analyzing a horse's conformation along with a good understanding of anatomy and its relationship to performance.

EQUS 423. Equine Nutrition. 2 Credits. (2 Lec) F
PREREQUISITE: ANSC 320 and Junior standing to be offered odd years.

PREREQUISITE: ANSC 320 and Junior standing or consent of instructor. Critical evaluation of current issues and related scientific literature in equine nutrition; application to designing effective feeding programs.

EQUS 424. Equine Exercise Physiology. 3 Credits. (3 Lec) F
PREREQUISITE: ANSC 265/266, ANSC 320, EQUS 347. This course seeks to provide a detailed understanding of equine exercise physiology. Topics covered: Physiological interactions of various systems during exercise, conditioning, training, and athletic performance; conditioning and training regimes and methods of assessing athletic fitness in horses.

EQUS 430. Horse Management. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: ANSC 265/266, ANSC 320, ANSC 321, ANSC 322, or consent of instructor. Horse management and problems with emphasis on behavior, nutrition, reproduction, and management programs.

EQUS 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F
PREREQUISITE: Consent of instructor and approval of department head. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis.

EQUS 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand F
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need. or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EQUS 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand F
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

EQUS 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand F
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

ERTH - Earth Systems

ERTH 101IN. Earth System Sciences. 4 Credits. (3 Lec, 1 Lab) F,S,Su
Examination of basic geologic processes, Earth and planets through geologic time, internal geosystems, and surficial geosystems.

ERTH 102CS. Topics in Earth Sciences. 1 Credit. (1 Lec; 16 cr max) F,S
A series of 16 one-credit immersion courses offered on topics related to Earth processes and impacts on humanity such as natural hazards, resources, and policy issues. Choose any 3 for Core credit in Contemporary Issues in Science.

ERTH 201IN. Honors Earth System Science. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: Enrollment in the MSU Honors Program. This Honors course explores the complex interactions occurring at all scales between the Earth’s geosphere, biosphere, hydrosphere, atmosphere, and anthrosphere. The goal of the course is to understand the Earth as a “system” of interconnected sources of energy through deep geologic time and space.

ERTH 212RN. Yellowstone Scenic Lab. 4 Credits. (3 Lec) F,S
The Yellowstone region is an unparalleled laboratory for earth scientists. The volcanic, glacial, climatic, and ecological processes that shaped the region will be introduced through lecture, discussions, and projects. Recitation sections and field trips provide additional hands-on experiences.

ERTH 303. Weather and Climate. 3 Credits. (3 Lec) F
PREREQUISITE: ERTH 101IN. The climates of the continents, and their classification, characteristics and interrelationships with other factors of the physical and human environment.

ERTH 307. Principles of Geomorphology. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: ERTH 101IN; familiarity with spreadsheets and word-processing is assumed; Junior standing. Framework, process, system, and time as factors which control the generation of land forms. Laboratories involve field trips and map interpretation, and computer modeling.

ERTH 432R. Surface Water Resources. 3 Credits. (2 Lec, 1 Lab) F
On Demand F
PREREQUISITE: Junior Standing, ERTH 101IN and STAT 216Q or STAT 352 and PHSX 205 or PHSX 220. Physical analysis of the surface portion of the hydrologic cycle: climate, evapotranspiration, precipitation, runoff, flooding, stream channels, sediment production, sediment transport and drainage basins. The surface-water resource in terms of regional supply and human use and intervention. Laboratory fee required.

ERTH 450R. Snow Dynamics and Accumulation. 4 Credits. (1 Lec, 2 Lab) S
PREREQUISITE: Ability to Ski/Board at intermediate level in back country alpine terrain. Junior or Senior standing, STAT 216Q, PHSX 205 or PHSX 220, and ERTH 101IN or consent of instructor. Senior capstone for the Snow Science Option. The accumulation, redistribution, and metamorphism of snow as related to humans. Avalanche, recreation, agriculture, silviculture, runoff, and the alpine environment. Field studies are conducted on a regular basis under rigorous field conditions.

ERTH 455. Physiography of the U.S.. 3 Credits. (3 Lec) F
On Demand F
PREREQUISITE: Junior standing, ERTH 307. The physiographic provinces of the United States, their physical characteristics, evolution, and identification.

ERTH 484. Quaternary Environment. 3 Credits. (3 Sem) F even years
PREREQUISITE: ERTH 101IN and Junior standing. This course is an opportunity to learn about the history of the western US over the last 2 million years through a critical analysis of current and historic literature. It will provide an overview of the tools and approaches used to study past environmental change, significant events in the climate history of region, the geologic record of ice-age environments, including glaciation, glacial lakes, and vegetation, the evolution of the postglacial landscape, and important biotic and human events during the Holocene. Co-convened with ERTH 584.

ERTH 490R. Undergraduate Research. 1-6 Credits. (1 Lec; 12 cr max) F,S,F,S,Su
PREREQUISITE: Consent of instructor. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

ERTH 491. Special Topics. 1-4 Credits.

ERTH 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand F
PREREQUISITE: Junior standing and as determined for each offering. Topics at the upper division level not covered in regular courses. Students participate in preparing and presenting discussion material. Co-convened with ERTH 594.
Teachers will examine processes within and among the four major Earth systems and middle school teachers uses Problem Based Learning (PBL) to explore the processes three years teaching experience at the middle school level to include having taught classroom exercises and dynamic activities. Students will keep a course journal that will readings and interactively participate through a combination of online discussions, and upcoming missions to the Moon. Students will review presentations and assigned differentiation, volcanism, impact cratering, space weathering and former, current its formation and the geologic processes that have helped it to evolve including, interrelationships, their influence on terrestrial ecosystems and the impacts of humans at the K-12 level.

ERTH 502. Fluvial Geomorphology, 3 Credits. (3 Lec) On Demand PREREQUISITES: ERTH 307 or other introduction to fluvial systems or instructor permission. This course provides a foundation for understanding fluvial processes, interpreting fluvial forms, and teaches basic tools for use in watershed and river assessment. Course will cover drainage networks, channel form, and apply these concepts to a river assessment problem.

ERTH 505. Geomicrobiology, 3 Credits. (3 Sem) S alternate years, to be offered even years.
The course examines geochemical and microbial interactions that control earth surface processes and uses the major biogeochemical cycles. The course focuses on how integrated approaches using geochemistry, stable isotope geochemistry, and microbial techniques are applied to research problems.

ERTH 512. Mtn & Plns Riparian Proc. 2 Credits. (2 Lec, 2 Sem) Su, On Demand PREREQUISITE: ERTH 101IN, secondary teaching certification plus two years teaching experience; recommended ERTH 516 and access to the world wide web. Riparian hydrologic and geomorphic processes with examples drawn from the mountains and plains, ground-water recharge and discharge, Horton overland flow; partial variable runoff areas; riparian best management practices; sapping, types of springs; sediment from slopes. K-12 riparian science education.

ERTH 516. North Rocky Mtn Geology, 2 Credits. (1 Lab) Su PREREQUISITE: ERTH 101IN, early history and evolution (GEO 211); graduate standing; secondary teaching certification plus two years teaching experience; a computer with modem. Geologic history of Northern Rocky Mountains, and landscapes from Arches to Yellowstone. Structural, teconic, and surficial elements. Field examination of geologic evidence for history of the Gallatin Range, Bridge Range, and Yellowstone National Park. Exploration and development of teaching methods and resources for the K-12 classroom.

ERTH 519. Watershed Hydrology for Teachers, 3 Credits. (1 Lec. 1 Lab. 1 Rec) Alternate Even Years Watershed hydrology for teachers explores the relationship of water quality and water quantity. Students in the course will learn about relationships among watershed hydrology, including water quality, water quantity, water inputs and outputs, effects of modification of catchments and modification of water systems. K-12 watershed hydrology for teachers explores the relationship of watershed hydrology and science education.

ERTH 520. Fundamentals of Oceanography for Teachers, 3 Credits. (3 Lec) Su PREREQUISITES: Graduate standing, science educator; interest in science Geology of the Moon is an on-line course designed for educators interested in learning about the Moon and its history and relationship to Earth. We will explore theories for its formation and the geologic processes that have helped to evolve including, differentiation, volcanism, impact cratering, space weathering and former, current and upcoming missions to the Moon. Students will review presentations and assigned readings and interactive learning through a combination of online discussions, classroom exercises and dynamic activities. Students will keep a course journal that will help them develop future moon-related curricula for their future use.

ERTH 522. Teaching Middle School Earth System Science, 3 Credits. (3 Lec) S PREREQUISITES: Participants must have minimum of a Bachelor's degree, and three years teaching experience at the middle school level to include having taught science unit(s) on Earth Sciences, Earth System Sciences, or landforms. This course for middle school teachers uses Problem Based Learning (PBL) to explore the processes and interactions between the geosphere, hydrosphere, atmosphere, and biosphere. Teachers will examine processes within and among the four major Earth systems and increase pedagogical skills through modeling PBL, teaching networking, and sharing of ideas and resources.

ERTH 524. K-14 Earth System Science, 2 Credits. (2 Lec.) F PREREQUISITES: The course is designed primarily for Certified Teachers at the K-14 levels with an interest in integrating mathematics and science education with computer technology and Internet resources. Registrants must be Certified Teachers, or permission of the instructor is required. Participants will learn to find the Internet's abundant digital Earth Systems Science (ESS) resources and use these resources to create Earth Science lessons that integrate the use of Earth Science specific skills, math, and content. Participants will learn to adapt online resources to their own instructional environments at the K-14 levels.

ERTH 525. Landforms for Elementary Teachers, 1 Credit. (1 Lec.) F PREREQUISITES: graduate standing; educator In this 8 week online course we will investigate landform science. We will look at a variety of landscapes and how they came to look like they do. We will model landforms and encourage sharing and discussions of teaching ideas in our course. This course intends to: 1) strengthen and deepen the elementary teacher's understanding of basic concepts of landforms and landform analysis; 2) increase the K-6 teacher's level of landform content knowledge and science principles; and 3) increase the K-6 teacher's pedagogical skills in teaching science in general and landform science in particular.

ERTH 527. Weather & Climate for Teachers, 3 Credits. (3 Lec.) S PREREQUISITE: Bachelor's degree, two years teaching experience, and an introduction to physical geography course or equivalent. This graduate course uses weekly readings, discussions, and hands-on activities to build a physical understanding of weather and climate, and to equip our teachers and educators with the tools to better prepare and motivate the next generation of Earth scientists.

ERTH 528. Climate Change for Teachers, 3 Credits. (3 Lec.) Su PREREQUISITE: Graduate standing; ERTH 527; Weather and Climate for Teachers The science of climate change is a complex subject that balances the physical record and scientific fact with politics, policy, and ethics. This course, specially designed for practicing science teachers at the upper middle to high school level, explores the science of climate change.

ERTH 551. Snow Science Seminar. 3 Credits. (2 Lec, 1 Lab) F alternate even years. PREREQUISITE: Graduate Standing: PHYS 211, STAT 332 or STAT 401; Interest in snow science. A mixed lecture and laboratory style course providing an in-depth examination of recent developments in snow science based upon current literature, newly published or about to be published literature, field methods and modeling regarding snow science. Topics will depend partially upon the interests of the instructor and students in the course.

ERTH 582. Quaternary Paleoecology. 3 Credits. (3 Sem) F alternate years, to be offered even years. PREREQUISITE: ERTH 101IN or BIOB 170IN or equivalent. Course examines the history and development of modern biomes and the causes and consequences of long-term ecological change.

ERTH 583. Topics in Paleoecology. 3 Credits. (3 Sem) F alternate years, to be offered odd years. PREREQUISITE: ERTH 101IN or BIOB 170IN or equivalent. Course examines important themes in paleoecology. Topics change on a yearly basis addressing needs and interests of current students. It is intended for students with an interest in ecology, paleontology and environmental history.

ERTH 584. Quaternary Envir of Western US, 3 Credits. (3 Sem) F, to be offered even years. PREREQUISITE: ERTH 101 or BIOB 170 or equivalent. This graduate course examines current research and recent developments in Quaternary paleoecology in the western U.S. The seminar will be centered around weekly discussions of the primary literature, hands-on experience with international data bases, and class paper and presentation. Co-convened with ERTH 484.

ERTH 585. Advances in Geobiology, 1 Credit. (1 Sem) F, to be offered even years. Discussion of recent developments in paleontology, paleoecology, biogeochemistry, and biogeography based on current literature and presentation of faculty and student works in progress.

ERTH 588. Professional Development, 1-3 Credits. (1-3 Lec; 3 cr max) On Demand Max 3 cr. PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies Courses offered on a one-time basis to fulfill professional development needs of in service educators. Specific topics are decided by the department or course which is appropriate to submitted. May be repeated.

ERTH 589. Graduate Consultation. 3 Credits. (3 Ind) F,S,Su PREREQUISITE: Master's standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty or staff time or help.
ERTH 590. Master's Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S,Su
PREREQUISITE: Master's standing.

ERTH 591. Special Topics. 1-4 Credits. (1-4 Sem; 12 cr max)
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ERTH 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of Department Head and Dean of Graduate Studies. Directed research and study on an individual basis.

ERTH 594. Seminar. 1-4 Credits. (1 Sem; 4 cr max) F,S
PREREQUISITE: Graduate standing, consent of instructor, or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material. Co-convened with ERTH 494.

ERTH 595. Historical Geology for Teachers. 3 Credits. (1 Lec. 1 Lab. 1 Rec) S
PREREQUISITE: Two years minimum experience as a teacher of science. The course will provide grade 7-12 science teachers with a rigorous overview of the evolution of the Earth and life and of the methods that geologists use to investigate the history of our planet.

ERTH 596. Geology of Glacier National Park for Teachers. 2 Credits. (1 Lec. 1 Lab) Su
PREREQUISITE: Teacher of science with a minimum of two years teaching experience. A field course for teachers of science examining geologic evidence for the evolution of the rocks and landscape of Glacier National Park and surrounding areas over geologic time.

ERTH 598. Internship. 2-12 Credits. (2 Ind; 12 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

ERTH 605. History of Geological Concepts. 3 Credits. (3 Lec) F
PREREQUISITE: Course limited to graduate students or senior undergraduates with permission. Weekly seminars examine the evolution of geological thinking through an exploration of its history and contributions to science. The course enables students to research the origins and importance of concepts in their area of scientific specialization.

ERTH 690. Dissertation Research. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral candidate standing.

ERTH 694. Doctoral Seminar. 1-3 Credits. (1-3 Sem; 6 cr max) F,S,Su
PREREQUISITE: Doctoral candidate standing.

ESOF - Software Engineering

ESOF 322. Software Engineering. 3 Credits. (3 Lec) F
PREREQUISITE: CSCI 232. Software lifecycles, Unified Modeling Language, design patterns, software engineering standards, requirements analysis, development issues, efficiency tools, verification and validation, configuration management, testing and maintenance.

ESOF 422. Advanced Software Engineering. 3 Credits. (3 Lec) S even years
PREREQUISITE: ESOF 322. Course focuses on the early and late phases of the software lifecycle, extending the knowledge developed in ESOF 322 around UML specifications to formulate precise requirements and develop an understanding of the theoretical foundations of the most common forms of software testing.

ESOF 423. Software Engineering Applications. 3 Credits. (1 Lec. 2 Lab) S
PREREQUISITE: ESOF 322 Application of software engineering techniques and methodologies acquired in previous courses to solve an open-ended software engineering problem provided by stakeholders. Students will use a team-based approach to requirements gathering, designing, implementation, testing, integration and delivery of the software solution.

ESOF 491. Special Topics. 1-4 Credits.

ESOF 522. Empirical Software Engrr. 3 Credits. (3 Lec) S odd years
PREREQUISITE: ESOF 322 or equivalent and STAT 216Q or equivalent. Empirical software engineering focuses on improving software quality through the use of metrics. The course will provide guidance on designing, analyzing and reporting empirical studies, provide information on techniques and metrics needed to measure desired qualities, and the use of practical approaches to study software evolution.

ESOF 523. Software Testing and Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: CSCI 232 and CSCI 246. Students learn and apply state-of-the-art techniques for analyzing and testing programs. This includes automatic test case generation, measuring test adequacy, mutation testing, fault localization and program repair. This course prepares students for practical work in the software industry by exposing them to the latest approaches and tools. This course also prepares students who are interested in cutting-edge research in software testing and analysis.

ETCC - Engr Tech, Civil & Constr

ETCC 204. Applid Analysis for Const Tech. 1 Credit. (1 Lab) F,S
PREREQUISITE: M 165Q or M 171Q or M 181Q. Computer applications in construction technology using contemporary software and solution techniques appropriate to the construction industry.

ETCC 299R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research/creative activity which may culminate in a written report or other creative project. Course will address responsible conduct of research. May be repeated.

ETCC 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ETCC 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of department head. Directed study and research on an individual basis.

ETCC 302. Soils and Foundations. 3 Credits. (2 Lec; 1 Lab) F,S
PREREQUISITE: EGEN 205 or EGEN 208. COREQUISITE: ERTH 101HN. Physical properties of construction materials with emphasis on soils, aggregates and asphalt. Earth pressures, flow nets, bearing capacity, retaining walls and slope stability.

ETCC 310. Concrete Technology. 3 Credits. (2 Lec; 1 Lab) S
PREREQUISITE: EGEN 205 or EGEN 208. Properties of concrete constituents, mechanical and service properties of concrete, mix design, field practices. Concrete reinforcing requirements and analysis of concrete members.

ETCC 412. Structural Elements. 3 Credits. (3 Lec) F,S

ETCC 490R. Undergraduate Research. 1-4 Credits. (1-4 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

ETCC 491. Special Topics. 1-4 Credits. (1-4 Ind; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ETCC 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of Department Head. Directed research and study on an individual basis.

ETCC 498. Internship. 1-2 Credits. (1-2 Ind; 6 cr max) F,S,Su
PREREQUISITE: Sophomore standing, consent of instructor, and approval of Department Head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field. Students may not take this course the semester they graduate.

ETCC 499R. Capstone: Const Engin Tech. 2 Credits. (1 Lec, 1 Lab) F,S
PREREQUISITE: ECIV 311, BGEN 361, ECIV 308, and EGEN 310R. COREQUISITE: ECIV 404 and ECIV 405; student must be graduating the semester of enrollment in ETCC 499R. A senior capstone course encompassing total project control through introduction of a professional construction management organization to ensure cost effectiveness and early completion of a project. Construction safety. A requirement of the course is to take the Constructor Qualification Examination Level I (CQE) administered by the American Institute of Constructors (AIC).
ETME - Engr Tech, Mechanical

ETME 100. Introduction to Mechanical Engineering Technology. 1 Credit. (1 Sem) F
A seminar course surveying the mechanical engineering technology profession. Topics include an overview of career opportunities, problem solving processes, an introduction to the basic engineering design process, professionalism, professional registration, and ethics.

ETME 202. Mechanical Engineering Technology Computer Applications. 1 Credit. (1 Lab) F,S
COREQUISITE: M 166Q. Computer methodology, and use of various computer software packages in mechanical engineering technology applications.

ETME 203. Mechanical Design Graphics. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: EMEC 103. Course emphasizes the design process as it pertains to manufacturability, and the role of graphics to communicate design intent to production. Using 3-D software, design method, G,D,T,C, and data management techniques, students will create drawings that communicate their designs.

ETME 215. Manufacturing Processes. 3 Credits. (3 Lec) F,S,Su On Demand
PREREQUISITE: EMAT 251 or EMEC 250. Introduction to basic applications of a wide range of manufacturing processes utilized in industry. Focus is on applications and capabilities of the processes, as well as equipment utilized and relative costs associated.

ETME 216. Manufacturing Process Laboratory. 1 Credit. (1 Lec, 2 Lab) F,S
PREREQUISITE: EMAT 252; ME and MET majors only; non-majors require instructor approval. COREQUISITE: ETME 215. Provides students with hands-on experience for performing and analyzing a broad spectrum of manufacturing processes including metal casting, injection molding, powder metallurgy, metal forming, metal removal, joining, inspection and measurement.

ETME 217. Manufacturing Process Laboratory - Mechanical Engineering. 1 Credit. (1 Lab) F,S
PREREQUISITE: EMAT 252; ME majors only. COREQUISITE: ETME 215. Course will supplement lecture materials covered in ETME 215. Provides students with hands-on experience for performing and analyzing a broad spectrum of manufacturing processes including metal casting, injection molding, powder metallurgy, metal forming, metal removal, inspection and measurement and welding.

ETME 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind) F,S,Su
PREREQUISITE: Consent of instructor and approval of department head or director. Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

ETME 291. Special Topics. 3 Credits. (1-4 Ind) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ETME 292. Independent Study. 1-3 Credits. (1-3 Ind) F,S,Su
PREREQUISITE: Consent of instructor and approval of department head or director. Directed research and study on an individual basis.

ETME 303. CAE Tools in Mechanical Design. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: ETME 203 or equivalent, EGEN 208, EGEN 324. COREQUISITE: ETME 321, EGEN 331. Emphasizes problem solving with the aid of the applied computer aided engineering techniques of Finite Element Methods and Computational Fluid Dynamics, in analysis and in the design process– with a focus on proper use of the methods, as well as, verification, validation, and interpretation of results.

ETME 309. Building Information Modeling in MEP. 2 Credits. F
2 Credit. (2 Lab) PREREQUISITE: ETME 203 or consent of instructor. - Introduction to the use of Building Information Modeling (BIM) in the Mechanical, Electrical, and Plumbing (MEP) disciplines of the Construction Industry. Instruction in BIM basics using contemporary software, with hands-on exercises in typical construction applications.

ETME 310. Machining and Industrial Safety. 3 Credits. (1 Lec, 2 Lab) F,S
PREREQUISITE: ETME 203 or instructor approval; for MET majors only. COREQUISITE: ETME 216. Offered Summers on demand. Introduction to modern machining technology and the key principles of industrial safety, material properties related to machining practices, design, and specifications. Semi-precision and precision lay-out are covered. An introduction to computer numerically controlled (CNC) technology and operations is included. Specific hands-on experiences included in laboratory.

ETME 311. Joining Processes. 3 Credits. (1 Lec, 2 Lab) F,S,Su
PREREQUISITE: EMEC 103; For MET majors only. COREQUISITE: ETME 216. Offered Summers on demand. Introduction to the modern science of joining technology, and detailed examination of metallurgy and materials properties as related to joining processes. Introduction to welding specification and symbols, and modern welding code usage. Weld design, set-up, preparation, application, and tests are emphasized. Specific hands-on experiences in OAW, SMAW, GMAW, GTAW, common separating processes; destructive and non-destructive testing are included in laboratory. This course will also expose students to other fastening joining techniques used in industry. Resistance welding, composites, riveting, and mechanical fastening and their application will be explored.

ETME 321. Applied Heat Transfer. 3 Credits. (3 Lec) F,S
PREREQUISITE: EGEN 324 or equivalent. COREQUISITE: EGEN 331 or equivalent. Study of the basic mechanisms of heat transfer and its applications. Introduction to equipment that utilize these mechanisms.

ETME 327. Commercial Building Energy Assessment Lab. 1 Credit. F
PREREQUISITE: ELE 250 or ELE 334 or consent of instructor. -Introduction to Preliminary Energy-Use Analysis (PEA), walk-through survey, energy survey and analysis, and detailed analysis of capital-intensive modifications. Laboratory activities include operation of equipment used to collect energy data and building system performance information.

ETME 340. Mechanisms. 4 Credits. (3 Lec, 1 Lab) F,S
COREQUISITE: EGEN 208, ETME 202. Introduction to mechanisms and machine elements used in the design and synthesis of mechanical devices.

ETME 341. Machine Design. 4 Credits. (3 Lec, 1 Lab) F,S
PREREQUISITE: EGEN 208 or equivalent. Application of mechanisms fundamentals, strength of materials, material selection, and tolerances and fits to the design of machines and machine systems. Specific hands-on experiences included in laboratory.

ETME 360. Measurements and Instrumentation Applications. 3 Credits. (2 Lec, 1 Lab) F,S,Su
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ETME 401. Fundamentals of Engineering Review. 1 Credit. (1 Lec) F,S
A review of engineering fundamentals presented throughout the mechanical engineering technology curriculum. It serves primarily to prepare students to take the Fundamentals of Engineering Exam, and subsequently prepare them to progress towards becoming registered professional engineers.

ETME 410. Computerized Numerical Control and Computer-aided Manufacturing Technology. 3 Credits. (1 Lec, 2 Lab) F,S
PREREQUISITE: ETME 310 or instructor approval. Application and optimization of computer numerical control (CNC) and computer-aided manufacturing (CAM) technology fundamentals as related to turning, milling, and plasma cutting operations. Development of toolpaths and machine code (G&M) from associated CAD models is emphasized. Specific hands-on experiences included in laboratory.

ETME 415. Design for Manufacturing and Tooling. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: EGEN 320 or equivalent. COREQUISITE: ETME 412, EGEN 331. Emphasizes problem solving with the aid of the applied computer aided engineering techniques of Finite Element Methods and Computational Fluid Dynamics, in analysis and in the design process– with a focus on proper use of the methods, as well as, verification, validation, and interpretation of results.

ETME 422. Principles of HVAC I. 3 Credits. (3 Lec) F,S
PREREQUISITE: EGEN 208, EGEN 324, ETME 321 or EMEC 326, or instructor consent. Heating, ventilating, air-conditioning and refrigeration (HVAC&R) for comfort and industrial applications. Psychrometrics, physiological factors in air-conditioning, HVAC load calculations; thermodynamic and HVAC system processes; air equipment and hydronic distribution; and an introduction to controls sequencing.
ETME 423. Principles of HVAC II. 3 Credits. (1 Lec, 2 Lab) S
PREREQUISITE: ETME 422 or consent of instructor. This course is designed to provide an in-depth study of various heating, ventilating, air-conditioning, plumbing, and electrical systems as they relate to building performance, and energy conservation. The focus of this course will primarily be to gain an understanding of system selection and layout, integrated building design, and building performance/energy modeling as it applies to various building structures. Control system layout and sequencing will also be explored in this course.

ETME 424. Thermal Processes Lab. 1 Credit. (1 Lab) F,S
PREREQUISITE: For MET majors only and only under the guidance of System minors only.
COREQUISITE: ETME 422. Laboratory experiences covering topics in heat transfer, thermodynamics, and HVAC areas in support of ETME 321, EGEN 324, and ETME 422.

ETME 425. Building Systems. 3 Credits. (3 Lec) On Demand
PREREQUISITE: PHSX 207 and junior standing. This course is designed to provide an overview of the major systems found in buildings today. The focus of the course will be to examine the fundamental criteria involved in design of these systems as well as to investigate the equipment used to satisfy the design criteria. Scheduling, integration, and ethical issues associated with building systems design and installation will also be discussed.

ETME 430. Fluid Power Systems Design. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: ELEE 250; EGEN 331 or EGEN 335; ETME 360 or EMEC 360 and EMEC 361; or consent of instructor. An introduction to the fundamentals and application of fluid power in industry today. Coverage includes: flow and pressure relationships, fluid properties, heat, filtration, selection of components, electro-hydraulic and electro-pneumatic systems, controls, design of hydraulic and pneumatic circuits, and troubleshooting.

ETME 460. Advanced Instrumentation. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: ETME 360 or EMEC 360, EMEC 361; or equivalent, or consent of instructor. An applications-based course in advanced instrumentation and control, focusing on parameter identification; test planning; proper transducer selection, installation, and operation; computerized data acquisition programming and operation; handling and presentation of acquired data. Theory and practice is merged in a project setting.

ETME 462. Industrial Processing Automation and Controls. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: ETME 360 or EMEC 360, and ELEE 250 The intent of this course is to equip engineering students with the basic understanding of industrial processes, knowledge of the fundamental machines, sensors, and controls used in automated processing, and an understanding of processing system design and control, focusing on parameter identification; test planning; proper transducer selection, installation, and operation; computerized data acquisition programming and operation; handling and presentation of acquired data. Theory and practice is merged in a project setting.

ETME 470. Renewable Energy Applications. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: ETME 360 or EMEC 360, EMEC 361; ETME 340 or EMEC 341; ETME 321 or EMEC 326; or consent of instructor. Experience with energy technologies including wind, solar thermal, solar photovoltaic, fuel cell, biomass, and hydro-electro systems. Lecture covers practical applications, component design, and theory for devices and systems. Social, economic, geo-political, and environmental considerations are discussed. Hands-on lab activities supplemented with site visits.

ETME 489. Capstone: Mechanical Engineering Technology Design I. 2 Credits. (1 Lec, 1 Rct) F,S
PREREQUISITE: EGEN 310, for MET majors only with senior standing.
COREQUISITE: ETME 303, ETME 360, EGEN 325 or EGEN 330, ETME 310, ETME 311, ETME 340, ETME 341. Senior capstone design experience in Mechanical Engineering Technology. Students, under the guidance of a faculty supervisor, solve real-world design problems.

ETME 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of certifying officer. Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Directed research and study on an individual basis.

ETME 498. Internship. 1-12 Credits. (1-12 Ind) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

ETME 499R. Capstone: Mechanical Engineering Technology Design II. 3 Credits. (1 Lec, 1 Rct, 1 Lab) F,S
PREREQUISITE: ETME 489, or consent of instructor. For MET majors only. Senior capstone design experience in Mechanical Engineering Technology. Students implement and test the function of design prototypes, under the guidance of a faculty supervisor.

FILM - Film & Photography

FILM 100H. Intro to Film & Photography. 3 Credits. (2 Lec) F,S,Su
An exploration of the historical, artistic and critical connections between photography and film as profoundly influential media shaping the 20th century and as the foundation of “new media” in the 21st century.

FILM 101H. Understanding Film and Media. 3 Credits. (1 Lec, 2 Lab) F
This course provides students with the tools of film and media analysis as a foundation for future cinema study and practice. Close analysis of films from different countries and time periods will be used to recognize the formal elements of film production, principally style and narrative.

FILM 112. Aesthetics of Film Prodctn I. 3 Credits. (1 Lec, 2 Lab) F,S
PREREQUISITE: FILM 101H A survey of major developments in international film history from the 1890s to the 1960s, examining the aesthetic, social, cultural and technological dimensions of cinema. School of Film and Photography.

FILM 202D. Film History II: 1960s to the Present. 3 Credits. (3 Lec) S
PREREQUISITES: FILM 101H, FILM 201D. A survey of major developments in international film and media history from the 1960s to the present, examining the aesthetic, economic, cultural and technological dimensions of moving images. School of Film and Photography.

FILM 212. Aesthetics of Film Production II. 4 Credits. (4 Lab) F,S
PREREQUISITE: FILM 100H, FILM 101H, FILM 112, PHOT 113RA and Sophomore standing in Film. An intensive intermediate course in the fundamental aspects of film production. Students learn to use professional filmmaking tools and apply these skills to short productions. The course emphasizes the language of visual/aural storytelling and the development of directorial vision.

FILM 251. Scriptwriting. 3 Credits. (1 Lec, 2 Lab) S
PREREQUISITE: FILM 100H, FILM 101H, FILM 112. PHOT 113RA and Sophomore standing in Film. An introduction to the basic skills of acting through hands-on exercises in a working studio environment.

FILM 253. Television Production. 3 Credits. (2 Lab) F
PREREQUISITE: Sophomore standing in Film. Introduces students to live television production and multi-camera studio operations, and the technologies used in the production and delivery of live TV. Explores the group production process using hands-on exercises in a working studio environment.

FILM 254. Acting for Film. 3 Credits. (1 Lec, 2 Lab) F,S
PREREQUISITE: FILM 100H, FILM 101H, FILM 112, PHOT 113RA and Sophomore standing in Film. An introduction to the basic skills of acting through acting exercises and individual projects, including a unit for acting for the camera.

FILM 259. Multimedia Audio Prod. 3 Credits. (1 Lab) F
PREREQUISITE: MTEC.Majors ONLY, MUST 220 All Other Majors: Consent of Instructor. The study of theoretical and practical approaches to audio production for multimedia, to include ADR/Dialog replacement, Foley, sound effects, field/ location recording, studio recording, music integration and editing, surround sound techniques/encoding, delivery paradigms, and aesthetics of audio for multimedia.

FILM 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S
PREREQUISITE: Consent of instructor. Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. School of Film and Photography.
**FILM 295. Practicum. 1-3 Credits.** (1-3 Ind; 12 cr max) F,S,Su

PREREQUISITE: Consent of instructor. Max 12 cr. Practical experience associated with production and research project in motion picture, television/video, photography, and theatre. May include rehearsal or performance activity. Credit will be offered to students doing basic work on faculty members' productions or on student productions under direct faculty supervision. Credit will be offered to students giving basic technical support to a/faculty teaching courses, b/faculty engaged in creative activities, or c/advanced students’ productions (while supervised by an SPF faculty member).

**FILM 301. Issues in Lens-Based Media. 2 Credits.** (2 Sem) F

Prerequisites: Enrollment in the Bachelor of Fine Arts in Integrated Lens-Based Media. An exploration of the interconnected histories of and critical approaches to cinema, photography, and other lens-based media.

**FILM 333. Production Management. 3 Credits.** (1 Lec) On Demand

PREREQUISITE: FILM 212, FILM 251 and FILM 254. A comprehensive approach to managing the personnel and financial resources of media production. Includes both fiction and nonfiction. Learn script breakdown, budgeting, scheduling, legal requirements, and paperwork. Practice managing the two key elements of professional cinematic art – people and money.

**FILM 351. Advanced Script Writing. 3 Credits.** (3 Sem) On Demand

PREREQUISITE: FILM 251 or permission of instructor. Advanced training in the techniques of writing for motion picture production. This class requires that students author a 100 page Hollywood script.

**FILM 352. Editing. 3 Credits.** (1 Lec) On Demand

PREREQUISITE: FILM 212. History and techniques of motion picture and video editing. The course will combine lectures with hands-on exercises in editing.

**FILM 354. Lighting. 3 Credits.** (2 Lec) On Demand

PREREQUISITE: FILM 212. An introduction to the aesthetics and technical principles of lighting for film and theatre with attention to familiarity with basic instruments and a lighting board. The opportunity for an exercise in lighting design will be provided.

**FILM 355. Cinematography. 3 Credits.** (1 Lec) On Demand

PREREQUISITE: FILM 212. An examination of the aesthetics and practice of cinematography using 16mm film and digital video cameras.

**FILM 356. Production Design. 3 Credits.** (2 Lec, 1 Lab) On Demand

PREREQUISITE: FILM 212. Introductory course in production design for theatre, film and video.

**FILM 357. Directing. 3 Credits.** (1 Lec, 2 Lab) On Demand

PREREQUISITE: FILM 212 and FILM 254. An examination of the theory and practice of directing and working with actors. Students complete projects for the stage and for filming during the semester.

**FILM 359. Sound Design. 3 Credits.** On Demand

PREREQUISITE: FILM 212 or Consent of Instructor. Theoretical and practical approaches to the motion picture soundtrack. Topics and exercises will include field recording, post-production, sound design, and the musical score.

**FILM 371. Non-Fiction Film Production. 4 Credits.** (4 Sem) F

PREREQUISITE: FILM 212, 251, and 254. Exploration of the aesthetics and practice of creating documentary films. The course will utilize production exercises, screenings, and presentations to develop understanding of documentary film and video production. Students will work in teams to produce short documentary film projects.

**FILM 372. Fiction Film Production. 4 Credits.** (4 Sem) F

PREREQUISITE: FILM 212, 251, and 254. Projects pursued under faculty supervision, emphasizing fiction productions using traditional and non-traditional approaches from pre-production through post-production. Details of individual sections and the supervising faculty will be posted by the department prior to preregistration.

**FILM 381. Studies in Film. 3 Credits.** (1 Lec; 9 cr max) On Demand

PREREQUISITE: Junior standing in Film. An advanced introduction to the theories which enable an understanding of the national cinemas practiced in light of, outside of, the influence of Hollywood. Focus on particular national cinemas varies by semester, but may include examinations of major European cinemas, Asian cinema, and/or the cinemas of the developing world.

**FILM 394. Seminar/Workshop. 2-4 Credits.** (2-4 Sem; 12 cr max) F,S,Su

PREREQUISITE: Consent of instructor. Seminar/Workshop devoted to a specific topic in Film Production or Film Studies. Topics vary.

**FILM 395. Practicum. 1-3 Credits.** (1 Ind; 12 cr max) F,S,Su

Max 12 cr. PREREQUISITE: Junior Standing in Film and consent of instructor. Practical experience associated with production and research projects in motion picture, television/video, photography, and theatre. May include rehearsal or performance activity. Credit will be offered to students doing advanced work on faculty members' productions or on student productions under direct faculty supervision.

**FILM 449. Film and Documentary Theory. 3 Credits.** (1 Lec, 1 Lab) F

PREREQUISITE: Upper-division standing. An intensive survey of major trends in film and media theory, as applied to feature-length fiction, documentary, and experimental cinema. Topics include: feminism, post-colonialism, cultural studies, psychoanalysis, star intertextuality, and cognitive methods.

**FILM 459. Sound Design. 3 Credits.** (3 Sem) S

PREREQUISITE: FILM 212 or FILM 510 This course emphasizes film sound created for 5.1 and other multi-channel systems.

**FILM 481. Advanced Studies in Film. 1-12 Credits.** (12 cr max) F,S, On Demand

PREREQUISITE: Any 300 level film studies course or permission of instructor. Course topic offered at the upper division level that are not covered in regular courses. Students participate in preparing and presenting discussion material. May be repeated.

**FILM 490R. Undergraduate Research. 1-6 Credits.** (1-6 Ind; 12 cr max) F,S,Su

Max 12 cr. PREREQUISITE: Consent of Instructor. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

**FILM 492. Independent Study. 1-3 Credits.** (1 Ind; 6 cr max) On Demand

1-3 cr. IND. May be repeated, Maximum 6 cr. total for FILM, PHOT & THTR 492 combined. PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis for advanced students.

**FILM 493. Study Tour. 3 Credits.** (3 Sem) S

On Demand

PREREQUISITE: Junior Standing and Consent of the instructor. This course prepares the students for an intensive encounter with accomplished professionals in the motion picture, video, and television industries.

**FILM 494. Seminar/Workshop. 1-4 Credits.** (1-4 Sem; 12 cr max) On Demand

PREREQUISITE: Consent of instructor. Advanced topics in film production or film studies. Topics Vary. School of Film and Photography.

**FILM 498. Career Internship. 2-12 Credits.** (2-12 Ind; 12 cr max for FILM, PHOT, THTR 498 combined) F

PREREQUISITE: Consent of School Director. An individualized assignment arranged with an outside agency, business, or other organization to provide guided experience in the field. School of Film and Photography.

**FILM 499. Senior Production. 5 Credits.** (5 Sem; 10 cr max) F

May be repeated Maximum 10 cr. PREREQUISITE: Complete 2 of FILM 371, 372 or THTR 304. Senior capstone course. Direction or major production role on a short film or stage production.

**FILM 504. Film and Documentary Theory. 3 Credits.** (3 Sem) F

An advanced introduction to the methods developed for studying the fiction, documentary and experimental film over the past 100 years.

**FILM 505. Crit Apprch Nat Nat filmmaking. 3 Credits.** (3 Lec) S

A close analysis and interpretation of the social function and cultural value of science and natural history films, with a particular emphasis for broadcast nationally and internationally.

**FILM 506. Crit Approch Sci Filmmaking. 3 Credits.** (3 Lec) S

An advanced introduction to the critical methodologies necessary for intelligently interrogating the representations of science and technology in print and media.

**FILM 510. Fundamentals of Filmmaking. 3 Credits.** (1 Lec, 2 Lab)

Basic field production techniques in film, video, sound, and editing. Training in digital video, 16mm cinematography, analogue and hard-disk sound recording, and digital nonlinear editing.

**FILM 513. Advanced Cinematography. 3 Credits.** (3 Sem) S

PREREQUISITE: MTA 510. This course will train graduate students in advanced motion picture, 16mm cinematography, analogue and hard-disk sound recording, and digital nonlinear editing.

**FILM 515. Science and Natural History Film Prod.. 3 Credits.** (3 Sem) S

PREREQUISITE: FILM 510. This course will teach production techniques used by professional science and natural history film makers.
FILM 517. Production Management. 3 Credits. (3 Lec) S
PREREQUISITE: MTA 510, 511, 512. COREQUISITE: MTA 515, 516. This course is about the logistical, financial, and managerial methodologies of documentary filmmaking.

FILM 518. Writing for Documentary and Non-Fiction Film. 3 Credits. (3 Sem) S
PREREQUISITE: FILM 510. This course examines models of non-fiction writing and explores elements such as acts, character, emotional arcs, turning points, emotional emphasis and information imperatives.

FILM 519. Post Production Workflow. 3 Credits. (3 Sem) S
PREREQUISITE: FILM 510. This course will examine the unique post-production requirements for contemporary documentary film and video.

FILM 521. Interactive Documentary. 3 Credits. (3 Sem) S
PREREQUISITE: MTA 504, MTA 505, MTA 507, MTA 510, MTA 515, MTA 517, MTA 518, MTA 519 - All. This production course explores the creation of non-linear documentary media.

FILM 523. Second Year Film Prep. 2 Credits. (2 Sem) F
PREREQUISITE: Second year standing. This course will prepare second year SNHF MFA students to create their required second year film.

FILM 524. Research Methods. 3 Credits. F
PREREQUISITE: FILM 510, FILM 504, FILM 505 This course will fill a need among the graduate students in the MFA in Science and Natural History Filmmaking Program for instruction in research methods, including sources and attribution, for both the written thesis and the thesis film.

FILM 525. Second Year Film Prod. 3 Credits. (3 Sem) S
PREREQUISITE: Second year standing. The objective of this course is to provide faculty support and supervision of second year MFA film projects.

FILM 526. Alternative Nonfiction. 3 Credits. (3 Sem) S
Graduate students will study a range of contemporary documentary and experimental documentary filmmakers. Each student will then develop and produce their own original short documentary works utilizing some aspect(s) of the contemporary works studied.

FILM 533. Adv Prob TV and Internet Prod. 1-9 Credits. (1-9 Lab; 9 cr max) F,S,Su
This course are the teaching of advanced techniques in broadcast and Internet production based on the website, podcast, and Montana PBS broadcast series Terra: The Nature of the World.

FILM 560. Post Production Meets Info Design. 3 Credits. (3 Sem) S
PREREQUISITE: FILM 510, 515, 516. Special Professional Projects provides students with special funded projects the opportunity for professional level supervision and assistance from the faculty and other students. Funding must be in place before the class begins.

FILM 590. Master’s Thesis. 1-15 Credits. (1-15 Ind; 15 cr max) F,S,Su
1-3 cr. IND Maximum credits unlimited PREREQUISITE: Master’s standing.

FILM 591. Special Topics. 1-3 Credits. (1-3 Sem; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor. Courses not required in a curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

FILM 592. Independent Study. 1-3 Credits. (1-3 Ind; 3 cr max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

FILM 598. Professional Internship. 1-12 Credits. (1-12 Ind; 12 cr max) F,S,Su
PREREQUISITE: FILM 510 and FILM 515. This course allows the student to spend a semester working in a professional environment under the guidance of a mentor.

FRCH - French

FRCH 101. Elementary French I. 3 Credits. (3 Lec)
NOTE: Offered on a rotating basis with German and Spanish in Summer. An elementary level course designed to help students acquire basic proficiency in communicating within culturally significant contexts. An integrated approach to teaching language skills with emphasis on vocabulary acquisition and basic grammatical structures.

FRCH 102D. Elementary French II. 3 Credits. (3 Lec)
PREREQUISITE: FRCH 101 or equivalent, or two years of high school French. Offered on a rotating basis with German and Spanish in Summer This course builds upon the foundation established in 101. Greater emphasis is placed upon oral and written expression. Reading and discussions are designed to increase comprehension of more linguistically complex texts and more conceptually complex cultural issues.

FRCH 105. Accelerated Elementary French I and II. 3 Credits. (3 Lec)
PREREQUISITE: Previous study of French. An accelerated version of FRCH101 and FRCH102D in a single semester for students who have some background in French or another Romance language but who are not currently prepared for FRCH 102D or FRCH 201. Designed to help students acquire basic proficiency in communicating within culturally significant contexts. An integrated approach to teaching language skills with emphasis on vocabulary acquisition and basic grammatical structures.

FRCH 193. Study Abroad. 12 Credits.

FRCH 201D. Intermediate French I. 3 Credits. (3 Lec)
PREREQUISITE: FRCH 102D or equivalent, or a minimum three years of high school French or placement interview. Intensive, methodical review of grammar and syntax combined with the integrated development of proficiency in the four language skills. Expansion of cultural knowledge and functional vocabulary through intensive readings and discussions. Increased emphasis on written communication.

FRCH 202D. Intermediate French II. 3 Credits. (3 Lec)
PREREQUISITE: FRCH 201D or equivalent, or placement interview. Fourth semester French language course designed to develop Intermediate level language proficiency. Application of language skills in discussions and explications of selected readings in literature and culture.

FRCH 255. French on Stage. 3 Credits. (3 Sem)
PREREQUISITES: FRCH 102D or equivalent. French on stage is a class for students who want to learn the French culture and language in a meaningful context. By reading, discussing, and acting out scenes of famous plays, you will improve your pronunciation, intonation, fluency, communicative skills, and have fun.

FRCH 293. Study Abroad. 12 Credits.

FRCH 301. French Oral and Written Expression. 3 Credits. (3 Lec)
PREREQUISITE: FRCH 202D. Fifth semester French language course designed to strengthen Intermediate level language skills. The course will introduce students to Francophone literature and culture. Application of language skills in discussions and explications of selected readings.

FRCH 305. Histoire Civilisation. 3 Credits. (3 Lec)
PREREQUISITE: FRCH 202D Survey of French culture from the middle ages to modern era; focus on historical, artistic, literary, and social developments. Taught in French.

FRCH 306H. French: From Reflection to Rev. 3 Credits. (3 Rcr)
Reading and discussion of selected major works from the eighteenth century. All reading and discussions are in English. Majors may be required to do some work in French.

FRCH 320D. La France Aujourd’hui. 3 Credits. (3 Lec)
PREREQUISITE: FRCH 202D. French conversation class designed to increase proficiency in various forms of written expression including business correspondence, problems of translation, and short essays.

FRCH 323. Adv Grammar and Comp. 3 Credits. (3 Lec)
PREREQUISITE: FRCH 202D or consent of instructor. Intensive review of French grammar to increase proficiency in various forms of written expression including business correspondence, problems of translation, and short essays.

FRCH 324. Adv Conv and Phonetrics. 3 Credits. (3 Lec)
PREREQUISITE: FRCH 201D. Intensive conversation coupled with a practical study of French phonetics and contrastive comparison with English for teaching application. Various levels of the spoken language from slang to formal speech.

FRCH 393. Study Abroad. 12 Credits.

FRCH 401. French Text & Cinema. 3 Credits. (3 Lec)
PREREQUISITE: FRCH 202D. Study of several fine French films and the literary works upon which they were based. Emphasis is on the transformation of written text into image. Taught in French.

FRCH 402. French Literature. 3 Credits. (3 Lec)

FRCH 450. Seminar: French Literature and Culture. 3 Credits. (3 Sem)
PREREQUISITE: WRIT 101W or consent of instructor. COREQUISITE: FRCH 401 or FRCH 402 Junior/Senior Seminar. The study of Francophone literature and culture. Topic varies with instructor. Course is taught in French. Cross-listed with FRCH 490R.
FRCH 490R. Undergraduate Research. 3 Credits. (3 Sem; 12 cr max) PREREQUISITE: FRCH 401 or FRCH 402. Senior capstone course. Advanced research in the study of Francophone literature and culture. Research paper required. Taught in French. Course will address responsible conduct of research. Cross-listed with FRCH 450.

FRCH 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) PREREQUISITE: Junior standing and consent of instructor. Directed research and study on an individual basis.

FRCH 493. Study Abroad. 12 Credits.

FRCH 497R. Education Methods. 1-3 Credits. (1-3 Sem; 4 cr max) COREQUISITE: FRCH 499. Classroom instruction associated with directed undergraduate research/creative activity projects. May be repeated.

FRCH 499R. Senior Thesis/Capstone. 1-6 Credits. (1 Ind; 12 cr max) Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. May be repeated.

GDSN Graphic Design

GDSN 223. Design Principles. 4 Credits. (2 Lec, 2 Lab) F PREREQUISITE: ARTZ 109R, ARTZ 105R and ARTZ 110R and Consent of Department. Introduction to fundamental design principles, basic layout, tools and techniques, and creative thinking.

GDSN 224. Form and Content. 4 Credits. (2 Lec, 2 Lab) F PREREQUISITE: GDSN 223 and Consent of Department. Further exploration of design principles with increased emphasis on typographic skills and visual communications.

GDSN 360. Yellowstone Digital. 3 Credits. (3 Lab) PREREQUISITE: GDSN 224 or ARTZ 211RA or MTA 265 or ARCH 261 and Consent of department. A field workshop located along the Yellowstone river using either 35mm or a Digital camera to create fine art digital prints. This course is designed for individuals with a working knowledge of photographic basics and a fundamental familiarity with their own equipment that desire to explore the new media of the fine art digital print.

GDSN 361. Teton Digital. 3 Credits. (3 Lec) PREREQUISITE: GDSN 224, ARTZ 211RA, or MTA 260, or ARCH 261 and Consent of department. An intensive field workshop located in the Jackson, Wyoming area and Grand Teton National Park using a Digital camera to create fine art digital prints. This course is designed for individuals with a working knowledge of photographic basics and a fundamental familiarity with their own equipment that desire to explore the new media of the digital print.

GDSN 366. History of Graphic Design. 3 Credits. (3 Lec) PREREQUISITE: Junior standing in graphic design option and Consent of department. A historical perspective of work created by graphic designers, over the past 125 years, and more particularly following the creative trends/technological breakthroughs/social achievements in Western art and design that have informed modern American design and designers.

GDSN 367. Identity Systems. 5 Credits. (5 Lab) PREREQUISITE: GDSN 224 and passing portfolio review and Consent of department. Research and production of large and small-scale identity programs, focusing on how identity functions in the context of graphic design practice.

GDSN 368. Art Direction. 5 Credits. (5 Lab) PREREQUISITE: GDSN 224 and passing portfolio review and Consent of department. The examination of art direction as it relates to the look and feel of contemporary advertising and marketing.

GDSN 369. Publication Design. 5 Credits. (5 Lab) PREREQUISITE: GDSN 224 and passing portfolio review and Consent of department. The research, development, organization, design and presentation of complex print communication documents.

GDSN 371. Motion Graphics. 5 Credits. (5 Lab) PREREQUISITE: GDSN 224, and passing portfolio review and Consent of department. Explores design issues unique to contemporary digital media including organization, narrative, motion and sound.

GDSN 372. Interaction Design. 5 Credits. (5 Lab) F,S PREREQUISITE: GDSN 224, passing portfolio review and Consent of Department. Explores web design and planning, specifically: wayfinding, navigation, interactivity and content development.

GDSN 373. Illustration. 5 Credits. (5 Lab) PREREQUISITE: GDSN 224, and passing portfolio review and Consent of department. The investigation of specialized illustration techniques and concepts to create artwork in traditional formats that emphasize realistic modeling, as well as expressive and historical perspectives.

GDSN 374. Digital Visualization. 5 Credits. (5 Lab) PREREQUISITE: GDSN 224, and passing portfolio review and Consent of department. Examining computer based image generation techniques including photography, illustration, 3-D rendering and other digital imaging methods.

GDSN 375. Letterpress. 5 Credits. (5 Lab) PREREQUISITE: GDSN 224 and passing portfolio review and Consent of department. Utilizing vintage presses and a collection of wood and cast type, to explore uncommon aspects of type and print, including the activities of hand-setting type, preparing proof sheets and specimen sheets, and printing small editions.

GDSN 376. Screenprinting. 5 Credits. (5 Lab) PREREQUISITE: GDSN 224 and passing portfolio review and Consent of department. Using modern screenprinting technology as a communication medium. Including the preparation of screens, mixing pigments, and printing.

GDSN 377. Design and Society. 5 Credits. (5 Lab) PREREQUISITE: GDSN 224 and passing portfolio review and Consent of department. The examination of the role of designers with local/national/global communities through a series of practical projects.

GDSN 378. Guerrilla Advertising. 5 Credits. (5 Lab) F,S,Su PREREQUISITE: GDSN 224 or consent of instructor. Photo and marketing majors are highly encouraged. Students stretch the boundaries of traditional advertising solutions by placing their work in unusual contexts for maximum impact. The workshop-like atmosphere involves quick-fire problem solving sessions, working outdoors, guest critiques and socially-driven solutions. Graphic Design, Film & Photography, and Marketing majors are particularly encouraged to apply.

GDSN 465. Professional Studio. 5 Credits. (2 Lec, 3 Lab) F,S,Su PREREQUISITE: GDSN junior year and Consent of department. Comprehensive projects dealing with a variety of visual communication applications. Emphasis on high standards of typography and graphic design, computer techniques, and presentation. Laptop computers are required for all upper level graphic design courses. Completion of junior level.

GDSN 491. Special Topics. 1-5 Credits. (1-5 Lec; 15 cr max) On Demand PREREQUISITE: Course prerequisites are determined for each offering. Courses not required in any curriculum for which there is a one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

GDSN 492. Independent Study. 1-5 Credits. (1-5 Ind; 15 cr max) F,S,Su Max 15 cr. PREREQUISITE: Junior standing in Graphic Design. Course in which student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of graphic design. Written, signed contract required prior to registering for this class.

GDSN 498. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor, and approval of the director. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the graphic design field.

GDSN 499. Senior Portfolio. 5 Credits. (3 Lab, 2 Sru) PREREQUISITE: GDSN 465 and Consent of department. Senior capstone course. Directed undergraduate research/creative activity which culminates in a professional portfolio. Graphic design students must take this course in the spring.

GEO - Geology

GEO 103CS. Intro to Envrmntl Geology. 4 Credits. (3 Lec, 1 Lab) F Application of geologic principles to topical problems in environmental and resource geology. Topics include analysis of environmental issues such as earthquake disaster preparedness, landlides, land use, floods and human occupation, ground water withdrawal and contamination issues, volcanic and coastal hazards, and the response of landscapes and people to resource development (minerals/air/water/energy). Laboratories will be used to analyze and debate data relevant to environmental problems from a geologic perspective.
GEO 105IN. Oceanography. 3 Credits. (3 Lec) F alternate years, to be offered odd years. Introduction to the formation, distribution, history, and resources of the oceans of the world. Emphasis is on the geologic, physical, chemical and biological processes operating in the ocean system, distribution of life in marine ecosystems, effects of human activity on ocean resources and the interdisciplinary perspective necessary to understand ocean dynamics.

GEO 111IN. Dinosaurs. 3 Credits. (2 Lec) S alternate years, to be offered even years. This course provides an introduction to dinosaur paleontology. Students will learn how hypotheses about extinct animals are formulated and tested, with comparisons to modern sedimentary environments and living animals. Recitation sections allow discussion of current research and hands-on experience with sedimentary rocks and fossils. Field trips provide additional education opportunities.

GEO 140IN. Planetary Geoscience. 3 Credits. (3 Lec) F Offered even years. Introduction to the formation, geochemical development, interior and surficial processes, and exobiology of the planets, moons, and other objects of our solar system, as well as known exoplanets. Observations and data relative to planetary interiors, surfaces, and atmospheres, using principles derived from integration of chemical, physical, geologic, biologic, and engineering sciences are addressed.

GEO 208IN. Earth Materials. 3 Credits. (2 Lec, 1 Lab) F PREREQUISITES: ERTH 101IN Earth Materials provides an overview of the minerals, rocks (igneous, sedimentary, metamorphic), and soils that comprise the solid part of the Earth system. Emphasis will be on hand sample identification, physical and chemical properties, natural occurrences, and interpretations of these materials to decipher geologic history, processes, and utility to humanity.

GEO 211. Earth History and Evolution. 3 Credits. (3 Lec) S Offered alternate years. Course will study the evolution of the earth and its life from origin to present configuration. Role of plate tectonic processes in the geologic development of the continents and ocean basins. Major evolutionary developments and crises in the history of life.

GEO 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S,S alternate years. Prerequisite: consent of instructor. Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

GEO 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

GEO 302. Mineralogy and Optical Mineral. 4 Credits. (2 Lec, 2 Lab) F PREREQUISITES: ERTH 101IN, CHMY 143, and GEO 208IN. Identification, properties, occurrence, and associations of the rock-forming minerals; introduction to crystallography (crystal classes, lattice types, and external morphology) and crystal chemistry (bonding and crystal structure types); analytical techniques including mineral optics, s-x-ray, and SEM analysis. Laboratory fee included.

GEO 309. Sedimentation and Stratigraphy. 4 Credits. (3 Lec, 1 Lab) F PREREQUISITE: GEO 211, and M 172Q. Physical, chemical, and biological processes and their effects on sediment dispersal, deposition, and diagenesis. Geology and lateral and vertical relationships between sedimentary rock bodies. Labs emphasize the description and analysis of sedimentary rock bodies.

GEO 310. Invertebrate Paleontology. 3 Credits. (2 Lec, 1 Lab) S alternate years, to be offered even years. PREREQUISITE: GEO 211. Investigation of invertebrate organisms and their evolution through time as preserved in the sedimentary rock record. Emphasis is on the morphology, paleoecology, evolution, and stratigraphic and environmental significance of important fossil groups. Labs stress fossil recognition.

GEO 312. Dinosaur Paleontology. 3 Credits. (2 Lec, 1 Lab) F alternate years, to be offered odd years. PREREQUISITE: GEO 211 and BIOB 170IN. Dinosaur Paleontology covers the origin, evolution and extinction of dinosaurs. Topics of special emphasis include phylogeny, the origin of birds, and functional adaptations. Labs examine dinosaur skeletons, their novel adaptations and role in developing evolutionary trees.

GEO 315. Structural Geology. 4 Credits. (3 Lec, 1 Lab) S PREREQUISITE: GEO 208IN, GEO 211. Geometry, kinematics, and dynamics of natural rock deformation. Laboratory will focus on analytical and graphical techniques of modern structural analysis. Field trip fee required.

GEO 350. Paleontology Lab Techniques. 2 Credits. (1 Lec, 1 Lab) F Offered odd years. PREREQUISITE: GEO 211. Provides laboratory and research experience in vertebrate paleontology, including: training in fossil preparation, identification of osteological specimens, documentation (photographic and scientific illustration), molding and casting, specimen curation, and other skills necessary for professional presentation of research.

GEO 411. Vertebrate Paleontology. 3 Credits. (2 Lec, 1 Lab) S alternate years, to be offered even years. PREREQUISITE: GEO 211, and BIOB 170IN. This course traces the history of vertebrates from the earliest chordates to synapsids, dinosaurs, and hominids. Lectures and labs emphasize phylogeny, anatomy, novel adaptations, and major evolutionary events such as the conquest of land, flight, and mass extinctions.

GEO 413. Macroevolution/Fossil Record. 3 Credits. (3 Sem) S alternate years, to be offered odd years. PREREQUISITE: GEO 310 or GEO 312 or BIOB 375. Macroevolution explores major trends in evolution through geologic time. The course examines such topics as whether communities evolve, cladogenesis, mass extinctions, rates of speciation and extinction, controls of biodiversity, and the role of sex and body size in evolution.

GEO 417. Taphonomy: Fossil Preservation. 3 Credits. (2 Lec, 1 Lab) F alternate years, to be offered even years. PREREQUISITE: GEO 309 and GEO 211. Scattered dinosaur bones lie entombed in a rock: what do they mean? Taphonomy examines the processes that act on an organism from the time of its death until its discovery and how these processes bias or help in fossil interpretation. Co-convened with GEO 517.

GEO 419. Field Paleontology. 2 Credits. (1 Lec, 1 Lab) Su alternate years, to be offered even years. PREREQUISITE: GEO 208IN. This two-week class provides field experience in vertebrate paleontology, including sedimentology, facies analysis, measuring stratigraphic sections, microsite screening, field identification of vertebrate and invertebrate fossils, excavation of fossil specimens, and taphonomic data collecting.

GEO 420. Hydrogeology. 3 Credits. (2 Lec, 1 Lab) On Demand PREREQUISITE: Junior standing, M 171Q or M 172Q, CHMY 143, PHSX 205 or PHSX 220, ERTH 101IN. The relationship between ground-water and other parts of the hydrologic cycle: ground-water availability; movement, chemistry, exploration, geology, and aquifer tests. The ground-water resource in terms of regional supply and human use and intervention.

GEO 428. Field Methods. 3 Credits. (3 Lec) F PREREQUISITES: GEO 211, GPHY 284, and GEO 302 or GEO 448. The goal of this course is to introduce the techniques that will allow you to develop basic field geology skills, and provide a foundation for future fieldwork in other Earth Sciences classes, graduate school, and/or careers in the geosciences. In particular, this course will serve as preparation for Geology Field Camp, a capstone course for Earth Science students pursuing the Geology and Paleontology options. The course will involve a mixture of background information delivered through lectures, in-class activities to cement key concepts and train specific techniques, and on- and off-campus field trips.

GEO 429R. Field Geology. 3 Credits. (3 Lab) Su PREREQUISITE: ERTH 307, GEO 211, GEO 309, and GEO 315. Must receive a minimum grade of "C" in these courses. A capstone course for the geology and paleontology options. Summer field course with application of field procedures and mapping techniques to a variety of geologic problems and exercises. Students will study a range of rock types, sedimentary depositional environments, and structural deformation styles in order to learn the geological and tectonic history of the western North America Cordillera. Extensive hiking and outdoor physical challenges require that students be physically fit. A fee for supplies, transportation, and other logistical expenses is required.

GEO 433. Tectonics. 3 Credits. (3 Lec) Alternate Even Years. PREREQUISITE: GEO 315. History of tectonic theory: modern view of plate tectonic processes; Precambrian tectonics; case studies of Phanerozoic orogenic belts; neotectonics; geophysics. Co-convened with GEO 533.

GEO 439. Geophysics. 3 Credits. (3 Lec) On Demand PREREQUISITE: GEO 211, GEO 302, M 171Q, PHSX 207. Seismology, gravity, isostasy, magnetism and paleomagnetism, electrical methods, radioactivity, geothermics, applied geophysics.

GEO 440. Volcanology. 3 Credits. (2 Lec, 1 Lab) F alternate years, to be offered even years. PREREQUISITE: GEO 208IN, GEO 302, and GEO 450. Overview of current ideas concerning volcanic eruptions and their resulting deposits, concentrating on examination of processes as elucidated from the study of modern volcanic environments. Required weekend field trip and field trip fee.
GEO 445. Glacial Geology. 3 Credits. (2 Lec, 1 Sem) F
PREREQUISITE: GEOL 309. In-depth study of the processes of glaciation and the resulting land forms. Includes class and library readings, and field examination of features of mountain glaciations.

GEO 448. Sedimentary Petrology. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: GEO 302. Detailed analysis and interpretation of the mineralogy, fabric, and genesis of terrigenous clastic and carbonate sedimentary rocks. Use of thin-section microscopy, the scanning electron microscope, and X-ray diffraction techniques are emphasized in the laboratory. Co-convened with GEO 548.

GEO 449. Metamorphic Petrology. 3 Credits. (2 Lec, 1 Lab) F
Offered odd years. PREREQUISITE: GEO 302. Introduction to the principles of metamorphic petrology; metamorphic facies, reactions, phase equilibria, processes, petrographic analysis, deformation, and interpretation of metamorphism in the context of global tectonics.

GEO 450. Igneous Petrology. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: GEO 208IN and GEO 302. Introduction to the distribution, mineral associations, and chemical compositions of igneous rocks in the earth’s crust and upper mantle. Emphasis is on the use of petrographic features and chemistry to identify igneous rocks and interpret rock-forming processes.

GEO 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S
PREREQUISITE: Consent of instructor. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

GEO 491. Special Topics. 1-4 Credits. (1 Ind; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand. Co-convened with GEO 591.

GEO 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

GEO 494. Senior Geology Seminar. 1 Credit. (1 Sem) F,S
Max 4 cr. PREREQUISITE: Junior standing and as determined for each offering. Topical seminars in special courses not covered in regular courses. Students participate in preparing and presenting discussion materials.

GEO 497. Geology Instruction. 1-2 Credits. (1-2 Lec, 1 Lab, 3 cr max) F,S,S
PREREQUISITE: Junior or senior standing in geology and consent of instructor and Department Head. Student works as a tutor and undergraduate teaching assistant in a teaching laboratory under close academic supervision. Weekly meeting focuses on geology, teaching, organization of class materials, and student supervision. Weekly lab emphasis on applying active learning concepts in a geologic laboratory context.

GEO 498. Internship. 2-12 Credits. (2 Ind; 12 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

GEO 499. Senior Thesis/Capstone. 3 Credits. (3 Lec) F,S
PREREQUISITE: Senior standing; minimum 3.0 cum gpa; faculty recommendation. Senior thesis provides an opportunity for students to undertake a supervised research experience. Students are introduced to and allowed to participate in the production of a research paper and an oral presentation to the department or at a professional meeting. Excellent preparation for graduate school and professional work.

GEO 508. Depositional Systems. 3 Credits. (3 Sem) S alternate years, to be offered odd years.

GEO 512. Graduate Depositional Petrology. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: GEOL 302. Detailed analysis and interpretation of the mineralogy, fabric, and genesis of terrigenous clastic and carbonate sedimentary rocks. Use of thin-section microscopy, the scanning electron microscope, and X-ray diffraction techniques are emphasized in the laboratory. Co-convened with GEO 448.

GEO 517. Taphonomy. 3 Credits. (2 Lec) F alternate years, to be offered every even years.
PREREQUISITE: Graduate standing and GEO 448 or GEO 309 and GEO 310 or GEO 312 or GEO 411 or their equivalents. Before one can ask questions about a fossil organism’s anatomy, paleoecology or evolution, one must clearly understand its geologic context. Taphonomy investigates the death to discovery history of fossils and the biases created by post-mortem processes to the fossil record. Co-convened with GEO 417.

GEO 520. Ancient Ocean Systems. 3 Credits. (3 Sem) S alternate years, to be offered every odd years.
PREREQUISITE: Course limited to graduate students or senior undergraduates with permission. Seminar on marine geology with emphasis on ancient deep-marine outcrops.

GEO 521. Dinosaur Paleontology. 2 Credits. (1 Lec, 1 Lab) F
PREREQUISITE: Graduate Standing. This course is an introduction to Dinosaur Paleontology and Hell Creek Formation of Eastern Montana. It will provide information and hands-on experience in field techniques used in vertebrate paleontology, including interpretation of sedimentary environments and taphonomy.

GEO 522. Dino Paleontology II. 2 Credits.
SU alternate years, to be offered every odd years.
PREREQUISITE: GEO 521 and consent of instructor. This course builds on experience and field techniques acquired from GEO 521 through hands-on participation in on-going paleontology research. Students acquire greater understanding of field data collection and formulation and testing of hypotheses; and advanced knowledge of paleoenvironments and geological processes.

GEO 530. Tectonics of Sedimentary Basins. 3 Credits. (3 Sem) On Demand
PREREQUISITE: GEO 309 and GEO 315. This course examines the plate tectonic setting and controls on development of modern and ancient sedimentary basins. Includes investigation of sediment provenance, facies patterns, methods of basin analysis, and subsidence history.

GEO 533. Graduate Tectonics. 3 Credits. (3 Lec) Alternate Even Years.
PREREQUISITE: GEO 315. History of tectonic theory; modern view of plate tectonics processes; Precambrian tectonics; case studies of Phanerzoic orogenetic belts; neotectonic processes. Graduate students will be required to write an in-depth research paper on a topic chosen in consultation with the instructor. Co-convened with GEO 433.

GEO 535. Advanced Stratigraphy. 4 Credits. (3 Lec, 1 Lab) S to be offered every odd years.
PREREQUISITE: Graduate standing. Weekly lecture and lab, including one-week field excursion, examines different approaches in stratigraphy used to reconstruct ancient terrains. Course emphasizes advanced correlation techniques and interpretation methods applied in sedimentary geology.

GEO 540. Volcanology. 3 Credits. (2 Lec, 1 Lab) F alternate years, to be offered every even years.
PREREQUISITE: GEO 208IN, GEO 302, and GEO 450. Understand processes by which magma and associated gases rise into the crust and are extruded onto the Earth’s surface and atmosphere, interpret the forms of volcanoes and their magmatic products, and provide the necessary background to perform research in volcanology.

GEO 542. Comparative Osteology. 3 Credits. (3 Sem) On Demand
PREREQUISITE: BICO 310, BIOC 504. Fossil bone histology and comparative osteology including enchondral ossification, epiphyseal ontogeny, cortical ossification, bone remodeling, special bone tissues, fossil bone content, bone architecture and biomechanics, bone chemistry and diageneis, comparative bone morphology, and functional anatomy.

GEO 548. Graduate Sedimentary Petrology. 3 Credits. (2 Lec, 1 Lab) F On Demand.
PREREQUISITE: GEO 302. Detailed analysis and interpretation of the mineralogy, fabric, and Genesis of terrigenous clastic and carbonate sedimentary rocks. Use of thin-section microscopy, the scanning electron microscope, and X-ray diffraction techniques are emphasized in the laboratory. Co-convened with GEO 448.

GEO 549. Graduate Metamorphic Petrology. 3 Credits. (2 Lec, 1 Lab) F alternate years, to be offered every odd years.
PREREQUISITE: GEO 302 Principles of metamorphic petrology; metamorphic facies, reactions, phase equilibria, processes, petrographic analysis, deformation, and interpretation of metamorphism in the context of global tectonics.

GEO 550. Graduate Igneous Petrology. 3 Credits. (2 Lec, 1 Lab) S
Prerequisites: GEO 208 and GEO 302. Emphasis on the distribution, mineral associations, and chemical compositions of igneous rocks in the earth’s crust and upper mantle. Emphasis is on the use of petrographic features and chemistry to identify igneous rocks and interpret rock-forming processes.
GEO 560. Geology Yellowstone Volcanic. 2 Credits. (2 Lec, 1 Lab) 3 cr. LEC 2 LAB 1 PREREQUISITE: MSSE student The purpose of this course is to provide an understanding of the geology of the Yellowstone Volcanic Center, the largest active explosive continental volcanic center on Earth. The course consists of 3 days of in-class instruction on campus and 2 subsequent days of field trips designed to explore the geology of the Yellowstone Volcanic Center. Topics covered include evidence of caldera formation, differing styles of volcanic eruptions, mineral and microbe interactions at thermal features, consequences of seismic activity, and controls of volcanic activity on landscape components including topography, soils, plant distribution, and water resources.

GEO 575. Professional Paper. 1-6 Credits. (1-6 Ind; 6 cr max)F,S,Su PREREQUISITES: Consent of Instructor A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee. Dept of Earth Sciences.

GEO 581. Quaternary Environments. 3 Credits. (2 Lec) On Demand PREREQUISITE: ERTH 367. The last two million years of earth history as interpreted from geologic, biologic, and pedologic proxy data. Includes both global and regional analyses of changing climates and their effects on earth surface processes and land forms.

GEO 583. Applied Geological Hydrology. 3 Credits. (2 Lec, 1 Lab) On Demand. PREREQUISITE: Graduate standing or GEO 420. Application of ground-water principles to ground-water resource, contamination and remediation problems.

GEO 591. Special Topics. 1-4 Credits. (1-4 Sem; 12 cr max) On Demand PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number. Co-convened with GEO 491.

GEO 592. Independent Study. 1-4 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor, approval of Department Head and Dean of Graduate Studies. Directed research and study on an individual basis.

GEO 594. Seminar. 1 Credit. (1 Sem) F,S PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

GEO 598. Internship. 2-12 Credits. (2 Ind; 12 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

GPHY - Geography

GPHY 121D. Human Geography. 3 Credits. (3 Lec) F Global geographies of population and economic development; patterns of language and religion; global distributions of agriculture, industry, and urban landscapes; use of human geography to analyze selected world problems.

GPHY 141D. Geography of World Regions. 3 Credits. (3 Lec) F,S,Su Resume of major world regions; their cultures, populations, resources, utilization of land; emphasis on regions outside Anglo-America.

GPHY 262. Spatial Sci Tech & Application. 3 Credits. (2 Lec, 1 Lab) S Fundamentals of GPS, GIS and remote sensing, and their application in a wide range of disciplines. Exploration of the increasing use of geospatial technologies in our world and their impact on our lives. Students will gain hands-on experience with GPS receivers, and GPS, GIS and remote sensing software.

GPHY 284. Intro to GIS Science & Cartog. 3 Credits. (2 Lec, 1 Lab) F,S Concepts of spatial thinking; understanding spatial relationships and interaction in the natural and built environment. Spatial data principles, data models, relational database concepts, contemporary digital cartography, map design and composition, spatial data conversion, introduction to spatial analysis and synthesis.

GPHY 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S,Su May be repeated. PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research.

GPHY 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

GPHY 321. Urban Geography. 3 Credits. (3 Lec) S alternate years, to be offered odd years. PREREQUISITE: GPHY 121D or STAT 216Q. Historical evolution and spatial patterns of urban places in the U.S. and the world; human-environment relationship in urban areas; analyses of urban economy and land use in the city; spatial structure of urban system in national and regional background; some important methods and theories in urban geographical research.

GPHY 322. Economic Geography. 3 Credits. (3 Lec) F alternate years, to be offered odd years. PREREQUISITE: GPHY 121D and STAT 216Q. Contemporary research questions and methodologies in economic geography; spatial patterns and processes of main economic activities; principles of spatial interaction; application of locational theory in urban and rural settings.

GPHY 325. Cultural Geography. 3 Credits. (3 Lec) F alternate years, to be offered odd years. PREREQUISITE: GPHY 121D American cultural landscape evolution; origins and diffusions of American culture traits; evolution of American culture regions.

GPHY 326. Geography of Energy Resources. 3 Credits. (3 Lec) S PREREQUISITES: GPHY 121 OR GPHY 414 pre-industrial and contemporary energy systems; global distribution of energy resources; implications of energy resource distribution for contemporary geopolitics and development; metrics of energy consumption.

GPHY 329. Environment and Society. 3 Credits. (3 Lec)F This course introduces students to the study of relationships between people and the environment from a social science perspective. It explores the social causes and consequences of environmental change and examines the different approaches to decision-making about environmental issues.

GPHY 337. GPS Fund/App in Mapping. 3 Credits. (1 Lec, 2 Lab) F PREREQUISITE: GPHY 284. Theory and application of the global positioning system Global Positioning System (GPS) to mapping in natural resource and land management sciences. Mapping issues and accuracy assessment are emphasized. Labs and term mapping project include hands-on experience with GPS receivers and work with Pathfinder Office and Arc GIS ArcGIS software. Students must be proficient with the latest version of ArcGIS.

GPHY 354. GPS Mapping Srv Learning. 1 Credit. (1 Ret) F COREQUISITE: GPHY 357 Participation in one of two established GPHY 357 service-learning projects: E-911 mapping of high density housing developments to aid in emergency response (section 1); AGAL canal mapping to update the Gallatin Valley inventory of water resources (section 2).

GPHY 365. Geographical Planning. 3 Credits. (3 Lec) S PREREQUISITE: GPHY 212D. Planning history in the U.S.; Main factors, elements, organization, and issues of urban and rural planning in a geographical context; main principles, methods and tools of geographical planning; integration of physical and human variables into the planning process.

GPHY 384. Adv GIS and Spatial Analysis. 3 Credits. (2 Lec, 1 Lab) F,S PREREQUISITE: GPHY 284 and consent of instructor. Advanced data model concepts in the context of spatial analysis. Spatial overlay analysis and synthesis in vector and raster. Error and Uncertainty. Data modeling and database design principles to support analysis and modeling applications.

GPHY 402. Water and Society. 3 Credits. (3 Lec)F, odd years PREREQUISITE: Junior, senior, or graduate student standing. This course introduces students to the study of relationships between people and the environment from a social science perspective. It explores the social causes and consequences of environmental change and examines the different approaches to decision-making about environmental issues. Co-convened with GPHY 502.

GPHY 411. Biogeography. 3 Credits. (3 Lec) S Offered odd years. PREREQUISITE: GPHY 121D or BIOB 170IN. Factors affecting the geography of plants and animals in space and time.

GPHY 425. Geographic Thought. 3 Credits. (3 Lec) S PREREQUISITE: Senior standing in Geography program. A senior capstone course for the geography option. The exploration of the history of geographic thought; the emergence and evolution of modern academic and applied geography. Contemporary trends and issues in geography.
GPHY 426. Remote Sensing. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: Junior standing or consent of instructor. Theory and application of remote sensing, the electromagnetic spectrum, earth-energy interactions, and operation of multispectral sensors. Applications include satellite image analysis for agriculture, environmental assessment, forestry, geology, rangeland, urban, wildlife, and others. This course is intended for students not in geospatial or GIS majors.

GPHY 429R. Applied Remote Sensing. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: Junior standing or consent of instructor. Applications of remote sensing, including advanced studies of multispectral and hyperspectral sensors and image processing algorithms. Emphasis is on using remote sensing technologies for solving applied land resource issues. This course is intended for students in geospatial and GIS majors. Co-convened with LRES 525. Dept of Land Resources & Environmental Science.

GPHY 431. Historical Geography. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: GPHY 121 Past geographies of North America. Political, cultural, economic, and urban evolution of North American regions from the colonial era to 1900.

GPHY 441R. Mountain Geography. 4 Credits. (2 Lec, 2 Lab) F alternate years, to be offered odd years.

GPHY 445. Adv. Regional Geography. 3 Credits. (3 Lec; 6 cr max) On Demand
PREREQUISITE: Two of the following: ERTH 101IN, GPHY 141D, or GPHY 121D. A topical and regional analysis of related political subdivisions or other geographical areas. Course may be taken twice if regional emphases differ. Co-convened with GPHY 455.

GPHY 446. East Asia in the Global System. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: ERTH 101IN, GPHY 141D. Physical environments, history, cultures, demography, economies, politics, international relationships and urban developments of East Asia as a geographical region and inside independent countries; main position and development tendency of East Asia in the world system.

GPHY 457. Adv GPS Mapping for GIS. 3 Credits. (3 Lab) F
PREREQUISITE: GPHY 284 and GPHY 357. Advanced topics and techniques in GPS/GIS mapping, emphasizing high accuracy data collection, data quality and documentation. Advanced data logging options, carrier phase and dual-frequency data collection, GPS photo link, and mobile GIS are some of the topics explored. Course includes topic research and presentation, and service-learning project work.

GPHY 461. Tourism Planning. 3 Credits. (3 Lec) S alternate years, to be offered every even years.
PREREQUISITE: GPHY 284 and GPHY 365. Concepts and components of tourism system; types and geographical patterns of main tourism resources; methods and theories in tourism geography studies; case analyses of tourism planning at site, regional and national scale.

GPHY 484R. Applied GIS & Spatial Analysis. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: GPHY 384, either STAT 217Q or STAT 332, and consent of instructor. Advanced spatial analysis, synthesis and modeling concepts and methods. Semester projects apply theory and concepts to a project related to student’s discipline. Students learn to develop GIS applications to address a variety of issues.

GPHY 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

GPHY 491. Special Topics. 1-4 Credits. (1-4 Ind; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand. Co-convened with GPHY 391.

GPHY 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

GPHY 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Junior standing and as determined for each offering. Topics at the upper division level not covered in regular courses. Students participate in preparing and presenting discussion material.

GPHY 497. Geography Instruction. 1-2 Credits. (5 Lab; 4 cr max) F,S,Su
PREREQUISITE: Junior or senior standing in geography and consent of instructor and Department Head. Student works as a tutor and undergraduate teaching assistant in a teaching laboratory under close academic supervision. Weekly meeting focuses on geography teaching, organization of class materials, and student supervision. Weekly lab emphasizes applying active learning concepts in a geography laboratory context.

GPHY 498. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

GPHY 502. Water and Society. 3 Credits. (3 Lec) F, odd years
PREREQUISITE: Graduate student standing. This course introduces students to the study of relationships between people and the environment from a social science perspective. It explores the social causes and consequences of environmental change and examines the different approaches to decision-making about environmental issues. Co-convened with GPHY 402.

GPHY 503. Settlement Geography. 3 Credits. (3 Sem) F alternate years, to be offered every even years.
PREREQUISITE: Graduate standing. Settlement history and contemporary land use in the trans-Mississippi west. Evolution of cultural landscapes in the Mountainous West.

GPHY 504. GIS Research Fundamentals. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: Graduate standing. Geographic Information Science Fundamentals in the context of developing a research program. Spatial data principles, data models, conversion and sampling strategies, analysis methods and cartography. Lab exercises uses GIS software. Students specialty area explored through literature review and individual project. Lecture co-convened with GPHY 384.

GPHY 505. Bioclimatology. 3 Credits. (3 Sem) On Demand
PREREQUISITE: GEO 211 or BIOE 370. The distribution of plants, as controlled by climate, geologic history and geographic location. Changes over time in distribution patterns as related to climate change and other human activities.

GPHY 506. Topics in Resource Geography. 3 Credits. (3 Sem) F Alternate Odd Years Resource geographers are concerned with the forces that shape resource development and its outcomes or landscapes, cultures and livelihoods. The goal of this seminar is to introduce and engage with fundamental and current scholarship that addresses resource development—its drivers and outcomes—from a geographic perspective. This is readings-intensive seminar.

GPHY 520. Land Use Planning. 3 Credits. (3 Sem) F alternate years, to be offered odd years.
PREREQUISITE: Graduate standing. History and philosophy of land use planning; application of geographical skills to contemporary land use planning issues. Selected topics include population pressure and land requirement, law, eminent domain, property right, public control over private land use, institution, and economics in land use planning.

GPHY 545. Adv Regional Geography. 3 Credits. (3 Lec) F alternate odd years PREREQUISITE: Two of the following: ERTH 101, GPHY 121, or GPHY 141 A topical and regional analysis of related political subdivisions or other geographical areas. Course may be taken twice if regional emphases differ. Co-convened with GPHY 445.

GPHY 575. Professional Paper. 1-6 Credits. (1-6 Ind; 6 cr max) F,S,Su
PREREQUISITE: Consent of Instructor A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee. Dept of Earth Sciences.

GPHY 591. Special Topics. 1-4 Credits. (1-4 Ind; 12 cr max) On Demand
PREREQUISITE: Graduate Standing; Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

GPHY 592. Independent Study. 1-4 Credits. (1-4 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

GPHY 594. Seminar. 1 Credit. (1 Sem) On Demand
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.
GRMN - German

GRMN 101. Elementary German I. 3 Credits. (3 Lec)
NOTE: Offered on a rotating basis with French and Spanish in Summer. An elementary level course designed to help students acquire basic proficiency in communication within culturally significant contexts. An integrated approach to teaching language skills with emphasis on vocabulary acquisition and basic grammatical structures.

GRMN 102D. Elementary German II. 3 Credits. (3 Lec)
PREREQUISITE: GRMN 101 or equivalent, or two years of high school German. Offered on a rotating basis with French and Spanish in Summer. This course builds upon the foundation established in 101. Greater emphasis is placed upon oral and written expression. Reading and discussions are designed to increase comprehension of more linguistically complex texts and more conceptually complex cultural issues.

GRMN 193. Study Abroad:. 12 Credits.

GRMN 201D. Intermediate German I. 3 Credits. (3 Lec)
PREREQUISITE: GRMN 102D or equivalent, or a minimum three years of high school German, or placement interview. Intensive methodical review of grammar and syntax combined with the integrated development of proficiency in the four language skills. Expansion of cultural knowledge and functional vocabulary through intermediate-level readings and discussions. Increased emphasis on written communication.

GRMN 202D. Intermediate German II. 3 Credits. (3 Lec)
PREREQUISITE: GRMN 201D or equivalent, or a placement interview. Designed to follow the third semester review of grammar and basic skills. Taught through a series of carefully selected readings in German culture, civilization and literature which will provide the basis for writing essays and reports and developing advanced language skills.

GRMN 293. Study Abroad:. 12 Credits.

GRMN 301. Oral and Written Expression I. 3 Credits. (3 Lec)
PREREQUISITE: GRMN 202D. In-depth review of grammar, syntax, and idiomatic expression; vocabulary building practice in conversation. Short readings in German as a basis for conversation and composition. Emphasis on accuracy in grammar and expression.

GRMN 302. Oral and Written Expression II. 3 Credits. (3 Lec)
PREREQUISITE: GRMN 201D or permission of the instructor. In-depth review of grammar, idiomatic expression, and conversation and writing skills. Longer readings in German. Emphasis on attaining proficiency in spoken and written German, some focus on phonetics and German for the professions.

GRMN 303H. Issues of German Cinema. 3 Credits. (3 Lec)
PREREQUISITE: Junior standing or consent of instructor. Acquaints students with the traditions of German cinema in national, European and global contexts. Theoretical film analysis of silent film, propaganda film, post-war cinema, rubble film, censored films, New German Cinema and other genres. All films, readings, and discussions in English.

GRMN 315. Survey of German Literature. 3 Credits. (3 Lec)
PREREQUISITE: GRMN 202D. A survey of representative works of German literature from selected literary periods before 1900.

GRMN 350. German Culture & Civilization. 3 Credits. (3 Lec)
PREREQUISITE: GRMN 202D. A survey of some of the great figures and periods of German art, literature, music, and public life in German-speaking countries which have made significant cultural contributions to world civilization up to 1871.

GRMN 353. Cold War Berlin: Life on Both Sides of the Wall. 3 Credits. (3 Lec)
This course covers the period from 1945 to the time of rapid change following the fall of the wall in 1989. We will investigate a wide variety of historical sources, authentic footage, films, literature, cultural events and the visual arts from East and West Berlin to gain an understanding of the cultural differences and undertones that led to the dramatic political events of the era. The class welcomes non-German speakers and German students: M/W will be in English, Friday class will be split into English and German discussion groups.

GRMN 360H. German Myths. 3 Credits. (3 Lec)
PREREQUISITE: Junior standing or consent of instructor. An examination of the German mythical figures in pursuit of love, knowledge, and blood. These themes are explored through the texts from medieval legends through contemporary popular culture. Authors include Goethe, Heine, and others. Films by Murnau and Herzog. All readings and discussions in English.

GRMN 393. Study Abroad:. 12 Credits.

GRMN 422H. German Text & Cinema. 3 Credits. (3 Lec)
PREREQUISITE: Junior standing or permission of instructor. This seminar focuses on the cultural, historical, and linguistic elements crucial to an understanding of the relationship between text and cinema within a national and international tradition. It is designed to provide a context for majors and minors to read longer texts not otherwise taught in the curriculum, including the canonical novels of the late 19th century. Taught in English.

GRMN 440H. German Cultural Studies. 3 Credits. (3 Lec)
Students acquire expertise in social, philosophical, and cultural concepts that inform the evolution of German cultural theory from the 18th century to the present. Topics covered include nation-building narratives, Marxism, psychoanalysis, feminism, critical theory, and contemporary cultural studies. (Conducted entirely in English).

GRMN 450R. Sem:German Lit and Culture. 3 Credits. (3 Sem) S
PREREQUISITE: GRMN 330, GRMN 315, or GRMN 320. Senior capstone course. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material. It is recommended to take this course multiple times (as GRMN 490R).

GRMN 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max)
Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

GRMN 491. Special Topics. 1-3 Credits. (1-3 Lec; 12 cr max)
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

GRMN 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max)
PREREQUISITE: Junior standing and consent of instructor. Directed research and study on an individual basis.

GRMN 493. Study Abroad:. 12 Credits.

HADM - Health Administration

HADM 445. Managing Healthcare Organizations. 3 Credits. (3 Lec) S
PREREQUISITE: CHTH 210 or KIN 105 and junior standing. An introduction to health administration. Management of public health organizations, patterns of health organizations, and various administrative factors involved in the practice of health administration. Issues of budgeting, finance, marketing and public relations will be explored.

HDCF - Human Devel Child/Family Life

HDCF 474. Senior Seminar. 4 Credits. (1 Lec; 3 Lab) S,Su
PREREQUISITE: Junior standing or consent of instructor. A senior seminar course. Students participate in preparing and presenting discussion material. It is offered on a rotating basis with French and Spanish in Summer. An introduction to the field of child and family services and family and consumer sciences. The lab section of this course will entail the scientific application of family and consumer sciences theory and methods. In consultation with course instructor, students will participate in a lab assignment.

HDCF 590. Master's Thesis. 1-10 Credits.
PREREQUISITE: Master's standing. Directed graduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

HDCO - Human Devel Counseling

HDCO 460. Student Leader Training. 2 Credits. (1 Lec; 6 cr max) S
Maximum 6 cr PREREQUISITE: Orientation leader status; restricted entry. Knowledge and skills necessary for interaction, presentation, and facilitation with regard to new student group leading, peer advising, and campus representation.

HDCO 463. Student Assistant Training. 1 Credit. (1 Lec) F
PREREQUISITE: Resident Assistant status; restricted entry. Course includes training in various aspects related to the performance of the Resident Advisor position duties. It includes areas such as self-understanding, interpersonal skills, intervention techniques, and perspectives on college students and the campus environment, which are fundamental to the effective functioning of Resident Assistants.
HDCO 464. Sdn't Asst Candidate Train. 1 Credit. (1 Lec) S
PREREQUISITE: Resident Assistant candidate status; pass/fail grading; restricted entry. Course includes exposure to college student development theories, advising, and communication skill development areas within a residence hall setting. Emphasis is given to working with individuals and groups in a peer counseling/educational role. Resident Advisor roles and responsibilities are also addressed.

HDCO 502. Csnl Ethic Prof Orient. 2 Credits. (2 Rct) Su
PREREQUISITE: Graduate standing in counseling program. This course will prepare the student with a strong orientation to professional and ethical issues as they apply to counseling. Contents of the course will examine historical aspects of counseling professions, professional counseling roles, professional organizations, consultation models, professional preparation standards, and credentialing. It will also introduce appropriate ethical codes for conduct and study case studies representing ethical dilemmas a counselor may face in schools, agencies, and private practice.

HDCO 503. Prof Issues in Counseling. 3 Credits. (3 Sem) F
PREREQUISITE: Graduate standing in counseling program. This course focuses on providing students with an understanding of the professional identity and roles of the counselor in prevention, consultation, crisis management, specialization, public policy, legal and ethical issues unique to working with schools, families, and community organizations.

HDCO 505. Prof Iss in School Couns. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing in counseling program. Presentation of professional and ethical issues in school counseling. Group discussion and various experiential activities will provide students with numerous opportunities to understand current issues and trends in the field of school counseling.

HDCO 506. School Counsel Programs. 3 Credits. (3 Lec) Su
PREREQUISITE: Graduate standing in counseling program. Foundations of the school counseling profession including historical and conceptual perspectives of the field, and the knowledge and skills necessary to be a professional school counselor. Particular emphasis will be placed on a thorough understanding of planning, design, implementation, and evaluation of comprehensive school counseling programs.

HDCO 508. Counseling Theories I. 3 Credits. (3 Lec) Su
PREREQUISITE: Graduate standing in counseling program. Students will learn a wide range of systems theories used in the diagnosis and treatment of individuals, couples, children, and families.

HDCO 510. Counseling Theories II. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing in counseling program. This course provides an overview of the major counseling theories and practical applications with various populations. Teaching modalities will include lecture, class discussion, study of taped counseling sessions, and small group interaction.

HDCO 521. Counseling Skills Lab. 1 Credit. (1 Lab) F
PREREQUISITE: HDCO 502 and graduate standing in counseling program. Students will learn, practice, and apply basic counseling skills in preparation for their practicum experience.

HDCO 522. Group Counseling. 3 Credits. (2 Lec; 1 Lab) F
PREREQUISITE: HDCO 502 and graduate standing in counseling program. The following information will be covered in relation to group counseling: theories, research, developmental stages, therapeutic factors, leadership functions, consultation and ethics. Use of leadership skills in structured and unstructured groups will be practiced.

HDCO 523. Theory and Practice of Addiction. 2 Credits. (2 Lec) S
PREREQUISITE: HDCO 510 and graduate standing in counseling program. This course is designed to review current developments in the field of addictions, as well as, evaluate research and treatment trends within addiction practice. Students will demonstrate an understanding of addictions theory and apply it to practice cases.

HDCO 524. Crisis Counseling: Theory and Practice. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing in counseling program; HDCO 508 and 510. The study of crisis counseling theories, strategies, and models. Includes specific applications related to collaboration among schools, mental health agencies, and private practitioners.

HDCO 525. Counsel Child & Adolescents. 3 Credits. (3 Lec) S
PREREQUISITE: HDCO 508 and graduate standing in counseling program. Application of counseling theories and techniques to preschool and school age (K-12) children and their families. A special emphasis will be placed on implementing appropriate intervention strategies according to age, developmental level, and the counseling setting.

HDCO 526. Adventure Counseling. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Graduate standing in counseling program. An introduction to the theory and practice of adventure-based counseling and experiential learning. The course will focus on the goals, concepts, and techniques of adventure work. Students will learn numerous adventure games, problem-solving initiatives, and how to design adventure programs.

HDCO 530. Mind-Body Well-Being Self-Care. 3 Credits. (3 Lec) S
PREREQUISITE: HDCO 510 and graduate standing in the counseling program. The objectives of this course are two-fold: 1) familiarize students with mind-body, well-being, and self-care interventions; and 2) train students in preventative methods.

HDCO 550. Counseling Research and Evaluation. 2 Credits. (2 Lec) S
PREREQUISITE: Graduate standing in counseling program; HDCO 502. This course will provide an understanding of research methods, statistical analysis, needs assessment, and program evaluation as they apply to the field of counseling.

HDCO 551. Appraisal. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: HDCO 571 and graduate standing in counseling program. Topics include test standardization, reliability and validity; developing understanding of appraisal instruments and needs assessment with individuals and systems; using information derived from selected appraisal instruments; and consultation models used when delivering test information to individuals and groups.

HDCO 554. Develop Theory Across Lifespan. 3 Credits. (3 Lec) F
PREREQUISITE: HDCO 521 and HDCO 571 and graduate standing in the counseling program. An introduction to the complex developmental relationships among individuals in the family across the life span. Systems, developmental, learning and personality theories across the life span are surveyed. Contextual variables on developmental processes are stressed.

HDCO 556. Sexuality Counseling. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: Graduate standing in counseling program. Exploration of sexual issues and the counseling process. Examination of foundations needed to respond to clients’ sexual concerns.

HDCO 558. Career Counseling. 2 Credits. (2 Lec) Su
PREREQUISITE: Graduate standing in counseling program. This course will prepare the student in the area of career guidance and counseling. Emphasis will be placed on the understanding of career development theories, use of occupational informational sources including computer programs, assessment of the individual and various working environments, and the design of career developmental programs from elementary school through retirement. The student will also be introduced to the impact social issues have on work, leisure and families.

HDCO 563. Multicultural Awareness. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing. This course explores the relationships between social organizations, processes of historical change, social stratification (race, gender, sexuality), and individuals and family structure.

HDCO 564. Diagnosis and Mental Health. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing in counseling program. This course will provide students with conceptual understanding of mental disorders within physiological, developmental, familial, and social cultural contexts. Students will learn how to use DSM diagnosis in the appraisal and differential diagnosis of mental disorders.

HDCO 565. Couples Counseling. 3 Credits. (3 Lec) F
PREREQUISITE: HDCO 508 and graduate standing in counseling program. Theoretical foundations and interventions for working with couple relationships, and includes promotion of healthy couple relationships and treatment of couples in crisis and/or transition. Emphasizes gender roles, sexuality, and issues related to intimacy from a systemic perspective.

HDCO 568. Mental Health Methods. 3 Credits. (3 Lec) F
PREREQUISITE: HDCO 510 and graduate standing in counseling program. Mental health counseling methods for treatment of mental disorders, including adults with serious mental illness and severely emotionally disturbed children. Appraisal, treatment planning, evidence-based interventions, medications, crisis intervention, case management, consultation, referral, and professional issues/ethics in treatment of DSM disorders.

HDCO 569. Advanced Family Counseling. 3 Credits. (3 Rct) S
PREREQUISITE: HDCO 508 and graduate standing in counseling program. Advanced theoretical foundations and interventions for the practice of family counseling. Includes current research regarding family counseling and treatment. Emphasizes assessment and interventions for families dealing with mental health diagnoses, substance abuse, sexual abuse, violence, divorce/remarriage, and child/adolescent issues.
HDCO 571. Prof Counsel Practicum. 3 Credits. (3 Lab; 15 cr max) S
PREREQUISITE: HDCO 508, HDCO 521, graduate standing in counseling program and consent of instructor. Supervised clinical practice with individuals, children, families, and groups. Weekly individual and group supervision.

HDCO 575. Prof Paper/Project. 1-4 Credits. (1-4 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing in counseling program. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major adviser and graduate committee.

HDCO 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand
PREREQUISITE: Graduate standing, teaching experience and/or current employment in a counseling organization and consent of instructor. Courses offered on a one-time basis to fulfill professional development needs of in-service educators or counselors. A specific focus is given to each course which is appropriately subtitled. May be repeated.

HDCO 589. Graduate Consultation. 1-3 Credits. (3 Ind; 3 cr max) F,S,Su
PREREQUISITE: Graduate standing in counseling program and approval of committee chair. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff-time or help.

HDCO 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Graduate standing in counseling program and consent of instructor.

HDCO 591. Special Topics. 1-4 Credits. (1-4 Lec; 4 cr max) On Demand
Max 4 cr. PREREQUISITE: Upper, division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HDCO 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: HDCO 508, graduate standing in counseling program and permission of instructor. Advanced theoretical foundations and interventions for the practice of family therapy. Includes current research regarding family therapy and treatment. Emphasizes assessment and interventions for families dealing with mental health diagnoses, substance abuse, sexual abuse, violence, divorce/remarriage, and child/adolescent issues.

HDCO 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
Max 4 cr. PREREQUISITE: Graduate standing in counseling program or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

HDCO 598. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) F,S,Su
Max 12 cr. PREREQUISITE: HDCO 571 and graduate standing in counseling program and clinical review. An individualized assignment arranged with an agency, school or other organization to provide guided experience in the field.

HDFP - Human Devel Family Fin Plan

HDFP 510. Fundamentals of Family Financial Planning. 3 Credits. (3 Lec)F,S
PREREQUISITE: Graduate standing. This course provides an overview of family financial planning by integrating concepts and issues with planning and counseling applications. Students will be introduced to the key concepts of family financial planning, including: insurance, tax investments, retirement, and estate planning. The family financial planning process is introduced with an emphasis on the integration and application of concepts in meeting individual and family financial goals and objectives. Other topics presented include an ethics overview, compensation trends within the industry, and regulatory frameworks. This course is offered as a distance-delivered course from Kansas State University.

HDFP 515. Insurance Planning for Families. 3 Credits. (3 Lec)F,S
PREREQUISITE: Graduate standing. The course covers risk management concepts, tools, and strategies for individuals and families, as well as ethical consideration. Case studies provide experience in selecting insurance. This course is offered as a distance-delivered course from the University of Nebraska.

HDFP 520. Investing for Family’s Future. 3 Credits. (3 Lec)F,S
PREREQUISITE: Graduate standing. This course covers various aspects of the principles of investments and their application to family financial planning. Topics include risk analysis, risk reduction, expected returns of various investments, and the nature of securities markets and investment companies. This course is offered as a distance-delivered course from Iowa State University.

HDFP 525. Retirement Planning, Employee Benefits, and Families. 3 Credits. (3 Lec)F,S
PREREQUISITE: Graduate standing. This course covers retirement planning for the individual and the family. Topics include qualified retirement plans, nonqualified plans, IRAs and other plans that offer tax advantages to the individual and family. This course is offered as a distance-delivered course from the University of Nebraska.

HDFP 530. Estate Planning for Families. 3 Credits. (3 Lec) F,S
online only PREREQUISITE: Graduate standing. Course covers the basics of estate planning for families including understanding the basic elements of estate planning, analyzing case studies of estate planning situations, and developing skills to work with families on estate planning problems.

HDFP 540. Personal Income Taxation. 3 Credits. (3 Lec)F,S
online only PREREQUISITE: Graduate standing. Course covers the basics of personal income taxation including taxation terminology, taxation issues in investments, taxes and retirement planning, tax management techniques, tax implications in marriage and other close relationships, and other tax topics related to family financial well-being.

HDFP 545. Family Theory and Research I. 3 Credits. (3 Lec)S
PREREQUISITE: Graduate standing. This course will cover the major issues relative to the economics of families, including household production and human capital development. It will also cover the economics of crises, public policy and family life cycle spending, saving and borrowing. A theoretical and research perspective will be used to illuminate the concepts in the course. This course is offered as a distance-delivered course from South Dakota State University.

HDFP 550. Housing/Real Estate. 3 Credits. (3 Lec)S
online only PREREQUISITE: Graduate standing. An overview of the role of housing and real estate in the financial planning process from a theoretical perspective. Taxation, legal aspects, mortgages, and financial calculations related to home ownership and real estate investments are included. New and emerging issues in the context of housing and real estate will be emphasized. The role of ethics in financial planning with housing and real estate will also be included. This course is offered as a distance-delivered course from Oklahoma State University.

HDFP 555. Financial Counseling. 3 Credits. (3 Lec)F,S
online only. PREREQUISITE: Graduate standing. This course emphasizes the development of professional skills for assisting individuals and families to become responsible financial managers through the financial counseling process. Professionals with financial counseling preparation may assist in preventing, alleviating, and/or eliminating financial problems. This course is offered as a distance-delivered course from North Dakota State University.

HDFP 560. Professional Practices in Family Financial Planning. 3 Credits. (3 Lec) F,S,Su
online only” This course will cover the professional practice of family financial planning including the process of planning and counseling, ethics of professional practice, types of organizations offering planning and counseling services, and the evaluation of effectiveness in planning and counseling. This course is offered as a distance-delivered course from Kansas State University.

HDFP 572. Financial Plan Case Studies. 3 Credits. (3 Lec)F,S
PREREQUISITE: Graduate standing. This course is a capstone course in the FFP masters and involved the analysis and presentation of case studies that require the application of all material gained in the masters courses to the financial planning process for families. This course is offered as a distance-delivered course from Kansas State University.

HDFP 575. Professional Paper. 1-4 Credits. (1-4 Ind; 6 cr max) F,S,Su
online only. PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

HDFP 576. Professional Practicum. 3 Credits. (3 Lec)F,S,Su
online only. PREREQUISITE: Graduate standing and consent of instructor. Practicum experience in the field of family financial planning.

HDFP 590. Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing. Directed graduate research/creative activity.

HDFP 591. Special Topics. 1-4 Credits. (1-4 Lec; 4 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HDFP 592. Individual Problems. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.
HDFP 594. Seminar. 1-3 Credits. (1-3 Sem; 4 cr max) On Demand
PREREQUISITE: Graduate standing in counseling program or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

HED - Health Enhancement

HED 195. Paraprofessional Experience I. 1 Credit. (1 Lab) S
COREQUISITE: HED 305. Critical thinking check required. Observation of teaching and data collection in elementary, middle, and high school physical education/health enhancement classes. Placement of students to assist in youth coaching or intramural programs. This course is specifically for future teachers in the public schools.

HED 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

HED 305. Methods of Teaching Movement Expl. 3 Credits. (3 Lec, 1 Lab) S
COREQUISITE: HED 195. Practice skills in music fundamentals teaching and learning folk, square, social, and various types of rhythmical activities and movement exploration. This course is specifically for future teachers in the public schools.

HED 306. Methods ofCond Act. 3 Credits. (3 Lec) F
Teaching practices for physical activity and fitness concepts appropriate for children and adolescents in school and recreational programs. Content includes pedagogical methods, strategies, styles, and techniques that encourage individuals to participate in and adhere to physical activity programs.

HED 310. Methods of Adapted HED. 3 Credits. (3 Lec) S
PREREQUISITE: KIN 221. Health enhancement (physical education and health) issues for school-aged populations who have physical, mental, and/or emotional disabilities. This course is specifically for future teachers in the public schools.

HED 430. Instrc Design in HE. 3 Credits. (3 Lec) S
PREREQUISITE: CTH 205, EDU 397, HED 305, HED 306, HTH 220 and upper division standing and acceptance into the professional teacher education program. A conceptual and practical approach to the design, implementation, and maintenance of various curricula for future teachers.

HED 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su
Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

HED 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max)
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

HED 506. Exercise and Chronic Disease. 3 Credits. (3 Lec) S
ALTERNATE YEARS OFFERED
PREREQUISITE: HED 310, graduate standing. Theory and practice in the exercise of various diseases, disabilities, and atypical conditions.

HED 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand
PREREQUISITE: Graduate standing, teaching experience and/or current employment in a counseling organization and consent of instructor. Courses offered on a one-time basis to fulfill professional development needs of in-service educators or counselors. A specific focus is given to each course which is appropriately subtitled. May be repeated.

HED - Health and Human Development

HED 501. Prof Comm Skills in HED, 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing in HED. Students will develop writing and verbal communication skills as they relate to scholarly pursuits in the areas of health and human development. They will also gain a working understanding of the various types of grants and their applications within public and private settings. Students will develop skills needed to write a successful grant application and will have a working knowledge of the various components of a grant proposal and research papers and theses.

HED 512. Research Methods in HED. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing in HED. A study of the tools necessary to conduct research in the movement sciences and health fields. Includes the writing of a research proposal.

HED 550. Sport Physiology. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Graduate standing in HED. Course will provide an overview of the bioenergetics of muscular work, neuromuscular and cardiorespiratory function, physical training and performance in various environments, nutrition and ergogenic aids, body composition, temperature regulation, endocrine response, and sport testing techniques utilizing virtual laboratory experiences.

HED 551. Sport Nutrition. 3 Credits. (3 Lec)
PREREQUISITE: Graduate standing in HED. Course will provide an overview of macronutrient and micronutrient metabolism and function, popular ergogenic aids and sports performance, nutritional quackery, nutritional recommendations for improved physical performance, fluid and electrolyte needs, thermoregulation, and nutritional analyses and consultation techniques.

HED 552. Sport Psychology. 3 Credits. (3 Lec)
PREREQUISITE: A Bachelor’s degree; prior undergraduate course(s) in exercise, sport or health sciences, psychology, or equivalent experience with computers/software. An overview of basic concepts, behavioral principles, and history; anxiety, arousal, and motivation; leadership, cohesion, and audience effects; aggression and violence; populations including ethnicity, gender, high risk, injured, youth, and elite; coaching psychology; and personality assessment techniques.

HIST - History

HIST 500. Seminar. 3 Credits. (3 Sem)
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

HIST 502. Public History. 3 Credits. (3 Sem) On Demand
Advanced readings and discussion in the practice of public history; including oral history, historic preservation, and museum studies.

HIST 503. America Before 1860. 3 Credits. (3 Sem; 6 cr max)
Topics in the social, cultural, economic, and political history of Early America in the Atlantic world. May be repeated, not to exceed 6 credits.

HIST 504. Topics in Environmental History. 3 Credits. (3 Sem)
On Demand
Advanced readings and discussions in environmental history. May be repeated.

HIST 505. U.S. History 1860-Present. 3 Credits. (3 Lec; 6 cr max)
Graduate research and analysis of important issues in recent American history.

HIST 506. Hist of Science/Tech/Society. 3 Credits. (3 Sem) On Demand
Max 6 cr. Advanced readings and discussion in the history of science, technology, and society. May be repeated.

HIST 507. Writing History. 3 Credits. (3 Sem) On Demand
PREREQUISITE: HIST 540 or equivalent. Advanced seminar in the practice of writing history.

HIST 508. Historic Preserv/Theory & Prac. 3 Credits. (3 Lec)
This course examines the built environment as a basis for understanding historic significance, discusses the American approach to history preservation and introduces the public policies and agencies which protect cultural resources.

HIST 512. Topics in World History. 3 Credits. (3 Sem)
PREREQUISITE: Graduate standing. Examination of topics of current scholarly concern in history other than United States.

HIST 513. Social & Cultural History. 3 Credits. (3 Sem)
PREREQUISITE: Graduate standing. Examination of topics in social and cultural history of current scholarly concern.

HIST 515. The American West. 3 Credits. (3 Lec)
PREREQUISITE: Graduate Standing. Directed readings and analysis of major problems in the history of the American West.

HIST 540. History Methods. 3 Credits. (3 Lec; 6 cr max)
PREREQUISITE: Graduate Standing. Consideration of historical thinking, the use of evidence and historical methodology.

HIST 575. Professional Paper & Project. 1-6 Credits. (1-6 Ind; 6 cr max)
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major adviser and graduate committee.
HIST 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand Max 3 cr. PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff time or help. May be repeated.

HIST 589. Graduate Consultation. 3 Credits. (3 Ind) PREREQUISITE: Master’s standing and approval of committee chair. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional time.

HIST 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S Prerequisite: Master’s standing. May be repeated.

HIST 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Max 12 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HIST 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Graduate standing, and approval of committee chair. Directed research and study on an individual basis.

HIST 598. Internship. 1-12 Credits. (2-12 Ind; 12 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

HIST 689. Doctoral Reading & Research. 1-10 Credits. (1-10 Ind; 15 cr max) On Demand Max 15 cr. Presentation and discussion of dissertation research and writing. May be repeated.

HIST 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) On Demand May be repeated.

HONR - Honors College

HONR 123. Hike and Read. 1 Credit. (1 Rct) F PREREQUISITE: Restricted entrance; admission to the Honors College. Reading and analysis of a text in the humanities, arts, or sciences. Course held off campus for a weekend.

HONR 124. Ski and Read. 1 Credit. (1 Rct; 3 cr max) S PREREQUISITE: Must be enrolled in the Honors College. HONR 201US. COREQUISITE: HONR 202IH. Reading and analysis of a text in the humanities, arts, or sciences. Course held off campus for a weekend. Honors College.

HONR 131. Freshman Research Symposium. 1 Credit. (1 Lec) F PREREQUISITE: Restricted entrance. Presentations of research by current MSU faculty. Tours of laboratory facilities at MSU. This course cannot be repeated.

HONR 201US. Texts & Critics: Knowledge & Imagination I. 4 Credits. (4 Sem) F PREREQUISITE: Restricted entrance; admission to the Honors College. University Seminar in critical reading/analysis of fundamental texts in the humanities, arts, communication, social studies, science, and history of ideas. Socratic teaching methodology. Particular emphasis on development of analysis and criticism through argument, writing, and oral communication. Academic writing and oral argumentation presentations. Course may not be repeated.

HONR 202IH. Texts & Critics: Knowledge & Imagination II. 4 Credits. (4 Sem) S PREREQUISITE: Restricted entrance; admission to the Honors College. Critical reading/analysis of fundamental texts in the humanities, arts, communication, social studies, science, and history of ideas. Socratic teaching methodology. Particular emphasis on development of analysis and criticism through argument, writing, and oral communication. Academic writing and oral argumentation presentations. Course may not be repeated.

HONR 204D. Great Expeditions. 3 Credits. (3 Sem; max unlimited) S PREREQUISITE/CO-REQUISITE: Restricted entrance; HONR 201US and HONR 202IH or HONR 301US. Preparation and execution of a journey paralleling a portion of a historically and/or culturally significant expedition. Students study the original expedition journals, history, social, scientific, artistic, and environmental context as well as plan their own expedition. The expedition usually occurs following the conclusion of spring semester and students are required to make a public presentation on the expedition and their specific research project during the subsequent semester.

HONR 210. Mentoring Gifted Students. 2 Credits. (2 Sem; 4 cr max) F,S PREREQUISITE/CO-REQUISITE: Restricted entrance; HONR 201US and HONR 202IH or HONR 301US. Honors students mentor gifted students from the Bozeman Public Schools. Students meet together in seminar discussion, plan and implement projects, and evaluate their projects.

HONR 291. Special Topics. 1-4 Credits. (1 Sem; 12 cr max) On Demand PREREQUISITE/CO-REQUISITE: Restricted entrance; HONR 201US and HONR 202IH or HONR 301US. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HONR 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE/CO-REQUISITE: Restricted entrance; HONR 201US and HONR 202IH or HONR 301US. Consent of instructor and approval of Dean. Directed research and study on an individual basis.

HONR 301US. Texts and Critics II. 4 Credits. (4 Sem) On Demand PREREQUISITE: Restricted entrance; admission to the Honors College. Critical reading/analysis of fundamental texts in the humanities, arts, communication, social studies, science, and history of ideas. Socratic teaching methodology. Particular emphasis on development of analysis and criticism through argument, writing, and oral communication. Academic writing and oral argumentation presentations. Course may not be repeated.

HONR 450. Advanced Honors Tutorial. 4-6 Credits. (4 Ind; 12 cr max) F,S Prerequisite: Maximum 12 cr. PREREQUISITE: HONR 201US and HONR 202IH or HONR 301US. Weekly seminar and tutorial supervision with extensive interdisciplinary reading, analytic writing, and oral argument, leading to comprehensive examinations. May be repeated.

HONR 490. Undergrad Rsch/Thesis. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su PREREQUISITE: Restricted entrance, HONR 201US and HONR 202IH or HONR 301US. Approval of Dean. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

HONR 491. Special Topics. 1-4 Credits. (1 Sem; 12 cr max) On Demand PREREQUISITE/CO-REQUISITE: Restricted entrance; HONR 201US and HONR 202IH or HONR 301US. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HONR 492. Independent Study. 1-3 Credits. (1 Ind; 12 cr max) On Demand Maximum 12 cr. PREREQUISITE: HONR 201US and HONR 202IH or HONR 301US. Junior standing, consent of instructor and approval of Dean. Directed research and study on an individual basis.

HONR 494. Honors Seminar. 2-4 Credits. (2-4 Sem; max unlimited) On Demand PREREQUISITE: HONR 201US and HONR 202IH or HONR 301US. Advanced Honors seminars are interdisciplinary courses which emphasize class discussion, development of analytic thinking and writing skills, and encourage independent creativity/research.

HONR 494CS. Honors Seminar in Contemp Sci. 4 Credits. (4 Sem) On Demand PREREQUISITE: HONR 201US and HONR 202IH or HONR 301US. Advanced Honors seminars are interdisciplinary courses which emphasize class discussion, development of analytic thinking and writing skills, and encourage independent creativity/research.

HONR 494D. Honors Seminar in Diversity. 2-4 Credits. (2-4 Sem; max unlimited) On Demand PREREQUISITE: HONR 201US and HONR 202IH or HONR 301US. Advanced Honors seminars are interdisciplinary courses which emphasize class discussion, development of analytic thinking and writing skills, and encourage independent creativity/research.

HONR 494A. Honors Seminar in Arts. 4 Credits. (4 Sem; max unlimited) On Demand PREREQUISITE: HONR 201US and HONR 202IH or HONR 301US. Advanced Honors seminars are interdisciplinary courses which emphasize class discussion, development of analytic thinking and writing skills, and encourage independent creativity/research.

HONR 494F. Honors Seminar in Humanities. 4 Credits. (4 Sem; max unlimited) On Demand PREREQUISITE: HONR 201US and HONR 202IH or HONR 301US. Advanced Honors seminars are interdisciplinary courses which emphasize class discussion, development of analytic thinking and writing skills, and encourage independent creativity/research.
HORT 226. Landscape Graphics II. 3 Credits. (3 Lab) S
PREREQUISITE: DDSDN 101, DDSDN 114 (may be taken as a co-requisite), and HORT 225. Understanding of the opportunities offered by computer graphic techniques for landscape architectural drawings, including plans, elevations, axonometric, perspectives, and layouts. Includes instruction in three major areas of computer applications for the different phases of a design project: computer-aided design, digital image editing and manipulation, and three-dimensional modeling. Focuses on AutoCAD, Photoshop Suite, SketchUp, and integration of hand graphics.

HORT 231. Woody Ornamentals. 3 Credits. (1 Lec, 2 Lab) S
Identification, culture and uses of deciduous and evergreen trees, shrubs and vines commonly used as ornaments in Montana, and some species utilized outside of Montana. Lab includes extensive plant walks.

HORT 232. Herbaceous Ornamentals. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: BIOL 170IN (may be taken as a co-requisite). Identification, characteristics, cultural requirements and ornamental uses of indoor tropical foliage and flowering plants, herbaceous landscape annuals and perennials and flowering bulbs. This is a hybrid course requiring student participation in one lab each week, with all other course information and participation via the web.

HORT 235. Crop Production. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: HORT 120 or consent of instructor. Modern production practices for all major temperate-zone vegetable crops, including crop management, development, storage, and post-harvest physiology. The class will include production of transplants and detailed discussion of several major vegetable crop families, including Solanaceae, Curcurbitaceae, Brassicaceae, Liliaceae, and the Fabaceae.

HORT 291. Special Topics. 1-4 Credits. (2-12 Int; 12 cr max) F,S,Su
Sustainable Foods & Bioenergy Systems students only. An individualized assignment arranged with an agency, business, or other organization to provide guided experience within the field.

HORT 300. Turfgrass Management. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: BIOL 170IN, Quantitative Reasoning Core, and HORT 105. Turfgrass propagation, fertilization, establishment, and maintenance. Recognition and adaptabilities of Northern and Southern turfgrasses used for landscape and sports use. Includes irrigation principles and basic hydraulic, establishment and fertilizer calculations, and pest management. Lab includes experimentation with establishment techniques, equipment calibration, soil testing, and turfgrass maintenance.

HORT 331. Planting Design. 3 Credits. (1 Lec, 2 Lab) F
PREREQUISITE: HORT 225 and HORT 226, and HORT 231 and HORT 232 (may be taken as co-requisites). Focuses on planting design elements and principles, landscape trends, styles and theory; involves application of planting design to a variety of project types including engineering, architectural, climatic control, habitat, sensory, and aesthetic uses. Emphasis on plant and environmental relationships. Construction documentation and cost estimating for planting landscape installation.

HORT 335. Site Development. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: M 105Q (formerly M 145Q), HORT 331. Introductory site engineering course for landscape architects. Course explores concepts and methods related to grading and drainage. Topics include landform as design, site grading problem solving, storm water management principles and ecological design strategies, graphic communication for grading plans.

HORT 336. Landscape Construction. 4 Credits. (2 Lec, 2 Lab) S
PREREQUISITE: HORT 331; HORT 335 (may be taken as a co-requisite). Understanding of construction materials used to create the built landscape. Design and production of computer-aided working drawings and models of structures and surfaces including paving, retaining walls, fences, decks and other landscape features. Production of landscape construction portfolio which details a complete site development project.

HORT 337. Vegetable Production. 3 Credits. (3 Lec) F
alternate, odd years PREREQUISITE: BIOL 110CS or BIOL 230. Modern production practices for all major temperate-zone vegetable crops, including crop management, development, storage, and post-harvest physiology. The class will include production of transplants and detailed discussion of several major vegetable crop families, including Solanaceae, Curcurbitaceae, Brassicaceae, Liliaceae, and the Fabaceae.

HORT 226. Landscape Graphics II. 3 Credits. (3 Lab) S
PREREQUISITE: DDSDN 101, DDSDN 114 (may be taken as a co-requisite), and HORT 225. Understanding of the opportunities offered by computer graphic techniques for landscape architectural drawings, including plans, elevations, axonometric, perspectives, and layouts. Includes instruction in three major areas of computer applications for the different phases of a design project: computer-aided design, digital image editing and manipulation, and three-dimensional modeling. Focuses on AutoCAD, Photoshop Suite, SketchUp, and integration of hand graphics.

HORT 231. Woody Ornamentals. 3 Credits. (1 Lec, 2 Lab) S
Identification, culture and uses of deciduous and evergreen trees, shrubs and vines commonly used as ornaments in Montana, and some species utilized outside of Montana. Lab includes extensive plant walks.

HORT 232. Herbaceous Ornamentals. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: BIOL 170IN (may be taken as a co-requisite). Identification, characteristics, cultural requirements and ornamental uses of indoor tropical foliage and flowering plants, herbaceous landscape annuals and perennials and flowering bulbs. This is a hybrid course requiring student participation in one lab each week, with all other course information and participation via the web.

HORT 235. Crop Production. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: HORT 120 or consent of instructor. Modern production practices for all major temperate-zone vegetable crops, including crop management, development, storage, and post-harvest physiology. The class will include production of transplants and detailed discussion of several major vegetable crop families, including Solanaceae, Curcurbitaceae, Brassicaceae, Liliaceae, and the Fabaceae.

HORT 291. Special Topics. 1-4 Credits. (2-12 Int; 12 cr max) F,S,Su
Sustainable Foods & Bioenergy Systems students only. An individualized assignment arranged with an agency, business, or other organization to provide guided experience within the field.

HORT 300. Turfgrass Management. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: BIOL 170IN, Quantitative Reasoning Core, and HORT 105. Turfgrass propagation, fertilization, establishment, and maintenance. Recognition and adaptabilities of Northern and Southern turfgrasses used for landscape and sports use. Includes irrigation principles and basic hydraulic, establishment and fertilizer calculations, and pest management. Lab includes experimentation with establishment techniques, equipment calibration, soil testing, and turfgrass maintenance.

HORT 331. Planting Design. 3 Credits. (1 Lec, 2 Lab) F
PREREQUISITE: HORT 225 and HORT 226, and HORT 231 and HORT 232 (may be taken as co-requisites). Focuses on planting design elements and principles, landscape trends, styles and theory; involves application of planting design to a variety of project types including engineering, architectural, climatic control, habitat, sensory, and aesthetic uses. Emphasis on plant and environmental relationships. Construction documentation and cost estimating for planting landscape installation.

HORT 335. Site Development. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: M 105Q (formerly M 145Q), HORT 331. Introductory site engineering course for landscape architects. Course explores concepts and methods related to grading and drainage. Topics include landform as design, site grading problem solving, storm water management principles and ecological design strategies, graphic communication for grading plans.

HORT 336. Landscape Construction. 4 Credits. (2 Lec, 2 Lab) S
PREREQUISITE: HORT 331; HORT 335 (may be taken as a co-requisite). Understanding of construction materials used to create the built landscape. Design and production of computer-aided working drawings and models of structures and surfaces including paving, retaining walls, fences, decks and other landscape features. Production of landscape construction portfolio which details a complete site development project.

HORT 337. Vegetable Production. 3 Credits. (3 Lec) F
alternate, odd years PREREQUISITE: BIOL 110CS or BIOL 230. Modern production practices for all major temperate-zone vegetable crops, including crop management, development, storage, and post-harvest physiology. The class will include production of transplants and detailed discussion of several major vegetable crop families, including Solanaceae, Curcurbitaceae, Brassicaceae, Liliaceae, and the Fabaceae.

HORT 226. Landscape Graphics II. 3 Credits. (3 Lab) S
PREREQUISITE: DDSDN 101, DDSDN 114 (may be taken as a co-requisite), and HORT 225. Understanding of the opportunities offered by computer graphic techniques for landscape architectural drawings, including plans, elevations, axonometric, perspectives, and layouts. Includes instruction in three major areas of computer applications for the different phases of a design project: computer-aided design, digital image editing and manipulation, and three-dimensional modeling. Focuses on AutoCAD, Photoshop Suite, SketchUp, and integration of hand graphics.

HORT 231. Woody Ornamentals. 3 Credits. (1 Lec, 2 Lab) S
Identification, culture and uses of deciduous and evergreen trees, shrubs and vines commonly used as ornaments in Montana, and some species utilized outside of Montana. Lab includes extensive plant walks.

HORT 232. Herbaceous Ornamentals. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: BIOL 170IN (may be taken as a co-requisite). Identification, characteristics, cultural requirements and ornamental uses of indoor tropical foliage and flowering plants, herbaceous landscape annuals and perennials and flowering bulbs. This is a hybrid course requiring student participation in one lab each week, with all other course information and participation via the web.

HORT 235. Crop Production. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: HORT 120 or consent of instructor. Modern production practices for all major temperate-zone vegetable crops, including crop management, development, storage, and post-harvest physiology. The class will include production of transplants and detailed discussion of several major vegetable crop families, including Solanaceae, Curcurbitaceae, Brassicaceae, Liliaceae, and the Fabaceae.
HORT 338. Fruit Production. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: BIOC 110CS or BIOC 230. Modern production practices for all major temperate zone trees and small fruit, including crop management, fruit crop growth and development, storage, and post-harvest physiology. The class will include a discussion of rootstocks, grafting, pruning, trellising, and quality control as they impact today’s fruit production system.

HORT 343. Comm Plant Production. 3 Credits. (3 Lec)
PREREQUISITE: HORT 105 Focus is on greenhouse and nursery design and operation, including environmental control, growing media, irrigation, and fertilization of field and • wildflower crops will be explored. Sustainable practices will be emphasized.

HORT 345. Market Gardening. 3 Credits. (3 Lec) S
PREREQUISITE: HORT 105 Focus is on the production of quality vegetable, herb and flower products for • local, regional or non-traditional marketing avenues. Special attention is made to present and analyze sustainable food crop production systems.

HORT 410. Horticulture Recitation. 1 Credit. (1 Ret) S
PREREQUISITE: Senior standing and consent of instructor. This course synthesizes and reinforce basic concepts covered throughout the Environmental Horticulture curriculum and applies this knowledge within new contexts. At the end of the semester students take the Certified Plant Professional exam.

HORT 432. Advanced Landscape Design. 4 Credits. (1 Lec, 3 Snu) PREREQUISITE: HORT 331, HORT 335, HORT 336. Sustainable site design for parks, civic properties, community organization grounds, playgrounds, or trails. Site planning and design processes incorporate landscape performance benefits and measurements. Utilizes service-learning design projects focused on advanced graphic and verbal communication, stakeholder participation, individual and group work skills, technical writing, and construction detailing.

HORT 435. Landscape Planning. 4 Credits. (1 Lec, 3 Lab) S
Alternate Odd Years PREREQUISITES: HORT 331 Explores opportunities for integrating biophysical characteristics and ecological assets with land use development at macro and micro scales. Topics include landscape ecology for land use planning, PROST (parks, recreation, open space and trails) planning, and master planning for green infrastructure.

HORT 440. Urban Planning and Design. 4 Credits. (1 Lec, 3 Lab) S
Alternate Even Years PREREQUISITES: HORT 331. Focuses on the challenges and opportunities of developing vibrant, sustainable neighborhoods and regions. Topics include city form, street design, sustainable neighborhoods, and urban ecological design. Studio projects focus on neighborhood master planning, brownfields redevelopment, and public infrastructure design.

HORT 447. Advanced Plant Propagation. 3 Credits. (1 Lec, 2 Lab) F
PREREQUISITE: Senior standing. Students will learn specialized sexual and asexual propagation techniques, with an emphasis on the physiological and environmental manipulation of plants associated with in vitro, seed and grafting production. Students will receive extensive tissue culture experience.

HORT 485R. Horticulture Capstone I. 1 Credit. (1 Lec) F
PREREQUISITE: Major only and senior standing. Second semester of a two-semester project for seniors majoring in Horticulture Science. This capstone course allows students to pursue a contemporary issue or problem in horticulture within a team research project.

HORT 486R. Horticulture Capstone II. 2 Credits. (2 Lec) S
PREREQUISITE: majors only and senior standing. Second semester of a two-semester project for seniors majoring in Horticulture Science. This capstone course allows students to pursue a contemporary issue or problem in horticulture within a team research project.

HORT 490R. Undergraduate Research. 1-4 Credits. (1-4 Ind; 12 cr max) F,S,Su
PREREQUISITE: Junior or senior standing and approval of instructor. Undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research.

HORT 491. Special Topics. 1-4 Credits. (1 Ind; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

HORT 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

HORT 498. Internship. 2-12 Credits. (2-12 Lec; 12 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

HPRV - Historic Preservation

HPRV 400. Historic Preservation: Theory and Practice. 3 Credits. (3 Lec) F
PREREQUISITE: Junior standing or consent of instructor. This course examines the built environment as a basis for understanding historic significance, discusses the American approach to history preservation, and introduces the public policies and agencies with protect cultural resources.

HSTA - History-American

HSTA 101IH. American History I. 4 Credits. (3 Lec)
An examination of the colonial world of the Americas and the development of the United States as a nation.

HSTA 102IH. American History II. 4 Credits. (3 Lec)
An examination of the United States after the Civil War through the 20th Century.

HSTA 160D. Introduction to the Am West. 4 Credits. (3 Lec) Alternate Even Years Introduction to the American West examines the conquest, settlement, and development west of the Mississippi River.

HSTA 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max)
PREREQUISITE: None required but some may be determined necessary by each offering department. Course not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HSTA 298. American History Internship. 1-12 Credits. (1-12 Ind; 12 cr max) On Demand
PREREQUISITE: Consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

HSTA 311. Early America. 3 Credits. (3 Lec) PREREQUISITES: HSTA 101IH or HSTA 102IH. The development of the British American colonies and the establishment of the United States before 1800. Topics include pre-Columbian Native Americans, the European invasion and settlement of America, the social, economic and political evolution of the colonies, the American Revolution, and the establishment of the new nation.

HSTA 315. The Age of Jefferson and Jackson: The Early American Republic. 3 Credits. (3 sem) S
PREREQUISITES: HSTA 101IH or HSTA 102IH. The political, social and economic history of the United States during its formative years. Topics include the emergence of national political parties and democratic politics, westward expansion, economic and social development, slavery, Indian removal and social reform.

HSTA 316. American Civil War Era. 3 Credits. (3 Lec) PREREQUISITES: HSTA 101IH or HSTA 102IH. Political, economic, and social developments leading to sectional division breakdown of political accommodations, Civil War, and Reconstruction.

HSTA 318. Origins of Modern America: From the Civil War to WWII. 3 Credits. (3 Lec)
The modern US was born in the fiery crucible of these pivotal decades, shaped by the resurgent racism of Reconstruction, the wrenching dislocation of rapid industrialization and technological change, the rise of big cities and big business, and the catastrophic economic collapse of the Great Depression that gave rise to the New Deal order that would define the nation for decades to come.

HSTA 320. Birth of Modern US: 1865-1945. 3 Credits. (3 Lec) PREREQUISITE: HSTR 101IH or HSTR 102IH or consent of instructor. The modern US was born in the fiery crucible of these pivotal decades, shaped by the resurgent racism of Reconstruction, the wrenching dislocation of rapid industrialization and technological change, the rise of big cities and big business, and the catastrophic economic collapse of the Great Depression that gave rise to the New Deal order that would define the nation for decades to come.

HSTA 322. Am History: WWII to Present. 3 Credits. (3 Lec) PREREQUISITES: HSTA 101IH or HSTA 102IH. Political, cultural, and economic history of the U.S. since the end of WWII.
HSTA 402. Sex and Sexuality in America. 3 Credits. (3 Lec) F
Alternate Odd Years PREREQUISITE: HSTA 101IH or HSTA 102IH or AMST 101D. This course explores how definitions of sex and sexuality have changed in the United States from the sixteenth-century to the present. In the course, students will come to understand sexuality and sex as historically constructed and will investigate the importance of these topics to American politics and culture. Students will also examine how societies have tried to govern sexuality and the constant challenge that individuals have offered to sexual regulation. Topics will include: prostitution, birth control, abortion, homosexuality, the development of transsexual identity, and women's liberation movements.

HSTA 406. McCarthy/Ike/Truman. 3 Credits. (3 Lec) PREREQUISITE: HSTA 101IH or HSTA 102IH. An analysis of the ways the Truman and Eisenhower administrations dealt with anti-communism, with a focus on McCarthyism.

HSTA 407. Gender in US & Canadian West. 3 Credits. (3 Lec) Alternate Even Years PREREQUISITE: HSTA 101IH or HSTA 102IH or HSTA 160D or AMST 101D. Exploring the US and Canadian West in the light of gender, Focuses on topics of race and ethnicity, families and intimacy, politics and the law, paid and unpaid work, and art and culture.

HSTA 408. Gender in America. 3 Credits. (3 Lec) PREREQUISITE: HSTA 101IH or HSTA 102IH or HSTA 160D or AMST 101D. History of women in America from colonial times to the present. Analysis of gender relations, the family, the struggle by women to achieve civil rights and social reform, the problems of working women, and the rise of feminism.

HSTA 409. Food in America. 3 Credits. (3 Lec) PREREQUISITE: HSTA 101IH or HSTA 102IH or HSTA 160D or AMST 101D. An examination of the history of the production, consumption, and cultural meaning of food in America. In this class, food functions as the gateway to examine issues of labor, gender, race, and class in America from the colonial period to the present.

HSTA 412IH. American Thought and Culture. 3 Credits. (3 Lec) On Demand PREREQUISITE: HSTA 101IH, or HSTA 102IH, or HSTA 160D or AMST 101D. The fundamental purpose of this course is to show the interconnectedness of science, philosophy, literature, and religion in shaping the American intellectual tradition from the Puritan founding to the present.

HSTA 416. Race and Class in America. 3 Credits. (3 Lec) S PREREQUISITE: HSTA 101IH or HSTA 102IH or HSTA 160D or AMST 101D Race in the history of the U.S. from early European and Native American contact until the present. Considers issues of racism, race relations, slavery, African-American culture, jazz, the modern Civil Rights movement, and current policy and racial questions.

HSTA 450. History of American Indians. 3 Credits. (3 Lec) PREREQUISITE: HSTA 101IH or HSTA 102IH. Indian affairs in America from 1600-1970. Emphasis on white reaction to the American Indians and the effect of the European invasion on Indian culture.

HSTA 460. Montana and the West. 3 Credits. (3 Lec) PREREQUISITE: HSTA 101IH or HSTA 102IH. A survey of how the region that became the territory and then the state of Montana developed. Focuses on the social, economic, cultural, military, and political patterns that connect Montana with the rest of the American West.

HSTA 464. Trans-Mississippi West. 3 Credits. (3 Lec) PREREQUISITE: HSTA 101IH or HSTA 102IH or consent of the instructor. Exploration of major themes in the development of the American West, such as conquest and settlement, economic development, racial and ethnic diversity, urbanization, and popular culture.

HSTA 468. History of Yellowstone. 3 Credits. (3 Lec) PREREQUISITE: HSTA 101IH or HSTA 102IH. Historical analysis of changing perceptions of nature on development of Yellowstone and of the Park’s place in the context of a modernizing American nation.

HSTA 470. American Environmental History. 3 Credits. (3 Lec) PREREQUISITE: HSTA 101IH or HSTA 102IH. Survey of changing perceptions and uses of the natural world from the colonial era to the present.

HSTA 482. Technology and the Fate of Humanity. 3 Credits. (3 Lec) F PREREQUISITE: HSTA 101IH or HSTA 102IH. From the earliest stone tools to electricity, nuclear weapons, and the modern smart phone, technologies have repeatedly transformed the very nature of what it means to be “human.” Using case studies from the United States and around the globe, this course reveals how key technologies have shaped history while also grappling with a profoundly important question: Can we learn to control the technologies that increasingly threaten our future existence?

HSTA 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su PREREQUISITE: Consent of instructor and approval of department head. Course will address responsible conduct of research. Directed research on an individual basis.

HSTA 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HSTA 492. Independent Study. 1-4 Credits. (1-4 Ind; 6 cr max) On Demand PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

HSTA 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) PREREQUISITE: Consent of instructor, consent of internship supervisor, and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

HSTA 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) Max 12 cr. PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HSTR - History-World

HSTR 101IH. Western Civilization I. 4 Credits. (3 Lec, 1 Rec) F,S,Su Survey of the ancient Near East, Greece, Rome, and the European world through 1600. Emphasis on social, economic, and cultural history.

HSTR 102IH. Western Civilization II. 4 Credits. (3 Lec) This course explores the political, social, and cultural transformation of Europe from the absolute monarchies of the 1600s through the birth of the European Union. Possible topics include overseas trade, revolutions, cityscapes, class and gender identities, environmental transformations, and/or the memory of war. Introduces students to historical methods for analyzing primary sources such as architectural plans, maps, paintings, photographs, music, diaries, political treaties, and propaganda films.

HSTR 105. Making Our Word-Ten Events. 3 Credits. (3 Lec) F This course identifies the ten most important events in world history by exploring the role of the past in creating today’s world.

HSTR 105IH. Making Our World-Ten Events. 3 Credits. (3 Lec) F This course identifies the ten most important events in world history by exploring the role of the past in creating today’s world.

HSTR 130D. Latin American History. 3 Credits. (3 Lec) F The history of Latin America, and the Caribbean from the Pre-Columbian period to the present, with emphasis focused on the origins and legacies of colonialism and imperialism.

HSTR 135D. The Modern Middle East. 4 Credits. (3 Lec) This introductory course examines the Middle East from the early twentieth century until the present day. Beginning with the Ottoman and Safavid empires, this course explores a variety of themes relating to the region and its place in the world.

HSTR 140D. Modern Asia. 4 Credits. (3 Lec) Explores the legacies of imperialism, war, and revolution in the rise of modern East Asia, primarily Japan and China.

HSTR 145D. Reinventing Japan. 4 Credits. (3 Lec) Explores the political and cultural development of Japan from earliest time to the present. Special attention will be given to Japanese relations with Asia and the West.

HSTR 160D. Modern World History. 4 Credits. (3 Lec) Introduction to themes important for understanding the world historical roots of conflict through an examination of religion and belief, social and cultural identities and differences, politics, and global interconnections.

HSTR 205CS. The World Environment. 3 Credits. (3 Lec) F Examines the history, science, and ethics of risk, focusing on the complex relationship of science, technology, and risk in modern age. Includes exploration of knowledge production in science and technology; case studies such as industrial health and safety, the atomic age, “natural” disasters, and global warming to understand how risk has been defined, perceived, and remedied; and team research projects on such topics as automobile safety, earthquakes, and maquiladores.
HSTR 207CS. Sci and Tech in World History. 3 Credits. (3 Lec)
Surveys the role of science and technology in relation to social, political, and economic change in global history. Special attention is given to the historical development of scientific and technological knowledge, the ways different societies have linked ideas of progress and science and how history can provide valuable perspective to contemporary debates over potentially revolutionary scientific and technological practices.

HSTR 208RH. Sci,Envir,Tech,Soc: Common Exp. 3 Credits. (3 Sem)
Science and technology have become pervasive instigators of social change. This course aims to understand the nature, causes, and consequences of the growth of science and technology from a humanistic perspective, including recent advances in stem-cell research, the human genome, atomic energy and weapons, and space technology. We will explore the immense social, cultural, political, and economic consequences of these advances and how they have affected our relationship to the natural world.

HSTR 232D. Religion in Latin America. 3 Credits. (3 Sem)
This course examines the history of religion in Latin America from pre-conquest times to the present.

HSTR 282CS. Darwinian Revolution. 3 Credits. (3 Lec)
Covers the history, philosophy, and our current understanding of the biological sciences, focusing especially on the theory of evolution. Explores Darwin’s ideas, the manner in which he came to them, his argument’s explanatory power, and the diverse ramifications of evolutionary theory, including the modern debates in science and religion, stem cell research, cloning, sociobiology, and other tricky contemporary issues.

HSTR 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max)
PREREQUISITE: None required but some may be determined necessary by each offering department. Course not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HSTR 298. World History Internship. 1-12 Credits. (1-12 Ins; 12 cr max) On Demand
PREREQUISITE: Consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

HSTR 302. Ancient Greece. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 101IH or HSTR 102IH. Origins to Alexander the Great with special attention to life in classical Athens. Emphasis on reading ancient sources in translation.

HSTR 304. Ancient Rome. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 101IH or HSTR 102IH. From the foundations of the city to the fall of the empire, with special attention to social and military history. Emphasis on reading ancient sources in translation.

HSTR 308. Ancient Egypt. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 101IH or HSTR 102IH or HSTR 160D. Survey of ancient Egyptian history, religion, and society from its earliest origins as a unified kingdom in the mid-third millennium BC through the Greek conquest of Egypt by Alexander the Great in 332 BC.

HSTR 322. 19th Century Europe. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 101IH or HSTR 102IH. A comparative and transnational approach to the history of modern Europe from the French Revolution to the First World War.

HSTR 324. 20th Century Europe. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 101IH or HSTR 102IH. Events and forces in 20th century Europe from World War I to the present. The rise of fascism, communism, and the interwar crisis along with post-World War II developments.

HSTR 330. History of Mexico. 3 Credits. (3 Lec)
PREREQUISITE: HSTA 101IH, HSTA 102IH or HSTR 130D. This course examines the historical processes that resulted in the creation of Modern Mexico.

HSTR 340. Age of the Shoguns. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 101IH or HSTR 102IH. The emergence of the Tokugawa state and the emergence of modern Japanese identity.

HSTR 342. Japan's Meiji Revolution. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 140D or HSTR 145D. Investigates the revolutionary changes that Japan underwent between the 1770's and 1910 and the emergence of modern Japanese nationalism.

HSTR 345. Modern China. 3 Credits. (3 Lec)
PREREQUISITE: Any 100-level HSTR, HSTA, or AMST course; 100-level PHL or RLST Course; 100/200 level CHIN course, or 300-level JPN course or consent of instructor. Social, political, and economic history of the People’s Republic of China.

HSTR 346. Modern India. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 160D, HSTR 102IH or HSTR 140D. Social, economic, political, and intellectual history of India during the 19th and 20th centuries.

HSTR 350. Modern Britain. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 102IH. The emergence and fall of Britain as a world power. Topics of study may include industrialization, the slow emergence of democracy in Britain, the role of the family in Victorian Britain, and the impact of the empire within Britain.

HSTR 353. Modern France. 3 Credits. (3 Lec)
A survey of French history from 1750 to the present, focusing on revolutions, the emergence of modern French culture, dynamics between Paris and provincial France, and the experience of war.

HSTR 359. Russia to 1917. 3 Credits. (3 Lec)
PREREQUISITE: Any HSTR course or junior standing, or consent of instructor. Examines the emergence and development of the Russian Empire with a focus upon the nineteenth and early twentieth centuries.

HSTR 362. Modern Germany. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 101IH or HSTR 102IH. An in-depth look at the economic, social, and political developments of modern Germany.

HSTR 366. Middle East/20th Century. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Any HSTR course, junior standing, or consent of instructor. Investigates major diplomatic, economic, cultural and religious themes from the Middle East in the 20th century. Students will choose topics and countries of interest for specific, instructor-guided research.

HSTR 371. The World at War. 3 Credits. (3 Lec) F, alternate years, to be offered even years,
PREREQUISITE: HSTR 101IH, or HSTR 102IH, or HSTA 101IH, or HSTA 102IH, or HSTA 160D. The First or Second World War examined through political, military, technological, and social history, in the contexts of the early decades of the 20th century and consequences up to the present.

HSTR 375. Eurasian Borderlands. 3 Credits. (3 Lec)alternate years to be offered even years.
PREREQUISITE: Any HSTR course, or junior standing, or consent of instructor. Provides a comparative and thematic approach to a series of issues related to the theme of cross-cultural contact. Draws on scholarly literature pertaining to the Balkans, the Middle East, and the former Soviet Union to examine imperialism, national and religious identity, human mobility, and genocide.

HSTR 376. Twentieth Century War. 3 Credits. (3 Lec)
Why was the 20th century the most violent period in human history? In this course, we will examine the fascinating causes and histories of the great military conflicts in the Pacific and Europe, including WWI and WWII and ending with the American war in Vietnam.

HSTR 407. Soviet Union: Rise & Fall. 3 Credits. (3 Lec)
PREREQUISITE: Any HSTR course, or junior standing, or consent of instructor. This course examines the history of the USSR and its successor states in Europe and Asia. Beginning with the late imperial era, it examines the major political, cultural, and social developments taking place in the region to the present day.

HSTR 415. Gender and Technology. 3 Credits. (3 Lec)
PREREQUISITE: Any 100-level HSTR, HSTA, or AMST course or consent of instructor. This class explores the relationship between gender and technology in comparative cultural, social, and historical perspective.

HSTR 417. Early Modern Science. 3 Credits. (3 Lec)
PREREQUISITE: HSTA 101IH, HSTR 101IH, HSTR 102IH, or HSTR 282CS.
Topics of study may include the relationships between religion and science, science and gender, and technological change and the structure of society.

HSTR 419. Modern Science. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 102IH, or HSTA 102IH. The emergence of modern science in Europe and America from the Scientific Revolution to the Atomic Age. Special emphasis will be given to the cultural, political, and economic rise of science and technology within society.

HSTR 423. European Intellectual History. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 101IH or HSTR 102IH. The ideologies and major thinkers who have influenced European history from the French Revolution to the present day.

HSTR 425. Mapping the World. 3 Credits. (3 Sem)
Other PREREQUISITE:HSTR 101IH or HSTR 102IH. This course explores the role of map-making in global history from the 1600’s through the present. Class discussions will focus on the role of cartographic images in modern state formation, maritime exploration, nation building, colonial conquest, and urban social geography.
HSTR 430. Latin Amer Social History. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 130D or consent of instructor. This seminar-style course examines Social History of Latin America through select case studies.

HSTR 431. Race in Latin America. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 130D, HSTA 101IH or HSTA 102IH. This course explores the history of race relations in Latin America, focusing on the traditional links between “race” and power. Topics may include examinations of Indigenous, African, and European cultures/ethnicities, from the Conquest to the present day.

HSTR 432. Colonial Latin America. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 130D, SPNS 329 or consent of the instructor. This seminar-style course examines the colonial period in Latin America. Important themes include cross-cultural contact and conflict, the development of a colonial economy, religious and cultural change, institutional and political history, and the organization of colonial society.

HSTR 433. Latin American Perspectives. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 160D, HSTR 102IH, HSTR 130D or consent of the instructor. This course approaches historical developments, literature, and construction of identity in twentieth-century Latin America. Taught in English with Spanish reading/writing option. Focus will vary by instructor. Cross-listed with SPNS 430.

HSTR 434. Gender in Latin America. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 130D. An exploration of the ways in which transformations in the historical construction of gender and sexuality shaped and were shaped by broader processes of socioeconomic, political, and cultural change in Latin American history.

HSTR 435. Latin America: Human Rights. 3 Credits. (3 Lec)
Other PREREQUISITE: HSTR 130D or HSTR 346 and junior standing, or consent of instructor. Seeks deeper understanding of phenomenon of violence in modern world by examining case studies from Latin America. Topics include military dictatorships, revolutions, foreign interventions, drug cartels, and street gangs.

HSTR 436. Armed Conflict for Modern Latin America. 3 Credits. (3 Lec, D)
PREREQUISITE: HSTR 130D or HSTR 102IH or junior standing or consent of instructor. Considers the roots and outcomes of different armed conflicts in modern Latin America, including foreign intervention, revolutionary conflict, state violence, and extra-legal violence.

HSTR 443. Gender in Asia. 3 Credits. (3 Lec)
PREREQUISITE: Any 100-level HSTR, HSTA or AMST course or 100-level PHI or RLST course or 100- or 200-level CHIN course or 100- or 300-level JPN course or W3 491 or consent of instructor. Explores the ways in which constructions of gender in China, Japan, and Korea shaped and were shaped by broad social, political, and cultural factors, from the pre-modern period to the present.

HSTR 444. Gender in Japan. 3 Credits. (3 Sem)
PREREQUISITE: HSTR 140D or HSTR 145D. Investigates the role of gender in Japanese history from ancient times to the present.

HSTR 445. Environ, Health & Sci in Japan. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 140D or HSTR 145D. Investigates the complex relationship between the Japanese and the natural world, including the history of disease and medicine.

HSTR 446. Science and Medicine in China. 3 Credits. (3 Lec)
PREREQUISITE: HSTR 140D or HSTR 145D or consent of instructor. An exploration of the transformations of medicine, technology, and natural knowledge in imperial and modern China.

HSTR 467. History of Mountaineering. 3 Credits. (3 Sem)
PREREQUISITES: Any 100 or 200-level HSTA or HSTR course. This course will focus on the dynamic relationship between the advance of science and the exploration, conception, and use of the world’s mountains. Environmental history will form a major component of the course.

HSTR 468. The Making of Modern Turkey. 3 Credits. (3 Lec)
PREREQUISITE: Any HSTR course or junior standing or consent of instructor. This course focuses upon the major political, cultural, social, and economic developments taking place in the history of Turkey from its establishment in 1923 up to the present day. Of particular importance to this course is the question of what the study of Turkey’s modern history can teach us about the modern era more generally.

HSTR 482. Animal Histories. 3 Credits. (3 Lec)
What is technology and how has it shaped the history of the United States and the broader globe? Does technology drive history? What are the sources of technological innovation and to what degree do humans guide and direct these? What is the relationship between technology and power?

HSTR 483. Africa: Colonial Through Modern Era. 3 Credits. (3 Lec)
PREREQUISITES: Junior and Senior level standing and/or successful completion of HSTR 102. This course addresses the history of Africa beginning in the late fifteenth century through the period of high colonialism in the late nineteenth and early twentieth centuries to the era of decolonization and its aftermath in the late twentieth and early twenty-first centuries. The course is designed to explore the themes of early Euro-African communities, Atlantic slavery, dominant tribal groupings and ethnicity, colonial economy, European conquest, indigenous resistance to European invasion, the European “Scramble,” African nationalism, gender, education, independence, post-colonial chaos, genocide, and the re-emergence of militant Islam.

HSTR 484. World Environmental History. 3 Credits. (3 Lec)
PREREQUISITE: Any 100- or 200-level HSTR course. This course examines the intersection of the natural world with major themes in world history. Topics may include diseases, agriculture, pollution, and environmentalism in global context.

HSTR 486. Museum History. 3 Credits. (3 Lec)
PREREQUISITE: History major (any concentration) or Museum studies minor and Any 100 or 280-level HSTA or HSTR course. An examination of the development of American museums and their relationship to other exhibitionary forms including wild west shows and world’s fairs. The course also introduces students to theoretical arguments about the nature and function of cultural representations.

HSTR 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind) On Demand
PREREQUISITE: Consent of instructor and consent of department head. Course will address responsible conduct of research. Directed research on an individual basis.

HSTR 491. Special Topics. 1-4 Credits. (1-4 Lec; max unlimited)
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

HSTR 492. Independent Study. 1-4 Credits. (1-4 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor, and approval of department head. Directed research and study on an individual basis.

HSTR 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) On Demand
PREREQUISITE: Consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

HSTR 499R. Sen Capstone: Hist Methodology. 3 Credits. (3 Sem)
PREREQUISITE: Senior standing and consent of instructor. Must register in History Department Office. History majors practice sound research and writing methods, using appropriate bibliographical tools and in light of contemporary historiography.

HTH - Health

HTH 140. Pharmacology for HC Providers. 3 Credits. (3 Lec)
General principles of drug action on multiple body systems, pharmacology of the major drug classifications, and drug side effects as well as basic concepts of mathematics used in the calculation, preparation, and administration of various medications.

HTH 220. Human Sexuality. 3 Credits. (3 Lec) F,S Su On Demand
A study of all aspects of human sexuality including the sexual reproductive systems, sexual behaviors, contraception, gender roles, sexual functioning, and sexually transmitted diseases.

HTH 455. The Ethic of Care. 3 Credits. (3 Lec) F,S,Su On Demand
PREREQUISITE: HDFS 1011S, PSYX 100 or SOCI 101 and junior standing. This course, intended for students interested in working in human service professions (education, health, social work, counseling, human relations and resources) will focus on understanding and applying the theory of the ethic of care in real world situations. Theoretical support for the ethic of care found in diverse areas of philosophy, social justice, education, feminism, parenting, nursing, theology, and medicine will be explored. Utilizing a service learning approach, students will be engaged in understanding theories related to the ethic of care through both in-class lecture and discussion and outreach in the community.

HUM - Humanities

HUM 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
HUM 491. Special Topics. 1-4 Credits. (1-4 Sem; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ICS - Intercultural Studies
ICS 291. Special Topics. 1-4 Credits. (1-12 Lect; 12 cr max) On Demand
Maximum PREREQUISITE: None required but some may be determined necessary by each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ICS 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
IND Maximum 6 cr. PREREQUISITES: Consent of instructor and approval of department head. Independent study on topics related to intercultural and/or global issues.

ICS 404. Intercultural Experience. 1-3 Credits. (1-3 Ind; 3 cr max) On Demand
Students must spend a minimum of three weeks in a non-US cultural setting, and must be accompanied by one or more MSU faculty members. Number of credits to be awarded will be determined by the Director of International Programs.

ICS 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S, Su
Max 12 cr. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

ICS 491. Special Topics. 1-4 Credits. (1-4 Lect; 12 cr max) On Demand
Maximum 12 cr. PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ICS 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
IND Maximum 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis of intercultural and/or global issues.

IDSN - Interior Design
IDSN 101. Intro to Interior Design. 3 Credits. (3 Lec) F,S
This course introduces design as it relates to interior design, architecture and related professions, through the study of the elements and principles of design and the ways in which humans interact with designed environments and elements. (ARCH majors substitute ARCH 121).

IDSN 110. Hist of Dsgn I Ancnt-1900. 3 Credits. (5 Lec)
This course offers exposure to stylistic variations found in interior design of the ancient world and traditional Europe. Students will become aware of how these styles have been the impetus for pre-1900 architecture and decorative arts in America. (ARCH majors substitute ARCH 322/323).

IDSN 111. Hist Dsgn II 1900-Contemp. 3 Credits. (3 Lec) S
This course is a continuation of the study of the development of the interior environment from the 19th century to the present. The difference in the basic philosophy between 19th and 21st century design is emphasized. (ARCH majors substitute ARCH 322/323).

IDSN 122. Textiles and Interior Finishes. 3 Credits. (3 Lec) F
PREREQUISITES: IDSN 130. COREQUISITES: IDSN 130. This course includes the study of textiles and interior finishes used by interior designers. Students will gain familiarity with a wide range of textile products used in both residential and commercial interiors including fiber content and yarn type, application and labeling, performance and maintenance. Students will also study the range and application of wall, ceiling and floor finish materials commonly used in interior design.

IDSN 130. Interior Design Graphics, 3 Credits. (2 Lec, 1 Lab) F,S
Interior Design Graphics provides interior design students with a basic knowledge of building structures, construction techniques, and building materials. It introduces the technical skills needed to read and to produce drawings used in the practice of interior design, including floor plans, interior elevations, reflected ceiling plans, and detail drawings. (ARCH majors substitute ARCH 151/152).

IDSN 131. Presentation Drawing. 3 Credits. (3 Lec) S
PREREQUISITE: IDSN 130 or (ARCH 151/152) This course presents the elements of two- and three-dimensional design as related to interior representational drawings. Emphasis is on one- and two-point perspective drawings and sketching. Addition of color to drawings by use of hand and digital methods is introduced. (ARCH majors substitute ARCH 261/262).

IDSN 135. Fundamentals of Space Planning. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITES: IDSN 101 (or ARCH 121) and IDSN 130 (or ARCH 151/152). This course explores the physical and psychological concepts pertaining to interior spaces. Students work with commercial design programs, schematic planning tools, commercial furniture, and universal design concepts to create functional spaces that meet program criteria. Students will explore space planning in relationship to plumbing and mechanical systems and apply NKBA kitchen and bath space planning guidelines. The basic space planning skills and terminology learned are applicable to the NCIDQ exam.

IDSN 150. Digital Technology Lab. 1 Credit. (1 Lab) F,S
PREREQUISITES: Either DDSN 101 or CAD I & 2 or DDSN 118/DDS 131. This course reinforces basic digital drafting principles and commands through repetition and skill building in a lab setting. Students are required to bring their assignments and outside work to gain practice and competence in digital drafting. This is a collaborative studio environment where students will gain knowledge from shared experiences. Students will advance and apply digital skills through the productions of course work assigned in other classes. Students will learn production tips and shortcuts from faculty.

IDSN 225. Light/Color/Lighting Systems. 3 Credits. (3 Lec) S
Prerequisite: IDSN 101, IDSN 130. Students will explore color theory, human response to color, and the properties of light and color. Students will also gain knowledge in lighting systems and specification of lamps and fixtures. The student will learn practical methods for applying these elements of design and demonstrate competency in color usage and lighting systems by designing projects including reflected ceiling plans, lighting and color specification.

IDSN 240. Studio I Residential. 4 Credits. (4 Lec) S
Prerequisite: WRIT 101, DDSN 118/DDS 131, CSTN 173, IDSN 135, IDSN 225. This course is a laboratory experience with real-life & hypothetical design projects. The focus of Studio I is primarily residential. Students will develop 2 or 3 complete presentations including but not limited to floor plans, interior elevations, interior perspectives, color board, room finish schedule, and a budget. Students will make oral presentations using the presentation boards to illustrate their design solutions.

IDSN 250. Studio II Commercial. 4 Credits. (4 Lec, 1 Lab) S
Prerequisite: IDSN 101, IDSN 130, DDSN 131, CSTN 173, IDSN 135, IDSN 225. Completion of all first year IDSN program courses with a C- or better. Studio II is an advanced laboratory class which focuses on commercial design projects, some for actual clients. Advanced space planning, utilization of appropriate codes and specification writing will be covered. Students will develop 2-3 complete presentations including but not limited to floor plans, interior elevations, interior perspectives, color boards, and specification schedules. Students will make oral presentations using the presentation boards and CAD drawings to illustrate their design solutions.

IDSN 255. Environmental Design Studio. 4 Credits. (4 Lec) S
PREREQUISITES: IDSN 101, IDSN 130, DDSN 131, CSTN 173, IDSN 135, IDSN 135, IDSN 225. Completion of all first year IDSN program courses with a C- or better. This course is a lecture/laboratory experience with a focus on an environmentally sustainable design project. Students will develop complete presentations including floor plans, interior elevations, interior perspectives, finish schedules, and make presentations digitally. Emphasis is on the design process and LEED goals. Gallatin College.

IDSN 266. Kitchen and Bath I. 4 Credits. (3 Lec 1 Lab) F,S
Prerequisite: IDSN 101, IDSN 130, DDSN 131, CSTN 173, IDSN 131, IDSN 135, IDSN 225. Completion of all first year IDSN program courses with a C- or better. This course is a lecture/laboratory experience with a focus on kitchen and bath design with an emphasis on sustainability. Students will learn principles of kitchen and bath design using NKBA’s guidelines to produce presentations including floor plans, interior elevations, interior perspectives, finish schedules, and make presentations digitally. Emphasis is on the design process and LEED goals. Gallatin College.

IDSN 275. Professional Practices. 3 Credits. (3 Lec) S
PREREQUISITES: IDSN 101, IDSN 130, DDSN 131, CSTN 173, IDSN 131, IDSN 135, IDSN 225. Completion of all first year IDSN program courses with a C- or better. This course is a lecture/laboratory experience with a focus on business principles and practices related to the interior design profession. Topics include business procedures, methods of charging, and steps involved in business formation. Use of contracts and specifications to achieve desired objectives is covered, as is marketing of professional services and promotion of the firm. A portfolio, resume and cover letter will be completed during this class.

IDSN 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Consent of instructor. Directed research and study on an individual basis.
IMD - Immunology Infectious Diseases

IMD 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) On Demand
PREREQUISITE: Sophomore standing. Directed undergraduate research. Course will address responsible conduct of research.

IMD 291. Special Topics. 1-3 Credits. (1-3 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Course prerequisites as determined by each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

IMD 452. Protein Biochemistry. 1 Credit. (1 Lab) On Demand
PREREQUISITE: IBID series or consent of instructor. Principles and techniques involved in biochemical analysis of proteins.

IMD 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Course prerequisites as determined by each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

IMD 501. Expert Immunology/Pathology. 3 Credits. (3 Lec) 5 alternate years to be offered every years. PREREQUISITE: BIOB 410. Recent advances in and history of immunochemistry, immunogenetics, immunopathology, molecular and cellular immunology. Cross-listed with Microbiology 525.

IMD 505. Eukaryotic Gene Regulation. 3 Credits. (3 Lec) 5 alternate years to be offered odd years. PREREQUISITE: CHMY 442 and graduate standing. Students in this course study the fundamental mechanisms of eukaryotic gene expression and this knowledge is placed within the context of modern genomics approaches. The course is divided between traditional lectures and a review of current literature in genome science, functional genomics (mRNA expression), and proteomics. Students learn basic informatics skills through a hands-on analysis of genome data with an emphasis on what can, and cannot, be learned from genome data.

IMD 521. Laboratory Rotation I. 2 Credits. (1 Lab) F
PREREQUISITE: Must be a first year IMD Graduate Student. An independent scientific project within a IMDIMD research laboratory. Student should identify a question, master the necessary methods, collect and analyze data, and interpret how the data addresses the question. Final results are presented in a 15-minute departmental seminar.

IMD 522. Laboratory Rotation II. 2 Credits. (1 Lab) S
PREREQUISITE: Must be a first year IMD Graduate Student. The IMD laboratory in which IMD 522 is performed must be different from the laboratories in which IMD 521 was performed. An independent scientific project within a IMD research laboratory. Student should identify a question, master the necessary methods, collect and analyze data, and interpret how the data addresses the question. Final results are presented in a 15-minute departmental seminar.

IMD 523. Laboratory Rotation III. 2 Credits. (1 Lab) S
PREREQUISITE: Must be a first year IMD Graduate Student. The IMD laboratory in which IMD 523 is performed must be different from the laboratories in which IMD 521 and IMD 522 were performed. An independent scientific project within a IMD research laboratory. Student should identify a question, master the necessary methods, collect and analyze data, and interpret how the data addresses the question. Final results are presented in a 15-minute departmental seminar. An independent scientific project with a IMD research laboratory.

IMD 575. Professional Paper. 1-4 Credits. (1-4 Ind; 6 cr max) On Demand
IND Maximum 6 cr. PREREQUISITE: Graduate Standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student, the major advisor, and graduate committee.

IMD 589. Graduate Consultation. 3 Credits. (3 Ind; max unlimited) F,S
PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

IMD 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing.

IMD 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

IMD 592. Independent Study. 1-4 Credits. (1-4 Ind; 8 cr max) On Demand
Max 6 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

IMD 594. Seminar. 1 Credit. (1 Sem; 4 cr max) F,S
Max 4 cr. PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses.

IMD 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral standing.

ITS - Information Technology Systems

ITS 110. Introduction to Networking and Cabling. 3 Credits. (2 Lec, 1 Lab) F
S
This course introduces students to current and emerging technology information and hands-on exposure to networking skills, that will empower them to enter employment or further education and training in the computer networking field.

ITS 142. CCNA 2: Discovery. 4 Credits. (2 Lec, 2 Lab) F
COREQUISITES: ITS 140 - Intro to Networking and Cabling, this course should be taken as a co-requisite, if student is attending part-time, ITS 140 should be taken first year and ITS 142 2nd year. Students will learn skills necessary to design, build, and maintain small to medium size networks.

ITS 163. Windows and Configuration. 4 Credits. (2 Lec, 2 Lab) S
This course is intended for students who want to learn about the Windows operating systems, networking fundamental, Operating system upgrades/configuration, installation procedures, security issues, backup procedures, remote access, command line, and graphical user interfaces. Second of a two-course sequence covering the A+ certification objectives.

ITS 164. Networking Fundamentals. 3 Credits. (2 Lec, 1 Lab) F
COREQUISITE: ITS 140. This course should be taken as a co-requisite if student is attending part-time. ITS 140 should be taken first semester and ITS 142 2nd semester along with this course. This course is an introduction to networking fundamentals with both lecture and hands-on activities. Topics include the OSI model and industry standards, network topologies, IP addressing (including subnet masks), and basic network design. Concepts are reinforced with lab activities using equipment in live and simulated environments.

ITS 170. Microsoft Windows Serve. 4 Credits. (2 Lec, 2 Lab) S
This course covers the ins and outs of the Windows operating system and prepares students to pass the Windows certification exam objectives of the operating system. This course is intended for students who want to learn about the Windows operating system and prepare to pass the Microsoft certification exam from CompTIA (Windows Server 2012). After you finish this course, you’ll have an in-depth knowledge of Windows Server 2012/R2, including installation, local and remote management, file and storage services, Active Directory, group policies, TCP/IP, networking services, and Hyper-V virtualization. Both the original release of Windows Server 2012 and the R2 release are covered.

ITS 218. Network Security. 3 Credits. (1 Lec, 1 Lab) S
This course focuses on the security issues, backup procedures, remote access, command line, and graphical user interfaces. Concepts are reinforced with lab activities using equipment in live and simulated environments.

ITS 224. Introduction to Linux. 4 Credits. (2 Lec, 2 Lab) S
This course is intended for students who want to learn about the Linux operating system and prepare to pass the Linux certification exam from CompTIA (Powered by LPIC). It does not assume any prior knowledge of Linux and is geared toward those interested in systems administration as well as those who will use or develop programs for Unix systems. The course provides comprehensive coverage of topics related to Linux certification, including Linux distributions, installation, administration, X-Windows, networking, and security.

ITS 280. Computer Repair Maintenance. 4 Credits. (2 Lec) S
This course teaches advanced hardware theory and practical application with the emphasis on individual computer components. Successful students will know how to identify and install appropriate computer hardware.
JPNS - Japanese

JPNS 101. Elementary Japanese I. 3 Credits. (3 Lec)
Elementary course designed to help students acquire basic language skills in Japanese: reading, writing, listening, speaking. Introduction to Japanese writing systems (hiragana, katakana, kanji). Emphasis on establishing correct pronunciation and grasp of grammar. Cultural perspectives such as greetings, simple dialogues.

JPNS 102D. Elementary Japanese II. 3 Credits. (3 Lec)
PREREQUISITE: JPNS 101 or equivalent, or placement interview with instructor. Continuation of JPNS 101. Expansion of cultural knowledge.

JPNS 150D. Japanese Culture & Civ. 3 Credits. (3 Lec)
PREREQUISITE: WRIT 101W or consent of instructor. Survey of Japanese society, literature, art, and religion from earliest times to the modern period. All readings and discussions in English. No knowledge of Japanese necessary.

JPNS 193. Study Abroad. 12 Credits.

JPNS 201D. Intermediate Japanese I. 3 Credits. (3 Lec)
PREREQUISITE: JPNS 102D or equivalent, or placement interview with instructor. Review of skills acquired in elementary Japanese, followed by additional study of grammatical patterns and vocabulary acquisition. Emphasis on gaining basic conversational skills and improving reading. Expansion of cultural knowledge.

JPNS 202D. Intermediate Japanese II. 4 Credits. (4 Lec)
PREREQUISITE: JPNS 201D or equivalent, or placement interview with instructor. Continuation of JPNS 201D. Students who successfully complete this course will have "survival" skills for daily life in Japan, and will be ready for more advanced course work using authentic materials. Expansion of cultural knowledge.

JPNS 293. Study Abroad. 12 Credits.

JPNS 305. Japanese Adv Conversations. 3 Credits. (3 Lec)
PREREQUISITE: JPNS 202D or placement interview with instructor. Review and further development of communication skills with an emphasis on both speaking and writing for various occasions. Cultural and social topics are explored through authentic materials to enhance knowledge of Japan and its people.

JPNS 320. Classical Japanese Literature. 3 Credits. (3 Lec)
PREREQUISITE: WRIT 101W or consent of instructor. Study of poetry, drama, and narrative from earliest times to mid-nineteenth century. All readings and discussions in English. No knowledge of Japanese necessary.

JPNS 321. Modern Japanese Literature. 3 Credits. (3 Lec)
PREREQUISITE: WRIT 101W or consent of instructor. Study of novels, short stories, and poems written by Japanese authors from the mid-nineteenth century onward. Covers Japan's initial encounter with the West and the establishment of individual identity. All readings and discussions in English. No knowledge of Japanese necessary.

JPNS 325IH. Outcast Literature. 3 Credits. (3 Lec)
PREREQUISITE: WRIT 101W or consent of instructor. A study of literature written in Japan by women, minorities, foreigners and outcasts—all those regarded as "other" in relation to mainstream Japanese culture. No knowledge of Japanese necessary.

JPNS 340. Japanese Adv Reading & Grammar. 3 Credits. (3 Lec)
PREREQUISITE: JPNS 202D or placement interview with instructor. Review and further development of grammar and vocabulary skills necessary for improved reading proficiency in Japanese. Topics for study address Japanese culture and society through manga/cartoons, newspapers, magazines, correspondence, and short essays, with some translation and comparison with English.

JPNS 361IH. Japanese Text and Cinema. 3 Credits. (3 Lec)
PREREQUISITE: WRIT 101W or consent of instructor. A study of literature written in Japan by women, minorities, foreigners and outcasts—all those regarded as "other" in relation to mainstream Japanese culture. No knowledge of Japanese necessary.

JPNS 365. Sem: Japanese Lit and Culture. 3 Credits. (3 Sem)
PREREQUISITE: JPNS 315 or JPNS 350. Senior capstone course. Topics offered at the upper division level which are not covered in regular courses. Students conduct individual research projects while also preparing and presenting discussion materials.

JPNS 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max)
PREREQUISITE: Junior standing and consent of instructor. Directed research and study on an individual basis.

JPNS 493. Study Abroad. 12 Credits.

KIN - Kinesiology

KIN 105. Foundations of Exercise Science. 3 Credits. (3 Lec) F,S
The aim of this course is to integrate the subdisciplines of exercise science (nutrition, biomechanics, exercise physiology, motor control, and exercise psychology) from the perspectives of definitions, basic science with application to health, fitness, and athletic performance.

KIN 221. Hlth Anatomy & Physiology. 3 Credits. (3 Lec) F,S
This course will focus on the key elements of anatomy and physiology necessary for students in allied health professions, specifically those who will work the areas of community health, health enhancement education, health promotion, and kinesiology. The aim of this course is for students to demonstrate working knowledge of the muscular, skeletal, nervous, cardiovascular, and respiratory, endocrine, and digestive systems, as well as body metabolism.

KIN 270. Exercise Prog for Older Adults. 3 Credits. (2 Lec, 1 Lab) S
Students will examine the special exercise-related needs of older adults and learn how to safely and effectively meet those needs. The lab will provide practical experience working with older adults in exercise program for seniors.

KIN 304. Tech Applications in Hlth Sci. 3 Credits. (3 Lec) S
Skills, knowledge, and applications necessary for integrating technology into developmentally appropriate teaching practices in Health Enhancement. Identifies theories, principles, and strategies for the integration of technology into physical education, physical activity, and health settings.

KIN 320. Exercise Physiology. 4 Credits. (3 Lec, 1 Lab) F,S
PREREQUISITE: Grade of "C" or better in BIOH 201 or KIN 221, or permission of instructor. Topics include factors and mechanisms involved with causing changes and adaptations in the physiological responses to training and participating in strength and endurance sports and activities. Lectures and labs emphasize explaining common observations and practices from the physiological viewpoint.

KIN 322. Kinesiology. 4 Credits. (3 Lec, 1 Lab) F,S
PREREQUISITE: BIOH 201 or KIN 221, and M core or permission of instructor. Emphasis on the effects of joint structures and muscles on movement of the upper extremity, lower extremity, and spine while providing an introduction to the principles of biomechanics.

KIN 325R. Biomechanics. 4 Credits. (3 Lec, 1 Lab) F,S
PREREQUISITE: HDFS 371, KIN 322, M 151Q or M 161Q, and PHSX 205, COREQUISITES: STAT 216Q. This course emphasizes the effects of structure, motion, forces, and their effects on and within the human body using both qualitative and quantitative analyses. Additional emphasis will be placed on the development of critical thinking skills associated with biomechanics-related research and interpretation.

KIN 335. Tissue Injury & Adaptation. 3 Credits. (3 Lec) F,S
PREREQUISITES: KIN 221 or BIOH 201. The aim of the course is to enhance students' understanding of muscle and connective tissue physiology through topics on injury, rehabilitation, and evidenced-based interventions. Students will explore injury-acute and overuse while describing the injury and repair process. Other topics will include pain theory and the physiology of wound healing.

KIN 410. Adv Strength Training and Cond. 3 Credits. (3 Lec) F,S
PREREQUISITE: KIN 320. Emphasizes the use of critical thinking skills for exercise development and progressions based on fundamental principles from kinesiology, biomechanics, exercise physiology, motor control, and motor learning. Preparation to obtain the Certified Strength and Conditioning Specialist (CSCS) certification. Emphasizes the practical application of this material to the areas of personal training, physical therapy, health enhancement teaching, and exercise physiology is emphasized.

KIN 412. Field-Based Fitness Assessment. 3 Credits. (2 Lec, 1 lab) S
PREREQUISITES: KIN 320 and KIN 322, or KIN 325R. COREQUISITES: With permission of the instructor the pre-requisites may be taken concurrently. This course is designed to provide the students with the opportunity to examine and conduct physical performance field-based assessments. Field-based assessments take place in an environment that is less controlled than in laboratory settings, and where the variables that are collected are typically used to predict physiological variables.

KIN 415. Adv Exercise Test and Prescrip. 4 Credits. (3 Lec, 1 Lab) S
PREREQUISITE: KIN 320, STAT 216Q, with grade "C" or better in each course, or permission of instructor. Senior capstone course. Students are familiarized with the hands-on training and theoretical background needed to competently assess levels of health/fitness in a "low-risk" healthy adult population. Lecture/lab content is structured to prepare students for taking the ACSM Health Fitness Specialist (HFS) certification exam.
KIN 430. Physical Fitness Program Design and Delivery. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: KIN 320. This course focuses on the development, organization, and implementation/administration of physical fitness programs. Includes extensive field experience.

KIN 440R. Sport Psychology. 3 Credits. (3 Lec) PREREQUISITE: HDFS 371 or consent of instructor. The application of basic principles of sport psychology for teachers and coaches, with specific emphasis on motivation, anxiety, and arousal, and selected groups of athletes.

KIN 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) -- Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research.

KIN 491. Special Topics. 3 Credits. (1-4 Lec; 12 cr max) On Demand Max 12 cr. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

KIN 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

KIN 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) F,S,Su Max 12 cr. PREREQUISITE: Consent of instructor. An individualized assignment with a professional agency to provide a guided field experience.

KIN 515. Exercise Performance and Nutr. 3 Credits. (3 Lec) F alternate years offered odd years PREREQUISITE: Knowledge in areas of anatomy and physiology, upper division courses in one or combination of: exercise physiology, biochemistry, or nutrition. This class covers selected topics in exercise physiology, nutrition, and metabolism related to physiological function and performance. The use of nutritional supplements during exercise and the environmental influences on physiological function and metabolism will be addressed.

KIN 525. Neuromechanics of Human Movement. 3 Credits. (3 Lec) S alternate years offered ODD years PREREQUISITE: KIN 221 or KIN 320 or KIN 325. Students will study the concepts, terms, and methods of investigating biomechanics, neuroscience/neuromechanics, motor control, and movement disorders in the human movement system.

KIN 545. Graduate Exercise Physiology. 3 Credits. (3 Lec) F alternate years offered even years PREREQUISITE: Graduate standing; undergraduate exercise physiology. This course defines and explains a conceptual mechanistic-driven model that explains the basis for maximizing human performance. The instructor relies heavily on readings from the current research literature and student participation to understand the plethora of topics covered.

KIN 575. Professional Paper and Project. 1-6 Credits. (1 Ind; 6 cr max) F,S,Su PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

KIN 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, and consent of instructor and Dean of the Graduate School. Courses offered on a one-time basis to fulfill professional development needs of in service educators. A specific focus is given to each course which is appropriately subtitled. May be repeated.

KIN 589. Graduate Consultation. 1-3 Credits. (1 Ind; 3 cr max) F,S,Su PREREQUISITE: Master's standing and approval of committee chair. This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty or staff time or help.

KIN 590. Master's Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S,Su PREREQUISITE: Master's standing. Directed graduate research/creative activity. May be repeated.

KIN 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Max 12 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

KIN 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Graduate standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

KIN 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand Max 4 cr. PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level that are not covered in regular courses. Students participate in preparing and presenting discussion material.

KIN 598. Internship. 2-12 Credits. (2 Ind; 12 cr max) On Demand Max credits unlimited PREREQUISITE: Graduate standing, and consent of instructor. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

LIBR - Library

LIBR 289R. Undergrad Resch/Instruction. 1-3 Credits. (1-3 Rct; max unlimited) F,S Classroom instruction associated with directed undergraduate research/creative activity projects. May be repeated.

LIBR 291. Special Topics. 1-3 Credits. (1 Lec; 12 cr max) On Demand Max 12 cr. Information literacy involves the capacity to recognize when information is needed and the ability to locate, evaluate, and use it effectively. Students in this course will learn to find information of increasing degrees of complexity in print and electronic formats.

LIBR 489R. Undergraduate Research. 1-2 Credits. (1-2 Rct; 4 cr max) F,S,Su Max 4 cr. COREQUISITE: LIBR 490. Classroom instruction associated with directed undergraduate research/creative activity projects. May be repeated.

LIBR 491. Special Topics. 1-3 Credits. (1 Lec; 12 cr max) On Demand Max 12 cr. Information literacy involves the capacity to recognize when information is needed and the ability to locate, evaluate, and use it effectively. Students in this course will learn to find information of increasing degrees of complexity in print and electronic formats.

LIBR 592. Independent Study. 1-4 Credits. (1-4 Ind; 8 cr max) F,S,Su Max 8 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of Associate Dean of Libraries, and Dean of Graduate Education. An individual assignment arranged with an agency, business, school, or other organization to provide guided experience in the field.

LING - Linguistics

LING 210IH. Intro to Language/Linguistics. 3 Credits. (3 Lec) F,S Examines the nature and function of linguistic systems, the psychology of language, the relationship between language and culture, usage patterns, linguistic variety and change, and levels of linguistic analysis.

LING 238. Structure and Function of Language. 3 Credits. (3 Lec) F,S,F,S,Su Focused study of how meaning is made in the English language, primarily through grammar. From parts of speech to sentence construction, this course will assist students in evaluating literary writing styles as well as in improving their own.

LING 338. Language and English Education. 3 Credits. (3 Lec) F,S Explores the various roles language has in secondary English pedagogy and policy. Special attention given to issues related to language diversity, language and identity, discourse analysis, and socio-political functions of language.

LIT - Literature

LIT 110IH. Introduction to Literature. 3 Credits. (3 Lec) F,S,F,S,F Examines the nature and function of linguistic systems, the psychology of language, the relationship between language and culture, usage patterns, linguistic variety and change, and levels of linguistic analysis.

LIT 169IH. Literature as Popular Culture. 3 Credits. (3 Lec) S Examines the interrelationships between high and low (popular) cultural traditions, emphasizing the social and artistic significance of popular cultural texts.

LIT 201. Intro to Literary Studies. 3 Credits. (3 Sem) F,S,S Examines the nature and function of linguistic systems, the psychology of language, the relationship between language and culture, usage patterns, linguistic variety and change, and levels of linguistic analysis.
LIT 202CS. The Environmental Imagination. 3 Credits. (3 Lec) S
An exploration of major developments in the study of environmental literature that introduces students to current debates and discussions about how diverse cultures have imagined the human place in the nonhuman world.

LIT 203H. Great Books. 3 Credits. (3 Lec)
An introduction to some of the "great books" of literary history and an exploration of why and how they have been regarded as great. Students engage with major, canonical literary works from classical antiquity to the present.

LIT 214D. Regional Literature. 3 Credits. (3 Lec) F,S
Examination of American literary regions in the context of critical multiculturalism. Analyzes topics such as the development of local color writing, borders/ transnational studies, and the concept of the frontier as contact zone. May focus on a specific regional literature or adopt a comparative approach.

LIT 233. Classical Foundations of Literature. 3 Credits. (3 Rec) S
Study of the literature of Classical Greece and Rome and how this tradition has influenced subsequent literature.

LIT 240. The Bible as Literature. 3 Credits. (3 Lec) F
Study of the Bible and related texts and how this tradition has influenced subsequent literature.

LIT 285D. Mythologies. 3 Credits. (3 Lec) F,S
The study of specific cultural mythologies to explore the nature, function, and theory of myth.

LIT 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Maximum 12 cr. PREREQUISITE: None required but some may be determined necessary by the department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

LIT 292. Independent Study. 1-3 Credits. (1-3 Ind. Study) On Demand
Directed research and study on an individual basis.

LIT 300. Literary Criticism. 3 Credits. (3 Lec) S
PREREQUISITE: Sophomore standing and a 200 level LIT course. Historical survey of principles, problems, and strategies of literary criticism.

LIT 308. Multicultural Literature. 3 Credits. (3 Lec) S
PREREQUISITE: Sophomore standing and any 200-level Literature course. Focuses on literature by American minorities, women, and ethnic subcultures.

LIT 310. American Literature to 1900. 3 Credits. (3 Lec) S alternate years, to be offered every even years.
PREREQUISITE: Sophomore standing and any 200-level Literature course. Intensive studies in early American literature, with attention to development of a distinct national literature and culture.

LIT 311. American Literature after 1900. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: Sophomore standing and any 200-level Literature course. Intensive studies in selected literary works by 20th-century American writers, with attention to historical context, particularly America's evolving national culture.

LIT 320. Advanced British Literature I (Formerly LIT 324). 3 Credits. (3 Lec) F
PREREQUISITE: Sophomore standing and any 200-level Literature course. Intensive studies in selected literary works from the origins of British literature to 1660, with attention to historical and cultural context.

LIT 321. Advanced British Literature II (Formerly LIT 325). 3 Credits. (3 Lec) F
PREREQUISITE: Sophomore standing and any 200-level Literature course. Intensive studies in selected literary works by British writers of the Restoration period, the eighteenth century, and the early nineteenth century, with attention to historical and cultural context.

LIT 322. Advanced British Literature III (Formerly LIT 326). 3 Credits. (3 Lec) F
PREREQUISITE: Sophomore standing and any 200-level Literature course. Intensive studies in selected British literary works from the early nineteenth century to the present, with attention to historical and cultural context.

LIT 335. Women and Literature. 3 Credits. (3 Lec) F
Alternate Odd Years PREREQUISITE: Sophomore standing and a 200-level LIT course. A study of the relationship between women and literature, with some attention to feminist approaches to critical interpretation.

LIT 371. 20th Century British/American Lit. 3 Credits.

LIT 372. Contemporary British and American Literature. 3 Credits.

LIT 382. Literature for Children and Adolescents. 3 Credits. (3 Lec) F alternate years, to be offered every even years.
PREREQUISITE: Sophomore standing and a 200-level LIT course. Studies in selected literary works for children and young adults. The course may focus on genres, authors, themes, and/or critical approaches.

LIT 411RH. Studies in Major Authors/s. 3 Credits. (3 Lec) 6 cr max F Max 6 cr PREREQUISITE: Sophomore standing and a 200-level LIT course. Intensive study in the works, biography, and criticism of a particular author.

LIT 437. Studies in Literary Genres. 3 Credits. (3 Lec) F alternate years, to be offered every even years.
Max 6 cr PREREQUISITE: Sophomore standing and a 200-level LIT course. Intensive study of a single genre, such as the epic, novel, poem, dream vision, hypertext, or the idea of "genre" itself. Selection and approach will vary with each offering.

LIT 438. Studies in Literary Topics. 3 Credits. (3 Lec; 12 cr max) F Max 12 cr PREREQUISITE: Sophomore standing and at least one 200 level LIT course. Provides an in-depth, rigorous analysis of current trends in literary scholarship. Organized around a specific theme, this course will expose students to new groups of literary works that cut across traditional historical, national, or generic boundaries.

LIT 440. Studies in World Literature. 3 Credits. (3 Lec) S
PREREQUISITE: Sophomore standing and at least one 200 level LIT course. Selected literary works in translation from non-English cultures and/or from English speaking cultures outside the United States and Britain.

LIT 473RH. Studies in Shakespeare. 3 Credits. (3 Lec) S
PREREQUISITE: Sophomore standing and at least one 200 level LIT course. Studies in selected Shakespearean works, drawn from tragedies, comedies, histories, romances, and poetry. Development of Shakespeare's philosophy, poetics, and dramaturgy in the context of the Renaissance.

LIT 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max)
Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research.

LIT 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max)
Independent study of literature.

LIT 494RH. Seminar: Research Issues. 3 Credits. (3 Lec) F,S
PREREQUISITE: Senior standing. Consent of instructor. Senior capstone course for literature majors. Integration and assessment of students' cumulative experiences as English literature majors through specific seminar-style research issues which vary with each offering. Restricted entry.

LRES - Land Resources & Env Sci

LRES 507. Environmental Risk Assessment. 3 Credits. (3 Lec) F
Alternate Even Years Principles of risk analysis, including risk assessment, perception, communication, and management. Emphasis on human toxicology, ecotoxicology, dose-response relationships, exposure analysis, environmental fate, and deterministic and probabilistic risk assessment. Case studies will include examples from pesticides, biotechnology, natural resource extraction, and invasive species. Co-convened with ENSC 407.

LRES 510. Biodiversity Survey and Monitoring Methods. 3 Credits. (2 Lec; 1 Lab) Biodiversity survey and monitoring designs, sampling methods, and data evaluation techniques are introduced. Emphasis is on plants but other taxa are addressed for agricultural, rehabilitation and wilderness systems. One week of fieldwork required prior to semester; course completion 3rd week of October. Co-convened with ENSC 410.

LRES 511. Environmental Data Mgmt. 2 Credits. (2 Lec; 1 Lab) PREREQUISITE: Biomath 415. Critical review of literature on the distribution and activity of microorganisms in natural microbial communities based on microbial adaption and physical, chemical and biological features of the microenvironment. A critical discussion of literature and approaches.

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Montana State University
LRES 521. Holistic Thought & Management. 3 Credits. (3 Lec) S PREREQUISITE: Graduating Students will be able to use holistic systems thinking approaches and Holistic Management process, for problem solving and decision making for complex issues in natural resource management, policy, ethics, research. Students will apply holistic and reductionist thought to their lives.

LRES 525. Applied Remote Sensing. 3 Credits. (2 Lec, 1 Lab) S 3 cr. LEC 2 LAB 1 Applications of remote sensing for graduate students, including advanced studies of multispectral and hyperspectral sensors and image processing algorithms. Emphasis is on using remote sensing technologies for solving applied land resource issues.

LRES 528. Bridging Principles & Practices of Sustainable Cropping Systems. 1 Credit. (1 Rct) alternate years to be offered odd years 1 cr. REC 1 PREREQUISITE: Any graduate student or undergraduate student with approval from the instructor. The course goal is to elevate agricultural students’ awareness of peer-reviewed literature that demonstrates application of principles to address issues of sustainability in cropping systems. The course will use a student-lead discussion format to highlight issues and principles in a series of papers that the class will read. The course will emphasize the practical interaction among agronomy, ecology, economics, and sociology to create an awareness of the interdisciplinary issues associated with sustainability in agriculture.

LRES 529. Cropping Systems and Sustainable Ag. 3 Credits. (3 Lec) PREREQUISITE: AGSC 341 or AGSC 342: graduate standing or consent of instructor. The course goal is to elevate agricultural students’ awareness of peer-reviewed literature that demonstrates application of principles to address issues of sustainability in agriculture. The course will use a student-lead discussion format to highlight issues and principles in review of a series of papers that the class will read, will focus on the interaction among agronomy, ecology, economics, and sociology to create an awareness of the interdisciplinary issues associated with sustainability in agriculture. Topical issues associated with climate change impacts, system resilience and thresholds and ways to understand complex interactions will be considered for discussion. Co-convened with AGSC 428.

LRES 530. Natural Resource Law. 3 Credits. (3 Lec) S 3 cr. LEC 3 The course examines major natural resource laws, emphasizing the federal model. A modified case study approach is used to review legislation and related court cases governing natural resources, including water, minerals, timber, range, wildlife, recreation, and wilderness. Co-convened with NRSN 430.

LRES 531. Applied Watershed Hydrology. 3 Credits. (3 Lec)S PREREQUISITES: ENSC 245 or GEO 325 Patterns of streamflow, their measurement, quantitative characterization, underlying physical processes including precipitation, evapotranspiration, snowmelt, and subsurface hillslope runoff, and channel flow are examined. Applications to aquatic and riparian resources, environmental problems, and human safety are emphasized.

LRES 532. Soil Ecosystems and Processes. 3 Credits. (3 Lec)S PREREQUISITE: BIO 160 This course focuses on biological and non-biological processes in soil ecosystems. Topics covered are soil’s function and role within our environment, nutrient and carbon cycling in soil, and effects of human activities and disturbance on soil and ecosystem function.

LRES 533. Wetland Ecology & Management. 3 Credits. (3 Lec)S PREREQUISITES: General Biology, General Ecology. This class will examine wetland ecology and the management of resources. Students will study hydrological and geomorphic processes at watershed and site scales, how processes drive wetland hydrology and hydric soil development and maintenance, and the interaction with biological systems.

LRES 534. Environmental Data Analysis. 3 Credits. (3 Lec)S PREREQUISITE: M 121Q or equivalent. Modern sciences are data-driven and this course focuses on making sense of data, both quantitatively and conceptually. Topics include a review of relevant algebra skills, methods to describe data, inferential statistical methods, sampling, experimental design, & regression focusing on interpretation.

LRES 535. Techniques of Spatial Analysis. 3 Credits. (2 Lec, 1 Lab) S (2 Lec, 1 Lab) PREREQUISITE: Either GPHY 426, 429R, 284, or 504 or LRES 525, and either STAT 401 or 411, or graduate standing and permission of instructor. Exploration and understanding of analytical techniques needed to deal with spatially correlated data. Emphasis is placed on practical applications within geographic information systems and image processing.

LRES 536. Ecology of Invasive Plants II. 1 Credit. (1 Lec)S PREREQUISITE: LRES 569 Through this course, students will learn to organize plant population data and analyze it to determine population temporal and spatial dynamics. In addition they will learn how to apply the conclusions drawn from the analysis to invasive species management decisions.

LRES 540. Ecology Plants & Community. 3 Credits. (3 Rct) F PREREQUISITES: General biology (BIOB 160), and general ecology (BIOB 258) and general statistics (STAT 216Q) and college mathematics. This course will explore plant ecology at the individual, population and community levels. Topics include plant response to stress, population biology, and community assembly, and possibly non-native species and restoration. Quantitative measures for assessing populations and communities will be addressed.

LRES 543. Agroecology/App Upland Plant Ecology. 3 Credits. (2 Lec, 1 Lab) S alternate years to be offered even years 3 cr. LEC 2 LAB 1 PREREQUISITE: BIOE 370, M 171, ENSC 443, STAT 216 Focus on the principles and theories of population and community ecology as they relate to invasive plant species in natural and agroecosystems. Measuring plant interference and assessing population interactions and dynamics through empirical and theoretical models. Review theory and methodology concerning plant population demographics, dispersal , and natural trait selection. Examine the role of biodiversity and evolution in determining sustainable management of ecosystems.

LRES 544. Water Quality. 3 Credits. (3 Lec) F PREREQUISITES: ENSC 110 or equivalent This course covers water quality fundamentals (physical, biological, and chemical) and integrates science-policy management and research. This course uses examples from county Extension, watershed groups, conservation districts, and agencies across Montana interfaced with MSU hydrology and water quality research.

LRES 545. Watershed Analysis. 3 Credits. (3 Lec) S 3 cr. LEC 2 LAB 1 PREREQUISITE: ENSC 444 and STAT 216 or BIO 318 Conceptual and quantitative analysis of watershed processes with an emphasis on modeling surface water hydrology and water resources management. Watershed modeling concepts including analysis of time series, spatially variable data, model calibration, and uncertainty analysis will be studied and demonstrated. The course will emphasize critical analysis of current hydrologic computational methods and hands-on use of watershed models.

LRES 546. Quant Methods Environmental. 3 Credits. (3 Lec) S Alternate Even Years PREREQUISITE: STAT 410 and ENSC 444 Introduction and application of numerical skills desirable for watershed and environmental modelers, including applied time series analysis, applied spatial statistics, introducing programming skills, and fundamental strategy of watershed hydrological process. The course will focus on the use of real life and relevant environmental/watershed case studies and examples to illustrate theory.

LRES 552. Adv Soil/Environ Microbiology. 3 Credits. (3 Lec) S alternate years to be offered even years 3 cr. LAB 3 PREREQUISITE: Graduate standing or consent of instructor. Advanced laboratory course wherein students define a project de novo, design and execute the appropriate experiments, interpret data appropriately, and then assemble the results into a written format that thoroughly discusses the project and outcomes. Projects may include the isolation and characterization of specific microorganisms or the study and in-depth characterization of select biogeochemical cycles catalyzed by microorganisms. Classic, novel, and ecologically relevant incubation approaches are used with the pertinent environmental samples that typically include soil, lake, river or groundwater samples.

LRES 554. Soil Landscape Modeling. 3 Credits. (2 Lec, 1 Lab) S alternate years to be offered odd years LEC 2 LAB 1 PREREQUISITE: ENSC 454 and STAT 410. Quantitative soil-landscape modeling with an emphasis on multi-variate spatial statistics, digital terrain modeling, and underlying landscape processes. The course is built around ‘hands-on’ projects and discussions of peer-reviewed literature.

LRES 555. Aquatic Geochemistry. 3 Credits. (2 Lec) S alternate years to be offered odd years 3 cr. LEC 2 REC 1 PREREQUISITE: CHMY 211, CHMY 228, ENSC 245 or equivalent. Advanced coverage of aquatic geochemistry in terrestrial and aquatic systems including chemical processes such as complexation, precipitation-dissolution, sorption-desorption, partitioning, oxidation-reduction and gas-water equilibria. Applications of these principles will be demonstrated in subject areas including biogeochemical cycling, bioremediation, contaminant fate and transport, salt-affected soils and wetland processes. Recitation will focus on current literature, applied problems, and case studies.

LRES 557. Thermal Biology in YNP. 2 Credits. (1 Lec, 1 Lab) Su 2 cr. LEC 1 RCT/DIS 1 PREREQUISITE: B.S. Science/Science Education; Enrollment limited to M.S. Science Education Graduate Program A survey of the ecology of important organisms common in thermal habitats of Yellowstone National Park, including a review of different life forms (prokaroytes and eukaryotes) and their modes of metabolism, and the physical, and chemical habitats that define their environment. Course includes lecture, laboratory, and field components. Students will be asked to design curricula for K-12 audiences.
LRES 558. Isotope Biogeochemistry. 2 Credits. (1 Lec) S alternate years
to be offered every even years PREREQUISITE: Consent of instructor. Fundamentals and
applications of isotope systems useful in the environmental sciences, including light
elements such as carbon, mid-mass elements such as iron, and heavy elements such as
uranium. Measurement techniques will be discussed, and application to student
inspired questions explored.

LRES 561. Belowground Plant Ecology. 3 Credits. (3 Lec) S alternate years, to be
offered odd years.
PREREQUISITE: STAT 401 or equivalent; BIOE 370 or equivalent; BISO 433 or equivalent.
Application of basic ecological principles to belowground interactions of
plant communities. Topics include plant competition, belowground herbivory, plant-
microbe interactions including mycorrhizae, and diversity/productivity links in soil
systems. Case studies will include invasive species, restoration scenarios, sustainable
agriculture, and wildland communities.

LRES 562. Land Rehab Field Problem. 2 Credits. (2 Lab) S alternate even years,
PREREQUISITE: ENSC 460, ENSC 461. Extended field trip to numerous drastically disturbed sites across the Northern Plains. On-site review of
land rehabilitation problems, solutions, and methodologies. Participation by industry,
regulatory agency staff, and rehabilitation professionals will occur at most sites.

LRES 563. Restoration Ecology. 3 Credits. (3 Lec) F
PREREQUISITE: BIOE 370 or equivalent ecology course. Review of ecosystem
structure and function, and community and population processes in intact systems,
along with the effects of major disturbances on natural systems. Restoration
amendments will be discussed in terms of their effects on ecosystem structure and function.
The course includes case studies, and focuses on plant and soil systems. Co-
convened with ENSC 461.

LRES 564. Fundamentals of Environmental Monitoring. 2 Credits. (1 Lec, 1 Lab) F
Provides a graduate level perspective on field measurement methodology in
environmental science. Foci are electronic transducers, data loggers, and programmatic
approaches to measurement and uncertainty analysis. Incoming students are expected to
have a quantitative undergraduate degree related to environmental science.

LRES 565. Environmental Biophysics. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: BIOE 170 or equivalent and PHSX 205.
The study of physical relationships between organisms, ecosystems, and their
environment. Basic principles of Micrometeorology, Biometeorology, Ecological
Climatology, and Biophysical Ecology as applied to contemporary ecological
challenges. Laboratory sessions will focus on computer exercises using ecosystem
models and field observations. Co-convened with ENSC 465.

LRES 566. Chemical Ecology. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing in LRES Graduate program or permission
of instructor. How organismal interactions are shaped through plant secondary
metabolites—emphasizing the impacts on ecosystems across multiple scales and in
response to a rapidly changing climate. This course combines lectures with student led
discussions on contemporary issues and developments in the field and is also designed
to improve critical readings of the primary literature and effective communication in
science. Cross-listed with ENSC 466.

LRES 567. Biogeochem Analy Synthesis. 1 Credit. (1 Sem) S, alternate years
to be offered every even years. The course is meant to serve as an introduction to the study
of biogeochemical dynamics from an Earth-systems perspective. The course will
consist mostly of readings from primary literature and student-led discussion. We will
choose a problem/question, work together to survey relevant literature through a meta-
analysis, and strive to produce a manuscript for publication.

LRES 568. Ecosystem Biogeochemistry. 3 Credits. (3 Lec) S
Introduction to the study of biogeochemistry and ecosystem dynamics from an Earth-
systems perspective. Discussion will emphasize factors governing the "grand elemental
cycles" of carbon, nitrogen, and phosphorus of Earth's major ecosystems and how
modern human activities are affecting these cycles. Co-convened with ENSC 468.

LRES 569. Ecol of Invasive Plants in GYE. 2 Credits. (1 Lec, 1 Lab) S
2 cr. LEC 1 LAB 1 Current theories on what makes species invasive and what
ecosystem conditions invite or resist non-indigenous plant species will be considered.
Direct involvement in field research associated with testing methodology for
monitoring the invasive potential of several exotic species in the otherwise pristine
mountain environments.

LRES 571. Landscape & Ecosys Ecology. 3 Credits. (3 Rct) F
PREREQUISITE: General Biology, General Ecology, General Statistics. Focuses on
principles and applications of landscape and ecosystem ecology. Students will explore
factors that shape landscape patterns in space and time and consequences for ecosystem
processes. The course explores the methods and tools of landscape and ecosystem
analysis.

LRES 572. Frontiers in Remote Sensing. 1 Credit. (1 Sem) S
Alternate Every Years PREREQUISITES: GPHY 429 or GPHY 426 or LRES 525 or equivalent.
This course focuses on emerging trends, research, and applications in remote sensing.
Each time the course is taught, it will focus on a novel aspect of remote sensing science. Potential topics include UAS, lidar, radar, newly deployed
satellites/sensors, and emerging scientific applications in remote sensing. Students who
have a background and/or interest in remote sensing applications will be exposed to
cutting-edge science, technologies and applications which will broaden their exposure
to this rapidly developing field.

LRES 573. Remote Sensing Env Sci. 3 Credits. (3 Rct) S
PREREQUISITE: General Ecology (BIOE 370) and general statistics (STAT 216Q).
This course focuses on understanding the basics of remote sensing science geared
towards critical interpretation of the applications of remote sensing in environmental
science. In addition, students will be exposed to hands-on exercises in basic digital
image processing and analysis.

LRES 575. Prof Paper & Project. 1-4 Credits. (1-4 Lec) S alternate years, to be
offered odd years.
PREREQUISITE: Graduate standing; ability to work with Microsoft Excel
spreadsheets; practicing educator. The primary goal of this course is to increase the
water resource knowledge of students through hands-on, field-based curriculum.
To accomplish this, students will be asked to adopt a local stream and perform lab
assignments "in the field" to build hands-on water quality monitoring
techniques. The course will improve the teaching skills of secondary science teachers
utilizing distant delivery technologies. By completing this course, secondary science
teachers will have a better understanding and hands-on working knowledge of the
characterization and quantification of water quality as it relates to secondary school
science curriculum and environmental issues on a global scale.

LRES 585. Water Quality in the Classroom for Teachers. 3 Credits. (3 Lec) S
PREREQUISITES: Educator; graduate standing. The goal of this course is to
introduce teachers to the basic principles of water quality in the classroom.
The integral part must have been mutually agreed upon by the student, the major advisor, and graduate committee.

LRES 587. Landscape & Ecosys Ecology. 3 Credits. (3 Lec) F
PREREQUISITE: Biology, General Ecology, General Statistics. Focuses on
principles and applications of landscape and ecosystem ecology. Students will explore
factors that shape landscape patterns in space and time and consequences for ecosystem
processes. The course explores the methods and tools of landscape and ecosystem
analysis.
LRES 589. Graduate Consultation. 3 Credits. (Ind) F,S,Su
3 cr. TUT PREREQUISITE: Master’s standing, consent of instructor and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their coursework (thesis, if on a thesis plan), but who need additional faculty or staff time or help.

LRES 590. Master’s Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S,Su
1 - 10 cr. IND Maximum credits unlimited. PREREQUISITE: Master’s standing.

LRES 591. Special Topics. 1-4 Credits. (1 Rec; 12 cr max) On Demand
1 - 4 cr. Maximum 12 cr. PREREQUISITE: Upper division course and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need or given on a trial basis to determine acceptability and demand before requesting a regular course number.

LRES 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
1 - 3 cr. IND Maximum 6 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of department head, and Dean of Graduate Studies. Directed research and study on an individual basis.

LRES 594. Seminar. 1 Credit. (1 Sem; 6 cr max) F,S,Su
1 cr. SEM Maximum 6 cr. PREREQUISITE: Graduate standing or senior by petition. Course prerequisites as determined for each offering. Students prepare, present, and critique scientific presentations.

LRES 598. Internship. 2-4 Credits. (2 Ind; 12 cr max) On Demand
2 - 4 IND Maximum 12 cr. PREREQUISITE: Graduate standing, consent of instructor and approval of department head, and Dean of Graduate Studies. An individualized assignment arranged with an agency, business or other organization to provide guided experience in a field of study.

LRES 690. Doctoral Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S,Su
1 - 10 cr. IND Maximum credits unlimited. PREREQUISITE: Doctoral standing.

LS - Liberal Studies

LS 101US. Interdisciplinary Ways of Knowing. 3 Credits. (3 Sem) F
Introduction to the processes of academic inquiry through examination of topics in disciplines encompassed by the Fine Arts, Humanities, Natural Sciences, and Social Sciences.

LS 102. Intro Liberal Studies. 1 Credit. (1 Sem) S
PREREQUISITE: University Seminar (US Course) or consent of instructor. An introduction to the history and philosophy of liberal education and a review of the Fine Arts, Humanities, Social and Natural Science disciplines. The LS degree components and options will be explained, as will career opportunities.

LS 103. Gateway to Sustainability. 3 Credits. (3 Lec) F
This course introduces students to the historical and philosophical background of sustainability, while acquainting them with the economic, scientific, and regulatory environments within which conversations about sustainability occur. It arms students with the theoretical, methodological, and political tools to begin envisioning a sustainable future for Earth’s inhabitants.

LS 191. Special Topics. 1-4 Credits.

LS 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

LS 301. Integrative Seminar. 1-3 Credits. (1-3 Sem; 6 cr max) F,S
PREREQUISITE: University Seminar and sophomore standing. The integration of knowledge, theories, and concepts across different disciplines in the Fine Arts, Humanities, Natural Sciences, and Social Sciences.

LS 350. Literature Reviews: Theory & Practice. 3 Credits. (3 Sem) S
PREREQUISITE: WRIT 101 This interdisciplinary course examines scholarly information resources, literature review processes, and effective techniques for tracking citations. Covers advanced literature research methodologies and prepares students for reading and creating literature reviews for their capstones, senior projects, and other in-depth research endeavors.

LS 411. Sustainability & Human Values. 3 Credits. (3 Lec) S
PREREQUISITE: Junior standing and ‘Q’ core course This course examines sustainability historically and from a contemporary cultural values perspective as a moral, ethical, and philosophical, and practical question in the context of current issues such as conservation, alternative energy, local foods, local economy, and the community deal.

LS 450. Evolution and Public Opinion. 3 Credits. (1 Lec; 2 Rec) S
This course will explore what evolution is and how it works. We will examine the creationist and Intelligent Design arguments against evolution, as well as the implications of this debate on public education and the public perception of science.

LS 451. Film, Photos, and Culture: A Global Perspective. 3 Credits. (3 Sem) S
This course is designed to improve student’s intercultural competence – the ability to work effectively with cultural difference. Films, television, TEDs and photos are used to identify and analyze the differing dimensions of global culture, and to learn various methods of adaptation.

LS 452. This is Your Brain on Art and Music. 3 Credits. (3 Sem) F
This course will also discuss the neurological effects as well as the emotional effects that art and music have on human beings. In addition to this, it will also discuss the alleged healing properties of art and music (i.e. music therapy, art therapy).

LS 460. Teaching Internship. 2 Credits. (2 Ind) F,S,Su
PREREQUISITE: US core and consent of instructor. As co-facilitators of a section of LS 101US, students will acquire and have the opportunity to practice classroom teaching strategies and mentoring skills.

LS 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su
Max 12 cr. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

LS 491. Special Topics. 1-4 Credits. (1-4 Lec) F
Maximum 12 cr. Maximum 12 cr. PREREQUISITE: Course prerequisites are dependent on the offering. Courses not required in any curriculum for which there is a particular one-time need or given on a trial basis to determine acceptability and demand before requesting a regular course number.

LS 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
Max 6 cr. Directed research and study on an individual basis.

LS 499. Senior Project. 4 Credits. (4 Sem) F,S
PREREQUISITE: Senior status, Foreign language/Foundation courses completed, and department consent required. Senior capstone course. Opportunity for Liberal Studies majors to apply knowledge and experiences acquired throughout the program in researching and designing solutions to contemporary public policy issues.

LSCI - Library Science

LSCI 121. Library Research Skills. 2 Credits. (2 Lec) F,S,Su
Library Research Skills is a course focusing on both the concepts and skills needed to conduct library research with an emphasis on electronic information sources. The purpose of the course is to provide individuals with a basic understanding of the library research process and the skills by which they can successfully find information for research, presentations, and other class assignments. This course may be taught solely online or as hybrid course that contains both classroom and online components.

LSCI 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S,Su
Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

LSCI 316. Bus Info Research Skills. 3 Credits. (3 Lec) F
PREREQUISITE: Junior standing or consent of instructor. Focuses on both the concepts and skills needed to conduct research in various areas of business. Provides individuals with an understanding of the research process and the skills by which they can successfully find business related information for research, presentations, class assignments and personal use.

LSCI 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su
Max 12 cr. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

LSCI 491. Special Topics. 1-3 Credits. (1 Lec) S
On Demand
Max 12 cr. Information literacy involves the capacity to recognize when information is needed and the ability to locate, evaluate, and use it effectively. Students in this course will learn to find information of increasing degrees of complexity in print and electronic formats.

LSCI 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: HSTA 1021H. Internship for archival arrangement and description.

LSCI 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of Department Head. An individual assignment arranged with an agency, business or other organization to provide guided experience in the field.
M - Mathematics

M 005. Co-Req Support for M 105Q. 1 Credit. (1 Lec) F,S
PREREQUISITES: MPLEX Level 2 or higher, ACT 17 or higher, new SAT 460 or 23 or higher, old SAT 420 or higher. COREQUISITES: Must concurrently enroll in the section of M105 with the matching section number. This co-requisite support course allows students who do not meet the prerequisites of M105Q to enroll in specific sections of M105Q. This course will provide an additional day of instruction and will present additional topics to support student success and understanding in M105Q.

M 065. Pre-Algebra. 4 Credits. (4 Lec) F,S
Offered by Gallatin College. This instructor-taught course covers basic concepts relating to fractions, decimals, ratios, proportions, percent, selected geometry topics, topics of signed numbers, and 1-variable linear equations. The course is offered as a review and/or preparation for further studies in Mathematics. This course is equivalent to M 085. Common final.

M 066. Pre-Algebra Lab and Study. 1 Credit. (1 Lec) F
Offered by Gallatin College. Students enrolled in M 065 co-enroll in this course for additional instruction and practice with M 065 curriculum and Math study skills. This course will help students understand Math concepts, practice course material, and prepare for Math tests. Course is offered pass/fail.

M 085. Prealgebra. 4 Credits. (4 Ind) F,S
Offered by Gallatin College. An accelerated lab-based course designed for students who need a review of prealgebra concepts and are prepared to learn in a self-paced, accelerated mode. Topics include signed numbers, fractions, decimals, ratios, proportions, percent, 1-variable linear equations, an introduction to 2-variable linear equations, and selected geometry topics. The course is offered as a review and as preparation for further studies in mathematics. This course is equivalent to M 065.

M 088. Mathematical Literacy. 4 Credits. (4 Lec) F,S
Offered by Gallatin College. Intended for students pursuing majors requiring M 105Q. Develop mathematical literacy through problem solving, critical thinking, writing, and communicating mathematics. Represent and solve relevant, real-world problems using various forms of numbers, equations, and graphs. Topics include proportional reasoning, algebra, geometry, and measurement. Common final.

M 091. Special Topics. 1-4 Credits.

M 096. Survey of Algebra. 4 Credits. (4 Lec) F,S,Su
Offered by Gallatin College. PREREQUISITE: M 065 or M 085 or Math Placement Test within the past 12 months. Offered for students pursuing majors requiring the M 121Q track and/or chemistry. This instructor-taught course initiates development in students’ ability to organize thought processes and systematically solve problems while preparing students for studies in other courses. Topics include linear equations and inequalities and their graphs, systems of linear equations, exponents, polynomials, factoring, rational expressions, and square roots. This course is equivalent to M 097.

M 097. Survey of Algebra (Mastery Learning). 4 Credits. (3 Lec, 1 Lab) F,S
PREREQUISITE: M 065 or M 085 or Math Placement Test within the past 12 months. Offered for students pursuing majors requiring the M 121Q track and/or chemistry. An accelerated lab-based course designed for students who need a review of algebra concepts and are prepared to learn in a self-paced, self-taught mode. Topics include linear equations and inequalities and their graphs, systems of linear equations, exponents, polynomials, factoring, rational expressions, and square roots. This course is equivalent to M 097.

M 105Q. Contemporary Mathematics (formerly M 145Q, Math for Liberal Arts). 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: M 088, M 096, or M 097 or Math Placement Test within the past 12 months. Formerly M 145Q. Designed to give liberal arts students the skills required to understand and interpret quantitative information that they encounter in the news and in their studies, and to make numerically-based decision in their lives. Topics include working with large numbers and units, linear and exponential relations, financial mathematics, and essentials of probability and statistics. Common final.

M 108. Business Mathematics. 3 Credits. (3 Lec) S
Offered by Gallatin College. PREREQUISITE: M 065. Students of this course will examine the mathematics of business ownership and will demonstrate an understanding of business decisions. Concepts to be covered include cash flow, simple and compound interest, inventory valuation, purchasing discounts, cost markup, business and consumer loans, and analysis of financial statements. Additional topics which may be covered include payroll, depreciation, and bonds and annuities.

M 111. Technical Mathematics. 3 Credits. (3 Lec) F,S
Offered by Gallatin College. This course presents basic mathematical topics as they are applied in a trades program. Topics covered include: use of measuring tools, measurement systems, dimensional arithmetic, percent, proportion, applied geometry, basic trigonometry. NOTE: This course is intended for specific programs and does NOT provide sufficient Pre-Algebra material to serve as a prerequisite for students wanting to take additional mathematics.

M 116. Math for Health Careers. 3 Credits. (3 Lec) S
Offered by Gallatin College. Inductive reasoning; logic; mathematical number systems; linear, quadratic, exponential, and logarithmic functions; graphing; probability; English, Apothecary and Metric systems and conversions; dosage calculations; and dimensional analysis. Offered by Gallatin College.

M 121Q. College Algebra. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: M 096, M 097 or Math Placement Test within the past 12 months. Intended for students preparing for precalculus or calculus. Further development of algebraic skills through the study of linear, quadratic, polynomial, exponential, and logarithmic functions. COMMON EXAMS.

M 132. Numbers & Operations for K-8 Teachers. 3 Credits. (3 Lec) F,S
PREREQUISITES: Level 3 Math Placement Test within the past 12 months, B or better in M 096/097 or C- or better in M 121 (see advisor). The study of number and operations for prospective elementary and middle school teachers, including whole numbers, decimals, fractions, percents, integers, operations, numeration systems, and problem solving. COMMON FINAL ONLY.

M 133Q. Geometry & Measure K-8 Teachers. 3 Credits. (3 Lec) F,S
PREREQUISITE: A grade of C or better in M 132. The study of geometry and geometric measurement for prospective elementary and middle school teachers, including synthetic, transformational, and coordinate geometry, constructions, congruence and similarity, 2-dimensional and 3-dimensional measurement, and problem solving. COMMON FINAL ONLY.

M 147Q. Language of Mathematics. 3 Credits. (3 Lec) S
PREREQUISITE: M 088, M 096, M 097 or Math Placement Test within the past 12 months. Reading comprehension and writing skills in the language of mathematics; vocabulary, grammar, syntax and logic; emphasis on understanding, expressing, proving, and thinking mathematical thoughts.

M 149Q. Secrets of the Infinite. 3 Credits. (3 Lec) F,S
PREREQUISITE: M 147Q or Math Placement Test within the past 12 months. Functions, graphs, and the use symbols for expressing mathematical thoughts. Polynomials, rational, exponential, logarithmic, and trigonometric functions. COMMON EXAMS.

M 151Q. Precalculus. 4 Credits. (4 Lec) F,S,Su
PREREQUISITE: M 121Q or Math Placement Test within the past 12 months. Functions, graphs, and the use symbols for expressing mathematical thoughts. Polynomials, rational, exponential, logarithmic, and trigonometric functions. COMMON FINAL ONLY.

M 152Q. Calculus for Technology I. 4 Credits.

M 161Q. Survey of Calculus. 4 Credits. (4 Lec) F,S
PREREQUISITE: M 121Q or Math Placement Test within the past 12 months. Functions, graphs, and the use symbols for expressing mathematical thoughts. Polynomials, rational, exponential, logarithmic, and trigonometric functions. COMMON EXAMS.

M 165Q. Calculus for Technology II. 3 Credits. (3 Lec) F,S
PREREQUISITE: M 151Q or Math Placement Test within the past 12 months. Calculus with emphasis on problems of interest to engineering technologists. Includes analytic geometry, differentiation, and introduction to integration. COMMON FINAL ONLY.

M 166Q. Calculus for Technology III. 3 Credits. (3 Lec) F,S
PREREQUISITE: M 151Q or Math Placement Test within the past 12 months. Calculus with emphasis on problems of interest to engineering technologists. Includes integration, infinite series, and differential equations. COMMON FINAL ONLY.

M 171Q. Calculus I. 4 Credits. (3 Lec) F,S
PREREQUISITE: M 151Q or Math Placement Test within the past 12 months. Functions, elementary transcendental functions, limits and continuity, differentiation, applications of the derivative, curve sketching, and integration theory. COMMON EXAMS.

M 172Q. Calculus II. 4 Credits. (3 Lec) F,S
PREREQUISITE: M 171Q. Methods of integration, applications of the integral, infinite sequences and series including Taylor series, parametric and polar equations. COMMON EXAMS.
### M 181Q, Honors Calculus I. 4 Credits. (4 Lec) F
PREREQUISITE: M 151Q with an "A" grade, 700 on the SAT Math exam, 31 on the ACT Math exam, or an AP Calculus exam, or consent of the instructor. Honors section of M 171Q. Topic coverage parallels M 171Q but with a greater emphasis on theory and more difficult problems.

### M 182Q, Honors Calculus II. 4 Credits. (4 Lec) S
PREREQUISITE: M 171Q with an "A" grade or M 181Q with a "B" grade. Honors section of M 172Q. Topic coverage parallels M 172Q but with a greater emphasis on theory and more difficult problems.

### M 221. Introduction to Linear Algebra. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: M 166Q or M 172Q. Matrix algebras, systems of linear equations, determinants, vector algebra and geometry in Euclidean 3-space, eigenvalues, eigenvectors.

### M 234. Higher Math for K-8 Teachers. 3 Credits. (3 Lec) F,S,Su
PREREQUISITES: A grade of C or better in both M 132 and M 133Q. The study of algebra, number theory, probability and statistics for prospective elementary and middle school teachers, including proportional reasoning, functions, elementary number theory, statistical modeling and inference, and elementary probability theory.

### M 242. Methods of Proof. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: M 172Q. Reasoning and communication in mathematics, including logic, generalization, existence, definition, proof, and the language of mathematics. Topics include functions, relations, set theory, recursion, algebra, number theory, and other areas of mathematics.

### M 273Q, Multivariable Calculus. 4 Credits. (4 Lec) F,S,Su
PREREQUISITE: M 172Q. Topics in two and three dimensional geometry. Manipulation and application of vectors. Functions of several variables, contour maps, graphs, partial derivatives, gradients, double and triple integration, vector fields, line integrals, surface integrals, Green’s Theorem, Stokes’ Theorem, the Divergence Theorem. COMMON FINAL ONLY.

### M 274. Introduction to Differential Equation. 4 Credits. (4 Lec) F,S,Su
PREREQUISITE: M 172Q. An introduction to qualitative, quantitative, and numerical methods for ordinary differential equations. Topics include modeling via differential equations, linear and nonlinear first order differential equations and systems, elementary phase plane analysis, forced oscillations, and Laplace transform techniques. COMMON FINAL ONLY.

### M 283Q. Honors Multivariable Calculus. 4 Credits. (4 Lec) F,S,Su
PREREQUISITE: M 182Q with a ‘B’ grade, M 172Q with an ‘A’ grade, AP Calculus BC exam with a 5, or consent of the instructor. Honors section of M 273Q. Topic coverage parallels M 273Q but with a greater emphasis on theory and more difficult problem solving.

### M 284. Honors Introduction to Differential Equations. 4 Credits. (4 Lec) S
PREREQUISITE: M 283Q with a ‘B’ grade, M 273Q with an ‘A’ grade, or consent of the instructor. Honors section of M 274. Topic coverage parallels M 274 but with a greater emphasis on theory and more difficult problem solving.

### M 290R. Undergraduate Research. 1-8 Credits. (1-8 Ind) F,S,Su
PREREQUISITE: Consent of the department head. Directed undergraduate research. Course will address responsible conduct of research.

### M 328. Higher Math for Sec Teachers. 3 Credits. (3 Lec) F
PREREQUISITE: M 242. Concepts, processes, and proof relevant to school mathematics, including number theory, abstract algebra, combinatorics and probability; a focus on standards-based content for teachers in secondary schools.

### M 329. Modern Geometry. 3 Credits. (3 Lec) S
PREREQUISITE: M 242. A study of Euclidean and non-Euclidean geometries, chosen from: hyperbolic, spherical, projective, finite, transformational, and fractal geometries; computer tools for geometry; a focus on standards-based content for teachers in secondary schools.

### M 330. History of Mathematics. 3 Credits. (3 Lec) F Alternate years, to be offered even years.
PREREQUISITE: M 273Q and M 274 or consent of instructor. Topics will be selected from the entire span of history from Egyptian, Babylonian, and Greek times through the 20th century. The course may focus on milestones that lead to the development of modern mathematics as well as the contributions of great mathematicians from ancient times until today. Some ideas will require mathematical sophistication at the upper division level.

### M 333. Linear Algebra. 3 Credits. (3 Lec) F

### M 348. Techniques of Applied Math I. 3 Credits. (3 Lec) F
PREREQUISITE: M 273Q and M 274. An introduction to advanced analytical techniques frequently used by scientists and engineers to study ordinary differential equations and two-point boundary value problems. Topics include series solution techniques, method of Frobenius, Laplace transforms, Fourier series, and boundary value problems.

### M 349. Techniques of Applied Mathematics II. 3 Credits. (3 Lec) S
PREREQUISITE: M 348. Science and engineering majors often encounter partial differential equations in the study of heat flow, vibrations, electric circuits, and similar areas. Topics include Sturm-Liouville theory, partial differential equations boundary value problems, and Laplace Transform methods.

### M 383. Introduction to Analysis I. 3 Credits. (3 Lec) F
PREREQUISITE: M 273Q and either M 242, M 333, or consent of instructor. A rigorous development of calculus with formal proofs. Functions, sequences, limits, continuity, differentiation, and integration.

### M 384. Introduction to Analysis II. 3 Credits. (3 Lec) S

### M 386R. Software Applications in Mathematics. 3 Credits. (3 Lec) S
PREREQUISITE: M 221, M 273Q, and M 274. An introduction to modern mathematical and scientific computing. Software such as MAPLE and MATLAB will be used to explore, solve, and visualize solutions of standard mathematical problems as well as simple models of various physical and/or biological systems.

### M 419. Ratio and Proportion in School Mathematics. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: For undergraduate credit: A grade of C or better in M 242 or M 234 and junior standing. For graduate credit: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Develop knowledge of ratio and proportion necessary to teach standards-based school mathematics. Connect ratio, rate, and proportion to elementary, middle, and high school topics. Explore use of manipulative materials and technologies, and discuss related pedagogical issues and national standards.

### M 420. Geometry, Measurement, and Data in the Middle Grades. 3 Credits. (3 Lec) S
Alternate Even Years. PREREQUISITE: A grade of C or better in M 234, or M 242, and junior standing. Develop content knowledge necessary to teach standards-based middle school mathematics. Investigate the underlying conceptual structure of topics in geometry, measurement and data analysis appropriate to middle school. Explore the use of manipulative materials and technologies, and discuss related pedagogical issues and national standards.

### M 424. Algebraic Thinking and Number Sense in the Middle Grades. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: For undergraduate credit: A grade of C or better in M 242 or M 234 and junior standing. For graduate credit: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Develop knowledge of ratio and proportion necessary to teach standards-based middle school mathematics. Investigate the underlying conceptual structure of topics in algebra and number appropriate to middle school. Explore the use of manipulative materials and technologies, and discuss related pedagogical issues and national standards.

### M 428. Mathematical Modeling for Teachers. 3 Credits. (3 Lec) F
PREREQUISITE: M 242, M 221 and STAT 217Q. Senior capstone course. Applications of the modeling process in key areas of mathematics and statistics. Simulation and other activities, use of relevant technology, modeling in the secondary curricula, and the classroom assessment of modeling activities. Emphasis on technology and authentic applications using pre-college mathematics.

### M 430. Mathematical Biology. 3 Credits. (3 Lec) S
PREREQUISITE: M 273Q and M 274 or consent of the instructor. Mathematical modeling of basic biological processes in ecology, physiology, neuroscience, epidemiology and molecular biology using difference equations, differential equations, and partial differential equations.

### M 431. Abstract Algebra I. 3 Credits. (3 Lec) S
PREREQUISITE: M 333. Senior capstone course. The integers, integers modulo n, the Euclidean algorithm. Groups, subgroups, normal subgroups, quotient groups, homomorphism and isomorphism theorems, and abelian groups. Rings, ideals, homomorphism and isomorphism theorems. Integral domains, fields, and fields of quotients.
M 441. Numerical Linear Algebra & Optimization. 3 Credits. (3 Lec) F

M 442. Numerical Solution of Differential Equations. 3 Credits. (3 Lec) S

M 450. Applied Mathematics I. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: M 273Q and M 274. An introduction to modern methods in applied mathematics. Topics include introductions to dimensional analysis and scaling, perturbation and WKB methods, boundary layers, calculus of variations, stability, and bifurcation analysis.

M 451. Applied Mathematics II. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: M 450. This is the second semester of a course that introduces modern methods in applied mathematics. Topics involve methods for linear and nonlinear partial differential equations, including introductions to Green’s functions, Fourier analysis, shock waves, conservation laws, maximum and minimum principles, and integral equations.

M 454. Introduction of Dynamical Systems I. 3 Credits. (3 Lec) F alternate years, to be offered even years.

M 455. Introduction to Dynamical Systems II. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: M 454. Gradient systems, Poincare’-Bendixon theory, Poincare’-maps, structural stability and chaotic systems.

M 472. Introduction to Complex Analysis. 3 Credits. (3 Lec) S
PREREQUISITE: M 273Q and M 274. An introduction to the techniques of complex analysis that are frequently used by scientists and engineers. Topics include complex numbers, analytic functions, Taylor and Laurent expansions, Cauchy’s theorem, and evaluation of integrals by residues.

M 476. Introduction to Topology. 3 Credits. (3 Lec) F
Alternate Odd Years PREREQUISITES: M 221 and M 242 or consent of instructor. Provides an intuitive and rigorous introduction to this important and broad-ranging discipline of modern mathematics. Students will learn to recognize those properties which are topological, i.e., stable under small perturbation. Course participants will compute and see the utility of various topological invariants which arise in a variety of fields from data science, to particle physics, to advanced mathematics.

M 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su
PREREQUISITE: Junior standing in mathematics and consent of department head. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

M 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

M 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

M 494. Seminar. 1 Credit.
PREREQUISITE: Senior capstone course. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

M 501. Advanced Linear Algebra. 3 Credits. (3 Lec) S

M 502. Advanced Mathematical Statistics. 3 Credits. (3 Lec) S

M 503. Advanced Algebra. 3 Credits. (3 Lec) S
PREREQUISITE: M 333 or consent of instructor. Topics include abstract vector spaces, diagonalization, Schur’s Lemma, Jordan canonical form and spectral theory for finite dimensional operators.

M 504. Abstract Algebra. 3 Credits. (5 Lec) S
PREREQUISITE: M 431 or consent of instructor. The theory of groups, rings and fields with particular emphasis on finite groups, polynomial rings and fields of characteristic zero.

M 505. Principles of Mathematical Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: M 384 or consent of instructor. Principles of analysis in Euclidean spaces and metric spaces.

M 507. Mathematical Optimization. 3 Credits. (3 Lec) S
PREREQUISITES: M 273, M 441. This course is an introduction to mathematical optimization at the graduate level for mathematics, science, engineering and management majors. It aims to provide an overview of the computational methods for solving linear and nonlinear optimization problems. In particular, the students will learn some of the fundamental optimization algorithms used in practice. Topics include fundamental concepts in optimization, simplex method, duality theory, methods for unconstrained optimization, optimality conditions for constrained problems, and penalty and augmented Lagrangian methods for solving constrained problems.

M 508. Mathematics of Machine Learning. 3 Credits. (3 Lec) S
PREREQUISITE: M 273 and M 441. Mathematics of Machine Learning” is an introductory graduate level course on mathematical models for pattern recognition and machine learning. The students will become familiar with fundamental concepts such as learning of parametric and non-parametric probability distributions, the curse of dimensionality, correlation analysis and dimensionality reduction, and concepts of decision theory. Advanced machine learning and pattern recognition problems will be covered, including data classification and clustering, regression, kernel methods, artificial neural networks, and Markov-based models such as hidden Markov models and Markov random fields. These methods will be illustrated by practical examples drawn from practical data science problems.

M 509. Stochastic Processes. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 421. Conditional probability theory, discrete and continuous time markov chains including birth and death processes and long run behavior; Poisson processes; queuing systems; system reliability. Cross-listed with STAT 509.

M 511. General Topology. 3 Credits. (3 Lec) F
PREREQUISITE: M 384 or consent of instructor. Definition of a topology, relative topology, metric topology, quotient topology, and the product topology. Connectedness, local connectedness, components and path components. Compactness and local compactness, countability and separation axioms, the Urysohn Lemma, metrization and compactification.

M 512. Geometry & Algebraic Topology. 3 Credits. (3 Lec) S
PREREQUISITE: M 511 or consent of instructor. Topics in continua theory, topics in dimension theory, covering spaces and the fundamental group, simplicial complexes, topics in homology and cohomology theory.

M 516. Language of Mathematics for Teaching. 3 Credits. (3 Lec) Su On Demand.
PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Features of the language of mathematics, including syntax, vocabulary, and structure. Logistic, proof and mathematical communication for high school classrooms.

M 517. Advanced Mathematical Modeling for Teaching. 3 Credits. (3 Lec)
PREREQUISITE: M 526. Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Focus on the use of modeling to solve real-world problems. Topics include the modeling process, an overview of relevant technology, strategies to engage students in modeling in the secondary classroom, and classroom assessment of modeling activities. Extensive use of mathematics to explore application areas, leading to the construction of original models.
M 518. Statistics For Teachers. 3 Credits. (3 Lec) Distance format. PREREQUISITE: Graduate standing in mathematics or science education, teaching endorsement in mathematics or science, or consent of instructor. Stochastic concepts including probabilistic underpinnings of statistics, measures of central tendency, variability, correlation, distributions, sampling, and simulation. Exploratory data analysis including experiments, surveys, measures of association and inferential statistics. Discussion of methods for teaching statistics in secondary mathematics and science.

M 519. Ratio and Proportion in School Mathematics. 3 Credits. (3 Lec) Su alternate years, to be offered odd years. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Development of knowledge of ratio and proportion necessary to teach standards-based school mathematics. Connect ratio, rate, and proportion to elementary, middle, and high school topics. Explore use of manipulative materials and technologies, and discuss related pedagogical issues and national standards.

M 520. Standards-Based Mathematics for Teaching. 3 Credits. (3 Lec) Su, to be offered odd years. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Study of key content themes and connections in algebra, geometry, probability/data analysis, number, and measurement with a focus on mathematical practices. Exploring, extending, designing, and teaching standards-based classroom activities for middle/high school students and reflecting on student outcomes.

M 521. Mathematics Learning Theory for Teaching. 3 Credits. (3 Lec) F alternate years, to be offered even years. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Examine theories of learning as they apply to the mathematics classroom. The course focuses on theories of learning, human development, personality and motivation. The theories and research are used (a) to understand mathematics learning among students of all cultural, linguistic and socioeconomic backgrounds, and (b) to formulate effective teaching and learning strategies.

M 522. Assessment of Mathematics for Teaching. 3 Credits. (3 Lec) S on demand. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Connects assessment theory and models to teachers’ practice through classroom observations and hand-on activities. Focus on assessment practices consistent with standards-based mathematics, classroom assessment of student learning, evaluation of mathematics programs and curricula, and standardized testing practices.

M 523. Number Structure for Teachers. 3 Credits. (3 Lec) Su, to be offered even years. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Develop the relationship and distinction between the mathematics that underlies the structure of number and the learning and teaching of number structure in schools. Explore representation, abstraction, and basic proof in the context of number and operations. Develop foundations of the real number system and examine relevant research about students’ understanding of number.

M 524. Linear Algebra for Teachers. 3 Credits. (3 Lec) Su. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Algebraic systems, special matrices, determinants, vector spaces, and linear programming. Includes applications relevant to industry and business and connections to topics in secondary mathematics.

M 525. Analysis for Teachers. 3 Credits. (3 Lec) F. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. A study of calculus concepts and processes from graphical, numerical and algebraic perspectives. Extensive use of activities and projects. Modeling and technology are incorporated throughout the course.

M 526. Discrete Mathematics for Teachers. 3 Credits. (3 Lec) Su for two consecutive years; alternates with M 517. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. A study of classical topics in discrete mathematics, chosen from combinatorics, probability, graph theory, and other areas relevant to secondary mathematics. Emphasis on problem solving and justification.

M 527. Geometry for Teachers. 3 Credits. (3 Lec) S. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Explorations of special topics in geometry, such as geometry of transformations including Euclidean motions and similarity, projective geometry, geometric topology and geometry of inversion.

M 528. Curriculum Design. 3 Credits. (3 Lec) S alternate years, to be offered even years. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Focuses on the design, implementation, and evaluation of curricula in mathematics. Includes historical changes and trends in mathematics curriculum and an examination of current research.

M 529. Assessment Models and Issues. 3 Credits. (3 Lec) F, to be offered odd years. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Focus on the history of mathematics as a context for classroom instruction. Includes the changing nature of mathematics, classical problems, proofs and mathematical processes, and the development of teaching units that incorporate the history of mathematics.

M 534. Research in Mathematics Education. 3 Credits. (3 Lec) F alternate years, to be offered even years. PREREQUISITE: Consent of instructor. Examination of quantitative and qualitative research findings and methodology in mathematics education. Review of current trends and literature. Writing for publication and proposals.

M 535. Technology and Mathematics for Teaching. 3 Credits. (3 Lec) Su On Demand. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Calculator, computer and Web-based technologies for K-12 mathematics education. Analysis of the influence of technology on the K-12 mathematics curriculum, instruction, and assessment.

M 540. Introduction to Calculus on Manifolds. 3 Credits. (3 Lec) F. PREREQUISITE: M 503 and M 505 or consent of instructor. An introduction to manifolds and their atlases, fiber bundles, vector fields, tensor fields and differential forms, the exterior and Lie derivatives, Stokes Theorem, and de Rham cohomology.

M 544. Partial Differential Equations I. 3 Credits. (3 Lec) F alternate years, to be offered odd years. PREREQUISITE: M 384 and M 451, or consent of instructor. An extended survey of the origins of a large number of scientific and mathematical partial differential equations and an overview of the theoretical techniques which are available to solve them.

M 545. Partial Differential Equations II. 3 Credits. (3 Lec) S alternate years, to be offered even years. PREREQUISITE: M 544 and M 547. Linear partial differential equations and the function spaces and functional analysis which one uses to study them. Topics include: Holder and Sobolev functions, Sobolev and Poincare inequalities, embedding density, semigroup theory for evolution equations.


M 551. Complex Analysis. 3 Credits. (3 Lec) S PREREQUISITE: M 505. Analytic functions and conformal maps, contour integrals, Cauchy’s theorem, Cauchy’s integral formula, the maximum modulus theorem, harmonic functions, Taylor’s theorem and Laurent series. Classification of singularities, the residue theorem and evaluation of definite integrals, Rouche’s theorem and the argument principle.


M 561. Methods of Applied Mathematics II. 3 Credits. (3 Lec) S alternate years, to be offered odd years. PREREQUISITE: M 560. Calculus of variations, Hamilton’s principle, asymptotic and perturbation methods, transform techniques and scattering theory. Partial differential equations, Green’s functions, separation of variables and transform methods.
M 570. Individual Problems. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

M 571. Principles of Action Research in Mathematics Education. 2 Credits. (2 Lec) Su On Demand.
PREREQUISITE: Graduate standing in mathematics education and consent of instructor. Prepares practicing mathematics teachers to study a mathematics education problem within their classroom, school or district with supervision by a faculty member. Course topics include how to interpret educational research and literature; design and implement reliable and valid action research; identify worthwhile problems; and formulate questions that can be addressed through action research.

M 572. Investigating Problems in Mathematics Education. 2 Credits. (2 Lec) F On Demand.
Distance format. PREREQUISITE: M 571, graduate standing in mathematics education and consent of instructor. With guidance from faculty, students research and investigate a problem related to mathematics education and student success in the context of their classroom, school or district.

M 575. Professional Paper and Project I. 1-4 Credits. (1-4 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

M 576. Internship. 2-12 Credits. (2-12 Ind; unlimited max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

M 577. Conducting Action Research in Mathematics Education. 3 Credits. (3 Lec) S
Alternate Odd Years. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics and consent of instructor. With guidance from faculty, students conduct action research addressing a problem in the context of their classroom, school or district that influences student success in mathematics. Students work with a faculty advisor to implement an intervention, collect and analyze data resulting, and summarize results. Findings are presented orally to peers and faculty.

M 580. Special Topics. 4 Credits. (1-4 Ind; 12 max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

M 581. Numerical Solution of Partial Differential Equations I. 3 Credits. (3 Lec) F
PREREQUISITE: M 442. Finite difference and finite element solution techniques for elliptic, parabolic, and hyperbolic partial differential equations, numerical linear algebra.

M 582. Numerical Solution of Partial Differential Equations II. 3 Credits. (3 Lec) S
PREREQUISITE: M 581. A continuation of topics from M 581.

M 584. Functional Analysis I. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: M 547. Banach spaces, fixed point theorems, Hilbert spaces, the Dirichlet principle, generalized Fourier series, and spectral theory.

M 585. Functional Analysis II. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: M 584. The Hahn Banach theorem, variational principles, weak convergence, uniform boundedness theorem, the open mapping theorem and the implicit function theorem.

M 586. Probability Theory. 3 Credits. (3 Lec) S alternate years, to be offered odd years.

M 587. Lie Groups. 3 Credits. (3 Lec) F
PREREQUISITES: M 504, M 511. Lie groups, Lie algebras, representation theory.

M 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand
PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. Courses offered on a one time basis to fulfill professional development needs of in-service educators. A specific focus is given to each course which is appropriately subtitled. May be repeated.

M 589. Graduate Consultation. 3 Credits. (3 Ind) F,S,Su
PREREQUISITE: Master's standing. This course may be used only by students who have completed all of their course work and or thesis, if on a thesis plan but who need additional faculty or staff time.

M 590. Master's Thesis. 1-10 Credits. (1-10 Ind; max cr unlimited) F,S,Su
PREREQUISITE: Master’s standing.

M 591. Topics in Applied Math I. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing and consent of instructor. Topics may include numerical solution of linear and nonlinear problems, eigenvalue problems, continuation methods, numerical optimization, computational mechanics, spectral methods, bifurcation theory, invariant manifold theory, index theory, nonlinear analysis, reaction-diffusion equations, nonlinear oscillations, asymptotic methods and perturbation methods.

M 592. Topics in Applied Math II. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing and consent of instructor. Topics may include numerical solution of linear and nonlinear problems, eigenvalue problems, continuation methods, numerical optimization, computational mechanics, spectral methods, bifurcation theory, invariant manifold theory, index theory, nonlinear analysis, reaction-diffusion equations, nonlinear oscillations, asymptotic methods and perturbation methods.

M 594. Seminar. 1 Credit. (1 Sem; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

M 595. Dynamical Systems I. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: M 503. Topics in differential equations including existence and uniqueness, continuous dependence on parameters, extendibility, the existence and stability of equilibria and limit cycles and the Poincare-Bendixon theorem.

M 596. Dynamical Systems II. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: M 595. Topics include Hartman’s theorem, invariant manifold theory, Smale-Birkhoff theorem, horseshoe chaos, and the Melnikov method. Topics in discrete dynamical systems may also be covered.

M 597. Topics in Math ii: Character Varieties and 3-manifolds. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing or consent of instructor. Topics include the theory of representations of finitely generated groups into matrix groups and applications of this theory to the study of low-dimensional topology. Our primary tools will be SL(2, C) and PSL(2, C) character varieties. Culler-Shalen theory and its applications will be discussed in depth. We will also cover some of the basics of low-dimensional topology along with classical affine and projective algebraic geometry. Computational techniques in algebraic geometry and commutative algebra will be highlighted to encourage experimentation and exploration.

M 598. Topics in Math Iii. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing and consent of instructor. Topics selected from: continuum theory, symbolic dynamics, ergodic theory and low dimensional topology.

M 689. Doctoral Reading & Research. 3-5 Credits. (3-5 Ind; 15 cr max) F,S,Su
PREREQUISITE: Doctoral standing. This course may be used by doctoral students who are reading research publications in the field in preparation for doctoral thesis research.

M 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral standing.

MART - Media Arts
MART 145RA. Web Design. 3 Credits. (2 Lec, 1 Lab) F,S
Basic design principles and how these principles apply to web site construction. HTML and HTML editors. Laboratory projects reflect practical usage of course concepts. Cross-listed with CS 145RA.

MAS - Military Aerospace Studies
MAS 110. Foundations of The Air Force I. 1 Credit. (1 Lec) F
COREQUISITE: MAS 115. Survey course designed to introduce students to the United States Air Force and provides an overview of the basic characteristics, missions, and organization of the Air Force. Communication Studies are woven throughout the four year program.
Cadets have an opportunity to try out these leadership and management techniques in a rigorous field training environment.

PREREQUISITE: MAS 110. A student planned, organized, and executed practicum with leadership developmental activities for prospective Air Force second lieutenants. Provides cadets the opportunity to further develop the leadership and followership skills learned at field training, sharpening planning, organizational and communications skills.

MAS 115. Leadership Laboratory 115. 2 Credits. (2 Lab) PREREQUISITE: Consent of instructor and approval of Department Head. COREQUISITE: MAS 111. A student planned, organized, and executed practicum with leadership developmental activities for prospective Air Force second lieutenants. Acquaints cadets with basic Air Force knowledge and skills to help them determine whether they wish to continue with the AFROTC program.

MAS 116. Leadership Lab 116. 2 Credits. (2 Lab) S PREREQUISITE: Consent of instructor and approval of Department Head. COREQUISITE: MAS 111. A student planned, organized, and executed practicum with leadership developmental activities for prospective Air Force second lieutenants. Acquaints cadets with basic Air Force knowledge and skills to help them determine whether they wish to continue with the AFROTC program.

MAS 201. The Employment of Air and Space Power I. 1 Credit. (1 Lec) F COREQUISITE: MAS 215. Introduction to air power through examination of the Air Force Core Functions and continued application of communication skills. Instills an appreciation of the development and employment of air power and transition sophomores from AFROTC cadet to AFROTC officer candidate.

MAS 202. Flight Ground School. 2 Credits. (2 Lab) S PREREQUISITE: Approval of instructor. (This MAS course is available only through Burns Telecom Center under separate registration). Basics required for learning to fly single-engine land type aircraft. Covers material tested on the FAA Private Pilot written exam, to include performance, the science of flight, meteorology, FAA regulations, navigation, and the physiology of flight.

MAS 215. Leadership Laboratory 215. 2 Credits. (2 Lab) F PREREQUISITE: Consent of instructor and approval of department head. COREQUISITE: MAS 210. A student planned, organized, and executed practicum with leadership developmental activities for prospective Air Force second lieutenants. Provides training to ensure every cadet is mentally and physically prepared for the rigorous field training environment.

MAS 216. Leadership Lab 216. 2 Credits. (2 Lab) S PREREQUISITE: Consent of instructor and approval of department head. COREQUISITE: MAS 211. A student planned, organized, and executed practicum with leadership developmental activities for prospective Air Force second lieutenants. Provides training to ensure every cadet is mentally and physically prepared for the rigorous field training environment.

MAS 260. USAF Aerospace Weapons. 3 Credits. (3 Lec) S The study of the weapons systems employed by the United States Air Forces. It also presents the basics of their integration and employment at the operations level.

MAS 261. Foundations of The Air Force II. 1 Credit. (1 Lec) S COREQUISITE: MAS 116. Survey course designed to introduce students to the United States Air Force and provides an overview of the basic characteristics, missions, and organization of the Air Force. Communication Studies are woven throughout the four year program.

MAS 290. Special Topics. 1-4 Credits. (1 Lec; 3 cr max) S Provides additional opportunities to develop leadership and supervisory capabilities, and prepares cadets for their first active duty assignment.

MAS 291. Leadership Laboratory 215. 2 Credits. (2 Lab) S COREQUISITE: MAS 311. A student planned, organized, and executed practicum with leadership developmental activities for prospective Air Force second lieutenants. Provides the foundation to understand their role as military officers in American society. An overview of the complex social and political issues facing the military profession; requires a measure of sophistication commensurate with the senior college level.

MAS 415. Leadership Laboratory 415. 2 Credits. (2 Lab) S COREQUISITE: MAS 311. A student planned, organized, and executed practicum with leadership developmental activities for prospective Air Force second lieutenants. Provides the foundation to understand their role as military officers in American society. An overview of the complex social and political issues facing the military profession; requires a measure of sophistication commensurate with the senior college level.

MAS 416. Leadership Lab 416. 2 Credits. (2 Lab) S PREREQUISITE: Consent of instructor and approval of department head. COREQUISITE: MAS 410. A student planned, organized, and executed practicum with leadership developmental activities for prospective Air Force second lieutenants. Provides the foundation to understand their role as military officers in American society. An overview of the complex social and political issues facing the military profession; requires a measure of sophistication commensurate with the senior college level.

MAS 416. Leadership Lab 416. 2 Credits. (2 Lab) S PREREQUISITE: Consent of instructor and approval of department head. COREQUISITE: MAS 410. A student planned, organized, and executed practicum with leadership developmental activities for prospective Air Force second lieutenants. Provides the foundation to understand their role as military officers in American society. An overview of the complex social and political issues facing the military profession; requires a measure of sophistication commensurate with the senior college level.

MAS 492. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) S Provides additional opportunities to develop leadership and supervisory capabilities, and prepares cadets for their first active duty assignment.

MAS 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) S Provides additional opportunities to develop leadership and supervisory capabilities, and prepares cadets for their first active duty assignment.

MCH - Machining & Manufacturing Tech

MCH 103. Intro to Computer Aided Manufacturing Lvl 1 Level 1 Immense 2Learn. 2 Credits. (2 Lec) F This is an online course run through the Immense 2Learn platform that supports all the hands-on activities offered in the CAS CNC Machine Technology program. Course will be supported by faculty in the CNC program.

MCH 104. Introduction to Computer Aided Manufacturing Level II. 2 Credits. (2 Lec) S PREREQUISITES: MCH 103. This class is a blended online and lecture to provide an online tutorial for CNC Machining on a Haas GUI interface. This class will serve to reinforce basic machine setup, and programming skills introduced in other classes.
MCH 120. Blueprint Reading. 2 Credits. (Lec 1) F
This is a face to face introducing the fundamental concepts necessary to interpret drawings and produce sketches for machine tool applications as applied to CNC Machining. Topics include advanced sectioning, geometric dimensioning, geometric tolerance, assembly and drawing.

MCH 122. Introduction to CAM (GibbsCAM). 3 Credits. (Lec 1, Lab 1) S
PREREQUISITE: MCH 120, and MCH 231 or MCH 234. MCH 122, Intro to CAM (GibbsCAM), is designed to give students practical experience in the application of a Computer Aidied Machining Program to create production code for CNC Mills and Lathes. The class includes basic CAM drafting practices, Coordinate Systems, Modeling (surface and solid) and tool development.

MCH 130. Machine Shop. 3 Credits. (Lec 1, Lab 2) F
The content covers a broad range of manual and CNC machining with the emphasis on shop and work area safety. The course will include an introduction to measurement and materials. Job planning, bench work and layout will be presented.

MCH 160. Machine Shop Level I. 3 Credits. (Lec 2, Lab 3) F
Machine Shop 1 introduces students to the common shop equipment used in the modern machining and manufacturing. Through a combination of lectures and practical lab exercises, the student will utilize common and essential machine shop tools and develop safe and correct practices thru proper use. During this class students will be trained in basic operation of metal lathes, Milling machines, pedestal/bench grinders, saws, and drill press. This course is also an introduction to measurement, materials, job planning, bench work and precision layout.

MCH 230. Tooling and Work Holding for CNC. 2 Credits. (Lec 2) S
PREREQUISITE: MCH 234. MCH 230, Tooling and Fixturing is a course designed to introduce students to the wide variety and complexity of work holding and tooling available for CNC Machining. This class will discuss tool design/shape and its effects on machining. Work holding and its effect on part density, repeatability and rigidity will also be discussed.

MCH 231. CNC Turning Operations Level I. 3 Credits. (Lec 3) F
CO-REQUISITES: MCH 234 CNC Milling Operations Level I This course is an introduction to CNC Turning Centers and the safe operation of common operating procedures, set-up and maintenance and control panel. The student will become acquainted with the ways in which various companies utilize CNC machine tools.

MCH 252. CNC Lathe Operation Level II. 3 Credits. (Lab 3) S
PREREQUISITE: MCH 231. MCH 252, CNC Lathe Operation Level II, reinforces student’s understanding of CNC Lathe operation and programming developed in MCH 231. Concepts to be covered include program planning (setup sheets, tool setup, offsets) metrology, program trouble shooting and intro to bar pulling.

MCH 234. CNC Milling Operations Level I. 3 Credits. (Lec 3) F
CO-REQUISITES: MCH 231 CNC Turning Operations Level I This course is an introduction to CNC Milling Centers. The common operating procedures, set-up, and maintenance of the machine and control panel will be introduced and implemented. The student will become acquainted with the way CNC machine tools are utilized, while learning programming setup and operations, methods for the installation of tools, establishing machine, fixture, and part zero reference offsets.

MCH 255. CNC Milling Programmer Level II. 3 Credits. (Lab 3) S
PREREQUISITE: MCH 234. MCH 255, CNC Mill Programmer Level II, reinforces student’s understanding of CNC Mill operation and programming. Concepts to be covered include program planning, setup sheets, tool setup, offsets, metrology and intro to fourth axis.

MCH 260. Machine Shop II. 3 Credits. (Lec 2) S
PREREQUISITE: MCH 160 or MCH 130. Machine Shop II reinforces through practice common skills used in a modern machining shop. Through practical lab exercises, the student will utilize common and essential machine shop tools and demonstrate safe and correct practices and proper use. During this class students will apply basic operation of metal lathes, milling machines, pedestal/bench grinders, saws, and drill press. This course will also reinforce basic measurement and print reading skills.

MCH 291. Special Topics. 3 Credits.

MCH 292. Independent Study. 1-3 Credits. (1-3 Lab) F,S
The MCH 292 Independent Study is a one to three credit course that teaches to the specific goals of the student. This course builds on the MCH foundation to increase skill development in general machining processes and fabrication skills.

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**MB - Microbiology**

MB 505. Host-Associated Microbiomes. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITES: BIOL 160, CHMY 125, BCH 380, BIOM 360. This course will introduce students to the microbial ecosystems that colonize human and animal hosts, detailing their essential roles in host nutrition, health and development. Students will also be exposed to modern molecular techniques used to study these systems.

MB 515. Microbial Ecology. 3 Credits. (Lec 3) S alternate years, to be offered odd years.

MB 520. Microbial Physiology. 3 Credits. (Lec 3) F
PREREQUISITE: BIOM 360 and BCH 380. An in-depth examination of microbial cell structure and function, bioenergetics, and intermediary metabolism and control. Students will also be expected to consider biochemical function within the context of genomic sequences, and be able to formulate predictions for carbon and energy flow.

MB 525. Advanced Immunology. 3 Credits. (Lec 3) S alternate years, to be offered even years.

MB 527. Toxicology. 3 Credits. (Lec 3) S
PREREQUISITES: CHMY 141 and CHMY 143 and BIOL 160. CO-REQUISITE: BCH 380 This course introduces mechanisms of toxicity; effects of toxicants on major organ systems: major classes of toxicants; absorption, distribution, biotransformation and elimination of toxicants. Human exposure to drugs of abuse and environmental agents, case studies, and risk assessment are discussed. Co-convened with BIOL 425.

MB 528. Advanced Genetics. 3 Credits. (Lec 3) S alternate years, to be offered odd years.
PREREQUISITE: BIOL 450 or equivalent. Recent advances in microbial genetics with an emphasis on molecular genetics and eukaryotic gene expression.

MB 530. Virology. 3 Credits. (Lec 3) F
PREREQUISITE: BIOL 160 or BIOL 260 or BIOL 375 or BIOL 320 or BCH 380 or BCH 442 or BCH 444R or BCH 445. Fundamentals of virology with emphasis on animal viruses of medical importance. Molecular aspects of structure, replication transmission and host response to viral infection will be covered.

MB 533. Current Topics in Microbiology for Teachers. 3 Credits. (Lec 1, Lab 1, 1 Crct) S
PREREQUISITE: A minimum of two years science teaching experience. This course will provide an inquiry based examination of current microbiology related topics. Topics may vary from semester to semester and will be selected by the assessment of what is considered “newsworthy.” Topics could include but not be limited to hospital acquired and community acquired infections, antibiotic resistance, immunizations, food safety and drinking water. Emphasis will be placed on the ramifications of issues with respect to industry, medicine, and personal health. A review of literature will provide background information for the topics in order to provide teachers sufficient and correct information to hold discussions regarding these topics in their classrooms.

MB 535. Genomic Analysis Lab. 4 Credits. (Lec 1, Lab 1) F
PREREQUISITE: Permission of instructor needed. The quantity of sequence information deposited into databases necessitates that scientists train in both discovery and hypothesis-based research that utilizes these resources. This class will cover experimental design, database searching and management, sequence alignment, molecular pattern recognition, and phylogenetics.

MB 536. Exploring Microbiology. 3 Credits. (Lec 3) S
PREREQUISITE: BS in Biology or equivalent degree COREQUISITE: Graduate standing or petition approval from the Vice Provost of Graduate Education. Explore microscopy, prokaryotes, microbial eukaryotes, viruses, acellular agents, microbial evolution, diversity, by focusing on an experimental microcosm. Ideal for middle/high school/college teachers and others in education and outreach roles, e.g. museums, zoos, National Parks, nature preserves, environmental health.

MB 537. Advance in Molecular Evol. 3 Credits. (Lec 3) F
PREREQUISITE: BIOM 410 or 450 or 455 or 528 or 538 or BIOL 402 or BCH 380 or BCH 441 or BIOL 475. The educational objectives of this course are to provide graduate students with a basic introduction to molecular evolution. The study of molecular evolution encompasses the origin and evolution of life on earth at the molecular level.
MB 538. Cell & Molecular Biol. 2 Credits. Su
PREREQUISITE: BIOM 360, BCH 380 or BIOL 402, MB 536, or the equivalent. COREQUISITE: Graduate standing or petition approval from the Vice Provost of Graduate Education. An inquiry-based laboratory in prokaryotic and eukaryotic C&M provides training in microbiological techniques: recombinant DNA, phylogenetic analyses, growth, cell cycle regulation, gene expression, protein purification, and immunosassays. Current literature and laboratory discussions cover molecular approaches for investigating complex cellular mechanisms.

MB 539. Infection and Immunity. 3 Credits. Su alternate years, to be offered even years.
PREREQUISITE: BIOM 410 or BIOM 435 or BIOM 431. COREQUISITE: Graduate standing or petition approval from the Vice Provost of Graduate Education. An inquiry-based study of recent advances in understanding the etiology, pathogenesis, chemotherapy and prevention of infectious disease which includes analysis of current literature, case histories, and online sources of information. This course is intended for practicing teachers and those in the MSSE program.

MB 540. Environmental Microbiology. 3 Credits. (3 Ind) F
PREREQUISITE: MB 536 and MB 541 or equivalent course. COREQUISITE: BS in biology or equivalent: Graduate standing or petition approval from the Vice Provost of Graduate Education. Biotechnology, industrial microbiology, antimicrobial chemotherapy, public health, epidemiology, climate change, food water, wastewater, extreme environments, space travel, biodegradation, bioremediation and biosaugmentation. Ideal for middle/high school/college teachers, and others in education/outreach, e.g., museums, zoos, National Parks, nature preserves, environmental health.

MB 541. Microbial Genetics. 3 Credits. (3 Lec) Su alternate years, to be offered odd years. Prokaryotes provide much of the understanding of fundamental genetics for all organisms, especially through in vivo and in vitro genetic tools. Transcription, translation, mutation and recombination are considered, so that science teachers understand of fundamentals of genetics. This course is intended for practicing teachers and those in the MSSE program.

MB 542. Microbial Ecology. 3 Credits. (3 Lec) S
PREREQUISITE: MB 536 or equivalent course or BS in Biology. COREQUISITE: BS in biology or equivalent: Graduate standing or petition approval from the Vice Provost of Graduate Education. Ecology of microorganisms, their nutrition, growth, control, metabolism, biogeochemical cycling, natural environments, habitats and interactions. Centered on an experiment, this discovery-based course is ideal for middle/high school/college teachers, and others in education/outreach roles, e.g., nature facilities, environmental health.

MB 544. Advanced Bioinformatics. 4 Credits. (3 Lec, 1 Lab) S alternate years to be offered on even years. This course will cover advanced topics in Bioinformatics, including genome assemblies and functional annotations of proteins. The course is meant to support experimental work by training students to make confident predictions from biological sequences and to develop testable hypotheses that will guide their experimental work. Students will learn about using local and worldwide prediction servers.

MB 547. Thermal Biology of YNP. 2 Credits. (1 Lec, 1 Lab) Su Thermal Biology, an interdisciplinary science that incorporates biology, geology, and chemistry to discover where and under what conditions life can exist in the thermal features of Yellowstone National Park. As such, it lends itself easily to incorporation to chemistry to discover where and under what conditions life can exist in the thermal features of Yellowstone? Why did Ebola recently spread through multiple West African countries, whereas previous outbreaks were restricted to small regions in Central Africa?

MB 549. Graduate Consultation. 1-3 Credits. (1-3 Ind) F,S,Su
PREREQUISITE: Master's standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

MB 590. Master's Thesis. 1-10 Credits. (3 Ind; 20 cr max) F,S,Su
PREREQUISITE: Master's standing.

MB 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

MB 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

MB 594. Seminar. 1 Credit. (1 Sem; 4 cr max) F,S
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material. There are separate sections for departmental seminar, general/environmental and biomedical microbiology journal clubs and graduate reading; consult the.

MB 598. Internship. 2-12 Credits. (2 Ind; max unlimited) PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

MB 690. Doctoral Thesis. 1-10 Credits. (3 Ind; 30 cr max) F,S,Su
PREREQUISITE: Doctoral standing.

MBEH - Microbiology Environmental Hlt

MBEH 294. Careers in Environmental Health. 1 Credit. (1 Sem) S Introduction to educational, internship and career opportunities in the environmental health track in microbiology, e.g. environmental public health, occupational safety and health, food service management, the water sector, epidemiology and research. Students will gain knowledge, skills and certifications which will increase their preparation and competitiveness for research and environmental health internships and jobs, by completing in-person trainings, e.g. in biosafety, chemical safety, respiratory protection, hearing protection and food safety. Field trip(s) included, with transportation provided.

MBEH 475. Field Project. 1-4 Credits. (1 Ind; 4 cr max) F,S,Su Max 4 cr. PREREQUISITE: Consent of instructor and department head. Research and field experience in some aspect of environmental health science.

MBEH 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su Max 12 cr. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

MBEH 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

MBEH 498. Internship. 2-12 Credits. (2 Ind; 12 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor, and approval of department head. An individual assignment arranged with an agency, business, or other organization to provide guided experience in the field.
MBSP - Molecular Biosciences Program

MBSP 561. Molec Biosci Lab Rotation I. 1 Credit. (1 Lab; 1 cr max) F,S
Each Molecular Biosciences Program graduate student will complete three laboratory rotations during their first year of graduate study. Each Laboratory Rotation provides students with a six-week period of active research experimentation time. Each Laboratory Rotation is a mini-research project and is designed to allow the student to explore a potential avenue of research for their thesis/dissertation research project in Years 2 and beyond. Students should become familiar with the relevant literature, concepts, methods, reagents, and instruments that will be needed to conduct their experiments and achieve the goals of their research project. Extensive bench research time will be required to obtain meaningful results.

MBSP 562. Molec Biosci Lab Rotation II. 1 Credit. (1 Lab; 1 cr max) F,S
Each Molecular Biosciences Program graduate student will complete three laboratory rotations during their first year of graduate study. Each Laboratory Rotation provides students with a six-week period of active research experimentation time. Each Laboratory Rotation is a mini-research project and is designed to allow the student to explore a potential avenue of research for their thesis/dissertation research project in Years 2 and beyond. Students should become familiar with the relevant literature, concepts, methods, reagents, and instruments that will be needed to conduct their experiments and achieve the goals of their research project. Extensive bench research time will be required to obtain meaningful results.

MBSP 563. Molec Biosci Lab Rotation III. 1 Credit. (1 Lab; 1 cr max) F,S
Each Molecular Biosciences Program graduate student will complete three laboratory rotations during their first year of graduate study. Each Laboratory Rotation is a mini-research project and is designed to allow the student to explore a potential avenue of research for their thesis/dissertation research project in Years 2 and beyond. Students should become familiar with the relevant literature, concepts, methods, reagents, and instruments that will be needed to conduct their experiments and achieve the goals of their research project. Extensive bench research time will be required to obtain meaningful results.

MBSP 564. Molec Biosci Lab Rotation IV. 1 Credit. (1 Lab; 1 cr max) F,S
Each Molecular Biosciences Program graduate student will complete three laboratory rotations during their first year of graduate study. Each Laboratory Rotation is a mini-research project and is designed to allow the student to explore a potential avenue of research for their thesis/dissertation research project in Years 2 and beyond. Students should become familiar with the relevant literature, concepts, methods, reagents, and instruments that will be needed to conduct their experiments and achieve the goals of their research project. Extensive bench research time will be required to obtain meaningful results.

MBSP 575. Mol BioSci Prgm Rsch Project. 1 Credit. (1 Lab) F,S
1 cr. LAB 1 This course will fulfill the research requirement of the first year Molecular Biosciences Program (MBSP) doctoral fellows. The fellow (students) will work on a research project under the direction of their advisor.

MBSP 579. Programming for Life Scientists. 3 Credits. (2 Lec; 1 Lab) F,S
PREREQUISITE: Permission from the Molecular Biosciences Program. The purpose of this course is to provide students with all the knowledge needed to design and then write (or program) data analysis toolkits on their computer. Programming is needed to process vast amount of information by filtering, correlating, aggregating it, tremendously speeding up analyses. Graduate Studies Department.

MBSP 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. This course focuses on the impact of basic science on medicine and medical practice. Basic science, clinical research, and investigative medicine will be integrated across five major topics: inflammation, vascular disease, obesity, cancer, and therapeutics.

MBSP 594. Molecular Biosci Prgm Sem. 1 Credit. (1 Sem) F,S
This course will fulfill the seminar requirement of the first year Molecular Biosciences Program (MBSP) doctoral fellows. The fellows (students) will attend three seminars sponsored by the MBSP focused on molecular biosciences research. Students will also attend twelve additional departmental or research center-based seminars from the participating MBSP centers and departments. Each student will write a summary of the fifteen attended seminars and turn it into the instructor by the last day.

MBSP 613. Scientific Proposal Writing. 3 Credits. (3 Lec) Su
PREREQUISITE: Students need to be in their second year of a STEM discipline. Research scientists and engineers in today’s highly competitive world need to develop and acquire research proposal writing skills and knowledge as part of their training for a successful career. The goal of this course is to provide doctoral students with strategies, practical skills and experience in seeking funding for their research as well as writing and evaluating scientific proposals. The student will leave this course with a research proposal that is ready to submit for funding.

MEDS - Medical Science

MEDS 140. Intro Medicine Health. 1 Credit. (1 Lec) S
This course will assist students in exploring various departments at MSU and choosing a major that best fits their passions, career goals, and educational interests. This course will also provide an opportunity to explore the breadth of health care professions.

MEDS 160. EMT Basic. 6 Credits. (4 Lec, 2 Lab) F
The EMT course focuses on the core responsibilities which are to provide medical care to victims of emergencies, stabilize their condition and to transport them safely. After completion students are eligible to take the National Registry’s certification.

MEDS 240. UG Clinical Observation. 1 Credit. (1 Lab) F
PREREQUISITE: GPA greater than 3.0, consent of instructor. This course will provide fundamentals in health care professionalism through discussions of professionalism, HIPAA, medical ethics, and case studies. Following successful completion of the didactic component of the course, students will participate in a series of clinical observation rotations.

MEDS 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

MEDS 340. Introduction to Dentistry. 1 Credit. (1 Lec) S
PREREQUISITE: CHMY 141 and CHMY 143; BIOB 256 and BIOB 260; at least junior standing, GPA >3.0 and consent of instructor. This course is ideal for students who want to confirm an interest in a career in dentistry. An overview of tooth anatomy, development and vocabulary will position students to better understand the various specialties presented at the clinics of community dentists.

MEDS 440. Clinical Observation. 2 Credits. (2 Lec) F,S
PREREQUISITE: CHMY 141 and CHMY 143; BIOB 256 and BIOB 260; at least junior standing, GPA >3.0 and consent of instructor. This shadowing experience will provide students with the opportunity to observe providers in a clinical setting and position them to meet, in part, the requirements for application to health professional school.

MEDS 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

MEDS 500. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
Max 4 cr. PREREQUISITE: WWAMI medical student or consent of the WWAMI Medical Program and Dean of The Graduate School. Yearly conference dealing with topics related to Montana’s colorful medical history.

MEDS 502. Introductory Primary & Continuity Care. 3 Credits. (1 Lec, 2 Rec) F,S,Su
PREREQUISITE: WWAMI Medical Student. This course introduces medical students to continuity of care by working with practicing physicians. This course is new as of Fall 2015 and is not equivalent to MEDS 582, Spanish for Health Professionals, offered prior to Fall 2015.

MEDS 503. Clinical Reasoning. 3 Credits. (1 Lec; 2 Lab) F,S,Su
PREREQUISITE: WWAMI Medical Student. This course will involve instruction and communication skills, interview techniques, physical examination skills and clinical reasoning. This course is new as of Fall 2015 and is not equivalent to MEDS 503, Poetics of Healing, offered prior to Fall 2015. WWAMI.

MEDS 505. Rural Health Care Delivery. 1 Credit. (1 Lec) F
PREREQUISITE: WWAMI medical student. Provide historical and current information about the health care industry, health care delivery systems and economics of health care and health care policy; with emphasis on rural health care. The purpose is to encourage WWAMI students to consider practicing in rural communities and/or providing health care to underserved populations. The infrastructure of the Montana health Care Delivery system will be presented in detail. Prior to Fall 2014, “Rural Health Care Delivery” was offered as MEDS 560.
MEDS 506. Spanish for Health Professionals. 1 Credit. (1 Lec) S
PREREQUISITE: WWAMI medical student. A mixed-level course for beginning to advanced learners of the Spanish language with a focus to communicate in a medical setting. Objectives include learning the essential skills to converse with Spanish-speaking patients, understand important cultural considerations, conduct patient interviews in Spanish focusing on different medical problems, and set a foundation for further learning of Spanish in the healthcare context. This course was previously offered, up to Spring 2015, as MEDS 502, Spanish Health Professionals. This course is not equivalent to MEDS 502, Intro Primary & Continuity Care, beginning Fall 2015. WWAMI.

MEDS 507. The Healer’s Art. 1 Credit. (1 Lec) S
PREREQUISITE: WWAMI Medical Student. Encourages cultivation of human dimensions in practice of medicine while strengthening personal commitment to medicine as a life’s work. Facilitates student recognition of commonality of personal concerns among peers and student response to the dimension of mystery in the experience of illness as well as development of the capacity for awe. WWAMI.

MEDS 508. Medical History Conference. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: WWAMI medical student. Guest lecturers discuss a variety of topics WWAMI Medical Program.

MEDS 510. Molecular & Cellular Basis of Disease. 9 Credits. (4 Lec, 1 Lab, 4 Rct) F
PREREQUISITE: WWAMI Medical Student. This course teaches the principles of cell and molecular biology, physiology, biochemistry, and genetics. Aspects include the organization of the genome and units of heredity, properties of macromolecules, and cytoarchitecture. Students will gain an understanding of intracellular communication, cell-cell interactions, properties of differentiated cells and the diversity of their physiological properties and functions. Introduction to anatomy, histology, and pharmacology content will be incorporated into the course. This course is not equivalent to MEDS 510 Micro Anatomy (Histology), last offered Fall 2014. WWAMI.

MEDS 515. Ecology of Health and Medicine- Foundations 1. 1 Credit. (1 Lec) F
This course integrates School of Medicine thematic content with an emphasis on core concepts needed for clinical practice in the changing healthcare environment. Students will explore areas related to humanism in medicine including the themes of diversity, health equity, ethics, professionalism, and determinants of health. Pass/ Fail only.

MEDS 520. Invaders & Defenders. 8 Credits. (4 Lec, 1 Lab, 3 Rct) F
PREREQUISITE: WWAMI Medical Student. This course will involve integrated content in immune system, microbial biology, infectious diseases, inflammation and repair, and skin and connective tissue. Introduction to anatomy, histology, and pharmacology content will be incorporated into the course. Prior to Fall 2015, MEDS 520 was "Molecular & Cellular Basis of Disease"; this course is not equivalent to earlier MEDS 520 courses. WWAMI.

MEDS 525. Ecology of Health and Medicine- Foundations 2. 1 Credit. (1 Lec) S
This course integrates School of Medicine thematic content with an emphasis on core concepts needed for clinical practice in the changing healthcare environment. Students will explore areas related to humanism in medicine including the themes of diversity, health equity, ethics, professionalism, and determinants of health. Pass/ Fail only.

MEDS 530. Circulatory System. 13 Credits. (5 Lec, 2 Lab, 6 Rct) S
PREREQUISITE: WWAMI Medical Student. Circulatory systems will present students with an integrated approach to the key supply chain and waste management systems of the body. Students will follow the movement of oxygen from the environment to the tissues, and movement of waste products of metabolism along the opposite path, examining the coordinated roles of the lungs, heart and kidney in the control and regulation of these processes. Introduction to anatomy, histology, and pharmacology content will be incorporated into the course. WWAMI Medical Education Program.

MEDS 535. Ecology of Health and Medicine-Foundations 3. 1 Credit. (1 Lec) Su
This course integrates School of Medicine thematic content with an emphasis on core concepts needed for clinical practice in the changing healthcare environment. Students will explore areas related to humanism in medicine including the themes of diversity, health equity, ethics, professionalism, and determinants of health. Pass/ Fail only.

MEDS 540. Blood, Cancer, Musculoskeletal. 7 Credits. (5 Lec, 2 Lab) Su
PREREQUISITE: WWAMI Medical Student. This course familiarizes students with basic pathophysiologic mechanisms leading to disturbances of red cell, white cell, and platelet production, as well as abnormalities of hemostasis presenting clinical problems. The Musculoskeletal content will focus on clinical manifestations in the musculoskeletal system and pathophysiology of trauma, aging, infection, and inflammation. Pass/Fail only. WWAMI.

MEDS 541. Clinical Practicum. 1 Credit. (1 Lab) F,S,Su
PREREQUISITE: Graduate level standing and acceptance into Post-Bacc Pre-Med or M.S. Health Sciences program. A practical course for students going into the medical field to observe and learn about the services provided by different health care professionals at various stages of patient care. Prior to Summer 2015, MEDS 541 was MEDS 540.

MEDS 545. Ecology of Health & Medicine- Foundations 4. 1 Credit. (1 Lec.) F
This course applies School of Medicine thematic content with an emphasis on core concepts needed for clinical practice in the changing healthcare environment. Students will explore areas related to humanism in medicine including the themes of diversity, health equity, ethics, professionalism, and determinants of health. Pass/ Fail only.

MEDS 550. Energetics & Homeostasis. 8 Credits. (4 Lec, 1 Lab, 3 Rct) Su
PREREQUISITE: WWAMI Medical Student. This course will involve integrated content in metabolism, nutrition, obesity, diabetes, gastrointestinal/liver physiology, and endocrinology. Additionally, this course includes relevant fundamental scientific principles in anatomy, pathology, and pharmacology. WWAMI Medical Education Program.

MEDS 560. Mind, Brain, and Behavior. 13 Credits. (5 Lec, 2 Lab, 6 Rct) F
PREREQUISITE: WWAMI Medical Student. In this course, students will learn the fundamental scientific principles of the structure and function of the normal human nervous system in situ, define major neurologic, psychiatric, and behavior disorders, and develop a systematic approach to their differential diagnosis and management. WWAMI Medical Education Program.

MEDS 570. Lifecycles & Reproduction. 8 Credits. (4 Lec, 1 Lab, 3 Rct.) F
PREREQUISITE: WWAMI Medical Student. This course will cover normal and abnormal human development, reproductive functions including formation and maturation of ova and sperm, menstruation, normal pregnancy, and labor and delivery. Additionally, this course includes relevant fundamental scientific principles in pelvic anatomy, pathology, and pharmacology. WWAMI Medical Program.

MEDS 575. Professional Paper and Project. 1-4 Credits. (1-4 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Graduate standing. Mechanism for M.S. students to complete scholarly project.

MEDS 580. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

MEDS 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max)
PREREQUISITE: Graduate standing, consent of instructor and approval of the Director of the WWAMI Medical Program. Directed research and study on an individual basis.

MEDS 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: WWAMI medical student. Topics offered at the graduate level which are not covered in regular courses.

MEDS 595. Research Methods. 6 Credits. (2 Lec. 2 Ind. 2 Lab) Su
Community health and disease, including assessment of disease risk and mechanisms of epidemic detection, spread, and control; interpretation of research design, data analysis, bias source; and clinical epidemiology, including evaluation and application of diagnostic tests, natural history of disease, and quantitative aids for clinical decision making.

ML - Modern Languages

ML 100H. Intro to World Cultures. 3 Credits. (3 Lec)
Introduces students to a range of issues in the field of international studies through an interdisciplinary approach to world regions. Through lectures, discussion, and project-based learning, students gain knowledge of key cultural, historical, and economic concepts in an international context. Students develop an understanding of national, regional, and area studies models for learning about global issues.

ML 290R. Undergraduate Research. 1-6 Credits.
ML 291. Special Topics. 4 Credits. (0-4 Lec; 12 cr max)
PREREQUISITE: None required but some may be determined necessary by each offering department. Max 12 cr. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
MOR 492. Independent Study. 1-3 Credits.
Max 12 cr. Directed undergraduate research/creative activity which may culminate in a written paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

MOR 491. Special Topics. 1-3 Credits.
Max 12 cr. Course prerequisites as determined for each offering. Max 12 cr. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ML 588. Professional Development. 1-3 Credits.
Max 3 cr. Directed standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. Max 3 cr. Courses offered on a one-time basis to fulfill professional development needs of in-service educators. A specific focus is given to each course which is appropriately subdivided.

ML 591. Special Topics. 1-3 Credits.
Max 12 cr. Course prerequisites as determined for each offering. Max 12 cr. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

ML 592. Independent Study. 1-3 Credits.
Max 6 cr. Directed standing, consent of instructor, approval of department head and Dean of Graduate Studies. Max 6 cr. Directed research and study on an individual basis.

MOR - Museum of the Rockies

MOR 289R. Undergrad Rsch/Instruction. 1-3 Credits. (1-3 Rct; max unlimited) F,S
Classroom instruction associated with directed undergraduate research/creative activity projects. May be repeated.

MOR 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

MOR 301. Museum Practices. 3 Credits. (3 Lec) F
PREREQUISITE: Junior standing or permission of instructor. Team-taught by Museum of the Rockies staff, the course will introduce students to the museum profession with emphasis on collections and exhibitions. Topics covered include museum missions, object-based learning, collecting theory, curatorial research, managing collections, and developing exhibitions.

MOR 489R. Undergrad Rsch/Instruction. 1-2 Credits. (1-2 Rct; 4 cr max) F,S,Su
Max 4 cr. COREQUISITE: MOR 490. Classroom instruction associated with directed undergraduate research/creative activity projects. May be repeated.

MOR 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

MSEM - Master of Sci & Engineer Mngmt

MSEM 501. Leading Human & Fin Ent. 9 Credits. (9 Lec) F
PREREQUISITE: Undergraduate Degree. Course will develop and enhance your business management skills as they relate to the technical, scientific, or professional enterprise. The course topics will be delivered in an integrated fashion using multiple instructors with expertise in several areas. The course will focus on the following three areas: leading people, leading the financial enterprise, and leading new product development.

MSEM 502. Leading the Tech Enterprise. 6 Credits. (6 Rct) S
PREREQUISITE: Undergraduate Degree, and admission to MSEM program. The course will cover the technical enterprise from the strategic level to the tactical implementation of engineering management fundamentals. Students will investigate ways to increase efficiencies of a technical enterprise through project, process, and people management.

MSL - Military Science Leadership

MSL 101. Leadership and Personal Development. 3 Credits. (2 Lec, 1 Lab) F
2 An introduction to issues and competencies that are central to a commissioned officer’s responsibilities. These initial lessons establish a framework for understanding officership, leadership and Army values. The class also addresses “life skills” including fitness and time management. Laboratory component is required.

MSL 102. Intro to Tactical Leadership. 2 Credits. (1 Lec, 1 Lab) S
PREREQUISITE: Recommended MSL 101. Building on problem solving, communications and leadership. “Life skills” include problem solving, goal setting, interpersonal communication skills and assertiveness skills. Further information about life in the Army. Laboratory component is required.

MSL 106. Army Physical Fitness. 1 Credit. (1 Lab) F,S
Max 4 cr. COREQUISITE: Must be signed up for a MSL 100, 200, 300, 400 level course. MSL 106 is designed to provide students a framework of fitness skills, planning and testing for a lifetime of health. The course consists of three Physical Training sessions per/week that include running, swimming, upper body and core development, sports, and team building exercises. This course may be repeated for credit.

MSL 201. Innovative Team Leadership. 2 Credits. (1 Lec, 1 Lab) F
Leadership studies. An understanding of how to build teams, influence, communicate, decision making, creative problem solving, planning and organizing. Laboratory component is required which includes physical fitness training, and other outdoor skills.

MSL 202. Found of Tactical Leadership. 2 Credits. (1 Lec, 1 Lab) S
An advanced look at leadership principles and the application and practice of those principles. Laboratory component is required and includes the operation of military radios and telephones, and a continued emphasis on physical fitness training.

MSL 204. Leader’s Training Course. 3 Credits. (3 Lec, 1 S Lab) F
PREREQUISITE: Consent of Professor of Military Science -- Practical application of basic knowledge required of an army officer. Subject matter parallels 100 and 200 level courses. Satisfies prerequisites for advanced course in lieu of the basic course.

MSL 205. American Military History. 3 Credits. (3 Lec) F,S
The study of the evolution of the American Military, with concentration on the development of the American military within the context of national historical development, specifically with regard to industrialization, national security, and the United States’ evolving international role and policies. Study of significant battles throughout our history of warfare which includes a field trip to a historical battleground.

MSL 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

MSL 292. Independent Study. 1-3 Credits. (3 Ind; 6 cr max) On demand Max 6 cr. PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

MSL 301. Adaptive Team Leadership. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: MSL 101, MSL 102, MSL 202, MSL 201, or MSL 204. The study, practice and evaluation of adaptive leadership skills. Small unit tactical operations are used to develop self-awareness and critical thinking. Preparation for Leader Development and Assessment Course. A lab component including a field training exercise is required.
MSL 302. Applied Team Leadership, 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: MSL 301. Situational leadership challenges are used to build awareness and skills in leading small units. Skills in decision-making, persuading and motivating team members are explored, evaluated and developed. Preparation for Leader Development and Assessment Course. A lab component including a field training exercise is required.

MSL 305. Leadership Dev Assess Course, 3 Credits. (1.5 Lab) F
PREREQUISITE: MSL 302. Enrollment restricted to successful completion of MSL 301 and MSL 302 and the Professor of Military Science's approval. Practical exercise in tactical, technical, and administrative duties common to all branches of the Army. Development of leadership and the ability to function effectively in small unit operations.

MSL 401. Adaptive Leadership, 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: MSL 302, approval of instructor. Develops proficiency in planning, executing and assessing complex operations, function as a member of a staff and providing leadership performance feedback to subordinates. A lab component is required.

MSL 402. Leadership in a Complex World, 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: MSL 401, approval of instructor. Study of military justice system and international military law. Study of Army organization and administrations. Exploration of the dynamics of leading in complex situations. Preparation for transition from college student to commissioned officer in the Army. A lab component is required.

MSL 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su
Max 12 cr. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

MSL 491. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

MSL 492. Coop Education/Internship. 1-3 Credits. (1 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

MSSE - Master of Science Education

MSSE 501. Inquiry Sci Eng Prac. 2 Credits. (2 Lec) F,S,Su
PREREQUISITE: Approved education methods course. This course provides a focus on inquiry instruction through the use of Science and Engineering Practices for grade K to 16 teachers in science education. Students will identify the components of inquiry in the context of Science and Engineering Practices as described in the NRC Framework for K-12 Science Education. Course goals include development and implementation of inquiry-based instruction and classroom research; and increased understanding of the role of assessment in an inquiry-based science classroom.

MSSE 502. Emerging Technology and the Science Classroom. 3 Credits. (1 Lec, 1 Ind, 1 Rec) Su
This course introduces skills and techniques to deepen students' understanding of technology-enriched instruction in the science classroom. Students in this course are practicing teachers of science. The focus is on emerging technology trends in the K-12 classroom with an emphasis on blended learning techniques, including flipped classrooms and gamification. Students will also explore how to use scientific data sets with their students. The assignments in this course are intended to be practical and have direct utility in the science classroom.

MSSE 503. Integrating Literature into the Science Classroom. 3 Credits. (1 Lec, 2 Rec) S
PREREQUISITE: Upper division courses and others as determined for each offering. This course is designed for elementary, middle and high school teachers of science. The course provides effective strategies to integrate literature in the science classroom. Students will share cross-level instruction and constructive ideas with each other. The goal of this course is to engage and support the integration of reading and science instruction.

MSSE 504. Formative Assess in Sci Ed. 3 Credits. (2 Lec, 1 Rec) F
PREREQUISITE: A minimum of 2 years teaching experience. Formative assessment is an ongoing process in education. This course will engage teachers in an ongoing discussion and study regarding the construction, selection and use of formative assessment methods. The teachers' own instructional settings (classrooms, museums, aquariums, outdoor schools, etc.) are used as "research bases" to conduct classroom assessment studies. The results of the assessments provide immediate feedback on both teacher effectiveness and student learning.

MSSE 505. Foundations of AR in Sci Ed. 3 Credits. (2 Lec. 1 Rec) S
PREREQUISITES: A minimum of 2 years teaching experience and acceptance in the MSSE Program. This course presents an overview of action research for practicing teachers and informal science educators. Students will explore the conceptual underpinnings of action research in science education as they relate specifically to curriculum, teaching and learning of science. Students will gain experience in data collection and analysis and will prepare an action research proposal based on their individual teaching situation.

MSSE 506. Crime Scene Investigators: Forensic Science for Teachers. 2 Credits. (1 Lec. 1 Lab) S
PREREQUISITES: Teachers with a minimum of three years teaching experience. "Crime Scene Investigators: Forensic Science for Teachers" is an exciting, hands-on course which is applicable to elementary school, middle school and high school teachers. Students will develop science process skills, demonstrate knowledge of the nature of science, in addition to implementing inquiry-based labs in their specific teaching context. Students will share cross-level instructional practices and creative pedagogical ideas. The principle goal of this course is to promote the study of forensics; an applied, cross disciplinary science and its implementation in the K-12 teaching environment. This fourteen week course is intended for teachers enrolled in the MSSE program.

MSSE 507. Capstone Data Analysis. 2 Credits. (2 Lec/Lab) S
PREREQUISITES: Bachelor degree in education, science education, or science field. This course is designed to provide graduate students in science education with a background in both descriptive and inferential statistics. By the end of the course, students will be able to choose the most appropriate method to both describe their data and display that data in a clear and concise manner. Students will be able to perform hypothesis tests using a variety of parametric and non-parametric methods with an understanding of the assumptions and limitations of each method as applied to the analysis of Capstone data reported students' Capstone paper, the culminating project for MSSE students.

MSSE 509. Implementing Action Research in Science Education. 3 Credits. (2 Lec. 1 Rec) F
PREREQUISITE: A minimum of 2 years teaching experience, enrollment in the MSSE Program and successful completion of MSSE 504 and MSSE 505. This course is designed for the implementation of action research for practicing science teachers. Students will learn how to effectively conduct research based on the action research model. Prerequisites are MSSE 504 Formative Assessment in Science and MSSE 505 Foundations of Action Research in Science Teaching and Learning.

MSSE 537. The 3 D’s of NGSS. 3 Credits. (2 Lec. 1 Rec) Su
PREREQUISITE: Teacher of science with a minimum of 2 years teaching experience. The course is designed to survey the three dimensions of the Next Generation Science Standards (NGSS): science & engineering practices, crosscutting concepts and disciplinary core ideas. Each dimension will be examined with emphasis on the interconnectedness of the dimensions. The course will help teachers of science, regardless of level or content, teaching in formal or informal settings to better understand the underpinnings of NGSS and to develop strategies to implement NGSS dimensions in their teaching. Weekly assignments include online readings, discussion among colleagues and reflection and application of the content.

MSSE 575. Capstone Paper and Symposium in Science Education. 3 Credits. (2 Lec) Su
PREREQUISITE: A minimum of 2 years teaching experience, enrollment in the MSSE Program, successful completion of MSSE 504, MSSE 505 and MSSE 509. Each Master of Science in Science Education (MSSE) student, with the cooperation of her or his graduate committee, identifies and completes a science education capstone project. The results of each student’s capstone project are summarized in a written, professional paper completed by mid-term of the final summer session. In addition, during the final summer session of a student’s graduate program each student presents their capstone project to their committee, their classmates, and other interested persons at the Symposium in Science Education.

MSSE 589. Graduate Consultation. 1-3 Credits. (1-3 Ind; 3 cr max) S
PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies, and must be the final course in the student's program. This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan) but who need additional faculty or staff time to help.

MSSE 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Max 6 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

MSSE 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Bachelor degree, consent of instructor, and admission to MSSE program. Directed research and study on an individual basis.
MTA - Media & Theatre Arts

MTA 291IH. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand 1 - 4 cr. Maximum 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

MTA 348. Interdisciplinary Projects II. 3 Credits. (3 Rec t) S PREREQUISITE: MTA majors: MTA 222 and MTA 254 and permission of instructor. Studies the theoretical practice of sound and lighting design for live performances. Students gain hands-on experience for designing and executing light and sound.

MTA 370. Professional Practices. 2-4 Credits. (2 Rec; 12 cr max) F,S,Su Max 12 cr. PREREQUISITE: Junior standing in FILM. Projects pursuing under faculty supervision, emphasizing an area of specialization in Theatre, Film or Video relating to professional practices. Details of individual sections and the supervising faculty will be posted by the department prior to pre-registration. May be repeated.

MTA 371. Junior Production:NonFiction. 4 Credits. (4 Rec) F,S,Su PREREQUISITE: Junior standing in FILM. Projects pursued under faculty supervision, emphasizing fiction production using traditional and non-traditional approaches, from conception and pre-production to post-production. Details of individual sections and the supervising faculty will be posted by the department prior to pre-registration.

MTA 511. Production Field Techniques I. 2 Credits. (2 Rec) F Basic field production techniques in film, video, sound, editing. Train on digital video, 16 mm cinematography, sound recording and digital nonlinear editing.

MTA 512. Prod Mgmt & Studies I. 2 Credits. (2 Rec) F COREQUISITE: MTA 510, 511. An introduction to working professionals and faculty that examines successful filmmaking methodologies. May include presentations, forums or seminars designed to explore specific actual production scenarios on a variety of documentary subjects including producing, directing, cinematography, sound, editing, grant writing, distribution and funding.

MTA 516. Production Field Techniques II. 2 Credits. (2 Rec t) S PREREQUISITE: MTA 510, 511. COREQUISITE: MTA 515. Advanced field and studio production exercises in equipment use and applications, including high definition digital imaging, 16 mm cinematography, location and studio sound recording and advanced editing and digital effects.

MTA 531. Bus Legal Aspects Film. 1 Credit. (1 Lec) Su PREREQUISITE: MTA 504, MTA 565, MTA 507, MTA 510, MTA 515, MTA 518, MTA 519 or permission of instructor. This course will examine business and legal issues relating to the production of documentary films.

MTA 532. Underwater Cinematography. 1 Credit. (1 Lab) Su PREREQUISITE: MTA 515 and MTA 516 and permission of instructor. This course will focus on the skills and training necessary to begin filming in the underwater environment.

MTA 552. Adv Production Practices I. 4-6 Credits. (1-6 Lab; 6 cr max) F,S Su PREREQUISITE: MTA 510, 511, 512, 515, 516, 517. COREQUISITE: MTA 572. Pre-production and production of the second year agenda-based professional project sponsored by a hosting agency that finds significant usage. Proposals and treatments are to be polished and refined so that dialogues with broadcasters and hosting agencies can be effectively initiated and funding fully secured. With approval of advisor and graduate committee, production sequence may begin.

MTA 553. Adv Production Practices II. 4-6 Credits. (4 Rec; 6 cr max) S PREREQUISITE: MTA 510,511,512,515,516,517,552. COREQUISITE: MTA 572. Production and post-production of the second year agenda-based professional project that finds significant usage. Production and/or post-production work is to be completed and deliverables presented to the hosting agency. Selects and all cuts are to be screened and critiqued by the hosting agency and by the advisor and graduate committee. The post production phase concludes with the completion of the second year project and the presentation of deliverables to the hosting agency and/or broadcast and distribution venues.

MTA 554. Prod Pract/Post-Production. 3-4 Credits. (3 Ind) S PREREQUISITE: MTA 550 and 552. A committee directed course in which the students begin the post-production phase and concludes with the completion of their second year project.

MTA 572. Thesis Preparation. 1 Credit. (1 Lab) S PREREQUISITE: MTA 510,511,512,515,516,517. COREQUISITE: MTA 592 or 553. Proposals and treatments are distributed to project advisor and to the graduate committee by the first day of fall semester for workshop review and critique. Pre-production, production and post-production schedule milestones must be determined in conjunction with advisor and graduate committee who provide oversight for the entire second year project production sequence. Due to the widely varying nature and unique demand of each project, those unable to meet the preferred residency requirements for their second year project and this course must adhere to a strict teleconference meeting schedule with their advisor and graduate committee and meet all due date requirements for materials review.

MTS - Materials Science

MTS 500. Survey of Mat Science. 1 Credit. (1 Sem) F,S,Su Topics offered at the graduate level which are not covered in regular courses focusing on relevant specialty areas of materials science and engineering research. Students will participate in preparing and presenting discussion material.

MTS 501. Advanced Materials Science I. 4 Credits. (4 Lec) F Ionic and covalent bonding; quantum mechanical foundation of the cohesion of solids, evolution of bond structure; three dimensional crystallography including point groups, stereographic projections, Bravais lattices and space groups; crystalline defects; and the foundation of defect chemistry in ionic crystals.

MTS 502. Adv Materials Science II. 3 Credits. (3 Lec) F Fundamental principles of how materials are designed and synthesized to achieve specific performance. The team taught course is broken up into three 12-lecture segments. Each segment will cover a specific topic including ceramics, polymers, magnetic materials, biomaterials, glasses, etc.

MTS 511. Thermodynamics of Materials. 3 Credits. (3 Lec) F Advanced thermodynamic principles are presented in the context of materials science and processing. The course focuses on the application of thermodynamic principles to materials structure, properties and processing. Subject matter includes elements of solution thermodynamics and application to equilibrium diagrams.

MTS 512. Kinetics Phase Transformations. 3 Credits. (3 Lec) S Treatment of mechanisms controlling the rates of structural/chemical changes in materials. Quantitative diffusion theory and the behavior of surfaces and interfaces. Nucleation and growth as a mechanism for phase transformations and application of phase transformations in materials manipulation and processing.


MTS 594. Seminar. 1 Credit. (1 Lec; 1 cr max) F,S,Su

MUSE - Music-Education

MUSE 123. Techniques Voice. 1 Credit. (1 Lab) F PREREQUISITE: Music Major or consent of instructor. COREQUISITES: MUSI 105; MUSI 140 Introductory vocal training and diction for instrumentalists and beginning singers. Students develop voice production and performance skills for solo and small group singing through a lab setting.

MUSE 130. Techniques Flute & Clarinet. 1 Credit. (1 Lab) F Teaching techniques, materials and basic playing approaches for flute and clarinet. For music education students.

MUSE 131. Techniques Sax, Oboe, Bassoon. 1 Credit. (1 Lab) S Teaching techniques, materials, and basic playing approaches for saxophone, oboe, and bassoon. For music education students.

MUSE 132. Techniques Brass. 1 Credit. (1 Lab) S Teaching techniques, materials, and basic playing approaches for brass instruments. For music education students.

MUSE 134. Techniques Percussion. 1 Credit. (1 Lab) S Teaching techniques, materials, and basic playing approaches for percussion. For music education students.

MUSE 135. Techniques Strings. 1 Credit. (1 Lab) F Teaching techniques, materials, and basic playing approaches for strings. For music education students.
MUSE 140. Lab Instrumental Ensemble. 1 Credit. (1 Lab; 8 cr max) F
Max 8 cr. Repertoire suitable for beginning and advanced secondary school ensembles (band and/or orchestra) will be reviewed. Students are asked to play their secondary instrument. May be repeated.

MUSE 141. Laboratory Choral Ensemble. 1 Credit. (1 Lab; 8 cr max) S
Max 8 cr. Repertoire suitable for beginning and advanced secondary school vocal ensembles will be reviewed. The ensemble will present a recital at the end of the semester under the direction of student conductors. May be repeated.

MUSE 220. Intro to Comp App Music Ed. 2 Credits. (1 Lec, 1 Lab) F
PREREQUISITE: Music Education Major An introduction to computer applications in music, including music notation, marching band and basic music notation, marching band and basic musicianship software programs, as well as audio recording. This course is particularly geared toward music education majors.

MUSE 239. Beginning Conducting. 1 Credit. (1 Lab) S
PREREQUISITE: MUSI 240 and MUSI 205 and MUSI 231. COREQUISITE: MUSI 241 and MUSI 206 and MUSI 232. This course will introduce students to the aural and technical skills necessary to conduct an ensemble. It provides an introduction to practice strategies, issues related to movement and sound and basic conducting technique.

MUSE 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
1-6 cr. IND may be repeated Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research.

MUSE 291. Special Topics. 1-6 Credits. (1 Ind; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

MUSE 339. Conducting Practicum. 1 Credit. (1 Lab) F,S
COREQUISITES: MUSI 335 (fall) or MUSI 336 (spring). Leadership of ensemble, opportunity to apply rehearsal techniques and conducting skills learned in MUSI 335 or MUSI 336. Experience teaching in small ensemble setting.

MUSE 340. Marching Band Techniques. 2 Credits. (2 Lec) On Demand
PREREQUISITE: MUSI 206. COREQUISITE: MUSI 155. Organization, administration, and creative skills necessary for directing a successful public school marching band.

MUSE 383. Assessment in Music Education. 3 Credits. (3 Rct) F,S,Su
3 cr. RCT 3 PREREQUISITE: EDU 222IS or EDU 223IS. Fundamental concepts of differentiated educational assessment for classroom teachers including the alignment of assessment to curriculum standards and essential understandings, quality of assessment, evaluation of student responses, interpretation of results, and improvement of techniques.

MUSE 395. Tching Practicum: General Music. 1-3 Credits. (3 Lab; max unlimited) COREQUISITE: MUSE 397. Students will be assigned to school classrooms to observe children, teachers, and teaching strategies and to serve as teacher aides. Students will teach lessons in subject areas corresponding to the methods classes in which they are currently enrolled.

MUSE 397. Methods: General Music. 3 Credits. (3 Lec) S
PREREQUISITE: MUSI 241, MUSI 206, MUSI 231, MUSE 383, and good standing in Teacher Education Program. COREQUISITE: MUSE 395. Elementary music methods for the music education major; in-depth study and application of elementary music methods using singing, listening, instrument playing, creating, and movement; materials, management, sequencing, planning, and assessment for K-6 music classes.

MUSE 439. Choral Field Experience. 1 Credit. (1 Lab) F
COREQUISITE: MUSE 497MC. A field experience in secondary (grades 5-12) choral music situations prior to student teaching. Observations, interviews, and brief teaching experiences with music ensembles at the secondary level.

MUSE 445. Studio Teaching Experience. 2 Credits. (2 Ind; 4 cr max) F,S
Max 4 cr. PREREQUISITE: Senior standing and one of the following: MUSI 438, MUSI 442, MUSI 452. Supervised teaching in student’s performance area. May be repeated.

MUSE 497MC. Methods: Chrl Mhds & Lit 5-12. 3 Credits. (3 Lec) F
PREREQUISITE: MUSI 336, MUSE 497MI. COREQUISITE: MUSE 439. Rehearsal techniques, materials, literature, strategies for classroom management and the administration of the choral program for the middle school and high school choral instructor.

MUSE 497MI. Methods: Inst Mhds & Lit 5-12. 3 Credits. (3 Lec) S
PREREQUISITE: MUSI 335, MUSE 397, COREQUISITE: MUSE 437. Rehearsal techniques, materials, literature, strategies for classroom management and the administration of the instrumental program for the middle school band and orchestra teacher.

MUSE 530. Music, Society, Education. 3 Credits. (3 Lec) Su alternate years, to be offered odd years.
PREREQUISITE: EDEL 410, EDSD 410 Philosophical, historical, psychological and social foundations of music education. Music in public education, music curricula, aesthetics, and music learning theory.

MUSE 532. Music Ed: Res and Practice. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: EDEL 410, EDSD 410 Examination and close study of research in music education and its implications for practice.

MUSE 535. Teaching Music Literacy. 2 Credits. (2 Lec)
On demand PREREQUISITE: EDEL 337. Analysis of the foundations of music literacy, contemporary trends in music reading and writing instruction and research related to these issues.

MUSE 542. Graduate Vocal Pedagogy. 3 Credits. (3 Sem) On Demand
3 cr. SEM 3 PREREQUISITE: MUSI 442. COREQUISITE: Must be an active music educator. Online/Seminar delivery centers around classroom application of vocal methodologies in the studio and classroom. Course content will include the study of vocal physiology and acoustics.

MUSE 545. General Music Practicum. 3 Credits. (3 Lec) S alternate years, to be offered every year.
Current issues and developments, teaching-learning systems, materials, media, strategies, and research relevant to K-8 general music education. Practical application of course content to one’s own teaching situation through online readings, research, discussions, and presentations.

MUSE 575. Professional Paper and Project. 1-4 Credits. (1-4 Ind. Study)
PREREQUISITES: Graduate Standing. Max 6 cr. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

MUSE 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand
PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. Courses offered on a one-time basis to fulfill professional development needs of in service educators. A specific focus is given to each course which is appropriately subtitled. May be repeated.

MUSE 590. Professional Paper and Project. 1-4 Credits. (1 Ind; 6 cr max) F,S,Su
Max 6 cr. PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

MUSE 591. Special Topics. 2 Credits. (2 Sem) Su
PREREQUISITE: Bachelor’s degree in Music, Music Education, or related field. This intensive course presented by music professionals and music educator session presenters will allow the student/teacher total immersion with experts in all areas of music teaching and performance to include woodwinds, brass, percussion, small and large ensembles. Woodwind, brass and percussion instruments will be studied regarding proper technique, pedagogical and physical problems, and the teaching of music through each individual performance area and the full instrumental ensemble. Selected concert band and ensemble literature will be studied and analyzed relating to the teaching of national standards for music through the instrumental ensemble medium and individual teaching techniques and effectiveness.

MUSE 592. Independent Study. 1-3 Credits. On Demand
Max 6 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of Director and Dean of The Graduate School. Directed research and study on an individual basis.

MUSE 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
Max 4 cr. PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.
MUSE 598. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) On Demand Max credits unlimited PREREQUISITE: Graduate standing, consent of instructor and Director. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

MUSI - Music-General

MUSI 101IA. Enjoyment of Music. 3 Credits. (3 Lec) S Introduces students to the rich legacy of Western Art Music, defined as noted musical traditions in Europe and later in the USA from liturgical chant to the present. Explores the historical context that led to the development of important genres and influenced the lives of composers. Facilitates active listening and curious inquiry into the language of music.

MUSI 102. Performance Study. 1 Credit. (1 Studio) F,S PREREQUISITES: Performance audition and consent of instructor required; music majors only. COREQUISITE: Concurrent university ensemble participation. Individual or group vocal or instrumental instruction.

MUSI 103RA. Fundamentals of Musical Creation. 3 Credits. (1 Lec, 1 Lab) F,S Open to all students. Study of the elements of music and their combination in musical creation. Activities include the acquisition of keyboard skills, exploration of traditional harmonic theory and exercises in music reading, analysis, and composition.

MUSI 105. Music Theory I. 3 Credits. (3 Lec) F PREREQUISITE: Music fundamentals pre-test. COREQUISITE: MUSI 140. Music fundamentals, diatonic harmony and elementary counterpoint. Successful completion of Music Fundamentals Pre-test (administered during the first class meeting and covering scales, rhythm/meter, clefs, and key signatures) required for enrollment in this course.

MUSI 106. Music Theory II. 3 Credits. (3 Lec) S PREREQUISITE: MUSI 105. Continuation of study of materials used in the previous semester: diatonic harmony and analysis in the common practice style, musical notation and language, function and interaction of the elements of music.

MUSI 112. Choir; University Chorus. 1 Credit. (1 Lab; 8 cr max) F,S; may be repeated, max 8 cr. PREREQUISITE: Consent of Instructor. Intermediate, mixed-voice choir performing a variety of concert music. Previous choral experience strongly suggested.

MUSI 114. Band I; MSU University Band. 1 Credit. (1 Lab, Max 8 cr.) Study and performance of traditional and contemporary repertoire for wind and percussion in a large ensemble format. Open to all students with high school instrumental music experience. May be repeated.

MUSI 120IA. Musicianship. 3 Credits. (1 Lec, 2 Lab) F This course involves the study of the elements of music. Activities will include exploration of basic music theory, aural perception, and keyboard skills. Class time will also include intensive practice in music reading, writing, and recognition, as well as the development of basic keyboard skills.

MUSI 130IA. History of Jazz. 3 Credits. (3 Lec) S Important literature from American jazz, with an emphasis on a detailed study of styles that have developed new directions in music and shaped America's culture.

MUSI 131. Jazz Ensemble I; MSU. 1 Credit. (1 Lab, Max 8 cr.) PREREQUISITE: Successful audition. Ensemble experience performing musical styles that include swing, jazz, commercial, and popular music. Open to all students with high school instrumental music experience. May be repeated.


MUSI 136. Keyboard Skills II. 1 Credit. (1 Lab) S PREREQUISITE: MUSI 135 or placement audition and music major. COREQUISITE: MUSI 106. Continued study of keyboard theory and techniques, creative activities, sight reading, and piano repertoire. For music majors.


MUSI 141. Aural Perception II. 1 Credit. (1 Lab) S PREREQUISITE: MUSI 140. COREQUISITE: MUSI 106. Continuation of studies in ear training and sight-singing to develop aural perception of tonal and temporal relationships. Primarily for students with planned concentration in music.

MUSI 155. Marching: Spirit of the West. 1-2 Credits. (1 Lab; max unlimited) F, S LAB Non-auditioned ensemble offering experience in marching techniques and outdoor performances. May be repeated.


MUSI 161. Intermediate Guitar II. 1 Credit. (1 Lab) S PREREQUISITE: MUSI 160 or placement audition. Continuation of MUSI 160.


MUSI 203IA. American Popular Music. 3 Credits. (3 Lec) F,S A study of the way in which American popular music is a product of the social, political, and historical context in which it developed, and in turn how this context was shaped by this music.


MUSI 211IA. Masterworks in Music. 3 Credits. (3 Lec) F,S Presentation of examples of great music literature to develop informed, perceptive listening and musical understanding.

MUSI 219IA. Honors Music & Society. 3 Credits. (3 Sem) S An investigation into the relationship between composers, and the cultural, political, and social influences that impacted their creative work. Various composers and significant musical works representing diverse style periods, cultures, and historical backgrounds will be discussed in depth. Students will be required to present a final paper discussing the work of a specific composer of their choice, incorporating the above criteria. Restricted entry. Priority to University Honors students.

MUSI 230. Internm Keyboard: Repertoire. 1 Credit. (1 Lab) F PREREQUISITE: MUSI 136 OR placement audition and music major. Continuation of the study of keyboard theory and technique, sight reading, and piano repertoire. For non-keyboard music majors.

MUSI 231. Internm Keyboard: Accompanying. 1 Credit. (1 Lab) F PREREQUISITE: MUSI 136 or placement audition and music major. Continuation of the study of keyboard theory and technique, ensemble playing, sight reading, and piano accompanying. For non-keyboard music majors.

MUSI 232. Internm Keyboard: Opn Sce Rng. 1 Credit. (1 Lab) S PREREQUISITE: MUSI 136 or placement audition and music major. Continuation of the study of keyboard theory and technique, creative activities, sight reading, improvisation and performance of jazz. For music majors.

MUSI 240. Aural Perception III. 1 Credit. (1 Lab) F PREREQUISITE: MUSI 141. Continued development of aural and vocal skills that deal with tonal and temporal relationships.

MUSI 241. Aural Perception IV. 1 Credit. (1 Lab) S PREREQUISITE: MUSI 240. COREQUISITE: MUSI 206. Continued development of aural and vocal skills that deal with tonal and temporal relationships.


MUSI 291. Special Topics. 1-6 Credits. (1 Lab; 12 cr max) On Demand Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.
MUSI 295. Applied Music II. 1-2 Credits. (1-2 Sru; Max 8 Enrollments) F,S,Su
PREREQUISITE: MUSI 195 and successful audition. Continued instruction in techniques of performance and interpretation to develop musical ability, expression, accuracy, and stylistic awareness in student’s performance area. May be repeated (maximum of eight enrollments).

MUSI 301. Music History I. 3 Credits. (3 Lec) S
PREREQUISITE: MUSI 106. Music as it relates to other arts and humanities from an historical and stylistic perspective. From Antiquity through the Baroque era.

MUSI 302. Music History II. 3 Credits. (3 Lec) F
PREREQUISITE: MUSI 106. Music as it relates to other arts and humanities from an historical and stylistic perspective. The Classical and Romantic eras.

MUSI 303. Music History of 20th Century. 3 Credits. (3 Lec) S
PREREQUISITE: MUSI 106 and MUSI 301 or MUSI 302. Music as it relates to other arts and humanities from an historical and stylistic perspective. 20th Century and Jazz.

MUSI 307IA. World Music. 3 Credits. (3 Lec) F,S
PREREQUISITE: Junior standing. Music, culture, and meaning within different traditions and styles from around the world.

MUSI 308. Orchestras II: MSU Symph Orch. 1 Credit. (1 Lab, Max 8 cr.)
PREREQUISITE: Successful audition. Advanced training in the performance repertoire for orchestra. May be repeated.

MUSI 309IA. Sing the Hallelujah Chorus - Performance & Study. 3 Credits. (3 Lec) S
PREREQUISITE: Previous choral experience is recommended, but not required. COREQUISITE: Must be able to match pitch. Students will explore Handel’s Hallelujah Chorus as well as other major choruses from the Messiah through choral preparation, performance and historical lecture.

MUSI 310. Opera Theatre II. 1 Credit. (1 Lab) F,S
1 cr. May be repeated, max 8 cr. PREREQUISITE: Successful audition. Advanced training in the performance of opera and musical theater repertoire.

MUSI 312. Choir III: MSU Chorale. 1 Credit. (1 Lab, Max 8 cr.)
PREREQUISITE: Successful audition. Advanced choral performance. May be repeated.

MUSI 314. Band III: MSU Wind Symphony. 1 Credit. (2 Lec, Max 8 cr.)
PREREQUISITE: Enrollment by audition. Study and performance of advanced, traditional, and contemporary wind band repertoire.

MUSI 322. Percussion Ensemble. 1 Credit. (1 Lab,Max 8 cr.)
PREREQUISITE: Successful audition Advanced ensemble performance experience focusing primarily on music written for percussion during the 20th century. May be repeated.

MUSI 331. Jazz Ens II: One O’Clock Jazz. 1 Credit. (1 Lab, Max 8 cr.)
PREREQUISITE: Successful audition. Advanced performance training in jazz literature from all style periods, guided improvisational experience. May be repeated.

MUSI 335. Instrumental Conducting. 2 Credits. (1 Lec) F
PREREQUISITE: MUSI 241, MUSI 206. Basic conducting and instrumental rehearsal techniques, instrumental score study, laboratory experiences.

MUSI 336. Choral Conducting. 2 Credits. (1 Lec) S
PREREQUISITE: MUSI 335. Basic conducting and choral rehearsal techniques, choral score study, laboratory experiences.

MUSI 348. Ensemble. 1 Credit. (1 Lab, Max 8 cr.)
PREREQUISITE: Successful audition. Selected students perform in small, coached instrumental and vocal ensemble performance. May be repeated.

MUSI 351. Accompanying. 2 Credits. (2 Lec) F alternate years, to be offered even years.
PREREQUISITE: MUSI 295. Study of repertoire and principles of accompaniment in all style periods. Laboratory experiences include accompanying instrumentalists and vocalists.

MUSI 362. Chmbr Ens III: MSU. 1 Credit. (1 Lab; 8 cr max) F,S
Max 8 cr. COREQUISITE: MUSI 195, MUSI 295, MUSI 395, MUSI 495, or MUSI 595; or successful audition. Students perform in small, coached instrumental and vocal chamber music ensembles. Students study and perform chamber music repertoire composed between 1650 and the present. Vocal chamber ensembles limited to eight members and one rehearsal per week.

MUSI 382. Dict: Gem & French (equiv 282). 2 Credits. (2 Lec) F alternate even years PREREQUISITE: MUSI 281 Correct pronunciation of German and French for singers using the International Phonetic Alphabet. Study of standard art song and operatic repertoire in German and French.

MUSI 395. Applied Music III. 1-2 Credits. (1-2 Sru; Max 8 Enrollments)
PREREQUISITE: MUSI 295 and successful audition. Continued study of techniques of performance and interpretation to develop musical ability, expression, accuracy, and stylistic awareness in student’s performance area. May be repeated (maximum of eight enrollments).

MUSI 407. Counterpoint. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: MUSI 206. Study and practice of the techniques of writing two- and three-voice counterpoint. 16th, 18th, and 20th-Century styles.

MUSI 410. Analysis. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: MUSI 206. Advanced analysis and in depth study of selected and representative works from specific categories, such as chamber, orchestral, vocal, or choral music.

MUSI 422. MSU Chamber Orchestra. 1 Credit. (1 Lab) S
PREREQUISITE: Audition or Consent of Instructor. A small (20-30member) auditioned orchestra of strings and a few winds suitable for playing appropriate literature, such as works from the Baroque of Classical era, or more modern works written for smaller forces.

MUSI 426. Montanans. 1 Credit. (1 Lab, Max 8 cr.)
PREREQUISITE: Successful audition. Advanced performance in small vocal ensemble using stylistic variety in programming.

MUSI 428. Gamelan. 1 Credit. (5 Lab Max 8 cr) PREREQUISITE: MUSI 195 and MUSI 307IA and consent of instructor. Balinese gamelan orchestra rehearsal and performance using authentic instruments. Both traditional music for the angklung gamelan as well as newer directions in music will be addressed. Traditional role learning and musical notation will be used. May be repeated.

MUSI 430. Keyboard Studio Pedagogy. 2 Credits. (2 Lec) F alternate years, to be offered odd years.
PREREQUISITE: Junior standing and MUSI 295. Study of studio and class piano teaching techniques, beginning piano methods, beginning keyboard literature and materials needed for studio/class piano teaching. Observations and supervised teaching experiences are included.

MUSI 432. Keyboard Literature. 2 Credits. (1 Lec, 1 Lab) S alternate years, to be offered even years.
PREREQUISITE: MUSI 430. Study of historical keyboard instruments and literature from the 1600s to the present.

MUSI 438. Instrmntl Studio Pedagogy & Lit. 2 Credits. (2 Lec) F,S and on demand. PREREQUISITE: Junior standing, MUSI 295. Studio teaching techniques and relevant studies, solo, and ensemble literature in the student’s major applied area. Evaluation of literature and progression of a young player. Required observation of experienced private lesson teachers.

MUSI 440. Orchestration. 2 Credits. (1 Lec, 1 Lab) S
PREREQUISITE: MUSI 206. Training in scoring principles for instrumental ensembles with emphasis on arranging and adapting music for public school programs.

MUSI 442. Vocal Studio Pedagogy and Lit. 2 Credits. (1 Lec, 1 Lab) S
PREREQUISITE: Junior standing, and one of the following: MUSE 123 or MUSI 295 (voice) and MUSI 231. Students will know the anatomy and physiology relating to the singing voice, develop and design teaching techniques, and select literature for the singing voice.

MUSI 446. Advanced Applied Conducting. 1-2 Credits. (1-2 Lab; 2 cr max) F,S
PREREQUISITE: Junior standing, and one of the following: MUSI 335 and MUSI 336 and MUSI 231 or MUSI 232. Provides BA-Music and BME-Music Education majors with practical experience in conducting, leadership, and management. Students will study advanced conducting and rehearsal techniques, and perhaps have the opportunity to conduct large ensembles as Student Conductors.

MUSI 450. Recital. 1 Credit. (1 Ind; max unlimited) F,S,S,Su
COREQUISITE: MUSI 395 or MUSI 495. Selection of appropriate program of works suited to student’s abilities, preparation for performance. May be repeated.

MUSI 460. Guitar Master Class. 1 Credit. (1 Ind) Su and on demand. PREREQUISITE: MUSI 295 (Guitar). Pedagogical and performance techniques in classical guitar.

MUSI 485. Acoustic Composition. 1-3 Credits. (1-3 Ind. Max 12 cr.) F,S
PREREQUISITE: MUSI 106. Max 12cr. Individual study of compositional practices for acoustic/orchestral instruments, compositional processes and techniques, standard notation and part-writing, and aesthetic concepts. Students meet minimum weekly progress standards and a total requirement for minutes of music written, adjustable for the complexity of the medium . May be repeated.
MUSI 491. Special Topics. 4 Credits. (1-2 Lec; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

MUSI 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
1-3 cr., Max 6 cr. PREREQUISITE: Junior standing, consent of instructor and approval of the director. Directed research and study on an individual basis.

MUSI 494. Seminar. 1 Credit. (1 Sem; 4 cr max) F,S,Su
Max 4 cr. PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

MUSI 495. Applied Music IV. 1-2 Credits. (1-2 Stu; Max 8 Enrollments)
PREREQUISITE: MUSI 395 and successful audition. Continued study of techniques of performance and interpretation to develop musical ability, expressivity, accuracy, and stylistic awareness in student’s performance area. May be repeated (maximum of eight enrollments).

MUSI 498. Internship. 2-6 Credits. (2-6 Ind; 12 cr max)
-- internship in music.

MUSI 499R. Senior Capstone Project. 3 Credits. (2 Lec)
COREQUISITE: MUSI 395 or MUSI 495.

MUSI 504. Studies in Hist and Analysis. 3 Credits. (3 Lec) Su alternate years, to be offered every even year.
PREREQUISITE: MUSI 206, MUSI 301, MUSI 302. Review and study of the history of music, with an emphasis on specific works. Review and practice of analytical and theoretical techniques and concepts in a variety of musical genres and styles.

MUSI 515. Contemp Direct Music. 2 Credits. (2 Lec)
On demand PREREQUISITE: MUSI 302. In-depth investigation of musical styles prevalent in western music between 1975-present.

MUSI 519. World Music. 2 Credits. (2 Lec)
On demand PREREQUISITE: MUSI 302. Approaches to and use of music in world cultures. The influence of world musics on Western music.

MUSI 520. Montana Chamber Music Workshop. 2 Credits. (2 Lab) Su
PREREQUISITE: MUSI 295, MUSI 295 and consent of instructor. Students investigate the wealth of chamber music literature that includes their own instrument in various instrumental combinations, through coached playing assignments and in performance forums.

MUSI 540. Advanced Conducting. 1-3 Credits. (1-3 Rct) F,S,Su
PREREQUISITE: MUSI 335 or MUSI 356. Conducting techniques, score study and rehearsal procedures for direction of instrumental and choral groups in the public schools. Online readings, research, and discussions with on-campus and off-site conducting of ensembles. May be repeated for credit.

MUSI 550. Graduate Recital. 1 Credit. (1 Ind) F,S,Su
PREREQUISITE: MUED 560. Formal recital to include works from different eras.

MUSI 595. Applied Music. 1-2 Credits. (1-2 Stu) F,S,Su
PREREQUISITE: MUSI 495 or demonstrated proficiency and consent of instructor. Advanced studies of techniques of performance and interpretation to develop musical ability, expression, accuracy and stylistic awareness in student’s performance area. May be repeated.

**MUST - Music-Technology**

MUST 112. Basic Home Recording. 3 Credits. (3 Lab) 5
This class will familiarize students with information and processes in a functioning home studio using Pro Tools. Through hands-on tutorials, the students will develop essential techniques for setup, recording, editing, and basic mixing.

MUST 115. Introduction to Digital Music. 3 Credits. (3 Lec)
PREREQUISITE: MTEC Majors ONLY First course in the Music Technology Sequence. Concepts and terms, creative projects using software and hardware, historical background, an introduction to the music industry, and tools for building self-directed careers within the changing field of music technology.

MUST 125. MIDI and Electro-Acoustic Comp. 3 Credits. (3 Lec)
PREREQUISITE: MTEC Majors ONLY, MUST 115 Continuation of the MIDI component of Introduction to Digital Music. Composition and music notation, synthesizer programming, constructing an integrated music technology studio, and advanced applications for film and theatre.

MUST 217. Entertainment Business. 3 Credits. (3 Lec) F
PREREQUISITE: W and US core. Explore the business of Music, Entertainment, and Film industries. Arrir Copyright, Royalties, Mechanical Licensing, Performance Contract, and basic contracts will be discussed with regard to business history, organization, media channels, and customer base.

MUST 220. Recording I. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: MTEC Majors ONLY, MUST 125, MUSI 105, MUSI 135, MUSI 140. Introduction to, and exploration of, technologies and concepts used to create, record, edit, format, manufacture, reinforce and reproduce audio. Combination of lecture and hands-on learning.

MUST 225. Elect Monster Laptop Ensemble. 2 Credits. (2 Lab) On Demand
2 cr. Lab 2, max 6 cr. PREREQUISITE: consent of instructor. Performance and study of music making in an ensemble of mainly laptop computers. Computer music programming skills as well as music performance experience desirable.

MUST 294. Seminar/Workshop. 1 Credit. (1 Sem)
PREREQUISITES: MTEC Majors ONLY, MUST 125 Introduction to faculty research through faculty mini seminars. Departmental research facilities. Research groups. Research planning decisions (MSU laboratory, summer internship, student exchange, REU, USF, etc).

MUST 305. Orchestration for New Media. 3 Credits. (2 Lec, 1 Lab)
PREREQUISITE: MTEC Majors ONLY, MUST 125, MUSI 106, MUSI 136, MUSI 141, Applied Music (MUSI 195 or MUSI 260); other music majors: permission of instructor only. Study of the full orchestra, its subgroups, and integration of software instruments for orchestrating music in today’s world.

MUST 320. Recording II. 3 Credits. (3 Lab)
PREREQUISITE: MTEC Majors ONLY, MUST 220, ELEE 217 An advanced laboratory course in recording and mixing, to include microphone techniques, outboard gear, recording and mixing individual instruments and ensembles, mastering techniques, session management, and business organization.

MUST 341. Sound Design and Synthesis. 3 Credits. (3 Lec)
PREREQUISITE: MTEC Majors ONLY, MUST 220, ELEE 217 Advanced study of techniques for the design of music, sounds, and aural environments. Students will explore artistic and scientific applications of recent research in sound, including software for analysis-synthesis, noise reduction, cross-synthesis, physical modeling, and acoustical analysis. Links between music composition, acoustics, computer science, and multimedia post production are emphasized.

MUST 350. Real-Time Computer Music. 3 Credits. (3 Lec) F
PREREQUISITE: MTEC Majors ONLY, MUST 341 Study of the real-time interactive computer music programming and application through performance. Students will learn standard objects and operational strategies in the program by building small modules and assembling them into larger patches, which then facilitate compositions and performances.

MUST 380. Interdisciplinary Proj I: Visual Music. 3 Credits. (3 Rct)
PREREQUISITE: MTEC Majors and FILM Majors Only, MUST 341 or FILM 212, All Other Majors: Consent of Instructor For upper-level Film and Music Technology students. Exploring and creating works in cross-disciplinary audiovisual genres. Multimedia projects with visuals and sound. Overview of the history and creation of innovative audio, audiovisual, and installation art forms.

MUST 382. Interdisciplinary Projects II. 3 Credits. (3 Lec; 12 cr max)
PREREQUISITE: MTEC Majors ONLY, FILM 259, All other Majors: Consent of Instructor Topics vary by semester in this interdisciplinary course connecting Music Technology with other areas of study. Possible projects include sound design and composition for large theatre productions, audio equipment design with Electrical Engineering students, studio design and acoustics, and others.

MUST 384. Film Scoring. 3 Credits. (1 Lec, 2 Lab)
PREREQUISITE: MTEC Majors ONLY, MUST 305 The course objective is to provide the student with knowledge and guidance through the various stages of the process of creating original music to accompany a visual medium. While no previous film scoring experience is required, a fundamental background in music theory, keyboard skills, and music technology is preferred.

MUST 482. Electronic Composition. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: MTEC Majors ONLY, MUST 341 Individual study of compositional practices employing electronic media, electronic/computer music, compositional processes and techniques, and aesthetic concepts. Students meet minimum weekly progress standards and a total requirement for minutes of music written, adjustable for the complexity of the medium.

MUST 494. Seminar. 1 Credit. (1 Sem; 4 cr max)
PREREQUISITE: MTEC Majors ONLY, MUST 220 Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.
MUST 498. Internship. 1-6 Credits. (2-6 Int; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: MTec Majors ONLY. MUST 220. Consent of instructor. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

MUST 499R. Senior Recital/Capstone Pjt. 3 Credits. (2 Lec) PREREQUISITE: MTec Majors ONLY. MUST 384, Senior Standing Creation and public performance of a large-scale work incorporating original sound design (film score, multimedia work, EP-length album, or theatrical soundtrack) plus research paper synthesizing knowledge and inquiry in the Music Technology major.

MUST 544. Comp App Mus Ed. 3 Credits. (1 Lec, 2 Lab) Su PREREQUISITE: Admission to the Master of Education with emphasis in Music program. Other graduate programs and non-degree-seeking graduate students by permission of instructor. An introduction to computer applications in music, including music notation, audio recording, and basic composition with audio and MIDI. This course is particularly geared toward music educators.

NAS - Native American Studies

NASX 105D. Introduction to Native American Studies. 3 Credits. (2 Lec, 1 Rct) F,S Su A survey of traditional and contemporary American Indian cultures, the historical development of the unique relationship between the federal government and Indian nations, and current issues facing American Indians today, with special emphasis on tribal groups in Montana.

NASX 205D. Native Americans in Contemporary Society. 3 Credits. (3 Lec) F Selected contemporary economic, social, political, educational, and cultural issues facing American Indians today, with special emphasis on tribal groups in Montana.

NASX 232D. MT Indians: Cultures, Histories, Current Issues. 3 Credits. (3 Lec) Movements of Indians into Montana. Social structures including kinship, political affiliations; military, warrior societies, and religion. Establishment of Montana’s reservations; treaties and agreements with the federal government; vested rights of Indians; sovereignty and self-government; contemporary tribal governments; contemporary Indian societies; socioeconomic problems.

NASX 239. Native North American History through Art and Material Culture. 3 Credits. (3 Lec) The aesthetic, cultural, and symbolic meanings of traditional and contemporary American Indian art: Plains, Southwestern, Northwest Coast, and Inuit art and artists.

NASX 253. Indigenous Literature and the West. 3 Credits. (3 Sem) On Demand This course will familiarize us with Indigenous literature and its relation to the American and Canadian West. We will seek to retrace the creation of the Western mythos while placing Indigenous perspectives and literature at the center of our discussions.

NASX 280HS. Native Ways of Knowing. 3 Credits. (3 Sem) On Demand This course critically examines the political and academic foundations of Native American Studies, it explores the theoretical and methodological underpinnings, emphasizing indigenous paradigms and practices. Students are expected to think analytically, participate in discussion, and do original research.

NASX 290R. Undergraduate Research. 1-8 Credits. (1-8 Ind; 8 cr max) F,S PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity. Course will address responsible conduct of research.

NASX 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Courses not required in any curriculum for which there is a particular one-time need, or given on a regular basis to determine acceptability and demand before requesting a regular course number.

NASX 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand PREREQUISITE: Consent of instructor. Directed research and study on an individual basis.

NASX 294R. Seminar/Workshop. 1-2 Credits. (1 Rct; 2 cr max) On Demand COREQUISITE: NASX 290R. Classroom instruction associated with directed undergraduate research and creative activity projects.

NASX 304. Native American Beliefs and Philosophy. 3 Credits. (3 Lec) On Demand PREREQUISITE: NASX 105D or NASX 232D and upper division standing or consent of instructor. An in-depth analysis of specific contemporary and historic, tribal, and pan-Indian beliefs. Basic elements of Native American religions are defined from the perspective of the practitioner’s understanding of their contributions to distinct cosmologies. The legal protection of Native American religions frames the analysis.

NASX 310. Native Cultures of North America. 3 Credits. (3 Lec) On Demand Histories and cultures of representative Native peoples of North America; impact of European discovery, conquest and colonization; political, social, and economic developments from pre-Colombian to present times including contemporary issues facing the indigenous peoples of the Americas.

NASX 340. Native American Literature. 3 Credits. (3 Lec) PREREQUISITE: Junior standing and WRIT 101W. Traditional and contemporary Native American literature including oral narratives, folktales, poetry, short stories, essays, and the novel. Methods of literary analysis will be explored to assist students in determining the meaning and function of the various genres.

NASX 340II. Native American Literature. 3 Credits. (3 Lec) On Demand PREREQUISITE: Junior standing and WRIT 101W. Traditional and contemporary Native American literature including oral narratives, folktales, poetry, short stories, essays, and the novel. Methods of literary analysis will be explored to assist students in determining the meaning and function of the various genres.

NASX 360. Native Americans and Cinema. 3 Credits. (3 Lec) Analysis of images and representations of American Indians in feature, independent, and tele-films based in a cultural studies approach to film and film production. Considerable attention is given to Indigenous aesthetics.

NASX 405. Gender Issues in Native American Studies. 3 Credits. (3 Lec) On Demand PREREQUISITE: Upper division standing or consent of instructor. Compare and contrast the social construction of gender in Native American cultures and Euroamericans. Explore role of women, men and “two-spirit” gender of early North American Indigenous societies. Analyze the impact of European colonization on traditional roles and examine contemporary gender issues.

NASX 415. Native Food Systems. 3 Credits. (1 Lec) On Demand PREREQUISITE: NASX 105D or NASX 223D and upper division standing or consent of instructor. This course engages indigenous practices and beliefs, focusing particularly on the food systems of the Native Americans, and using comparative data from across time and space. Of specific interest are dynamic connections between Native foods and the health of people and place, both traditionally and in societies affected by colonization and rapid cultural change.

NASX 430. American Indian Education. 3 Credits. (3 Lec) On Demand PREREQUISITE: Upper division standing or consent of instructor. Historical development and contemporary directions in American Indian education, values and assumptions inherent in programs devised at the state and federal levels and their results, the cultural basis of Indian education, and selected materials appropriate to the various educational levels.

NASX 440. Montana Indian Literature. 3 Credits. (3 Lec) F alternate odd years PREREQUISITE: Upper division standing or consent of instructor. Examination of literature written by and about Native American peoples in Montana. Emphasis on the changing status (function and value) of such writing and on social and political analyses of texts and writers, including Earlgin, McNickle, Mourning Dove, and Welch.

NASX 450. History of American Indians. 3 Credits. (3 Lec) On Demand PREREQUISITE: Upper division standing or consent of instructor. Historical development and contemporary directions in American Indian education, values and assumptions inherent in programs devised at the state and federal levels and their results, the cultural basis of Indian education, and selected materials appropriate to the various educational levels.

NASX 470. Indigenous Planning: Strategic Economic and Human Development Approaches. 3 Credits. (3 Lec) F The intent of this course is to empower students through substantive knowledge of contemporary strategic planning and Indigenous community development. This course will build a foundational understanding of the political, legal and cultural protocols, values, social structure, development economics and traditional knowledge of American Indian, Alaska Native and Pacific Islander peoples, and engage with historical and contemporary models of activism within Indigenous and non-Indigenous communities, with an emphasis on producing authentic interdisciplinary initiatives that both indigenous and non-Indigenous communities can use.

NASX 470. Indigenous Planning: Strategic Economic and Human Development Approaches. 3 Credits. (3 Lec) F Alternate odd years PREREQUISITE: Any 400- or 500-level NASX course or equivalent (e.g., upper division history, political science, or anthropology courses dealing with Indigenous peoples). To explore historical and contemporary models of activism within Indigenous and non-Indigenous communities, with an emphasis on producing authentic interdisciplinary initiatives that both indigenous and non-Indigenous communities can use.

NASX 476. American Indian Policy and Law. 3 Credits. (3 Lec) F PREREQUISITE: NASX 105D or NASX 232D and upper division standing or consent of instructor. Survey of institutions, laws, cultures, and political forces which shaped federal Indian policy from colonial times to the present. Examination of primary documents, treaties, case law, and agencies which are the foundations of federal relationships with Indian Tribes.
NASX 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) 
-- PREREQUISITE: Consent of instructor. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research.

NASX 490Z. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) 
-- Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research.

NASX 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand 
PREREQUISITE: Course prerequisite as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number. Co-convened with NASX 591.

NASX 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand 
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis. Co-convened with NASX 592.

NASX 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand 
COREQUISITE: NASX 490R. Classroom instruction associated with directed undergraduate research/creative activity projects.

NASX 498. Internship/Cooperative Educ. 2-12 Credits. (2-12 Ind; 12 cr max) On Demand 
PREREQUISITE: Consent of instructor. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

NASX 505. Proseminar Native Amer Studies. 3 Credits. (3 Sem) F 
PREREQUISITES: Graduate standing. This course is a Graduate introduction to Native American Studies.

NASX 515. Native Food Systems. 3 Credits. (3 Lec) 
This course engages indigenous practices and beliefs, focusing particularly on the food systems of the Native Americans, and using comparative data from across time and place. Of specific interest are dynamic connections between Native foods and the health of people and place, both traditionally and in societies affected by colonization and rapid cultural change.

NASX 520. Fem/Gender Theories IN NAS. 3 Credits. (3 Lec) On Demand 
PREREQUISITE: Graduate standing. This course is intended to explore gender issues in Native American Studies. It will critically explore the problems and points of conflict between Native American women's gender concerns and Euroamerican feminist theories.

NASX 521. Tribal Government: Yesterday & Today. 3 Credits. (3 Lec) 
PREREQUISITE: Graduate standing. The course examines the complexities of American Indian governments' organization, their histories, and the unique relationship between the Federal government and American Indian tribes. The course highlights several models of both traditional and contemporary tribal governance systems.

NASX 523. Am Indians/Minority in High Ed. 3 Credits. (3 Lec) On Demand 
PREREQUISITE: Graduate standing. The course will develop and build the students' understanding of the historical and current situation of American Indians and other minorities in the U.S. higher education. It will also focus on the unique place of tribal colleges in the U.S. higher education.

NASX 524. Contemporary Issues in American Indian Studies. 3 Credits. (3 Lec) On Demand 
PREREQUISITE: Graduate standing. The course is intended to develop and refine the students' knowledge of the historical background of American Indian issues and how history now affects the contemporary issues facing American Indians.

NASX 525. Indigenous Philosophies/Sacred Ecologies. 3 Credits. (3 Lec) 
PREREQUISITE: Graduate standing. This course begins by examining indigenous philosophies of sacred ecologies, contrasting these views with those held by Europeans regarding the natural world. It traces the impact of historical colonialism in the environment up to contemporary conflicts over sacred sites and environmental resources.

NASX 530. Federal Law and Indian Policy. 3 Credits. (3 Lec) F 
PREREQUISITE: Graduate standing. Advanced analysis of theories, doctrines, case law, and legislation with a focus on key legal and policy concerns for contemporary Native America including treaties, criminal jurisdiction, land, environmental regulation, water rights, fishing and hunting, child welfare, gaming, taxation, repatriation, and religious freedom. Co-convened with NASX 476.

NASX 540. Theoretical Positions in NAS. 3 Credits. (3 Lec) S 
PREREQUISITE: Graduate standing. An introduction to the central conceptualizations of the academic discipline of Native American Studies and several of the theoretical paradigms operative within it. Students will gain an understanding of the contributions of Native American Studies to theoretical understandings within, across, and beyond dominant academic disciplines.

NASX 541. Critical Approach to NAS Methods. 3 Credits. (3 Lec) S 
PREREQUISITE: Graduate standing. A critical survey of the interdisciplinary approaches used in NAS grounded in a sociopolitical context with emphasis on ethical questions raised by research of Native Americans. Students receive individual attention toward formulating an effective methodology for their master's project.

NASX 550. Native Americans: Dispelling the Myths. 3 Credits. (3 Lec) On Demand 
PREREQUISITE: Graduate standing. This course is designed around a series of commonly held assumptions or "myths". When unexamined, these assumptions undermine our ability to communicate across cultures, and ultimately form the basis for some of the worst forms of racism and stereotyping. We wrestle with these preconceptions while learning the most basic elements of American Indian-which is to say American-history.

NASX 551. Native North America: Art, Agency, Activism. 3 Credits. (3 Lec) Su 
PREREQUISITE: Graduate standing. NASX 551 explores Native Framed from an Indigenous perspective, the aesthetic, cultural, and symbolic meanings of traditional and contemporary Native American art, artists and activists illustrate the agency of Native culture in North America. Illustrative examples are derived from a wide array of sources, from ancient art to graphic novels, graffiti, cuisine, court and contemporary artists.

NASX 552. Indigenous Nations of Montana. 3 Credits. (3 Lec) On Demand 
PREREQUISITE: Graduate standing or consent of instructor. NASX 552 is a graduate level introduction to Montana's contemporary Indigenous Nations, with a summary overview of Montana's PaleoIndian prehistory and post-contact history. Students explore the traditional culture and history of each Montana tribe, and focus on the contemporary life and issues pertinent to each tribe.

NASX 553. Indigenous Literature and the West. 3 Credits. (3 Lec) 
PREREQUISITES: Graduate standing. This course will familiarize us with Indigenous literature and its relation to the American and Canadian West. We will seek to retrace the creation of the Western mythos while placing Indigenous perspectives and literature at the center of our discussions.

NASX 554. Indian Education for All. 3 Credits. (3 Lec) 
On demand PREREQUISITE: Graduate standing. This course is an in-depth analysis of the theory and practice of cultural diversity in educational contexts. It examines the historical, political, and cultural forces that foster systemic disparities based on ascribed characteristics, and critically examines strategies for addressing such disparities. The evolution and implementation of Indian Education for All is explored.

NASX 555. Activism and Indigeneity. 3 Credits. (3 Lec) S 
PREREQUISITES: Any 400 or 500 NAS level course) To explore historical and contemporary models of activism within Indigenous and non-Indigenous communities, with an emphasis on producing authentic interdisciplinary initiatives that both Indigenous and non-Indigenous communities can use.

NASX 560. Native American Lit Tradition. 3 Credits. (3 Lec) 
PREREQUISITE: Graduate standing. A survey of prose writing, mainly long fiction, by and about contemporary Native Americans.

NASX 570. Indigenous Planning; Strategic Economic and Human Development Approaches. 3 Credits. (3 Lec) F 
The intent of this course is to empower students through substantive knowledge of contemporary strategic planning and Indigenous community development. This course will build a foundational understanding of the political, legal and cultural protocols, values, social structure, development economics and traditional knowledge of American Indian, Alaska Native and Pacific Islander peoples, and engage with constructive planning practice that contributes to both local economic development and human development outcomes. Co-convened with NASX 470.

NASX 575. Professional Paper. 1-6 Credits. (1-6 Ind; 6 cr max) F,S,Su 1-6 cr. IND Maximum 6 cr. PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major adviser and graduate committee.

NASX 589. Graduate Consultation. 1-3 Credits. (1-3 Ind; 3 cr max)F,S,Su 
PREREQUISITE: Graduate standing. This course may be used only by graduate students who have completed all of their course work and their theses, if on a thesis plan, but who need additional faculty or staff time and assistance.
NRSG 115. Nursing as a Profession. 2 Credits. (2 Lec) F,S

Su The purpose of this course is to initiate and foster the professional socialization process. Content and activities expose students to issues surrounding the profession of nursing, multiple roles of nursing in society and health care, and concepts related to the dimensions of nursing practice: nurse, client, health and environment.

NRSG 220. Foundations Ethical Nursing. 2 Credits. (1 Lec, 1 Rct) F,S,Su

PREREQUISITE: Consent of Instructor. Drawing on contemporary issues in bioethics this foundational course explores fundamental moral values, philosophical principles and theories as formal grounding for ethical decision making and action in health care. A broad historical, cultural and societal perspective is emphasized to provide the background for understanding the everyday ethical problems that health care professionals encounter in their practices. A psychological and social framework of analysis is used to foster sensitivity, skills of analysis and ethical behavior in situations of moral conflict.

NRSG 225. Foundatns Plng Prvdng Clin Nrs Cr. 4 Credits. (2 Lec, 2 Lab) F,S,Su

PREREQUISITES: BIOH 201, BIOH 211, FCS 101IS, and BIOM 250. COREQUISITES: NRSG 238 or consent of instructor. Application of nursing principles, concepts and related skills for care of the individual needing assistance. The clinical decision-making process is utilized in the provision of nursing care in clinical settings.

NRSG 238. Hlth Assmnt Across Lifespan. 4 Credits. (2 Lec, 2 Lab) F,S,Su

PREREQUISITES: BIOH 201 and BIOH 211. COREQUISITE: NRSG 225 or consent of instructor. This course is designed to teach the student a health oriented approach to nursing assessment of clients across the life span in a variety of community based settings. The primary focus of the course is on normal health assessment findings, with recognition of abnormal variations. This course emphasizes development of the skills needed to perform a comprehensive health assessment of children, adults, and the elderly. Data collection through comprehensive history taking and physical assessment is emphasized. Utilizations of assessment findings in clinical decision making is discussed throughout the course.

NRSG 242. Complementary Healing. 2 Credits. (2 Lec) S

PREREQUISITE: Undergraduate nursing students or permission of the instructor. The purpose of this course is to explore the time honored medical models and treatments of Complementary and Alternative Medicine (CAM). Using quality of life as a foundation, students will explore the integration of these models into practice.

NRSG 258. Principles of Pathophysiology. 3 Credits. (3 Lec) F,S,Su

PREREQUISITES: BIOH 201, BIOH 211, CHMY 121IN, and CHMY 123. This course provides an introduction to the abnormal functioning of human cells, tissues, and organ systems, and the physiological adaptations that occur. Commonly encountered age-related variations are addressed. The influences of environment, genetics, nutrition, and culture are emphasized. Current research that explains the changes that accompany a particular syndrome or disease is considered.

NRSG 290R. Undergraduate Research. 1-6 Credits. (1-6 Lec; 6 cr max) On Demand

NRSG 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand

PREREQUISITE: As determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

NRSG 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand

Max 6 cr PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

NRSG 294. Workshop/Seminar. 1-4 Credits. (1 Sem; 12 cr max) On Demand

1 - 4 cr. SEM Maximum 12 credits PREREQUISITE: As determined for each offering. Topics offered at the lower division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

NRSG 336. Nursing Pharmacotherapeutics. 3 Credits. (2 Lec, 1 Lab) F,S,Su

PREREQUISITES: CHMY 121, CHMY 123, NUTR 221, NRSG 258, and NRSG 238. The focus of this course is to examine pharmacotherapeutics in nursing practice. Clinical application of pharmacological and pathophysiological principles are integrated. Physical, psychological, social and cultural factors; age related variations; and alternative therapies are highlighted.

NRSG 341. Psychosocial Nursing Concepts. 3 Credits. (2 Lec, 1 Lab) F,S,Su

PREREQUISITES: PSYX 100, SOCI 101, NRSG 115, NRSG 220, NRSG 225, NRSG 258 and NRSG 238. This course explores selected psychosocial concepts and theories basic to nursing practice with clients in a variety of settings. Topics include family theory, palliative care, crisis theory, anxiety, loss, grief & other human responses; and related psychosocial nursing strategies.

NRSG 348. Nurs Care of Childbearing Family. 5 Credits. (2 Lec, 3 Lab) F,S

PREREQUISITES: NRSG 341, NRSG 352 and NRSG 336. The focus of this course is the nursing care of childbearing women, neonates and their families in a variety of settings. Normal pregnancy and childbirth are addressed, as well as the identification and management of high risk childbearing situations. Selected health care of women content is included.

NRSG 352. Acute and Chronic Illness. 5 Credits. (2 Lec, 3 Lab) F,S

PREREQUISITES: NRSG 258, NRSG 336, NRSG 341, and NRSG 352. The focus of this course is health promotion, disease prevention, illness management and nursing care of children within the family context in a variety of settings. This course builds upon and integrates knowledge gained from nursing, sciences and the humanities.

NRSG 377. Intro to Community Based Nursng. 2 Credits. (2 Lec) F,S

The focus of this course is to introduce the student to community based nursing practice for individuals, families, populations and communities. There is an emphasis on health promotion, disease prevention and health determinants in a variety of settings.

NRSG 387R. Research in Health Care. 3 Credits. (2 Lec, 1 Lab) F

PREREQUISITE: STAT 216Q or Consent of Instructor. Students are introduced to research processes, examine research reports, and describe practice applications. Students engage in research processes, examine research reports, and describe practice applications.
NRSG 457. Psychiatric Nursing. 6 Credits. (3 Lec, 3 Lab) F,S
PREREQUISITES: NRSG 341 and NRSG 377 and NRSG 346 or NRSG 348 or NRSG 352. The focus of this course is nursing care of clients with acute and chronic psychiatric disorders, including psychopathology associated with major mental illness. Community based experiences provide opportunity for continued development of therapeutic skills. Social, cultural, spiritual and environmental issues influencing mental health are explored.

NRSG 444. Care Management. 3 Credits. (2 Lec, 1 Rct) F
PREREQUISITES: NRSG 352 and NRSG 387R. This course focuses on care management with application of ethical and legal concepts. The care management process is explored. Care management is examined as a method of managing health care.

NRSG 454. Urgent and Palliative Care. 6 Credits. (3 Lec, 3 Lab) F,S
PREREQUISITE: NRSG 352. The focus of this course is application of theoretical and empirical knowledge to nursing care for complex clients across the adult lifespan requiring urgent and palliative care in a variety of settings. Clinical decision making, triage and symptom management are emphasized. This course builds upon and integrates knowledge gained from nursing, sciences and the humanities.

NRSG 469. Cultural Applications Apps in Nursing: The (Specific Culture) Experience. 2 Credits. (1.6 Lec/Lab) F,S,Su
PREREQUISITE: Enrolled in the undergraduate nursing program. This course is designed as an intense, but time limited, immersion into another culture and is focused on health beliefs, healthcare, and nursing applications. The experience will be preceded by analysis of cultural and healthcare principles applicable to nursing, and concluded by analysis of, or participation in, healthcare delivery in another culture.

NRSG 477. Pop Based Nursing Care in Comm. 6 Credits. (3 Lec, 3 Lab) F,S,Su
PREREQUISITES: NRSG 437 and NRSG 454. The focus of this course is the health and well-being of the community. Global and national health problems are examined from a public health perspective. Community assessment and epidemiologic methods are used to identify populations at risk and potential areas for intervention.

NRSG 479. Population Health & Leadership. 6 Credits. (4 Lec, 2 Lab) S
The purpose of this course is to apply a population-based, epidemiological approach to discover risk factors and evidence-based health promotion and disease prevention practices. Interdisciplinary leadership and management concepts will be incorporated to guide improved outcomes for populations. College of Nursing.

NRSG 487. Nursing Ldrshp/Mgmt Dvlpmnt. 6 Credits. (3 Lec, 2 Lab) F,S,Su
PREREQUISITES: NRSG 437, NRSG 444 and NRSG 454. Senior capstone course. The focus of this course is to provide an integration of theory and skill development in leadership, management and organizational concepts for the design, coordination, and management of health care using the community based philosophy.

NRSG 489. Research & Statistics to Support Evidence Based Practice. 6 Credits. (Lec 5, Lab 1) F
This course provides an introduction to research principles, methodologies and statistical procedures used to analyze data to support evidence-based practice. Emphasis is placed on critical analysis of nursing and health care research and correct application and interpretation of statistics. College of Nursing.

NRSG 489R. Research & Statistics to Support Evidence Based Practice. 6 Credits. (Lec 5, Lab 1) F
This course provides an introduction to research principles, methodologies and statistical procedures used to analyze data to support evidence-based practice. Emphasis is placed on critical analysis of nursing and health care research and correct application and interpretation of statistics. College of Nursing.

NRSG 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Junior standing. Directed undergraduate research/ creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

NRSG 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Junior standing and as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial/training to determine acceptability and demand before requesting a regular course number.

NRSG 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITES: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

NRSG 494. Workshop/Seminar. 1-4 Credits. (1 Sem; 12 cr max) On Demand
Max 12 credits PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

NRSG 498. Internship. 3 Credits. (3 Lab) Su
PREREQUISITE: Satisfactory completion of all 1st semester junior level clinical nursing courses. Placement subject to availability. This elective course is designed to increase competence and confidence in previously learned clinical skills. The student works with a registered nurse (RN) in a cooperating clinical agency for a period of intensified clinical experience.

NRSG 501. Tchg Concepts Nursing Educator. 2 Credits. (2 Lec) F
PREREQUISITE: Graduate Standing. Designed for students interested in nursing education (academic or practice environment). Emphasizes teaching strategies and delivery of nursing education for diverse learners in a variety of settings. Roles and responsibilities are explored. Includes history and evolution of teaching and learning.

NRSG 502. Effective Clinical Teaching. 2 Credits. (2 Lec) S
PREREQUISITE: Graduate Standing. Focuses on educator roles and responsibilities in teaching clinical nursing (academic or practice environments). Designed for students interested in developing clinical teaching skills. Major themes: development of learning activities, evaluation of student performance, concepts of student supervision, and agency coordination.

NRSG 503. Curriculum Development. 3 Credits. (3 Lec) Su, alternate years to be offered Su even years. PREREQUISITE: Graduate Standing. Theories and models of curriculum development are explored and designed for nurses teaching in either academic or practice environments. Variables associated with design and planning of educational interventions are explored. Students synthesize appropriate theoretical concepts to develop a model curriculum.

NRSG 504. Assess & Eval of Education. 3 Credits. (3 Lec) Su, alternate years to be offered Su odd years. PREREQUISITE: Graduate Standing. Students engage in discussions around design, assessment, and evaluation of instruction by nurses. Topics include writing instructional objectives and constructing activities to assess student learning outcomes. Students complete a project to gain skills in evaluating learning related to a specific unit of study.

NRSG 508. Clinical Leadership Practicum. 7 Credits. (5.333 Lab) F,S,Su
PREREQUISITES: NRSG 509, NRSG 604, NRSG 608, and NRSG 611. In collaboration with the faculty and clinical preceptor, students will design, manage, and evaluate care to improve health outcomes for a selected population. Designed to promote integration of coursework through immersion in the CLN role.

NRSG 509. Clinical Nurse Leader Lab I. 2 Credits. (1 Lec) F
PREREQUISITE: NRSG 604, NRSG 608 or consent of instructor. Students will engage in activities that promote development of CLN competencies. Strategies used to promote patient-centered care and interprofessional collaboration in selected settings will be examined.

NRSG 511. Pathophysiology and Pharmacology for the Clinical Nurse Leader. 3 Credits. (3 Lec) F
Designed for the advanced nurse generalist. Understanding of symptoms/patterns of pathophysiology experienced in populations requiring interventions and management within healthcare delivery systems. Health maintenance, preventive, acute, chronic, palliative, and end of life care will be considered.

NRSG 512. Pharm for Infant Child Adults. 1 Credit. (1 Lec) S
PREREQUISITE: NRSG 517 or consent of instructor. Addresses pharmacological intervention in managing common health care problems of childhood families. Students will apply knowledge of medication management of commonly encountered pediatric and women’s health care concerns.

NRSG 519. Pharm for Middle Aged Adults. 1 Credit. (1 Lec) Su
PREREQUISITE: NRSG 517 or consent of instructor. Addresses pharmacological intervention in managing common health care problems of middle aged adults. Students will apply knowledge of pharmacological management of commonly encountered health problems of middle aged adults.

NRSG 520. Pharm for Older Adults. 1 Credit. (1 Lec) F
PREREQUISITE: NRSG 517 or consent of instructor. Addresses pharmacological interventions in managing common health problems of elders and their families. Students will apply knowledge of pharmacological management of commonly encountered health problems for the aging population. Regulatory issues regarding prescriptive practice for APRNs are considered.

NRSG 528. Family Mental Hlth/Nurs IV. 6 Credits. (1 Lec; 3.333 Lab) F
PREREQUISITE: NRSG 527. Students will integrate the conceptual and theoretical foundations for working with individuals and families with mental health problems or psychiatric disorders. Interventions include health promotion, coordination and use of organizational or community resources, consultation, teaching/coaching, and application of nursing leadership skills.
NRSG 561. Primary Care I & 2 Credits. (3 Lec, 3 Lab) S
PREREQUISITE: NRSG 517, NRSG 521, NRSG 530 and NRSG 560.
COREQUISITE: NRSG 531 and NRSG 555. Focuses on comprehensive assessment, intervention and preventive care for childbearing and child rearing families in primary health care for the advanced practice nurse. Includes content on physiological, pathophysiological, psychological, developmental, sociocultural and spiritual care.

NRSG 562. Primary Care II. 6 Credits. (3 Lec, 3 Lab) Su
PREREQUISITE: N 561. This course includes content on the physiological, pathophysiological, psychological, developmental, sociocultural and spiritual responses to acute and chronic conditions will be explored along with the advocacy role of the nurse practitioner.

NRSG 563. Primary Care III. 6 Credits. (3 Lec, 3 Lab) F
PREREQUISITE: NRSG 562. Assessment, treatment and preventive care for aging families in primary health care settings. Physiological, pathophysiological, psychological, developmental, sociocultural and spiritual responses to acute, chronic conditions and chronic illnesses. Ethical and legal responsibilities, pharmacologic mechanisms, clinical use of selected drug classifications for the treatment and management of acute and chronic conditions will be explored along with the advocacy role of the nurse practitioner.

NRSG 571. Clinical Preceptorship. 6 Credits. (4 Lab) S
PREREQUISITE: Final semester of course work. This practicum allows students to further refine family nurse practitioner skills in practice settings such as family health, pediatrics, women’s health or gerontology or a broad based general practice based on availability.

NRSG 574. Teaching Practicum. 1-4 Credits. (.667-2.667 Lab; 4 cr max) F,S,Su
PREREQUISITE: NRSG 504 or consent of instructor. Teaching/learning principles are integrated into nursing education in academic or practice environments. Students practice, observe, and evaluate teaching/learning processes. The instructor and student negotiate laboratory activities.

NRSG 575. Professional Paper and Project. 1-4 Credits. (1 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

NRSG 590. Master’s Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing. May be repeated.

NRSG 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

NRSG 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

NRSG 594. Seminar. 1 Credit. (1 Sem; 4 cr max)
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

NRSG 601. Advanced Health Assessment. 3 Credits. (2 Lec,.667 Lab) F
Advanced health assessment of individuals. Documenting and validating information, analyzing, synthesizing, and making clinical decisions about the client’s health status. Includes assessment of normal and abnormal physiological and psychosocial processes relevant to gender and culture across the lifespan.

NRSG 602. Adv Physio/Pathophysiology. 4 Credits. (4 Lec) F
Comprehensive examination of physiological functioning and common pathophysiological alterations in humans. Builds on fundamentals of anatomy, physiology, and pathology examined from subcellular level through major body systems. Focus on etiology, pathogenesis, developmental and environmental influences and clinical manifestations of injury and disease.

NRSG 603. Advanced Pharmacology I & 2 Credits. (2 Lec) S
PREREQUISITE: NRSG 602 This course provides an understanding of the science of therapeutics and principles of pharmacokinetics and pharmacodynamics.

NRSG 604. Evidence Based Practice I & 4 Credits. (4 Lec) F
PREREQUISITE: SAT216Q and NRSG 387R or NRSG 489R. Focuses on the various methods and processes used to translate knowledge into evidence based practice. Students explore processes for acquiring, appraising, and using evidence to improve clinical outcomes.

NRSG 605. Evidence Based Practice II. 3 Credits. (3 Lec) S
PREREQUISITE: NRSG 604; NRSG 606 Focuses on the methods for evaluating and using information to inform practice. Students will become skilled using a variety of tools from research, biostatistics, epidemiology, and other data based disciplines to address clinical problems.

NRSG 606. Statistical Applications. 2 Credits. (2 Lec) F
PREREQUISITE: STAT 216Q or equivalent Builds on basic understanding of quantitative methods and resulting statistical analyses. Particular application to critique health sciences research. Students will gain facility in statistical techniques of correlation, regression, Chi square, t-test, analysis of variance, logistic regression and confidence limit estimation.

NRSG 607. Diagnostic Reasoning. 3 Credits. (2 Lec,.667 Lab) S
PREREQUISITE: NRSG 601; NRSG 602 This graduate nursing course promotes the development of the practitioners’ comprehensive assessment proficiency, critical thinking and diagnostic reasoning. The practitioner will utilize a systematic approach for clinical decision making, diagnosis and documentation.

NRSG 608. Design H C Delivery Systems. 3 Credits. (3 Lec) S
PREREQUISITE: NRSG 604, EIND 458 for IE students or instructors permission Examines the role of nurses and industrial engineers in healthcare. Examines major systems within healthcare organizations which affect care delivery. Learn strategies for analyzing, improving processes, and coordinating interdisciplinary healthcare teams to enhancing healthcare quality management and reducing health risk through medical error elimination.

NRSG 609. Adv Practice Nrsng Ldrship. 2 Credits. (2 Lec) Su
PREREQUISITE: NRSG 602, NRSG 603. Prepares doctor of nursing practice students for direct and indirect advanced practice nursing roles and core competencies in organizational and systems leadership. Emphasis on leadership, communications, collaboration, negotiation, team functioning, conflict resolution and scholarship.

NRSG 610. Health Care Informatics. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate Standing. Explores health care information systems and computer technology to optimize health information management and communication systems while maintaining privacy and security of data.

NRSG 611. Program Planning & Evaluation, Outcomes, & Quality Improvement. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate Standing This graduate nursing course addresses concepts in organizational and systems leadership. Emphasis on leadership, communications, collaboration, negotiation, team functioning, conflict resolution and scholarship.

NRSG 612. Ethics, Law, and Policy for Advocacy in Healthcare. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate Standing The graduate nursing student will integrate knowledge of bioethics, current legal issues, ethical comportment, clinical decision-making, and functions of law and policy analysis as applied to clinical practice.

NRSG 613. Finance & Budget H C Systems. 2 Credits. (2 Lec) S
PREREQUISITE: Graduate Standing. This course focuses on the application of fiscal management principles of health care systems. Emphasis is on health care economics, fiscal management, and budgeting concepts as they relate to healthcare.

NRSG 614. Vulnerability and Health Care in Diverse Communities. 4 Credits. (2 Lec, 2 Lab) F
PREREQUISITE: Graduate Standing. This graduate nursing course addresses concepts of vulnerability and disparity in health and healthcare among diverse and rural populations. Students will examine vulnerable populations. Interactions with the healthcare systems, including access, utilization, and outcomes will be examined. Students will address strategies for addressing disparities in healthcare.

NRSG 615. Translational Research Adv Pra. 3 Credits. (3 Lec) F
PREREQUISITE: NRSG 601, 602, 603, 604, and 605. This graduate nursing course provides students opportunities to explore translational research. The course focuses on understanding complementary disciplines with the goal of enhancing communication and collaboration among researchers.

NRSG 620. Adv Pharm II. 3 Credits. (3 Lec) Su
PREREQUISITE: NRSG 602, NRSG 603. Focuses on pharmacologic effects and clinical use of selected drug classifications for the treatment and management of acute and chronic illnesses. Ethical and legal responsibilities, pharmacologic mechanisms, contraindications, complimentary alternative medicine and patient education will be addressed.
NRSG 621. Advanced Clinical I-FI. 6 Credits. (3 Lec, 3 Lab) Su
PREREQUISITE: NRSG 601, 602, 603, 604, 605 and 607. Focus on comprehensive assessment, intervention and preventive care for childcare and childrearing families in primary health care. Includes content on physiological, pathophysiological, psychological, developmental, sociocultural and spiritual primary health care needs of childcare and childrearing families.

NRSG 622. Advanced Clinical II Primary Care for Midlife Families. 6 Credits. (3 Lec, 3 Lab) F
PREREQUISITES: NRSG 621 Adv Clin I; NRSG 620 Adv Pharm II Comprehensive assessment and prescriptive capabilities for midlife families in primary health care settings. Recognizing the holistic nature of individuals within families, this course will include content on the physiological, pathophysiological, psychological, developmental, sociocultural and spiritual primary health care needs of midlife families.

NRSG 623. Advanced Clinical II: Psychotherapeutic Modalities. 6 Credits. (3 Lec, 3 Lab) Su
PREREQUISITE: NRSG 622. Focus on assessment, treatment and preventive care for aging families in primary health care settings. Physiological, pathophysiological, psychological, developmental, sociocultural and spiritual responses to acute and chronic conditions will be explored emphasizing the importance of advocacy.

NRSG 624. Advanced Clinical IV (NP, Family/Individual) Primary Care Clinical Preceptorship. 7 Credits. (1 Lec, 6 Lab) S
PREREQUISITE: NRSG 623. In this graduate nursing practicum, students will further refine their role as a doctor of nursing practice demonstrating expertise, specialized knowledge, and expanded responsibility and accountability in the care and management of individuals and families. Students in the Family Nurse Practitioner (FNP) option participate in the selection of a practice setting such as family health, pediatrics, women’s health, gerontology, a broad based primary care, or specialty practice. Students will incorporate a holistic perspective in the management of patients and engage in the formation of therapeutic partnerships in a clinical practice. College of Nursing.

NRSG 630. Adv Psychopharm II, 3 Credits. (2 Lec) Su

NRSG 631. Advanced Clinical I – Psych/Mental Health. 6 Credits. (3 Lec, 3 Lab) Su
PREREQUISITE: NRSG 601, 602, 603, 604, 605, 607. The role and scope of advanced psychiatric nursing practice and foundational legal and ethical issues are explored. The neuroanatomy and neurophysiology of psychiatric disorders are reviewed. Conduct comprehensive and systematic psychiatric assessments in complex situations.

NRSG 632. Advanced Clinical II: Psychotherapeutic Modalities. 6 Credits. (3 Lec, 3 Lab) F
PREREQUISITE: NRSG 630, 631. Conceptual and theoretical foundations for psychotherapy, including selected therapeutic modalities for individuals, group psychotherapy, and the integration of multicultural skills for health promotion and management of mental health problems and psychiatric disorders are introduced and examined.

NRSG 633. Advanced Clinical III, Psych/Mental Health. 6 Credits. (3 Lec, 3 Lab) Su
PREREQUISITE: NRSG 632. In this course, students will explore the conceptual and theoretical foundations for providing psychotherapy with families and couples. Continuation of psychopharmacology concepts presented in Advanced Clinical I and II will be provided with an emphasis on expanded pharmacology concepts.

NRSG 634. Advanced Clinical IV, NP, Psych/Mental Health. 7 Credits. (1 Lec, 6 Lab) S
PREREQUISITE: NRSG 633, Advanced Clinical III. This graduate nursing course builds upon content and skills attained in Advanced Clinical I, II, and III. In this practicum students will further refine their role as a doctor of nursing practice demonstrating expertise, specialized knowledge, and expanded responsibility and accountability in the advanced psychiatric care and management of individuals and families.

NRSG 674. DNP Scholarly Project Seminar. 2 Credits. (1 Lec, 1 Lab) F
PREREQUISITES: NRSG 601, 602, 604 COREQUISITES: NRSG 603. The DNP scholarly project exemplifies the discovery, application, and synthesis of advanced nursing knowledge to improve health outcomes for individuals, families, communities, or systems.

NRSG 675. Professional Paper and Project. 1-6 Credits. (1-6 Ind; 6 cr max) F,S,Su
PREREQUISITE: NRSG 602, NRSG 603, NRSG 604, NRSG 674. Professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

NRSM - Natural Resource Sci & Mgmt

NRSM 101. Natural Resource Conservation. 3 Credits. (3 Lec) F
An overview of soils, water, rangelands and wildlife conservation from the global to the local level. Impacts of human population growth, economics, ethics and agriculture on the sustainability of natural resources will be examined using basic principles of ecology.

NRSM 102. Montana Range Plants. 1 Credit. (1 Lec) F
The laboratory exercises are designed to complement the lectures of NRSM 101. Rangeland inventory and classification methods will be reviewed. Sixty common native and introduced plants will be identified in the field and the classroom.

NRSM 235. Range and Pasture Monitoring. 1 Credit. (1 Lec) F
PREREQUISITE: ANSC 100, NRSM 101, NRSM 102. Methods which can be used by private operators as well as state and federal land managers to identify site potential, inventory forage resources, evaluate range and pasture condition, estimate stocking rates, and measure forage utilization by wildlife and livestock.

NRSM 236. Small Pasture Management. 1 Credit. (1 Lec) Su
PREREQUISITE: ANSC 100, NRSM 101, NRSM 102 or consent of instructor. Management of small acreages (< 50 acres) to produce forage for horses and non-commercial livestock. Topics include determination of site productivity, plant and animal response to grazing, forage production, protection of water quality and controlling invasive plants. Field trips include operations with successful grazing programs and problem areas.

NRSM 240. Natural Resource Ecology. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: NRSM 101 or consent of instructor. Focus on the role of physical and biotic processes on ecosystem function, including natural and managed ecosystems. Emphasis on rangelands, wildlife habitat, watersheds, and disturbed environments.

NRSM 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind) F
PREREQUISITE: Consent of instructor and approval of department head. Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

NRSM 291. Special Topics. 1-3 Credits. (1 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

NRSM 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

NRSM 330. Fire Ecology and Mgmt. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: NRSM 101 or NRSM 240 or BIOE 370. This course covers the wildlife patterns that shape and define western rangeland and forest ecosystems. Discussions on the historical role of fire will provide the background for using prescribed fire to accomplish a broad range of habitat management goals.

NRSM 350. Vegetation of Western Wildlands. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: NRSM 240, BIOO 230, and either AGSC 454 or BIOO 435. COREQUISITE: NRSM 351. Identification of commonly occurring plants of western North American wildlands and rangelands. Important ecological and management relationships of the plants will be emphasized.

NRSM 351. Bionium of Western Wildlands. 2 Credits. (2 Lec) S
PREREQUISITE: NRSM 240. COREQUISITE: NRSM 350. Climatic, physical, and biological interactions of natural biomes. The structure of western North American wildland and rangeland biomes will be considered in detail.

NRSM 353. Grazing Ecology and Management. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: NRSM 101, NRSM 102, and NRSM 240. Ecological perspectives of livestock grazing in the major rangeland biomes of the western United States and southern Canada. Impacts on soils, individual plants, plant communities, livestock, wildlife, and hydrology will be reviewed in the scientific literature.

NRSM 421. Holistic Thought/Mgmt. 4 Credits. (4 Lec) S
4 cr. LEC 4 PREREQUISITE: Junior standing. Application of holism and systems thinking to natural and human resource management issues. Use of Holistic Management for decision-making, research, and policy formation. Use of real case studies involving BioRegions Program work in Greater Yellowstone, Japan, Mongolia, Nepal, or other locations.
NRSM 430. Natural Resource Law. 3 Credits. (3 Lec) S
PREREQUISITE: Junior standing, WRIT 201 or WRIT 221, or consent of instructor. Examines major natural resources laws emphasizing the federal model. A modified case study approach is used to review legislation and related court cases governing natural resources, including water, minerals, timber, range, wildlife, recreation, and wilderness.

NRSM 453. Habitat Inventory and Analysis. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: NRSM 240 or BIOE 370, STAT 216 or BIOB 318, and Junior standing. Focus on collecting, analyzing, and interpreting measures of rangeland resources including plant, animal, soil, and watershed components. Emphasis on sampling objectives, field procedures, monitoring, and evaluation.

NRSM 455. Riparian Ecology & Management. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: ENSC 245IN and NRSM 240 or ENSC 272CS or ERTH 303 or BIOE 370. This course will provide an overview of one of the most ecologically diverse ecosystems in western North America. Students will have the opportunity to study the physical and biological processes which shape and maintain riparian ecosystems. A field laboratory will provide experience in biological and physical monitoring methodologies that are central to land management decisions.

NRSM 490R. Undergrad Research. 1-6 Credits. (1 Ind; 12 cr max) S
PREREQUISITE: Consent of instructor and approval of department head. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis.

NRSM 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

NRSM 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

NRSM 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

NUTR - Nutrition

NUTR 221CS. Basic Human Nutrition. 3 Credits. (3 Lec) F,S,Su
Basic concepts of human nutrition which include carbohydrates, lipids, proteins, vitamins, minerals, absorption, digestion, metabolism, and energy utilization as they relate to health and food consumption at different stages of the life cycle.

NUTR 226. Food Fundamentals. 3 Credits. (3 Lec) S
PREREQUISITE: NUTR 221CS. Principles of food composition, preparation, selection, food safety and storage with special reference to physical and chemical changes which occur during normal food handling. Includes an introduction to meal planning, sensory evaluation, and cultural food perspectives.

NUTR 227. Food Fundamentals Lab. 2 Credits. (1 Lec, 1 Lab) F
PREREQUISITE: NUTR 221CS. Practical experiences which illustrate the principles of ingredient functionality, methods of preparation, preservation, food safety and sensory evaluation. Utilizes knowledge from NUTR 226.

NUTR 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) F,S,Su
PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

NUTR 301. Food and Culture. 3 Credits. (3 Lec) F
PREREQUISITE: NUTR 221CS, NUTR 226, and NUTR 227. Food is an essential component of life and livelihoods everywhere. However, food patterns vary across the globe. Students will build cultural competency by examining and experiencing the concurrent influences of food and culture over the course of history.

NUTR 321. Nutrition in the Life Cycle. 3 Credits. (3 Lec) F
S PREREQUISITE: NUTR 221CS. Nutritional needs and health concerns during the different stages of life: pregnancy, lactation, infancy, preschool years, middle childhood, adolescence, adulthood, and later maturity. Major service-learning project with agencies offering nutrition services.

NUTR 322. Food Service System Management. 3 Credits. (3 Lec) F
PREREQUISITE: NUTR 221CS, NUTR 226, and NUTR 227 or consent of instructor. Primarily covers the processes of quantity food procurement, production, and presentation. Emphasizes food safety and sanitation principles and organizational management for food and nutrition professionals.

NUTR 325. Introduction to Food Processing. 3 Credits. (3 Lec) S
PREREQUISITE: NUTR 221CS, NUTR 226, NUTR 227 or consent of instructor. This course focuses on the impacts of thermal and non-thermal processing treatments on the microbiological, nutritional, and sensory qualities of food products.

NUTR 351. Nutrition and Society. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: NUTR 221CS. Social and cultural, economic, policy, and environmental factors in the community influencing nutritional status, and public health, techniques to assess community nutritional needs, and methodology for designing, implementing, and evaluating community nutrition programs, practices, and policies. Major service-learning project completed for a public or private agency.

NUTR 395. Pract: Quant Foods Prod & Mgmt. 3 Credits. (1 Lec, 2 Lab) S
PREREQUISITE: NUTR 221CS, NUTR 226, NUTR 227, and NUTR 322 or consent of instructor. Hands-on food lab experience in culinary purchasing, production, analysis, and presentation activities. Applied food safety and sanitation principles. Application of organizational management theories in culinary businesses.

NUTR 401. Nutrition Assessment/Counsel. 3 Credits. (3 Lec) S

NUTR 411. Nutrition for Sports/Exercise. 3 Credits. (3 Lec) F,S
PREREQUISITE: KIN 221 or BIOH 201, and NUTR 221CS and junior standing. Nutrition for physical activity, sport performance, health and fitness. Nutritional needs are discussed for endurance, strength, low-body weight, team sport athletes and other physically active people. Energy balance and weight management examined.

NUTR 421. Macronutrient Metabolism. 3 Credits. (3 Lec) F
PREREQUISITE: NUTR 221CS, BCH 380, BIOH 211. Digestion, absorption, and metabolism of macronutrients, metabolic pathways utilizing carbohydrates, fats, and proteins, and changes that occur in metabolism under different physiological conditions.

NUTR 422. Micronutrient Metabolism. 3 Credits. (3 Lec) S
PREREQUISITE: BCH 380, BIOH 211, NUTR 221CS. Digestion, absorption, and metabolism of micronutrients, metabolic roles of vitamins and minerals, and changes that occur in metabolism under different physiological conditions.

NUTR 425. Medical Nutrition Therapy I. 3 Credits. (3 Lec) F
PREREQUISITE: NUTR 221CS, NUTR 321, NUTR 401, BCH 380, and BIOH 211. Examination of metabolic and physiological changes in selected conditions and implications for medical nutrition therapy. Extensive case studies utilized to facilitate critical thinking for appropriate nutritional care.

NUTR 426. Medical Nutrition Therapy II. 3 Credits. (2 Lec) S
PREREQUISITE: NUTR 221CS, NUTR 321, NUTR 401, NUTR 425, BCH 380, and BIOH 211. Application of principles of clinical nutrition. Further development of critical thinking skills and application of medical nutrition therapy concepts in the nutrition care process format.

NUTR 435. Experimental Foods. 3 Credits. (3 Lec) F
PREREQUISITES: NUTR 221, NUTR 226, NUTR 227, STAT 216Q OR BIOB 318, NUTR 325. This course introduces the principles and procedures of food experiments including sensory, shelf life, and proximate analyses following current food regulations and standards.

NUTR 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

NUTR 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering and consent of instructor. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

NUTR 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

NUTR 494. Seminar. 1 Credit. (1 Sem; 4 cr max) F
PREREQUISITE: Senior standing. Preparation of an application for a dietetic internship or graduate program. Emphasizes resume and portfolio development, ethics, professionalism, and interviewing.
NUTR 498. Internship. 2-12 Credits. (2 Ind) On Demand
PREREQUISITE: Consent of internship director in academic area. An individualized professional assignment arranged for specific discipline. Some academic areas will offer specific sections in sequence for their students. All students must receive department permission prior to registration, and register for a senior seminar in their major area.

NUTR 499. Capstone for Dietetics. 1 Credit. (1 Sem) S
PREREQUISITE: NUTR 425. COREQUISITE: NUTR 426 or consent of instructor. Emphasizes the use of evidence based research, professional communication skills, effective counseling and behavior change techniques in the application for the Nutrition Care Process to a wellness setting and a variety of community based settings.

NUTR 511. Exercise Metabolism and Health. 3 Credits. (3 Lec) S alternate years to be offered even years PREREQUISITE: Knowledge in areas of anatomy and physiology, upper division courses in one or combination of: exercise physiology, biochemistry, or nutrition. This course examines how cellular demands influence the need for carbohydrates, amino acids, lipids, vitamins, and minerals, how the availability of these nutrients influences adaptations, and the influence of these adaptations on exercise performance and disease risk.

NUTR 524. Adolescent Nutrition. 2 Credits. (2 Lec) S
This is an online course designed to provide teachers strategies for incorporating nutrition education into their curriculum. Course participants explore nutrition science relevant to adolescent health, gain exposure to quality education resources and investigate school wellness issues and strategies.

NUTR 526. Nutrition for Fitness/Perform. 3 Credits. (3 Lec) F
PREREQUISITE: NUTR 221CS, BIOH 211, CHMY 121, BCH 380. Examine energy metabolism and physical activity. Use nutrition strategies to meet the energy, power output, and nutrient demands of exercise, and athletic performance. Examine behavioral relationships that affect fitness and health, including disordered eating and the female athlete triad, evaluation of nutrition information and dietary supplements, with extensive use of internet resources.

NUTR 575. Research/Prol Paper/Project. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

NUTR 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand
PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, and consent of instructor. Courses offered on a one-time basis to fulfill professional development needs of in-service educators. A specific focus is given to each course which is appropriately subtitled.

NUTR 589. Graduate Consultation. 1-3 Credits. (1-3 Ind; 3 cr max) F,S,Su
PREREQUISITE: Graduate standing in nutrition major. This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty or staff time or help.

NUTR 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Master’s standing. Directed graduate research/creative activity.

NUTR 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not offered in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

NUTR 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of The Graduate School. Directed research and study on an individual basis.

NUTR 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level that are not covered in regular courses. Students participate in preparing and presenting discussion material.

NUTR 598. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor. Individualized supervised practice assignments arranged with agencies, businesses or other organizations to provide guided experience in the field.

PHL - Philosophy

PHL 101IH. Intro Phil:Reason and Reality. 3 Credits. (3 Lec) F,S
Exploration of the nature of reality and human knowledge. A critical look at the presuppositions of our common sense world view.

PHL 103D. Philosophy and Popular Culture. 3 Credits. (2 Lec) S alternate odd years Introduces philosophy to students through popular culture. Basic philosophical concepts, methods, and theories will be learned through discussion of technology, video games, films, television, therapy, sports, race, gender, alternative sexuality and drug use.

PHL 110IH. Intro Ethics/Good and Evil. 3 Credits. (3 Lec) F,S,Su
An examination of traditional and contemporary conceptions of good and evil.

PHL 205CS. Other Animals. 3 Credits. (3 Lec) S
Explores how animals have been understood over time from scientific, philosophical, and cultural perspectives. The various methodologies employed, their underlying assumptions and possible limits, will be discussed, as well as the larger moral issues that they raise.

PHL 212RH. Morality and Society. 3 Credits. (3 Lec) F
PREREQUISITE: Consent of instructor. The philosophical study of contemporary moral issues such as capital punishment, euthanasia, racism, and terrorism. The term will culminate in a substantial piece of original research on a moral issue chosen by the individual student.

PHL 236Q. Logic. 3 Credits. (3 Lec) F,S
Modern forms of valid inference with applications.

PHL 242CS. Snc/Pseudo Snc & Subjectivity. 3 Credits. (3 Lec) F
-- Introduces both deductive and inductive aspects of scientific reasoning as a foundation for addressing broader questions such as, "Is there demarcation between science and non-science?"; "Is science subjective?"; Is scientific knowledge cumulative?"; and many more.

PHL 255D. Philosophy and Culture. 3 Credits. (3 Lec) F
PREREQUISITE: Consent of instructor. Addresses questions of how philosophy and culture interact, as well as exploring the differences and commonalities between philosophical traditions. Themes may include social justice, identities, society, and culture.

PHL 270D. Philosophies of Asia. 3 Credits. (3 Lec) F
A critical examination of some classical schools of Indian and Asian philosophy such as Confucianism, Hinduism, or Buddhism.

PHL 278CS. Origins of Life. 3 Credits. (3 Lec) F
Examination of philosophical theories regarding the nature of life and the methods for scientific discovery of its origin. What are the defining characteristics of life? How would we look for life on other planets? Is artificial life possible?

PHL 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PHL 303. Approaches to Epistemology. 3 Credits. (3 Lec) F
PREREQUISITE: Two previous courses in Philosophy or consent of instructor. The course gives an introduction to some epistemological problems like the problem of skepticism, the problem concerning the nature of justification, the problem of induction, and the problem associated with the nature and existence of God.

PHL 304. Metaphysics. 3 Credits. (3 Lec) S, even years
PREREQUISITE: PHL 101IH or PHL 110IH, and PHL 236Q. The most basic questions human beings raise in reflecting on their world, themselves and their place in the world. Sample questions concern the possibility of freedom, the relation of mind and brain, and the nature of being.

PHL 305. Contemporary Philosophy. 3 Credits. (3 Lec) F
PREREQUISITE: Previous course in Philosophy or consent of instructor. This course introduces students to recent trends in analytical philosophy. Among the topics the course addresses are philosophy of mind that involves problems concerning the mind/body relationship, the nature of consciousness, artificial intelligence, and others.

PHL 308. Language and the World. 3 Credits. (3 Lec) F
PREREQUISITE: PHL 101IH or PHL 110IH, and PHL 236Q. A discussion of linguistic meaning, the concept of truth, and the relation between thought and language as viewed by contemporary philosophers.

PHL 310. Moral Theory. 3 Credits. (3 Lec) S
PREREQUISITE: Previous course in Philosophy or consent of instructor. An examination of moral theory. The focus is on such issues as whether morality is objective or subjective as well as methods of moral reasoning.

PHL 312. Contemporary Moral Problems. 3 Credits. (3 Lec) F
PREREQUISITE: Previous course in Philosophy or consent of instructor. An examination of general moral theory with applications to moral problems of current interest such as abortion, the legal enforcement of morality, the death penalty, and nuclear war.
PHL 317. Law and Morality. 3 Credits. (3 Lec) S
PREREQUISITES: Either PHL 101H or PHL 110H. Examination of philosophical arguments and moral dilemmas that arise in legal contexts including what makes something law, the extent to which laws ought to be followed, legitimate restrictions on individual liberty, and how judges ought to interpret law.

PHL 321. Philosophy & Biomedical Ethics. 3 Credits. (3 Lec)
An examination of moral problems in medicine such as abortion, euthanasia, human experimentation, and the distribution of scarce medical resources.

PHL 322. Philosophy & Environmental Ethics. 3 Credits. (3 Lec)
PREREQUISITE: Previous course in Philosophy or consent of instructor. This course reviews the major readings, both classical and contemporary, on environmental ethics, and isolates the major issues. It provides the appropriate theoretical background. It applies these readings and this background to the investigation and resolution of several environmental policy questions.

PHL 327. Aesthetics and the Arts. 3 Credits. (3 Lec)
PREREQUISITE: Previous course in Philosophy or consent of instructor. Philosophical examination of the nature and function of the arts and the aesthetic experience.

PHL 328. Philosophy and Film. 3 Credits. (3 Lec) On Demand
PREREQUISITE: Previous course in Philosophy or permission of instructor. Philosophical study of the moving image. Examines topics such as ontology of the image, theory of cinematic narrative, problem of realism versus illusion in film, its aesthetic, moral, and cultural value; and what constitutes appropriate interpretative activity in judging film.

PHL 345. Philosophy of Science. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: Previous course in Philosophy or consent of instructor. An examination of the concepts of explanation, confirmation, and theory and their application to classic works in the history of the natural and social sciences.

PHL 350RH. State, Community & Individual. 3 Credits. (3 Lec)
PREREQUISITE: One course in Philosophy or consent of instructor. The philosophical study of the state and society. Topics include the nature and limits of political legitimacy and the nature of just economic systems.

PHL 351. Philosophy and Feminism. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
Philosophical analysis of concepts and assumptions central to feminist theories. Topics may include the nature of gender and oppression, masculinity, the relationship between sexism and other forms of oppression, the ideal society, and feminist challenges to traditional philosophical theories.

PHL 353. Philosophy and Technology. 3 Credits. (3 Lec)
PREREQUISITE: Previous course in Philosophy or consent of instructor. An examination of certain concepts used to describe and explain technology and their application to questions concerning the limitations of a technological way of life.

PHL 354. Philosophy of Race. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: Previous course in Philosophy or consent of instructor. Examines the development of the concept of race in philosophy since the 17th century. Traces the effects race has had on concepts such as the person, self-respect, rationality, knowledge, state of nature, science, social justice, and ordinary life.

PHL 361RH. Hist of Philos/Ancient/Medieval. 3 Credits. (3 Lec) F
PREREQUISITE: Previous course in Philosophy or consent of instructor. Great systems of philosophic thought and their originators during ancient and medieval times.

PHL 362. History of Philosophy: Modern. 3 Credits. (3 Lec) S
Great systems of philosophic thought, Descartes to Kant.

PHL 365. Phil of Mind and Consciousness. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: Previous course in Philosophy or consent of instructor. In this course we will examine different philosophical theories regarding the workings of the mind and the nature of consciousness. Are you the same thing as your mind? What is thought? Is conscious experience explainable by the physical sciences?

PHL 370. Philosophy of Religion. 3 Credits. (3 Lec)
PREREQUISITE: Previous course in Philosophy or consent of instructor. Analysis of concepts of revealed truth, God, and immortality; the nature of religious emotion and experience, and of religious language; relation of faith to reason; traditional proofs of God’s existence; the problem of evil; religious diversity; spirituality.

PHL 383. Reason and Revolution. 3 Credits. (3 Lec)
PREREQUISITE: Previous course in Philosophy or consent of instructor. An examination of the scope and limits of reason and their role in revolution as exemplified by leading nineteenth century philosophers.

PHL 385. Existentialism and After. 3 Credits. (3 Lec)
PREREQUISITE: Previous course in Philosophy or consent of instructor. Existentialism and related developments such as phenomenology and post modernism.

PHL 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su Max 12 cr. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

PHL 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Max 12 cr. PREREQUISITE: Course prerequisites as determined for each offering. Course is not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PHL 492. Independent Study. 1-4 Credits. (1-3 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

PHL 494. Seminar. 3 Credits. (3 Sem; 9 cr max) F,S,Su Max 9 cr. PREREQUISITE: Junior standing, Senior capstone course. Each semester is given over to the detailed study of a major figure or problem in philosophy. Since the figures and problems studied vary from semester to semester, the course may be repeated for credit. Two semesters of PHL 400 are required for all philosophy majors.

PHL 498. Internship. 1-12 Credits. (2-12 Ind; 12 cr max) On Demand Max 12 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

PHL 591. Special Topics. 1-4 Credits. (1-4 Lec; 4 cr max) On demand PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PHL 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of department head, and Division of Education. Directed research and study on an individual basis.

PHL 594. Seminar. 3 Credits. (3 Sem; 9 cr max) On Demand Max 4 cr. PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

PHOT - Photography

PHOT 113RA. Understanding Photography. 3 Credits. (2 Lec, 1 Lab) F,S,Su An introduction to traditional black and white photographic practice, theory and visual principles, including camera operation, use of B&W darkroom technique. Photography majors must take this class fall semester to fit into the sequential nature of the Photography program. A 35mm film camera is required for this class. School of Film and Photography.

PHOT 154IA. Exploring Digital Photography. 3 Credits. (1 Lec) F,S,Su (non-majors only) Introduces technical and aesthetic ways of creating digital photographic images. Emphasis is on the production of photographic images, from acquiring them with digital cameras to manipulating them using computer software for manipulating digital images. Instructor and peer critique of student work is an integral part of the course.

PHOT 213. Intermediate Photography. 3 Credits. (2 Lec, 1 Lab) S PREREQUISITE: B or better in PHOT 113RA and registration as a Photography major. Theory and continued application of image control in B&W photography, through the use of a variety of 35mm and medium format films and the introduction of basic zone system principles. Advanced traditional B&W printing techniques in preparation for portfolio review. A 35 mm film camera is required for this class. School of Film and Photography.

PHOT 255. Intro to Color Photography. 4 Credits. (2 Lec, 2 Lab) S PREREQUISITE: PHOT 213 and Photography portfolio review. Introduction and analysis of color theory, color imagery and color materials. Exploration of image capture via film, scanning and digital cameras. Technical skills are developed in digital systems, applications and printing along with critical exploitation of color visual language and aesthetic issues. School of Film and Photography.
PHOT 258. View Camera. 4 Credits. (2 Lec, 2 Lab) F
PREREQUISITE: PHOT 213 and Photography portfolio review. Introduction to view camera theory and practice. Basic studio and lighting techniques will be addressed as well as advanced contrast control through application of the zone system, large format black and white photography, digital view camera, and large format digital and analog printing techniques. School of Film and Photography.

PHOT 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) FS
Directed undergraduate research which may culminate in a written work or other creative project. course will address responsible conduct of research. School of Film and Photography.

PHOT 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand 1 - 4 cr, Maximum 12 cr. PREREQUISITE: Nong required but some may be determined necessary by each offering department. Courses not required in curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PHOT 295. Practicum. 1-3 Credits. (1-3 Lec) F,S,Su
Practical experience associated with research projects in Photography.

PHOT 303. Early History of Photography. 3 Credits. (3 Lec) S
alternate even years PREREQUISITE: WRIT 101W. The visual and technical evolution of photography within the cultural context. Personalities, ideas, and style of individual photographers are explored. Prehistory to 1913.

PHOT 304. Recent History of Photography. 3 Credits. (3 Lec) S
alternate odd years PREREQUISITE: WRIT 101W. Continued exploration of the visual and technical evolution of photography from 1913 to the present, including study of criticism and the relationship to contemporary culture and art.

PHOT 331. Prof Practices in Photography. 4 Credits. (2 Lec) On Demand PREREQUISITE: PHOT 255 and PHOT 258. Introduction to professional practices in photography. Emphasis on the fundamentals of business and marketing. Class is strongly recommended for those who plan on entering the photographic profession. School of Film and Photography.


PHOT 352. Advanced Lighting Practices. 4 Credits. (2 Lec, 2 Lab) On Demand PREREQUISITE: PHOT 255 and PHOT 258. Advanced photographic theory and practice in studio and on location. Emphasis given to creative aspects of artificial lighting and staged subject matter in all camera formats.

PHOT 359. Alternative Photographic Techniques. 4 Credits. (2 Lec, 2 Lab) On Demand PREREQUISITE: PHOT 255 and PHOT 258. Image creation through the use of historical contact printing processes. A variety of alternative processes will be addressed such as gum printing, cyanotype, and platinum/palladium. Extensive aesthetic exploration will be supported through a blend of the old processes and current digital negative making techniques.

PHOT 371. Portraiture. 4 Credits. (2 Lec, 2 Lab) On Demand PREREQUISITE: PHOT 255 and PHOT 258. Advanced portrait techniques, theory, and practice in studio and on location. Emphasis on creative exploration and application of a variety of styles in portraiture, such as informal, editorial, environmental, etc.

PHOT 373. Non-Fiction Photography. 4 Credits. (2 Lec) F PREREQUISITE: PHOT 255 and PHOT 258. The applied study of image, text and design to effectively communicate an intended message. The topic of truth in photography will be explored.

PHOT 374. Experimental Photography. 4 Credits. (2 Lec, 2 Lab) On Demand PREREQUISITE: PHOT 255 and PHOT 258. The applied study of experimental photographic techniques. These techniques will be explored in analog and digital image capture and output in the traditional darkroom.

PHOT 395. Practicum. 1-3 Credits. (1-3 Ind; 12 cr max) F,S,Su
Max 12 cr, total for both PHOT 395 & FILM 395 combined. PREREQUISITE: PHOT 255 and PHOT 258. Practical experience associated with research projects in photography.

PHOT 401. Contemp Issues in Photography. 3 Credits. (3 Lec) F
PREREQUISITE: PHOT 303 or PHOT 304. The critical exploration of photography as cultural phenomenon, personal expression and art form. Emphasis on aesthetic, ethical, and political issues raised through application of the medium and consumption of its products.

PHOT 409R. Undergrad Research. 1-6 Credits. (1-6 Ind; 12 cr max) On Demand 12 cr. PREREQUISITE: Senior standing in photography. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

PHOT 491. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand 1 - 4 cr, Maximum 12 cr. PREREQUISITE: Consent of Instructor. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PHOT 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand 1 - 3 cr, Maximum 6 cr. total for FILM, PHOT & THTR 492 combined. PREREQUISITE: PHOT 255 and PHOT 258, consent of instructor and approval of school director. Directed research and study on an individual basis.

PHOT 494. Seminar/Workshop. 1-4 Credits. (1-4 Sem; 12 cr max) PREREQUISITE: PHOT 255 and PHOT 258 or consent of instructor. Topics offered at the upper division level that are not covered in regular courses. Students participate in preparing and presenting discussion material.

PHOT 498. Career Internship. 2-12 Credits. (2-12 Ind; 12 cr max) PREREQUISITE: Consent of School Director. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

PHOT 499. Sr Production Photography. 5 Credits. (5 Sem; 10 cr max) F,S,Su PREREQUISITE: Senior standing in the Photography option and consent of the instructor. Senior capstone course. Independent production of a significant body of work in photography; extensive production combined with group critique and faculty consultation.

PHSX - Physics

PHSX 101. Freshman Physics Experience. 1 Credit. (1 Lec) F
An introduction to frontier areas of physics, including the "Standard Model" of elementary particle physics, quantum mechanics, and big-bang cosmology. Students explore these topics using order-of-magnitude estimates, dimensional analysis, and simple observations. Intended for physics majors or those considering a major or minor in physics.

PHSX 103IN. The Physics of How Things Work. 3 Credits. (3 Lec) F PREREQUISITE: High School Algebra. A practical approach to a broad array of fundamental topics in physics for non-science majors taught by analyzing things that are used and observed in everyday life. Classroom demonstrations will provide the opportunity for in-class analysis, discussions, and hands-on activities. Physics principals will be used to scrutinize issues such as energy and recycling from economic and environmental perspectives. The latest technology in transportation, electronics, and energy production will be analyzed. The connection between basic research in physics and modern technology will be examined. Students will not receive credit if they have passed PHSX 205, PHSX 220, or PHSX 240.

PHSX 200. Research Programs in Physics. 1 Credit. (1 Lec) F
An introduction to some of the exciting ideas, developments, problems, and experiments of modern day physics.

PHSX 201IN. Physics by Inquiry. 3 Credits. (3 Lec) F,S
An in-depth exploration of basic physics principles. Scientific model building and proportional reasoning skills will be developed in the context of properties of matter, observational astronomy, and DC electric circuits. For pre-service elementary teachers.

PHSX 205. College Physics I. 4 Credits. (3 Lec, 1 Lab) F,S,Su PREREQUISITE: High school trigonometry or M 151Q. First semester of sequence. Topics include kinematics and dynamics of linear and rotational motion; work and energy; impulse and momentum; and fluids. Students will not receive credit if they have passed PHSX 220 or PHSX 240. Common exams.

PHSX 207. College Physics II. 4 Credits. (3 Lec, 1 Lab) F,S,Su PREREQUISITE: PHSX 205 or PHSX 220. Second semester of sequence. Topics include simple harmonic motion; electric forces and fields; de electric circuits; magnetic forces and fields; and magnetic induction and motors. Students will not receive credit if they have passed PHSX 222 or PHSX 242. Common exams.

PHSX 220. Physics I (w/ calculus). 4 Credits. (3 Lec, 1 Lab) F,S,Su COREQUISITE: M 171Q or M 181Q First semester of a three-semester sequence primarily for engineering and physical science students. Covers topics in mechanics (such as motion, Newton's laws, conservation laws, work, energy, systems of particles, and rotational motion) and in mechanical waves (such as oscillations, wave motion, sound, and superposition). Common exams.
PHSX 222. Physics II (w/ calculus). 4 Credits. (3 Lec, 1 Lab) F,S,Su
PREREQUISITE: PHSX 220 or PHSX 240; M 171Q or M 181Q; COREQUISITE: M 172Q or M 182Q. Covers topics in thermodynamics (such as temperature, heat, laws of thermodynamics, and the kinetic theory of gases) and modern physics (such as relativity; models of the atom; quantum mechanics; and atomic, molecular, solid state, nuclear, and particle physics).

PHSX 240. Honors Gen & Mod Phys I. 4 Credits. (3 Lec, 1 Lab) F
COREQUISITE: M 171Q or M 181Q; Restricted to Honors students only. The honors section of PHSX 220. The concepts are discussed in more depth and the range of applications is greater. Common final only.

PHSX 242. Honors Gen & Mod Phys II. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: PHSX 220 or PHSX 240; M 171Q or M 181Q; Restricted to Honors students only. COREQUISITE: M 172Q or M 182Q. The honors section of PHSX 222. The concepts are discussed in more depth and the range of applications is greater.

PHSX 253. Physics of Photography. 2 Credits. (2 Lec) F
PREREQUISITE: High school algebra. Improvement of photographic skills through an understanding of the basic principles of photography. The nature of light and color and the physical principles involved in the operation of a camera will be presented. Unusual effects and recent developments will be discussed. Numerous demonstrations, photographs, and slides will be used to illustrate the principles.

PHSX 261. Laboratory Electronics I. 3 Credits. (1 Lec, 1 Lab) F
COREQUISITES: PHSX 222 or PHSX 242. Laboratory electronic measurements and analysis, and design of basic linear circuits.

PHSX 262. Laboratory Electronics II. 2 Credits. (1 Lec, 1 Lab) S
PREREQUISITE: PHSX 261. Analysis and design of basic digital circuits and advanced laboratory electronic measurements.

PHSX 290R. Undergraduate Research. 1-8 Credits. (1 Ind; 8 cr max) F,S,Su
PREREQUISITE: Consent of instructor and approval of department head. Directed undergraduate research. Course will address responsible conduct of research.

PHSX 291. Special Topics. 1-4 Credits. (1-2 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PHSX 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Consent of instructor and approval of department head. Directed study on an individual basis.

PHSX 301. Intro Theoretical Physics. 3 Credits. (3 Lec) S
PREREQUISITE: M 273Q or M283Q; PHSX 222 or PHSX 242. COREQUISITE: M 274 or M 284. Mathematical methods essential to the practice of theoretical physics, such as matrices, vector calculus, differential equations, complex variables, and Fourier series, with applications to examples from mechanics and electromagnetism.

PHSX 305RN. Art & Science of Holography. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: Junior standing. M 151Q or equivalent M Placement Test. Beginner’s course on creating holograms. Pictorial and geometric interpretations of lasers, interference, coherence, film, and holography enable students with limited science and M backgrounds to create their own holographic masterpieces. Lab techniques and documenting the creative process are emphasized.

PHSX 320. Classical Mechanics. 4 Credits. (4 Lec) F
PREREQUISITE: PHSX 301; PHSX 220 or PHSX 240. Principles of Newtonian, Lagrangian, and Hamiltonian mechanics including single particle motion, systems of particles, rigid body motion, moving coordinate systems, and small oscillations.

PHSX 331. Meth of Computational Physics. 1 Credit. (1 Lec) F
PREREQUISITE: PHSX 301. Introduction to the use of computational methods in physics. Emphasis will be placed on common methods of casting problems into forms amenable to numerical solution and for displaying numerical results.

PHSX 343. Modern Physics. 3 Credits. (3 Lec) F
PREREQUISITE: PHSX 224, PHSX 301, and M 284 or M 274. Waves in classical physics and quantum mechanics: complex representation, amplitude mechanics, and interference; Special relativity: postulates, Lorentz transformations, applications in nuclear and particle physics; Quantum mechanics: introduction of key experiments, Schrodinger equation, particles in potentials, spin, the atom; Introduction to nuclear and particle physics.
PHSX 446. Thermodynamics & Stat Mech. 3 Credits. (3 Lec) PREREQUISITE: PHSX 301 or Graduate Standing. Statistical physics and thermodynamics and their applications to physical phenomena. This course is strongly recommended for students intending to study physics in graduate school.

PHSX 451. Elementary Particle Physics. 3 Credits. (3 Lec) S Alternate Odd Years PREREQUISITE: PHSX 343 or Graduate Standing. A survey of elementary particle physics, beginning with an historical viewpoint and leading up to today's remarkably successful 'Standard Model' of quarks, leptons, and gauge bosons.

PHSX 461. Quantum Mechanics I. 3 Credits. (3 Lec) F PREREQUISITE: PHSX 343 and PHSX 320, or Graduate Standing. The wave function, the Schrödinger equation in 1-D, formalism and Dirac notation, and 3-D effects including the hydrogen atom.

PHSX 462. Quantum Mechanics II. 3 Credits. (3 Lec) PREREQUISITE: PHSX 461 or Graduate Standing. Identical particles, time independent perturbation theory, time dependent perturbation theory, and the variational principle.

PHSX 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su Max 6 cr. PREREQUISITE: Junior standing and signed consent of instructor/ research advisor and academic advisor. Directed undergraduate research/creative activity, which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

PHSX 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand Max 12 cr. PREREQUISITE: Course prerequisites as determined for each offering. Course not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PHSX 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed study on an individual basis.

PHSX 494. Seminar/Workshop. 1 Credit. (1 Sem; 4 cr max) On Demand Max 4 cr. PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material. Co-convened with PHSX 594.

PHSX 499. Senior Capstone Seminar. 1 Credit. (1 Sem) S PREREQUISITE: Senior standing, completion of a senior project, and 2 credits of PHSX 490R. Senior capstone course. Participation in this course requires the completion of a senior project that integrates the student’s knowledge and skills acquired during the undergraduate curriculum. Students will be required to complete: i) an APS-style abstract, ii) an APS-style 10-minute oral presentation, iii) a poster session, and iv) a written research report, based on their research/creative activity.

PHSX 499R. Senior Capstone Seminar. 1 Credit. (1 Sem) S PREREQUISITE: Senior standing, completion of a senior project, and 2 credits of PHSX 490R. Senior capstone course. Participation in this course requires the completion of a senior project that integrates the student’s knowledge and skills acquired during the undergraduate curriculum. Students will be required to complete: i) an APS-style abstract, ii) an APS-style 10-minute oral presentation, iii) a poster session, and iv) a written research report, based on their research/creative activity.


PHSX 511. Astronomy for Teachers. 3 Credits. (3 Rct) F,S,Su PREREQUISITE: Graduate standing. Currently certified middle and high school teachers with one year of teaching experience. This is an online, distance education course primarily intended for science educators. Topics include: the laws of gravity and orbital dynamics, a survey of the solar system, stars and stellar evolution, galaxies, and Big Bang cosmology.

PHSX 512. General Relativity Online. 3 Credits. (3 Lec) S alternate years, to be offered even years. PREREQUISITE: PHSX 222 or PHSX 242; M 182Q; PHSX 405; Bachelor’s degree and one year teaching experience. This online course addresses the theory of general relativity, which underlies our understanding of gravity and the large-scale structure of the cosmos. Designed for practicing high school physics teachers. Assignments and discussions use electronic computer conferencing and simulation software.

PHSX 513. Quantum Mechanics Online. 3 Credits. (3 Lec) S alternate years, to be offered even years. PREREQUISITE: Graduate standing; Currently certified high school teachers with one year of teaching experience; an introductory physics course; and a working knowledge of elementary differential and integral calculus. This online course addresses the key ideas behind quantum mechanical observations and devices, including the fundamental behavior of electrons and photons. Designed for practicing high school physics teachers. Assignments and discussions use electronic computer conferencing and simulation software.

PHSX 514. Comparative Planetology Online. 3 Credits. (3 Lec) S PREREQUISITE: Bachelor’s degree, professional teaching certificate, and at least one year of K-12 teaching experience. Because the use of technology is integral to the course, some familiarity with using technology in the classroom is required. Establishing a Virtual Presence in the Solar System has been developed and tested as an Internet-delivered course for off-campus students. Its audience consists of practicing elementary and secondary teachers who have experience in teaching general science but have little, if any, formal course work in astronomy. Its goal is to help graduate-level teachers learn solar system astronomy concepts to integrate the new National Science Education Standards and NASA resources into existing instructional strategies. Course participants learn advanced solar system concepts, utilize WWW-resources, communicate with research scientists using the Internet, analyze digital images using image processing software, and organize materials for use in K-12 classroom environments.

PHSX 515. Advanced Topics In Physics. 3 Credits. (3 Lec; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Graduate standing. Topics in astrophysics, condensed matter physics, optics, mathematical physics, or particle physics are presented as needed to supplement the curriculum.

PHSX 516. Experimental Physics. 3 Credits. (2 Lec. 1 Lab; 6 cr max) F,S,Su PREREQUISITE: (PHSX 261, PHSX 423, and PHSX 461) or graduate standing. Experiments chosen from laser optics and atomic, solid-state, and nuclear physics are carried out in depth to introduce the graduate student to methods, instrumentation, and data acquisition techniques useful for experimental thesis projects. Co-convened with PHSX 444.

PHSX 519. Electromagnetic Theory I. 3 Credits. (3 Lec) S PREREQUISITE: PHSX 425 or graduate standing. Electro- and magnetoostatics, conservation laws and covariance of Maxwell’s equations, and dynamics of relativistic particles and fields.


PHSX 523. General Relativity I. 3 Credits. (3 Lec) F, alternate years. PREREQUISITE: PHSX 519. Tensor calculus, differential geometry, and an introduction to Einstein’s theory of gravity. The Schwarzschild solution and black hole physics.

PHSX 524. General Relativity II. 3 Credits. (3 Lec) S alternate years, to be offered odd years. PREREQUISITE: PHSX 523. Advanced topics in gravitation theory such as singularities, cosmological models, and gravitational waves.

PHSX 525. Current Topics in General Relativity. 3 Credits. (3 Lec) S PREREQUISITE: PHSX 523. Current topics in general relativity will be explored.

PHSX 531. Nonlinear Optics/Laser Spectroscopy. 3 Credits. (3 Lec) F alternate years. PREREQUISITE: PHSX 507. Two-level atoms in laser fields and applications to nonlinear optics such as photon echoes, second harmonic generation, and stimulated Raman scattering. Atomic and molecular energy level structure, linear and nonlinear spectroscopy, and applications to gaseous and solid state laser materials.

PHSX 535. Statistical Mechanics. 3 Credits. (3 Lec) S PREREQUISITE: PHSX 446 or graduate standing. Basic concepts of equilibrium statistical mechanics, with application to classical and quantum systems, will be presented as well as theories of phase transitions in fluid, magnetic, and other systems.
PHSX 544. Condensed Matter Physics I. 3 Credits. (3 Lec) F, alternate years, to be offered even years.
PREREQUISITE: PHSX 446 or graduate standing, and PHSX 507. Crystal structure and the reciprocal lattice. Quantum theory of electrons and phonons.

PHSX 545. Condensed Matter Physics II. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: PHSX 544. Applications to the transport, optical, dielectric, and magnetic properties of metals, semiconductors, and insulators.

PHSX 555. Quantum Field Theory. 3 Credits. (3 Lec) S
PREREQUISITE: PHSX 507. Techniques of canonical and path integral quantization of fields; renormalization theory. Quantum electrodynamics; gauge theories of the fundamental interactions.

PHSX 560. Astrophysics. 3 Credits. (3 Lec) F, alternate years, to be offered even years.
PREREQUISITE: PHSX 425, PHSX 462, PHSX 446, and PHYS 435, or graduate standing. The purpose of this course is to prepare graduate students for thesis-level research in astrophysics, solar physics or related fields. Topics covered include: fluid mechanics, hydrodynamics, plasma physics, radiation processes and stability of equilibrium states.

PHSX 565. Astrophysical Plasma Physics. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
CONTRAQUISITE: PHSX 520. An introduction to the physics of fluids and plasma relevant to astrophysical plasmas such as the solar corona. Topics covered include: magnetostatics, one-fluid (MHD) and two-fluid approaches, linear waves and instabilities, shocks, transonic flows and collisional effects.

PHSX 566. Mathematical Physics I. 3 Credits. (3 Lec) F
PREREQUISITE: M 349, M 472, and PHSX 320 or graduate standing, mathematical methods which find application in physics. Differential equations, contour integration, special functions, integral transforms, boundary value problems, and Green’s functions.

PHSX 567. Mathematical Physics II. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: PHSX 566. Theory of computational techniques, and applications such as numerical integration, differential equations, Monte Carlo methods, and fast Fourier transforms.

PHSX 582. Astrobiology for Teachers Online. 3 Credits. (3 Lec) F,S
PREREQUISITE: (1) a bachelor’s degree, including college level biology and college level physics or astronomy (2) two years of experience teaching science (3) must be currently certified and teaching science at the middle or high school level. Astrobiology is the study of the origin, evolution, distribution, and destiny of life in the universe. It defines itself as an interdisciplinary science at the intersection of physics, astronomy, biology, geology, and mathematics, to discover where and under what conditions life can arise and exist in the Universe. The course topics will cover the discovery of planetary systems around other stars, the nature of habitable zones around distant stars, the existence of life in extreme environments. These concepts will serve as a foundation to study possible extraterrestrial ecosystems on planets and moons like Mars and Europa.

PHSX 589. Graduate Consultation. 3 Credits. (3 Ind) F,S
PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan) but who need additional faculty or staff time or help.

PHSX 590. Master’s Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S
Max credits unlimited. PREREQUISITE: Master’s standing.

PHSX 591. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand Max 12 cr. PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PHSX 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

PHSX 594. Seminar. 1 Credit. (1 Sem; 8 cr max) On Demand Max 8 cr. PREREQUISITE: Graduate standing or senior by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

PHSX 595. Teaching Mechanics Using Research-based Curriculum. 2 Credits. (1 Lab) Su
PREREQUISITES: Teacher of science with a minimum of two years teaching experience. This course prepares participants to teach a mechanics course built around Tutorials in Introductory Physics (McDermott, et al.). This research-based curriculum was designed to be used in recitations to augment traditional lecture courses operating essentially independent of the lecture. The course will model both the student-centered tutorial instruction and the supporting active-engagement lectures for a selection of topics from the first semester of the two-semester sequence.

PHSX 596. Teaching Electricity & Magnetism for Teachers. 2 Credits. (1 Lec. 1 Lab) Su
Participants will learn how to teach an integrated course built around Tutorials in Introductory Physics (McDermott, et al.). This research-based curriculum challenges students to confront their misconceptions and build gut-level models of the key concepts of electricity and magnetism. The course will showcase both the student-centered tutorial instruction and the supporting active-engagement PowerPoint lectures. We will also review the physics education research literature that provides the foundation for these curricular materials.

PHSX 689. Doctoral Reading & Research. 3-5 Credits. (3 Ind; 15 cr max) On Demand Max 15 cr. PREREQUISITE: Doctoral standing. This course may be used by doctoral students who are reading research publications in the field in preparation for beginning doctoral thesis research.

PHSX 690. Doctoral Thesis. 1-10 Credits. (1 Ind; max unlimited) F,S,Su
Max credits unlimited. PREREQUISITE: Doctoral standing.

PSCI - Political Science

PSCI 201. Scope and Methods of Political Science. 3 Credits. (3 Lec) F
This course introduces students to the concepts and methodology of Political Science as well as the various fields of the discipline including American politics, comparative politics, international politics and political theory. Students will analyze political ideas, theories, ideologies, systems and policies in order to focus on and investigate political problems on a national and global level as well as define central concepts related to the study of political science.

PSCI 210IS. Introduction to American Government. 3 Credits. (3 Lec) S
Examines the major institutions of national government and politics. Special emphasis on the constitution and other political rules of the game as shapers of public consciousness and government policy.

PSCI 230D. Introduction to International Relations. 3 Credits. (3 Lec) F,S
A survey of the major global issues and the means nation-states use to resolve them. The students will explore the concepts of sovereignty, the elements of power, and the global trends of regionalism and internationalism.

PSCI 240. Introduction to Public Administration. 3 Credits. (3 Lec) S
Implementation of public policy in American government. Topics include but are not limited to: bureaucratic politics, decision making, budgeting, personnel management, ethics, organization theory, and organization behavior.

PSCI 250. Introduction to Political Theory. 3 Credits. (3 Lec) F
This class provides an introduction to political theory as a tradition of Western thought and a foundational subfield within Political Science. We will examine methods of theoretical inquiry, as well as substantive questions related to power, identity and the state.

PSCI 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand for requesting a regular course number.

PSCI 302. Media & Politics. 3 Credits. (3 Lec)
PREREQUISITE: Sophomore standing. Explores role of the media in the political process with special emphasis on various print media, television, film, and cyberspace.

PSCI 306. Legislative Process. 3 Credits. (3 Lec) F
Alternate Odd Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Examines legislative decision-making in a constitutional, political, and comparative context. Special emphasis on how institutional rules and relationships shape the making of public policy at both the Congressional and state legislative level.
PSCI 310. Applied Political Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250 and Quantitative Reasoning CORE course, or consent of department. Provides an introduction to methods and techniques in quantitative political statistics. Topics covered range from levels of measurement and descriptive statistics to logistic regression, using political science data sets and examples.

PSCI 323. Modern Political Thought. 3 Credits. (3 Lec) S
PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, and PSCI 250, or consent of department. Examines issues of power, authority, legitimacy, community and freedom in the work of Machiavelli, Hobbes, Locke, Rousseau, Mill, Marx, and Nietzsche, among others. Recommended prerequisite for PSCI 354 (Contemporary Political Thought) and PSCI 455 (Politics & Virtue.).

PSCI 331. International Relations Theory. 3 Credits. (3 Lec) F
PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Overview of the idealism versus realism debate during the first half of the twentieth century. Followed by theories formulated in the postwar period to study causes of war/conflict, problems of interdependence, and recent developments such as the end of the Cold War, global democratization, growing ethnic conflict, and a more active United Nations.

PSCI 337. Model United Nations. 3 Credits. (3 Lec) F
PREREQUISITE: Consent of instructor. This course introduces students to the workings of the global organization that is the United Nations. Students gain an understanding of international negotiations that unfold in the U.N. setting in the context of current international issues and events.

PSCI 338. Comparative Politics. 3 Credits. (3 Lec) F
Comparative study of different types of governmental regimes, political systems, and political cultures throughout the world and the sources and consequences of these differences.

PSCI 341. Political Parties and Elections. 3 Credits. (3 Lec) F
Other. PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Examines the structure and function of political parties, interest groups, and the mass media in the electoral process. Special emphasis on electoral rules and citizen participation from a comparative democratic perspective.

PSCI 346. American Presidency. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. The American presidency as a government institution. Examination of the legal, political, administrative, and policy making roles of the president. Emphasis on recent issues of responsiveness to national needs and public accountability.

PSCI 353. British Politics. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: PSCI 210IS and consent of instructor. While the US and the UK share a common origin and philosophical heritage, their political systems have diverged since the revolution. This course investigates the similarities and differences in their political systems and the ramifications for politics and policy.

PSCI 354. Contemporary Issues in Political Theory. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Examines the structure and function of political parties, interest groups, and the mass media in the electoral process. Special emphasis on electoral rules and citizen participation from a comparative democratic perspective.

PSCI 356. American Presidency. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. The American presidency as a government institution. Examination of the legal, political, administrative, and policy making roles of the president. Emphasis on recent issues of responsiveness to national needs and public accountability.

PSCI 359. Comparative Politics. 3 Credits. (3 Lec) S
Comparative study of different types of governmental regimes, political systems, and political cultures throughout the world and the sources and consequences of these differences.

PSCI 362. Natural Resource Policy. 3 Credits. (3 Lec) S
PREREQUISITE: PSCI 210IS, PSCI 240, and Junior standing. Public lands policy and the economic and political issues that emerge. Special emphasis is placed on the National Parks and federal public lands of the Greater Yellowstone Ecosystem.

PSCI 390R. Research Methods. 3 Credits. (3 Lec) S
PREREQUISITE: Students should complete the lower division political science foundation block before taking PSCI 390R. This includes PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, and PSCI 250. This course introduces students to the qualitative and quantitative research methods used in the social sciences generally and political science.

PSCI 406. The Political Economy of Energy. 3 Credits. (3 Lec) F
Other PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. We examine the interface between politics and economics for energy issues at the international, national, state and local level. The dynamics of the international oil and gas markets, US energy dependence, alternative energy and state and local energy policies are key topics.

PSCI 407. Public Policy Analysis. 3 Credits. (3 Lec) F
Alternate Even Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Analysis of impact of public decisions with emphasis placed on secondary data sources and interpretation.

PSCI 414. Drug Trafficking and Governance in the Americas. 3 Credits. (3 Lec) S
PREREQUISITES: Consent of Instructor This course offers an introduction into the impact of drug trafficking and related activities on democracy and governance in Latin America and the U.S. The course takes a multi-disciplinary, comparative country and regional approach and looks at public policies throughout the region.

PSCI 418. The Politics of War & Peace. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Combines two well-established subjects in the area of political science concerned with the study of international relations: the causes of war and the study of war and peace (emphasis of class). Covers a broad range of theorizing, research, and practice in both areas and will consider the relationship between them in constructive and critical ways.

PSCI 423. Politics of Development. 3 Credits. (3 Lec) F
Alternate Odd Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Consideration of explanations for global development patterns, the political economy of development, broader measures of development, approaches for evaluating policy effectiveness, and examples of policy success. Examination of region-specific development challenges and concerns.

PSCI 429. National Security Policy Decision-Making. 3 Credits. (3 Sem) S
Other PREREQUISITES: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Engage in simulations on national security decision making at the highest level of the US government, taking on role of National Security Council Members. Learn about the organization, analysis of security challenges, and considerations posed by Congress, the media and interest groups.

PSCI 434. International Law. 3 Credits. (3 Lec) S
Alternate Odd Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. The nature and origin of modern public international law and its role in contemporary world politics. Topics include the rights and duties of states, human rights, law pertaining to armed conflict, aggression and international crimes, and the role of international law in conflict management.

PSCI 436. Politics of Food & Hunger. 3 Credits. (3 Lec) F
Other PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. The role of civil society, government and multilateral organizations are examined in a comprehensive analysis of food and hunger, including the issues presented by agricultural policy, famine, biotechnology and food safety, domestic and international food aid, and the right to food.

PSCI 437. International Political Econ. 3 Credits. (3 Lec) F
Other PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. The nature and origin of modern public international law and its role in contemporary world politics. Topics include the rights and duties of states, human rights, law pertaining to armed conflict, aggression and international crimes, and the role of international law in conflict management.

PSCI 438. Politics of Food & Hunger. 3 Credits. (3 Lec) F
Other PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. The role of civil society, government and multilateral organizations are examined in a comprehensive analysis of food and hunger, including the issues presented by agricultural policy, famine, biotechnology and food safety, domestic and international food aid, and the right to food.

PSCI 444. Congressional Campaign. 3 Credits. (3 Lec) F
Alternate Even Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Examines the structure of the modern congressional campaign, with specific attention to fundraising, advertising, polling practices, and voter mobilization. Special emphasis on linking political science theory to the practice of electioneering.

PSCI 451. State and Local Government Policy Making. 3 Credits. (3 Lec) S
An examination of the institutions, actors, and issues relevant to state and local governments in the United States, with a particular emphasis on Montana.
PSCI 454. Cinema and Political Theory. 3 Credits. (3 Lec) Su
PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Explores the intersection of political theory with topics such as civil society, bureaucracy and public policy through the use of film. Special attention is given to both descriptive and prescriptive applications of modern and contemporary political theory to these topics.

PSCI 455. Politics & Virtue. 3 Credits. (3 Sem) S
Alternate Even Years PREREQUISITES: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250 and PSCI 325 or PSCI 356, or consent of department. What is "virtue"? What different sets of virtues exist in the history of Western thought? What is the nature of contemporary political debates about specific virtues? Course will focus particularly on humility, solidarity, civility, empathy, autonomy, humaneness, temperance, and forgiveness.

PSCI 461. Administrative Law. 3 Credits. (3 SEM) S
Alternate Odd Years. PREREQUISITIEs: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. This course serves as an introduction to the legal and procedural environment of public administration. Students will explore the legislation and case law associated with contemporary administrative law in order to understand its impact on administrative practices and democratic governance.

PSCI 465. Public Administration and Policy. 3 Credits. (3 Lec) F
Alternate Even Years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Examines the major political and strategic processes of public policy development and implementation. Topics covered include agenda setting, stakeholder influence, use of political narratives, decision making and implementation strategies.

PSCI 471. American Constitutional Law. 3 Credits. (3 Lec) F
alternate odd years PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, PSCI 250, or consent of department. Explores the relationship between law, individual rights, and public policy. Legal research and case law approach are stressed. Topics will include, but are not limited to, the aspects of the Bill of Rights and the 14th and 15th Amendments.

PSCI 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) 1 - 6 cr. IND May be repeated. Max 12 cr. PREREQUISITE: Junior standing, cumulative GPA of 2.5 or higher, consent of the instructor and approval of the department head. Students propose, develop, and complete an individual research project under the direction of a faculty mentor. Written and oral presentation of the results are expected. Course will address responsible conduct of research. May be repeated.

PSCI 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand 1 - 4 cr. Maximum 12 cr. PREREQUISITE: Consent of instructor. Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PSCI 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand 1 - 3 cr. IND Maximum 6 cr. PREREQUISITE: Junior standing, cumulative GPA of 2.5 or higher, consent of the instructor and approval of the department head. Directed research and study on an individual basis.

PSCI 494. Seminar/Workshop. 1-3 Credits. (1 Lec, 2 Sem; 4 cr max) 3 cr. SEM 3 PREREQUISITE: Junior standing. Topics offered at the upper division level which are not covered by catalogued courses. Students are expected to do individual research projects leading to an oral and written report of each student's findings.

PSCI 498. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) 2 - 12 cr. IND 5 - 11RCT 1 - 2 PREREQUISITE: Junior standing, cumulative GPA of 2.5 or higher, consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

PSCI 499R. Senior Project/Thesis. 3 Credits. (3 Sem) PREREQUISITE: PSCI 201, PSCI 210IS, PSCI 230D, PSCI 240, Senior standing and Political Science Major. Senior capstone course. Required course for graduation. Students examine the major concerns and issues in the discipline of political science in a mentored research project.

PSCI 520. Government Leadership & Ethics. 3 Credits. (3 Lec) S
PREREQUISITE: PSCI 554. This course exposes students, using the most current theoretical and empirical literature, to the essential competencies need for ethical management and leadership roles in public and non-profit organizations.

PSCI 525. Non-Profit Management. 3 Credits. (3 Lec) F
Alternate Odd Years. PREREQUISITES: Graduate Standing. This course provides students an introduction to the legal, social, political and structural operation of nonprofit organizations in contemporary environments. Students, through a combination of lecture, discussion, written work (essays and project reports) and, where possible, service learning opportunities, will develop both an understanding of the role and operation of nonprofit organizations, as well as a sense of the function they serve in the wider community.

PSCI 530. Tools of Public Administration. 3 Credits. (3 Lec; 6 cr max) Su PREREQUISITES: Graduate Standing. This course encompasses two content areas needed for public managers: tools for human resource management and decisions and public budgeting. Topics regarding human resources include historical development of public personnel, position classification, recruitment, selection, equal opportunity, affirmative action, collective bargaining and flexible employment relationships under more limited and decentralized government. Topics regarding public budgeting include the politics of the budgeting process, budgeting forms and processes at the federal, state and local levels, and revenue projection and expenditure decisions.

PSCI 551. Research Methods for Public Administrators. 3 Credits. (3 Lec) S
PREREQUISITE: PSCI 554 and Graduate standing. A survey of the research process as a means of acquiring knowledge that is reliable and relevant to the making of public management decisions. Students will prepare and submit a research design that meets social scientific standards.

PSCI 552. Public Policy Processes. 3 Credits. (3 Lec) S
PREREQUISITIEs: PSCI 554 and Graduate standing. This course explores the major topics of public policy development and implementation.

PSCI 553. Research Methods II: Data Analysis. 3 Credits. (3 Lec) S
PREREQUISITE: PSCI 551 Students will get an introduction to qualitative and quantitative data collection, management, and analysis techniques. This fast-paced course will prepare graduates for their research theses and professional papers.

PSCI 554. Foundations of Public Administration. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing. An introduction to the theoretical, historical, intellectual foundations of public administration and the relationship between public administration theory and practice, the political context and the intellectual heritage of the field. Examines basic functions and processes of public administration, the relationship between public administration and contemporary issues of governance facing the public sector.

PSCI 555. Human Resources Management. 3 Credits. (3 Lec) F
Alternate odd years. PREREQUISITE: PSCI 554 and Graduate standing. A survey of the development of the concept of "public service" in the United States. Topics include historical development of public personnel, position classification, recruitment, selection, equal opportunity, affirmative action, collective bargaining and flexible employment relationships under more limited and decentralized government.

PSCI 558. Organization Dynamics. 3 Credits. (3 Lec) S
PREREQUISITE: PSCI 554 and Graduate standing. A survey of organization theory in governance organizations. The class explores major theories of organization and their contribution to effective organization performance.

PSCI 559. Program Evaluation. 3 Credits. (3 Lec) S
Alternate Even Years. PREREQUISITE: PSCI 554 and Graduate standing. A survey of methods of program evaluation and policy analysis for public programs. Quantitative and qualitative methods of analysis are contrasted. Implementation, utilization, and political context of the analysis and evaluation process are examined. Philosophical and ethical issues underlying alternative methods are explored.

PSCI 560. Ethics and Public Service. 3 Credits. (3 Lec) S
Alternate even years. PREREQUISITE: PSCI 554 and Graduate standing. The course explores ethics as applied to issues in public service and policy making through theoretical and case study approaches.

PSCI 575. Directed Professional Research Project. 3-6 Credits. (3-6 Independent Study) F,S
PREREQUISITE: PSCI 551 Research Methods I; and PSCI 533 Research Methods II recommended. This is an applied, hands-on course in which students will get an introduction to qualitative and quantitative data collection, management, and analysis techniques. This fast-paced course will prepare graduate students for their research theses and professional papers. Classroom sessions take place in a computer lab for active instruction and data analysis practice.

PSCI 589. Graduate Consultation. 1-3 Credits. (1 Ind; 3 cr max) F,S,Su
PREREQUISITE: Master's standing and approval of the Dean of The Graduate School. This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty support.
An individualized pre-professional assignment arranged with an agency, business, or other organization.

PSPP - Plant Sciences/Plant Pathology

PSPP 516. Research Design and Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 401. Data analysis and interpretation of problems unique to agricultural and biological research. Topics include: sample size determination, assumptions and transformation of data scale, completely random, randomized block and Latin square designs, comparisons among means, factorial experiments with restricted randomization and analysis of covariance, analysis of counts, and non-parametric methods.

PSPP 524. Adv Plant Pathology. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
This course is designed to give graduate students in the This course will serve as a companion to Genetic Plant Improvement (PSPP 542) taught in Spring odd alternate years by the plant breeding faculty.

PSPP 530. Crop Physiology. 3 Credits. (3 Lec) F
PREREQUISITE: BIOO 433; CHMY 211. This online offering examines interactions between plants and the environment. Light, environment, plant canopy development, photosynthesis, source-link relations, growth analysis, growth regulation, water relations, and environmental stresses are addressed.

PSPP 541. Advanced Plant Genetics. 3 Credits. (3 Lec) F alternate years, to be offered even years.
Genome and genetic analysis of flowering plants, including structure of the genome, methods of genetic analysis and the genetic basis of plant morphology and development. A familiarity with current and classical literature is stressed.

PSPP 542. Genetics of Plant Improvement. 3 Credits. (3 Lec) S odd years
PREREQUISITE: AGSC 441; STAT 401. The past, present and future of plant improvement. Emphasis on genetic principles underlying classical plant breeding, and on molecular biological principles underlying plant genetic engineering.

PSPP 546. Herbicide Physiology. 3 Credits. (3 Lec) F
Offered Even Years PREREQUISITE: BCH 380 and BIOO 433 or equivalents. A team-taught, distance delivery course on the biochemistry and physiology of herbicide action in plants. Herbicide discovery, classification, and mechanisms of action and resistance are explored.

PSPP 547. Biomimicry for Teachers. 2 Credits.

PSPP 548. Flower Plains of North Rock Mtn. 2 Credits. (2 Lec) Su odd years
A field oriented study of the flowering plants of Montana with an emphasis on plant keying skills. Objectives are: 1) to identify the parts of flowering plants and become familiar with botanical terms; 2) to learn morphological characteristics of common plant families; 3) to learn how to use a plant key to successfully identify flowering plants; application of these skills and botanical texts to the classroom. Mon - Tues are class/lecture days; Wed - Fri are day field trips to local trail heads.

PSPP 549. Plants, People, Health for Teachers. 2 Credits. (1 Lec, 1 Lab) Su
Alternate Even years PREREQUISITE: BIOB 160. Co-convened with AGSC 455. This course teaches the molecular mechanisms by which plants and pathogens/insects interact during the progress of pathogenesis or resistance, and the methods to study and visualize intercellular interactions during pathogenesis and defense. Co-convened with BIOM 465.

PSPP 589. Graduate Consultation. 1-3 Credits. (1-3 Ind) F,S
PREREQUISITE: Master’s standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan), but who needs additional faculty or staff time help.

PSPP 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max cr unlimited) F,S
PREREQUISITE: Master’s standing.

PSPP 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand.

PSPP 592. Independent Study. 1-3 Credits. (1-3 Lec; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of Department Head and Dean of Graduate Studies. Directed research and study on an individual basis.

PSPP 594. Seminar. 1 Credit. (1 Sem) F,S
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Students prepare, present, and critique scientific presentations.

PSPP 598. Internship. 2-4 Credits. (2-4 Ind; 12 cr max) F,S
PREREQUISITE: Graduate standing, consent of instructor and approval of Department Head, and Dean of Graduate Studies. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

PSYX - Psychology

PSYX 100IS. Intro to Psychology. 4 Credits. (3 Lec, 1 Lab) F,S
PSYX 100IS is offered even years.
PREREQUISITE: Doctoral standing. This course introduces students to the scientific method and its use to understand behavior, emotion, and cognition, and build theories and knowledge within key areas of psychological inquiry. A lab component offers hands-on experiences to demonstrate psychological ideas and principles.

PSYX 110IS. Honors Intro to Psychology. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: Honors Standing. This course introduces students to the scientific method and its use to understand behavior, emotion, and cognition, and build theories and knowledge within key areas of psychological inquiry. A lab component offers hands-on experiences to demonstrate psychological ideas and principles.

PSYX 223. Research Design and Analysis I. 4 Credits. (3 Lec, 1 Lab) F,S
PREREQUISITE: PSYX 100IS and either M 105Q (formerly M 145Q) or STAT 216Q. For Psychology majors and minors only. Prerequisites are strictly enforced. This course introduces students to the scientific method and its use to understand behavior, emotion, and cognition, and build theories and knowledge within key areas of psychological inquiry. A lab component offers hands-on experiences to demonstrate psychological ideas and principles.

PSYX 225. Research Design and Analysis II. 3 Credits. (3 Lec) F,S
PREREQUISITE: PSYX 223. For Psychology majors and minors only. This course introduces students to the scientific method and its use to understand behavior, emotion, and cognition, and build theories and knowledge within key areas of psychological inquiry. A lab component offers hands-on experiences to demonstrate psychological ideas and principles.

PSYX 230. Developmental Psychology. 3 Credits. (3 Lec) F
PREREQUISITE: PSYX 100IS. Human development across the lifespan using major theories of development including psychodynamic, psychosocial, learning, and cognitive. Physical, cognitive, social, emotional, and personality development are explored from conception to death.
PSYX 235D. Contemp Issues in Human Sexual. 3 Credits. (3 Lec) F,S
PREREQUISITE: PSYX 100IS. Issues of diversity and difference in human sexuality will be examined. The development and expression of sexual behavior as a complex sociocultural, biological, psychological, and historic phenomenon will be discussed. Course will examine sexual behavior and identity in both the majority culture and other cultures in the U.S. and world.

PSYX 263CS. The Psychology of Film. 3 Credits. (3 Lec) Su
PREREQUISITE: College Writing (W) and University Seminar (US) CORE. Uses psychological science to understand the persuasive power of media as portrayed in popular films. Evaluates the media’s ability to both reflect and affect behavior. Focus is on contemporary themes such as aggression, drug use, sexuality, and prejudice.

PSYX 270. Fund Psychology of Learning. 3 Credits. (3 Lec) On Demand
PREREQUISITE: PSYX 100IS. Introduction to scientific principles, theories, and applications of learning, including respondent and operant conditioning, social learning, verbal learning. Other types and approaches to learning will also be discussed.

PSYX 274. Psychological Measurement. 3 Credits. (3 Lec) On Demand
PREREQUISITE: PSYX 225. Principles of psychological testing and measurement as related to intelligence, aptitudes, attitudes, occupations, and personality. Topics include nature and types of psychological tests, test construction, test administration, basic psychometric theory, methods for estimating the reliability and validity of psychological tests, and ethical issues regarding psychological testing and measurement.

PSYX 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

PSYX 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PSYX 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) F,S,Su
Max 6 cr. PREREQUISITE: Consent of instructor. Directed research and study on an individual basis.

PSYX 325. Applied Critical Thinking. 3 Credits. (2 Lec) On Demand
PREREQUISITE: PSYX 100IS, and any Quantitative (Q) CORE course. Study of critical thinking skills through an understanding of psychological factors involved. Practical strategies are explored in relation to hypothesis formation and evaluation, decision making, problem solving and creativity, reasoning, and memory. Applications are emphasized.

PSYX 333. Psychology of Aging. 3 Credits. (3 Lec) S
PREREQUISITE: PSYX 100IS and junior standing or consent of instructor. Surveys different domains in which human behavior is influenced by aging. Topics include the influence of age on cognitive processes (e.g., attention and memory), social processes (e.g., personality and wellbeing), and biological processes (e.g., brain-related changes).

PSYX 335. Psychology of Gender. 3 Credits. (3 Lec) F
PREREQUISITE: PSYX 100IS. Traditional and feminist perspectives on psychological needs and concerns specific to women, including gender stereotyping and beliefs, cognitive differences between the sexes, psychological disorders common to women, women’s sexuality, and cultural and biological roles and norms.

PSYX 340. Abnormal Psychology. 3 Credits. (3 Lec) F,S
PREREQUISITE: PSYX 100IS. Historical and current perspectives on psychopathology, including neuroscience, behavioral cognitive, psychodynamic, and humanistic/existential approaches. Traditional approaches and recent innovations in therapy and diagnosis are considered along with current diagnostic categories, especially DSM.

PSYX 350. Physiological Psychology. 3 Credits. (3 Lec) F,S
PREREQUISITE: PSYX 100IS and PSYX 225. Introduction to the biological bases of behavior; brief review of functional neuroanatomy and physiology in relation to such topics as sensation, movement, motivation, emotion, sleep, learning and memory, consciousness, and abnormal behavior.

PSYX 354. Sensation & Perception. 3 Credits. (3 Lec) F
PREREQUISITE: PSYX 350. Basic principles of sensory systems (with emphasis on the visual system), contemporary psychophysical procedures, and principles of perception.

PSYX 360. Social Psychology. 3 Credits. (3 Lec)
PREREQUISITE: PSYX 100IS. Experimental research and theoretical viewpoints in social psychology, including such topics as: interpersonal attraction, perception, aggression, attitudes and attitude change, altruism, group behavior, social influence, stereotypes and prejudice, and the self.

PSYX 370. Psychology of Learning. 3 Credits. (3 Lec) S
PREREQUISITE: PSYX 100IS. Examines basic principles and theories of learning and motivation. Classical and operant conditioning, discrimination learning, incentive motivation, reward and punishment, and concept learning.

PSYX 375. Behavior Modification. 3 Credits. (3 Lec) F
PREREQUISITE: PSYX 100IS and PSYX 270 or PSYX 370. Human behavior change with emphasis on practical techniques for changing individual and group behavior in real-life situations.

PSYX 380. Memory & Cognition. 3 Credits. (3 Lec)
PREREQUISITE: PSYX 100IS, Junior standing, or consent of instructor. Theories and evidence concerning human information processing, focusing especially on attention and memory, problem solving, decision making, reasoning, and related topics.

PSYX 383. Health Psychology. 3 Credits. (3 Lec) On Demand
PREREQUISITES: PSYX 100IS and PSYX 380. Examination of the historical development of major concepts, theoretical ideas, and approaches to psychology, with emphasis on perspectives of broad current interest such as behavioral science, cognitive science, and neuroscience.

PSYX 442. The Self. 3 Credits. (3 Sem) S
PREREQUISITE: PSYX 100IS or Consent of Instructor. Explores the psychological science of the self, including the ways that our sense of self emerges, develops, and affects a wide variety of behaviors. Specific topics include self-awareness, self-knowledge, self-beliefs, and the self-concept.

PSYX 443. Collective Memory. 3 Credits. (3 Seminar) F,S
PREREQUISITES: PSYX 225, PSYX 380. Collective Memory is the study of memory in social contexts. This class will focus on psychological processes of small group memory research and how those processes build up to larger scale collective memories. Specific topics include collaborative remembering and forgetting, autobiographical memory, flashbulb memory, national identity, and cultural differences in memory for historical events. Each class, we will a read and discuss research articles to understand and critique what past researchers have found, what the current thinking is about each issue, and to suggest ideas for future research.

PSYX 461. Indust & Organiz Psych. 3 Credits. (3 Lec) On Demand
PREREQUISITE: PSYX 100IS. Basic concepts and theoretical frameworks for the fundamental areas of industrial and organizational psychology. Topics include history of I/O psychology, personnel selection, psychological testing, personnel training, performance appraisal, managerial decision making, job satisfaction, work motivation, leadership, job stress, organizational conflict, job design, and organizational development.

PSYX 462. Psychology of Prejudice. 3 Credits. (3 Lec) S
PREREQUISITE: PSYX 100IS or consent of instructor. Reviews theory and research on prejudice. Topics include stereotyping and discrimination, cognitive and affective dynamics of prejudice, causes of prejudice, eliminating prejudice, affirmative action and diversity programs, and psychological effects of prejudice.

PSYX 463. Social Cognition. 3 Credits. (3 Lec) F,S
PREREQUISITE: PSYX 100IS. Addresses how fundamental cognitive processes (e.g., concept activation, attention, memory) influence social behavior and thought. Topics include impression formation, mental simulations of alternative realities, nonconscious mental processes, subliminal stimuli, mental representations, stereotypes, and heuristics and biases.
PSYX 475. Advanced Behavior Analysis. 3 Credits. (3 Lec) S,Su
PREREQUISITE: PSYX 100IS and PSYX 375. Advanced Behavior Analysis is designed to deepen students’ understanding of antecedent stimuli, behaviors, and consequences. Functional behavioral assessments. Systems for increasing appropriate behavior, and ways of promoting generalization will be described. Ethical considerations of Applied Behavioral Analysts will be discussed.

PSYX 477. Science of Psych Well-Being. 3 Credits. (3 Lec) On Demand
PREREQUISITE: PSYX 100S. The Science of Psychological Well-Being examines topics within the rubric of Positive Psychology. Positive psychology focuses upon identifying, researching, and promoting the development of human strengths, thereby shifting the focus in psychology from psychopathology to human growth and potential.

PSYX 481. Judgment & Decision Making. 3 Credits. (3 Lec) On Demand
PREREQUISITE: PSYX 100S, Quantitative (Q) CORE, and Junior standing. Theories and evidence on the psychology of judgment and decision making, including rationality, normative rules for choice, irrationality of some human judgments, and group decision making. Applications of decision theory at the personal, organizational, and societal levels are reviewed.

PSYX 482. Linguistics. 3 Credits. (3 Lec) On Demand
PREREQUISITE: PSYX 100S, PSYX 389 or ENGL 236 are preferred but not required. Examines the psychological processes that make it possible for humans to learn and acquire language. Emphasizes on how spoken and written language is understood, how speech is produced, and how language is acquired.

PSYX 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S
Max 12 cr. PREREQUISITE: Junior or Senior standing, PSYX 225 and consent of instructor. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

PSYX 491. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

PSYX 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) F,S
Max 6 cr. PREREQUISITE: Junior standing, consent of instructor. Directed research and study on an individual basis.

PSYX 494. Seminar. 3 Credits. (3 Sem) On Demand
PREREQUISITE: PSYX 225 or consent of instructor. Topics in current Psychological Science offered at the upper division level that are not covered by cataloged courses. Topics vary each semester. Students participate in preparing and presenting discussion material based on primary journal articles.

PSYX 495. Field Pract in Applied Psy. 3-12 Credits. (3 Ind; 12 cr max) F,S
PREREQUISITE: PSYX 225 or Consent of Instructor. Field Practicum gives psychology majors direct experience in applied settings relevant to psychology. Students arrange an internship and submit progress reports summarizing their field experience while relating it to psychological principles and readings. Graduated A – F.

PSYX 499R. Senior Thesis/Capstone. 3 Credits. (3 Sem) F,S
PREREQUISITE: PSYX 490R or PSYX 495 (minimum 3 cr.). Senior capstone course. Written and oral presentation of senior thesis work.

PSYX 501. Adv Research Design & Analysis. 3 Credits. (1 Lec, 2 Lab) F
PREREQUISITE: Graduate standing or PSYX 225. Advanced topics in the design and analysis of psychological research.

PSYX 502. Advanced Design/Stat I. 3 Credits. (3 Sem) S
PREREQUISITE: Graduate standing in psychological science or PSYX 225 and a 3.25 GPA and consent of instructor. This is the first course in a sequence on advanced research design and statistical analysis in psychological science. Topics include design, methodological issues, hypothesis testing, basic (e.g., t-tests, ANOVA) and advanced statistical tests (e.g., factorial ANOVAs, ANCOVA, and Multiple Regression). This is the first course in Advanced Research Design and Analysis. The second is PSYX 501.

PSYX 503. Structural Equation Models. 3 Credits. (3 Sem) S
Alternate Even Years PREREQUISITE: Graduate standing, PSYX 501, PSYX 502, and consent of department. Introduces students to the theoretical perspectives and practical application of Structural Equation Modelling (e.g., latent variable analysis, confirmatory factor analysis, path analysis, and causal modelling) as applied in Psychological Science and builds upon student’s previous knowledge of multivariate statistical techniques.

PSYX 505. Teaching of Psychology. 1 Credit. (1 Lec; 2 cr. max) F,S
PREREQUISITE: Graduate standing in Psychology or consent of instructor. Theory and practice in selecting, organizing and presenting psychological science to undergraduates. Development of skills for lecture, discussion, student participation and laboratory teaching, including uses of current technologies. (May be repeated once).

PSYX 510. Topics in Psychological Science. 3 Credits. (2 Lec, 1 Rec) F,S
PREREQUISITE: Graduate standing or consent of instructor. Recent advances in topics in Psychological Science with emphasis in different years on either biological, social, or cognitive psychology. (Maximum 9 credits).

PSYX 539. Psychological Processes. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing or consent of instructor. Overview of research methods and relevant aspects of neuropsychology, neuroanatomy and neuropharmacology. Applications of prior work to the problem of discovery in biopsychology.

PSYX 541. Cognitive Processes. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing or consent of instructor. Theories, methods, findings, and applications concerning memory and cognitive processes.

PSYX 542. Learning. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing or consent of instructor. Principles and theories of learning and motivation. Topics include conditioning, learning, incentive motivation, reward and punishment. Application to organizational and human resource management problems.

PSYX 543. Memory. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing or consent of instructor. Theories and applications of human memory from cognitive psychological perspective. Topics include memory in social, legal, and educational contexts; memory conformity; memory across the lifespan, memory and expertise; autobiographical memory; metamemory; and forgetting.

PSYX 544. Social Psychology. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing or consent of instructor. Advanced experimental and applied research and theoretical viewpoints in social psychology. Topics include social cognition, interpersonal attraction, aggression, attitudes and attitude change, self, group dynamics, stereotypes and prejudice, and social influence.

PSYX 546. Social Cognition. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing. This course examines decision making, judgment, cognition, and affect from a social-cognitive perspective. Topics may include theory development, stereotypes, prejudice and discrimination, group behavior, attitudes and attitude change, mood and affect, heuristics and biases, memory, the self, and decision making. The primary goal is to understand theory and research in social cognition.

PSYX 562. Psychology of Prejudice, Stereotypes, Discrimination and Stigma. 3 Credits. (3 Sem) F
Alternate Odd Years PREREQUISITE: Graduate standing, or approval from course instructor. Advanced theoretical, experimental and applied research emphasizes distinctions among stereotypes, prejudice, discrimination, and stigma. Theories, methods, and findings from classic and modern day scholars are used to understand the who, when, and why people are prejudice and the impacts on and experiences of the stigmatized.

PSYX 575. Professional Paper and Project. 1-6 Credits. (1 Ind; 6 cr max) F,S
Max 6 cr. PREREQUISITE: Graduate standing. A research or professional paper dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

PSYX 584. Stress and Health. 3 Credits. (1 Lec 2 Sem) S
Alternate Every Year PREREQUISITE: Graduate Standing or consent of Instructor required. An interdisciplinary course that will consider the impact of stress on the student and his or her major advisor and graduate committee.

PSYX 589. Graduate Consultation. 3 Credits. (3 Ind) F
PREREQUISITE: Graduate standing and approval of The Graduate School. This course may be used only by students who have completed all of their course work and/or thesis, if on a thesis option for a master’s degree but who need additional faculty help or time.

PSYX 590. Master’s Thesis. 1-10 Credits. (1 Ind; 15 cr max) F,S
Max 15 cr. PREREQUISITE: Graduate standing.

PSYX 591. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
PREREQUISITE: Graduate standing and consent of instructor. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
RBPF - Residential Bldg Performance

**RBPF 100. Res Build Perf Seminar. 1 Credit.** (1 Lec) F
Taught in a discussion format, students learn critical thinking skills and explore issues in building science. Students will research career paths and industry certifications. This course serves as an orientation to MSU and the degree with a short, optional field experience. Intended for students in the Residential Building Performance Program.

**RBPF 103. Wx Installer Tech Fund. 2 Credits.** (2 Lec) F,S
COREQUISITE COURSE: RBPF 100 This course provides an overview of weatherization measure standards, and residential building performance practices including building science basics and the house as a system. Additionally it introduces basic health & safety issues and heating systems and mechanical codes.

**RBPF 104. Weatherization Installer Tech. 2 Credits.** (2 Lec) S
PREREQUISITE: RBPF 100. This course provides an overview of weatherization measure standards, and residential building performance practices including building science basics and the house as a system.

**RBPF 110. App Energy Effic Math. 1 Credit.** (1 Lec) F
COREQUISITE COURSE: RBPF 100 Students in this course will learn about topics in applied mathematics (heat transfer, air changes per hour, HVAC sizing, etc.) directly connected to weatherization and energy efficiency.

**RBPF 116. Energy App Health & Safety. 2 Credits.** (2 Lec) F,S
COREQUISITE COURSE: RBPF 100 Energy Applied Health and Safety provides students with a knowledge of energy related molds, combustion gases, building air tightness, lead based paint, asbestos and other risks associated with improving the energy of existing homes.

**RBPF 121. Insulation Sys & App. 2 Credits.** (2 Lec) F,S
COREQUISITE COURSE: RBPF 100 and RBPF 110 The student will learn types, performance and applications of interior and exterior residential insulation systems.

**RBPF 124. Res Green Design Build. 2 Credits.** (2 Lec) F
COREQUISITE COURSE: RBPF 100 This course provides an overview of energy efficient residential building concepts including building design, composition, materials, and orientation. The purpose of the course is to provide a foundation for understanding green building systems and processes.

**RBPF 129. Manufactured Home Weather. 2 Credits.** (2 Lec) S
PREREQUISITE: RBPF 100. This course provides an overview of mobile home weatherization measures, standards, and practices. This is a required course for the Residential Building Performance Program.

**RBPF 134. Single Family Enrgy Audit. 2 Credits.** (2 Lec) S
PREREQUISITE: RBPF 100. This course covers basic guidelines for Energy Auditors in Single Family Homes as well as math basics, building assessment strategies, and work order procedures.

**RBPF 140. Heat Sys Enrgy Aud & Inspectors. 2 Credits.** (2 Lec) S
PREREQUISITE: RBPF 100. This course covers basic guidelines for evaluating heating systems as an Energy Auditor. Low pressure boilers, forced air furnaces, and sealed combustion system analysis are the main focus of this course.

**RBPF 160. Building Performance Software. 2 Credits.** (2 Lec)
PREREQUISITE: RBPF 100. This course provides an overview of various options for Energy Audit and Building Performance Software concentrating on evaluating homes and gathering required data for input.

**RBPF 170. Renewable Energy Concepts. 2 Credits.** (2 Lec)
PREREQUISITE: RBPF 100. This course provides an overview of installation and maintenance of renewable energies including wind, solar (pv), geothermal, and solar hot water.

**RBPF 181. Combustion Appliances. 2 Credits.** (2 Lec) F
PREREQUISITES: RBPF 100 Provides a broad overview of multiple combustion appliances including sealed and non-sealed combustion appliances, natural gas vs. propane appliances, furnaces, RV heating boilers, etc. Also covered is how to perform inspections, health and safety, and installation considerations. This course is recommended for students who are interested in the HVAC (Heating, Ventilation, and Air Conditioning) track.

**RBPF 189. Bldg Perform Indus Cert Prep. 2 Credits.** (2 Lec) S
PREREQUISITES: RBPF 100 Prepares students for key industry certifications such as BPI (Building Performance Institute), RESNET (Residential Energy Network), and the NABCEP (North American Board of Energy Practitioners). Each certification possibility will be explored regarding prerequisites, required experience, knowledge requirements, practical skills, and employment possibilities.

**RBPF 198. RBP Program Internship. 4 Credits.** (4 Ind) S
PREREQUISITE: RBPF 100. This is a course available for Weatherization Assistance Program (WAP) employees who are currently enrolled at Gallatin College and are working in a Weatherization Office for Human Resource Development Council. It is also available to contractors working currently in building performance.

**RBPF 292. Independent Study. 1-3 Credits.** (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of instructor. Directed research and study on an individual basis.

**RLST - Religious Studies**

**RLST 100D. Intro to the Study of Religion. 3 Credits.** (3 Lec)
-- The great themes of the world’s religions and the methodological approaches to the academic study of religion and culture.

**RLST 110D. Religion, Conflict & Politics. 4 Credits.** (3 Lec)
-- This course will focus on issues in which political events and conflict have had their roots in religion or in interpretations of religion.

**RLST 201. Islam. 3 Credits.** (3 Lec) F
The textual traditions and historical forms of Islam will be studied from literary, historical, archaeological, and/or cultural perspectives.

**RLST 202D. Hindu Traditions. 3 Credits.** (3 Lec)
-- The sacred texts and the historical forms of religious thought and practice in the traditions of India.

**RLST 203D. Buddhist Traditions. 3 Credits.** (3 Lec)
-- The sacred texts and images of the religious thought and practices in the traditions of China, Korea, India, Southeast Asia, and/or Japan.

**RLST 204H. Intro to the Hebrew Bible. 3 Credits.** (3 Lec)
-- The Hebrew Bible (Old Testament) and its interpreters will be studied from literary, historical, archaeological, anthropological, and cultural perspectives.

**RLST 205H. Introduction to New Testament. 3 Credits.** (3 Lec)
-- The New Testament and its interpreters will be studied from literary, historical, archaeological, anthropological, and cultural perspectives.

**RLST 206H. Origins of God. 3 Credits.** (3 Lec)
-- The history and roots of and of varieties of concepts of the divine in various religious traditions.

**RLST 207H. Myth and Belief. 3 Credits.** (3 Lec)
-- The study of religion through story and image from their early contexts to their re-imagined forms. We will examine riddles such as myth and metaphor within a de-mythologized or literal worldview. We will apply and critique theories of myth and of metaphor to topics such as the monster or the trickster, and to themes such as cosmogony or metamorphosis.

**RLST 217H. Religion, Sci & Environment. 3 Credits.** (3 Lec)
-- The interdisciplinary course investigates models for interpreting the relationship of religion, science, and nature using cultural, textual, and historical approaches. The purpose of this course is neither to examine nor to critique the conclusions of scientific work; neither is it a course in theology nor a testing ground for faith.

**RLST 220H. Interpretations of Amenc Relig. 3 Credits.** (3 Lec)
-- Religion in America and America as religion: an examination of figures, texts, movements, and material culture in creating America’s religious and cultural landscapes.

**RLST 223H. Sacrifice, Rite & Ritual. 3 Credits.** (1 Lec)
-- The course explores how nature may be an idea shaped by cultural influences or worldviews. Analyses will include perspectives on myth, scientific theories, technologies, gender, geography, history and politics, film, literary and visual studies.
RLST 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max)
Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

RLST 321. Religion and Gender. 3 Credits. (2 Lec)
PREREQUISITE: Any RLST or PHL course. Investigation of metaphors and myths of gender and world cultures.

RLST 325. Religion and Literature. 3 Credits. (3 Sem)
PREREQUISITE: At least two 200 level courses in any one or combination of Religious Studies, English, Humanities, Modern Languages, or permission of the instructor. This course explores the intersection of religion with literary and other narrative cultures, with a focus on close reading and the interpretation of texts.

RLST 326. Topics in Religion. 3 Credits. (3 Sem)
PREREQUISITE: Any RLST course. Charismatic individuals, whether they found, reform, or depart from existing tradition, are an important feature of religion worldwide. This course examines such persons from different disciplinary perspectives. Topics may include guru culture; religion and colonialism; mystical experience and more.

RLST 330. Religion of Ancient Egypt. 3 Credits. (3 Lec)
PREREQUISITE: Any RLST course. Survey of Egyptian culture, religion, and society from the beginning of the history of a unified kingdom of ancient Egypt in the middle of the third millennium BCE through the Hellenistic conquest of Egypt by Alexander the Great.

RLST 332. Archaeology & Religion. 3 Credits. (3 Lec)
PREREQUISITE: Any RLST course. This course will utilize archaeology and archaeological method and theory as a means to study the history and development of the peoples, places, writings, and religious beliefs of the ancient Near Eastern world.

RLST 402. Natural/Unnatural/Supernatural. 3 Credits. (3 Lec)
PREREQUISITE: Any RLST course. This course considers how secular and religious thinkers have defined the supernatural and distinguished it from the natural world, with attention to the contemporary implications of debates about supernaturalism.

RLST 405. Text and Image. 4 Credits. (3 Lec)
PREREQUISITE: Any RLST course. From iconoclasts to bibliophiles, religion has remained deeply entangled in matters of text and image. This course situates religion within the interdisciplinary study of visual, material, and media cultures using theoretical, cultural studies, anthropological, art historical, and/or literary approaches.

RLST 407. Violence & Religion. 3 Credits. (3 Sem)
PREREQUISITE: Any RLST course. This course will examine the religious roots of various social and political categories in today’s world which might include, among others, nationalism, fundamentalism, or sexism, and examine the means by which these categories affect contemporary society and events.

RLST 510. What is Religion? 3 Credits. (3 Lec)
PREREQUISITE: Any RLST course. This course is a cross-cultural investigation of the ideas of personhood, including theories of the individual, the social, the body, and the transpersonal and transtemporal.

RLST 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su
Max 12 cr. PREREQUISITE: Any RLST course. Directed undergraduate research. Course will address responsible conduct of research. May be repeated.

RLST 491. Special Topics. 1-4 Credits. (1 Sem; 12 cr max)
Max 12 cr. PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

RLST 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max)
Max 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

RLST 494. Seminar. 1-3 Credits. (1-3 Sem; 6 cr max)
On Demand Each semester is given over to the detailed study of a major figure or problem in religious studies. Since the figures and problems studied vary from semester to semester, the course may be repeated for credit.

RLST 499RH. Senior Capstone. 3 Credits. (Sem)
PREREQUISITE: Consent of instructor. Religious Studies majors will explore significant themes relevant to the academic study of religion, using advanced research techniques, appropriate bibliographic tools, and in-depth analysis of historical, literary, theoretical, and/or visual sources.

RLST 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max)
Max 6 cr. PREREQUISITE: Graduate standing, consent of instructor, approval of Associate Dean, and Dean of Graduate Studies. Directed research and study on an individual basis.

SFBS - Sustainable Food & Bioenergy

SFBS 146. Introduction to Sustainable Food and Bioenergy Systems. 3 Credits. (3 Lec) S
This course provides an introductory foundation to explore and draw connections between key sustainability issues related to food and bioenergy systems. Interactive lectures, readings, activities, and field trips will provide exposure to a wide range of interdisciplinary topics including agro-ecology, natural resource management, crop production, livestock production, biodiversity, land use, livelihoods, nutrition, food choices, and policy.

SFBS 296. Practicum: Towne’s Harvest. 3 Credits. (1 Lec, 2 Lab)
PREREQUISITE: SFBS 146 or permission of instructor. Emphasizes hands-on field experience with small-scale market gardening, distribution through community-supported agriculture, and market sales at local farmers’ markets. Students will complete one independent project, service-learning at local farms and complete weekly writing assignments.

SFBS 298. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor. An individualized assignment with a professional agency to provide a guided field experience.

SFBS 327. Measure Innovation in Food Sys. 3 Credits. (3 Lab) F
PREREQUISITE: SFBS 146, SFBS 296 or SFBS 298, NUTR 221CS, or consent of instructor. Students will learn natural and social science tools to measure innovation in food systems. Training will be provided on experimental design as well as data collection, analysis and dissemination. Research methods will draw from agro-ecology, botany, cultural anthropology and nutrition.

SFBS 346. Sustainable Food and Bioenergy Systems Summer Field Course. 1 Credit. (1 Lab) Su
PREREQUISITE: SFBS 146 or consent of instructor. COREQUISITE: SFBS 296. This field trip course compares and contrasts large-scale agricultural operations across Montana. Students will gain an appreciation of the choices, opportunities, and challenges facing conventional, diversified, and organic producers. Interdisciplinary and systems level thinking will be practiced.

SFBS 429. Small Business and Entrepreneurship in Food and Health. 3 Credits. (3 Lec) F
PREREQUISITE: ECNS 101IS, or HDFS 138 or HDFS 239 and senior standing or permission of instructor. Basic bookkeeping, marketing, and management concepts for owning and operating a successful small business. Students will prepare a modified business plan based on individual interests. Special emphasis on sustainable design and corporate responsibility in food system enterprises.

SFBS 445R. Culinary Marketing/Farm/Table. 3 Credits. (1 Lec, 2 Lab) Su
PREREQUISITE: NUTR 221CS, NUTR 226, NUTR 227, and NUTR 322 or permission of instructor. Emphasizes hands-on food experience, including market garden tending and harvesting, distribution by community supported agriculture, food marketing and retail at farmers’ markets, culinary practice with seasonal garden produce and food preservation, educational outreach and culinary demonstrations, and independent research projects.

SFBS 451R. Sustainable Food Systems. 3 Credits. (3 Lec) S
PREREQUISITE: NUTR 221CS and senior standing or consent of instructor. This course examines the connections among the food industry, agriculture, and the environment and considers the sustainability of food choices. Students gain a systems perspective on current nutrition problems such as hunger, obesity, and disordered eating. Students conduct independent research.

SFBS 466. Food System Resilience, Vulnerability and Transformation. 3 Credits. (3 Lec) S
PREREQUISITE: SFBS 146, SFBS 296 or SFBS 298, NUTR 221CS or consent of instructor. In this lecture and literature-review based course, we will examine the impacts of global environmental change, policy, and markets on agro-ecosystems, diets and community health within the framework of systems theory. Students will participate in food system vulnerability assessments and develop plans for system resilience and transformation.

SFBS 491. Special Topics. 1-4 Credits. (1-4 Sem; 12 cr max)
On Demand PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

SFBS 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor. An individualized assignment with a professional agency to provide a guided field experience.
SOCI 211S. Criminal Justice System. 3 Credits. (3 Lec) F,S
Su This course is an overview of the institutions that comprise our justice system. The emphasis is on criminal justice and the sources of crime but topics relevant to the broader study of the law and justice included.

SOCI 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

SOCI 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

SOCI 303. Society and the Individual. 3 Credits. (3 Lec) On Demand PREREQUISITE: SOCI 101IS. Social behavior of the individual in the group, linguistic behavior, social perception, motivation and learning, and self-focus on symbolic interaction.

SOCI 307. Soc of Childhood & Adolescence. 3 Credits. (3 Lec) On Demand PREREQUISITE: SOCI 101IS. Examination of cultural and societal forces influencing development among children and adolescents from a sociological perspective.

SOCI 308. Becoming an Adult in America. 3 Credits. (3 Lec)S PREREQUISITE: SOCI 101IS. Examine the sociohistorical construction of the transition to adulthood, the changing institutional roles associated with the transition, and unique aspects of the transition to adulthood among marginalized populations.

SOCI 311. Criminology. 3 Credits. (3 Lec) F,S PREREQUISITE: SOCI 101IS. Discussion of major theories of crime and delinquency with special attention to systems of adult and juvenile deterrence.

SOCI 313. Princ of Crim Law & Procedure. 3 Credits. (3 Lec) On Demand PREREQUISITE: SOCI 101IS. This course introduces the student to fundamental American legal principles as developed in criminal law. In addition, the student will gain a basic understanding of key issues in the application and development of contemporary legal procedures.

SOCI 318R. Sociological Research Methods. 3 Credits. (3 Lec) F,S PREREQUISITE: SOCI 101IS and STAT 216Q or SOCI 202. Introduction to research methods in sociology with emphasis given to defining variables, hypothesis formation, and development of strategies used to test hypotheses. Student research project. For Sociology majors. Non-majors allowed with consent.


SOCI 326. Sociology of Gender. 3 Credits. (3 Lec) On Demand PREREQUISITE: SOCI 101IS. Examines the social and biological bases of gender, how gender is constructed through socialization, social interaction and institutional processes, and the social, cultural and economic consequences of gender differences for men and women.

SOCI 327. Sociology of Deviance. 3 Credits. (3 Lec) On Demand PREREQUISITE: SOCI 101IS. This course examines how particular attributes or behaviors are defined as deviant, the social consequences of formal and informal deviant designations, and the construction and imposition of norms, values, and rules.

SOCI 332. Sociology of the Family. 3 Credits. (3 Lec) On Demand PREREQUISITE: SOCI 101IS. The family as a structural and functional unit in social life and organization, as a unit of social control; its status, change, and associated problems.

SOCI 333. Sociology of Education. 3 Credits. (3 Lec) On Demand PREREQUISITE: SOCI 101IS. This course will focus on the relationship between education and society including the role of education in structuring socialization; racial, ethnic, gender and class stratification; human capital development; economic, political and labor market opportunities; and the political system.

SOCI 335. Juvenile Justice System. 3 Credits. (3 Lec) On Demand PREREQUISITE: SOCI 101IS or SOCI 221IS. An analysis of the juvenile justice system in the United States, including the historical development of policies and practices. The role of various social agencies in defining, preventing, and responding to delinquency will also be considered, primarily from a sociological perspective.
SOCI 340. Social Movements. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Of all the means of achieving social change, movements are among the most controversial. This course looks at movements through the theories used to interpret their activities in order to improve our understanding of their dynamics.

SOCI 344. Sociology of Race & Ethnicity. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Historical, comparative, and social psychological study of race and ethnic relations in the U.S. and elsewhere. Power, prejudice, and discrimination relating to minority status are emphasized.

SOCI 345. Sociology of Organizations. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Rational, natural, and open systems theories of complex organizations. Introduction to organizational structure. Irrational aspects of organizations. Organizational environments and their effects on structure and activity.

SOCI 346. Rural Sociology. 3 Credits. (3 Lec)S, On Demand
PREREQUISITE: SOCI 101IS. Demographic, economic and sociocultural change in rural communities with an emphasis on global economy, political structure, urbanization, and economic and social infrastructure. Special attention given to the rural west and Montana.

SOCI 355. Population and Society. 3 Credits. (3 Lec) On Demand

SOCI 357. Occupational/Corporate Crime. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. A sociological analysis of crimes committed by individuals within the workplace and by corporations. Addressed are the extent of the problems, social costs, legal responses, and theoretical perspectives assessing the etiology of such crimes.

SOCI 358. Crime and Inequality. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. This course examines how crime amid justice play out in the context of a stratified society. Students explore how social organization, inequality and conflict influence and shape the nature and distribution of crime and social control.

SOCI 359. Crime, Justice and Media. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Examines interrelationships between mass media, criminal justice system and crime in the US; public policy implications of media portrayals of crime, criminals, police and court system; relationship between media consumption and crime.

SOCI 362. Sociology of Law Enforcement. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS or SOCI 221IS. An examination of policing in society, with emphasis on the cultural context in which it occurs, its structural characteristics, and social psychological processes.

SOCI 370. Sociology of Globalization. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Examines the global interconnectedness of economic, political and cultural processes. Topics covered include theories and historical analysis of globalization, global culture and consumerism. The human struggles that accompany these changes including gender, family, and immigration.

SOCI 374. Sociology of Culture. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Survey of major approaches to the sociology of culture and the use of cultural theory in sociological analysis. Focus on cultural aspects of hegemony, language, artifacts, ideas, identities, and narratives to construct social reality.

SOCI 380. Sociology of Health & Medicine. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. An in-depth exploration of differing perspectives on health, medicine, practitioners, and healthcare systems with a focus on how gender, race/ethnicity, and social class affect health care systems, policies, practice and individual experiences of health and illness.

SOCI 401. Animals and Society. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. This course explores the spaces that animals occupy in human social and cultural worlds and the interactions humans have with them. Central to this course will be an exploration of the ways in which people and animals shape each other’s lives.

SOCI 414. Family Violence. 3 Credits. (3 Lec) On Demand

SOCI 420. Violence in American. 3 Credits. (3 Lec) S
PREREQUISITES: SOCI 101 or consent of instructor. This course offers a comprehensive explanation of the nature of violence and its control in America. We will explore a number of different types of violence, including homicide, rape, assault, domestic violence, child abuse, robbery, and terrorism.

SOCI 423. Sociology of Corrections. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Examination of the nature and extent of corrections in the United States as well as the purposes, structures, and procedures of penal sanctioning and the institutional systems of correction. Emphasis on historical developments and current trends and issues in corrections.

SOCI 425. Victim and Society. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS or SOCI 221IS. This course introduces students to the field of victimology, response to victimization in the United States, and crime victim typologies. Special topics include: human trafficking, school violence, child abuse, intimate partner violence, stalking, sexual assault, hate crimes & cyber victimization.

SOCI 427. Sociological Analysis. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Application of analytical tools to the analysis of sociological data.

SOCI 434. Sociology of Human Sexuality. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Investigation of human sexuality from a sociological perspective. Focus on social aspects of human desires experiences, and meanings in historical and cultural context primarily using a social construction of human sexuality perspective.

SOCI 435. Law and Society. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Analysis of law, legal processes, and legal and quasi-legal institutions from sociological and philosophical perspectives. Some issues that are addressed include the functions of the law in modern society, the issue of the law’s power (or impotence) in the everyday, and the law’s violence.

SOCI 436. Law and Inequality. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. This course addresses the problem of social inequality by examining the contradictory ways in which the law may be used as both an instrument of social change and as a medium to formalize and solidify social inequality.

SOCI 437. Communities & Crime. 3 Credits. (3 Lec) S
PREREQUISITES: SOCI 101IS This course examines the ways in which crime and violence are concentrated in certain neighborhoods and communities. The course overviews relevant theoretical models, the spatial concentration of crime, and informal and formal efforts to combat crime at the neighborhood level.

SOCI 448. Society and Sport. 3 Credits. (3 Lec)S
PREREQUISITE: SOCI 101IS. Sports sociology as a means to understand and analyze social issues related to sports. Addresses both the positive and negative features of sport in society today, examines the current popularity of sports, the benefits they provide, and the problems they may pose. Discusses how participation in sports can teach cultural values, encourage socially appropriate behavior, and foster community spirit and looks at how particular social problems such as economic inequality, sexism, and racism.

SOCI 455. Classical Sociological Theory. 3 Credits. (3 Lec) F
PREREQUISITE: SOCI 101IS. Introduction to major sociological theories with focus on the implication for the development of empirical research. Theory as a set of tools to guide research. The explanations provided by theorists are compared and their contributions to the study of selected social phenomena are discussed. For Sociology majors. Non-majors allowed with consent.

SOCI 470. Environmental Sociology. 3 Credits. (3 Lec) On Demand

SOCI 485. Political Sociology. 3 Credits. (3 Lec) On Demand
PREREQUISITE: SOCI 101IS. Power. Who has it, who doesn’t, and why. Political sociology explores the omnipresence of power in society from political power in government to power relationships in our day-to-day lives. Political economy will also be examined.

SOCI 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) On Demand
PREREQUISITE: SOCI 101IS. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

SOCI 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: SOCI 101IS. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
SPNS 101. Elementary Spanish I. 3 Credits. (3 Lec) PREREQUISITE: Consent of department. Placement required. An elementary level course designed to help students acquire basic proficiency in communicating within culturally significant contexts. An integrated approach to teaching language skills with emphasis on vocabulary acquisition and basic grammatical structures.

SPNS 102D. Elementary Spanish II. 3 Credits. (3 Lec) PREREQUISITE: SPNS 101 or equivalent as determined by placement exam. This course builds upon the foundation established in 101. Emphasis is placed upon oral and written expression. Reading and discussions are designed to increase comprehension of more linguistically complex texts and more conceptually complex cultural issues.

SPNS 193. Study Abroad. 12 Credits.

SPNS 193D. Study Abroad. 12 Credits.

SPNS 196. Service/Experiential Learning. 1-6 Credits. (1-6 Ind; 6 cr max) Service or experiential learning through departmental outreach initiatives or faculty-led study abroad programs.

SPNS 201D. Intermediate Spanish I. 3 Credits. (3 Lec) PREREQUISITE: SPNS 102D or equivalent, or placement exam. Intensive, methodical review of grammar and syntax combined with the integrated development of proficiency in the four language skills. Expansion of cultural knowledge and functional vocabulary through intermediate-level readings and discussions. Increased emphasis on written communication.

SPNS 202D. Intermediate Spanish II. 3 Credits. (3 Lec) PREREQUISITE: SPNS 201D or equivalent, or placement exam. Designed to follow the third semester review of grammar and basic skills. Taught through a series of carefully selected readings in Hispanic culture, civilization, and literature which will provide the basis for writing essays and reports and developing advanced language skills.

SPNS 250. Spanish for Healthcare Professionals. 3 Credits. (3 Lec) PREREQUISITE: SPNS 101 or equivalent. Prepares undergraduates to converse with Spanish-speaking patients and develop cultural competency. Emphasis on conversation/grammar necessary during medical interviews, cultural aspects of Latino health care, interviewing in Spanish. Includes guest speakers, real-world situations, and discussion of current issues.

SPNS 291. Special Topics. 1-3 Credits. (1-3 Lec; 12 cr max) On Demand PREREQUISITE: None required, but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

SPNS 293. Study Abroad. 12 Credits.

SPNS 296. Service/Experiential Learning. 1-6 Credits. (1-6 Ind; 6 cr max) Service or experiential learning through departmental outreach initiatives or faculty-led study abroad programs.

SPNS 305. Spanish Phonetics. 3 Credits. (3 Lec) F PREREQUISITES: SPNS 102D or equivalent. Introduction to the analysis of the Spanish sound system (Phonetics and Phonology). Topics will include the phonology of sound production, phonetics, phonetic transcription, rules of syllabification and accentuation, among others. One of the goals of the course will be to improve students’ pronunciation of Spanish.

SPNS 313. Don Quijote. 3 Credits. (3 Lec) PREREQUISITE: SPNS 201D. Don Quijote is often considered to be the first novel. In this course, students read and discuss the themes and issues that the novel explores and how they relate to modern society. The reading and discussion of the novel will also be used as a means of building vocabulary and increasing students’ proficiency in Spanish.

SPNS 320. Spanish Culture & Civilization. 3 Credits. (3 Lec) PREREQUISITE: SPNS 202D. This is a history course on Spain that begins in the pre-historical period and ends in the twentieth century. Students learn about the most famous and consequential events. Architecture is taught as the “visible history” from the Arabic palaces and Christian medieval churches and cathedrals through the Renaissance, Baroque, Neoclassic, and ending with Art Nouveau houses. The course is taught 100% in Spanish.

SPNS 323. Spanish/Advanced Grammar & Phonetics. 3 Credits. (3 Lec) PREREQUISITE: SPNS 202D. In-depth review of problem areas in grammar, complete review of the verb system and a practical study of Spanish sounds. This class is designed to provide prospective teachers and advanced students with an understanding of the function of Spanish grammar. In Spanish.

SPNS 324. Spanish/Adv Conversat and Comp. 3 Credits. (3 Lec) PREREQUISITE: SPNS 202D. Development and refinement of advanced oral and writing skills, intensive practice in expository and imaginative composition, review of idiomatic expressions, and vocabulary expansion.

SPNS 329. Early Cultures of Latin America. 3 Credits. (3 Lec) Readings, lectures, and discussions in Spanish. This course examines the historical, social, and ideological aspects of Latin American culture from the pre-Columbian period through independence.

SPNS 330. Modern Cultures Latin America. 3 Credits. (3 Lec) PREREQUISITE: SPNS 202D. Readings, lectures and discussions in Spanish. This course examines the historical, social, and ideological aspects of modern Latin American culture. Taught in Spanish.

SPNS 332. Contemp Latin Amer Literature. 3 Credits. (3 Lec) PREREQUISITE: SPNS 202D. An examination of the major authors, works, and literary movements in Latin America from the 19th century until today. Taught in Spanish.

SPNS 333. To Infinity and Beyond: Jorge Luis Borges. 3 Credits. (3 Sem) PREREQUISITE: Completion of, or concurrent enrollment in, SPNS 202D. An examination of the work of the Latin American writer and thinker, Jorge Luis Borges. Readings may include essays and poetry, but the emphasis will be on Borges’ short stories. While the course will explore the themes of Borges’ work, activities and assignments will be geared toward strengthening Intermediate level proficiency and developing Advanced level skills on the ACTFL scale. Taught in Spanish.

SPNS 335HL. Travel in Latin Am Lit & Film. 3 Credits. (3 Lec) PREREQUISITE: SPNS 202D or Junior standing. The course examines travel in Latin America texts and films as exploration and search for individual and national identity and as disruptive displacements caused by political and economic forces and the problems of adapting to a new environment. In English.

SPNS 341. Warriors and Damsels in Spanish Literature. 3 Credits. (3 Lec) PREREQUISITE: SPNS 202D. This course explores Spanish literature from its medieval origins through the baroque period. Students read several canonical works in their entirety and learn about the historical, social, and political factors that influenced literary styles. Students learn about Spanish painting from the Middle Ages, the Renaissance, and Baroque in order to gain a better understanding of the tenets that form the foundation of each literary period. The course is taught 100% in Spanish.

SPNS 342. Passion & Politics in Spanish Literature. 3 Credits. (3 Lec) PREREQUISITE: SPNS 202D. This course covers canonical texts from the neoclassic period up to the present. Students read a combination of short literary works (poems and short stories) and three novels. Students learn the tenets of the most influential literary movements and write papers throughout the semester that explore the assigned texts. Spanish painting is taught to help elucidate the characteristics of each literary period. The course is taught 100% in Spanish.
STAT 216Q. Introduction to Statistics. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: Level 3 Math Placement Test within the past 12 months, B or better in M 096/097 or a C- or better in any 100 level or above M course. Traditional and resistant estimators of location and spread, fundamentals of inference using randomization and classical methods, confidence intervals, and tests of hypotheses. This course is taught in the TEAL format. COMMON EXAMS.

STAT 217Q. Intermediate Statistical Concepts. 3 Credits. (3 Lec) F,S,Su
PREREQUISITE: C- or better in STAT 216Q. One- and two-sample tests and associated confidence intervals for means and proportions; analysis of variance; F-tests, correlation; regression; contingency tables. Statistical analysis using the computer. COMMON FINAL ONLY.

STAT 226Q. Honors Introduction to Statistics. 3 Credits. (3 Lec) S On Demand.
PREREQUISITE: Enrollment in the MSU Honors Program or consent of instructor. Honors section of STAT 216Q. Topic coverage parallels STAT 216Q but with greater emphasis on applications, data analysis and interpretation, statistical computing, and statistics in the media.

STAT 290R. Undergraduate Research. 1-8 Credits. (1-8 Ind; 8 cr max) F,S,Su
PREREQUISITE: Consent of department head. Directed undergraduate research. Course will address responsible conduct of research.

STAT 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

STAT 332. Statistics for Scientists and Engineers. 3 Credits. (3 Lec) F,S
PREREQUISITE: M 172Q. Methods of estimation, data collection, analysis and display of quantitative information, continuous and discrete random variables, families of probability distributions, hypothesis testing, regression, ANOVA.

STAT 401. Applied Methods in Statistics. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: Graduate standing and STAT 216Q. This course is intended for graduate students majoring in mathematical sciences and not ready for STAT 511. Graphical techniques, data collection plans, populations, samples, sampling distributions, analysis of variance for one-way classifications, multiple comparisons, simple linear regression.

STAT 408. Statistical Computing and Graphical Analysis. 3 Credits. (3 Lec; 3 cr max) F,S
PREREQUISITE: One of the following: STAT 217Q, STAT 332, or STAT 401. Introduction to statistical packages R or SAS, including data importation, cleaning, graphing, and basic programming. Emphasis on use of graphical displays to explore, understand, and present data, and on organization of code.

STAT 411. Methods for Data Analysis I. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: STAT 217Q or STAT 332, or equivalent and consent of instructor. Introduction to statistical inference and design, t-tests, non-parametric alternatives, one-way ANOVA, simple linear regression, multiple linear regression, with an emphasis on statistical thinking, appropriate inference, interpretation of results, and writing. Co-convened with STAT 511.

STAT 412. Methods for Data Analysis II. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: STAT 411. Continuation of STAT 411/STAT 511 to cover principles of experimental design, multi-factor ANOVA, repeated measures, logistic regression, Poisson log-linear regression, and introductions to multivariate and time series analyses, with an emphasis on statistical thinking, appropriate inference and interpretation, and writing. Co-convened with STAT 512.

STAT 421. Probability Theory. 3 Credits. (3 Lec) F
PREREQUISITE: M 273Q and M 242 Strongly recommended. Fundamentals of probability; discrete and continuous random variables; expected value; variance; joint, marginal, and conditional distributions; conditional expectations; applications; simulation; central limit theorem; order statistics.

STAT 422. Mathematical Statistics. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 421. Senior capstone course. Introduction to the theory of point estimation, interval estimation, and hypothesis testing.

STAT 425. Biostatistical Data Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 325. F alternate years starting S 2015 then to be offered F even years. PREREQUISITE: STAT 411 Statistical methodology applicable to vital statistics, life tables and survival curves, clinical trials, epidemiologic investigations, and cause-effect studies. Co-convened with STAT 725.

STAT 431. Nonparametric Statistics. 3 Credits. (3 Lec) S
To be offered alternate odd years PREREQUISITE: One of the following: STAT 217Q, STAT 332, STAT 401 or STAT 411/STAT 511. Goodness-of-fit tests, sign tests, randomization and permutation tests, Wilcoxon and Mann-Whitney tests, Kruskal-Wallis and Friedman’s tests, Spearman and Kendall’s measures of association, bootstrap techniques, and other alternative nonparametric test procedures. Emphasis on methods and interpretations rather than theory.

STAT 436. Introduction to Time Series Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 411/STAT 511 or consent of instructor. An introduction to time series analysis considering time series regression, autoregressive, moving average, and ARIMA models, time series model building, estimation, and forecasting, and basic frequency domain methods. Co-convened with STAT 536.

STAT 437. Introduction to Applied Multivariate Analysis. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 412/STAT 512 or consent of instructor. Classic multivariate methods, including but not limited to principal components analysis, canonical correlation analysis, factor analysis, discrimination and classification methods, cluster analysis, and other topics may depend on instructor.

STAT 439. Introduction to Categorical Data Analysis. 3 Credits. (3 Lec) S

STAT 441. Experimental Design. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 411/STAT 511 and M 221 or M 333 or M 441 or consent of instructor. An introduction to the design and analysis of experiments: topics include analysis of variance methods, matrix forms, multiple comparisons, fixed and random effects, factorial designs, balanced complete and incomplete blocking designs, designs with nested effects, and split plot designs. Co-convened with STAT 541.

STAT 446. Sampling. 3 Credits. (3 Lec) F
PREREQUISITE: One of the following: STAT 217Q, STAT 332, or STAT 401. Probability sampling, sources of bias and uncertainty, survey design, methods for the natural sciences, simple random sampling, stratified random sampling, systematic sampling, cluster sampling.

STAT 448. Mixed Effects Models. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 412/STAT 512 alternate years offered in odd years. PREREQUISITE: STAT 411/STAT 511 or consent of instructor. In depth analysis of random, fixed and mixed effects models including use of stat software and interpretation of results. Emphasis on observations correlated in time (repeated measures) and space, and on random coefficients models (growth curves).

STAT 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su
PREREQUISITE: Junior standing in statistics and consent of department head. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

STAT 491. Special Topics. 1-4 Credits. (1-4 Ind; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Course not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

STAT 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
Max 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

STAT 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting material.

STAT 498. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. An individualized assignment arranged with an agency business, or other organization to provide guided experience in the field.

STAT 501. Intermediate Probability and Statistics. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 422 or consent of instructor. Families of probability distributions, distributions of functions of random variables, limiting distributions, order statistics. Cross-listed with M 501.

STAT 502. Intermediate Mathematical Statistics. 3 Credits. (3 Lec) S
STAT 505. Linear Models. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 412 or STAT 512. Special matrix theory for statistics, multivariate normal distribution, distributions of quadratic forms, estimation and testing for the general linear model, one-way and two-way classification models, contrasts (main effect, simple effect and interaction), multiple comparison techniques.

STAT 506. Advanced Regression Analysis. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 505. Applications of linear models using statistical packages; detecting and dealing with violations of assumptions including nonconstant variance, nonnormality, and collinearity; mixed effects models.

STAT 509. Stochastic Processes. 3 Credits. (3 Lec) S alternate years, to be offered every even years.
PREREQUISITE: STAT 421. Conditional probability theory, discrete and continuous time markov chains including birth and death processes and long run behavior; Poisson processes; queuing systems; system reliability. Cross-listed with M 509.

STAT 510. Statistical Consulting Seminar. 1 Credit. (1 Sem; 6 cr max) F,S
PREREQUISITE: Graduate standing in statistics. Seminar discussions of issues and cases in statistical consulting. Supervised practice in consulting with researchers from various disciplines.

STAT 511. Methods of Data Analysis I. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: Graduate standing, STAT 216Q or STAT 401, and consent of instructor. This course targets non-statistics graduate students. Introduction to statistical inference and design, t-tools, non-parametric alternatives, one-way ANOVA, simple linear regression and multiple linear regression, with an emphasis on statistical thinking, appropriate inference, interpretation of results and writing. Semester project required. Co-convened with STAT 411.

STAT 512. Methods of Data Analysis II. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: STAT 411/STAT 511 (co-convened). Continuation of STAT 411/STAT 511 to cover principles of experimental design, multi-factor ANOVA, repeated measures, logistic regression, Poisson log-linear regression, and introductions to multivariate and time series analyses, with an emphasis on statistical thinking, appropriate inference and interpretation, and writing. A semester project is required. Co-convened with STAT 412.

STAT 520. Topics in Applied Statistics. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 422 and consent of instructor. Current topics selected from computational statistics, time series and spatial statistics, decision theory, sampling, linear and mixed models, and multivariate statistics.

STAT 525. Biostatistics. 3 Credits. (3 Lec) F alternate years, to be offered every even years. PREREQUISITE: STAT 411 or STAT 511. Statistical methodology applicable to vital statistics, life tables and survival curves, clinical trials, epidemiologic investigations, and cause-effect studies. Co-convened with STAT 425.

STAT 528. Statistical Quality Control. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: STAT 421 or an equivalent transfer course in probability theory. Modeling process quality, traditional SQC tools, control charts for variable and attribute data, CUSUM and WMA charts, process capability analysis, reliability statistics, accelerated testing.

STAT 532. Bayesian Data Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 422 or STAT 502 or M 502 and STAT 506 recommended. Fundamentals of Bayesian inference, methods of Bayesian data analysis, computational methods for posterior simulation, fundamentals of hierarchical modeling.

STAT 534. Spatial Data Analysis. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: STAT 412, STAT 512, and STAT 422, or equivalent, or consent of the instructor. Statistical methods of spatial data analysis, stationary and nonstationary random fields, covariance structures, geostatistical models and analysis, spatial point process models and analysis, spatial lattice models and analysis.

STAT 536. Time Series Analysis. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: STAT 411, STAT 511, or consent of the instructor. An introduction to time series analysis considering time series regression, autoregressive, moving average, and ARIMA models, time series model building, estimation, and forecasting, and basic frequency domain methods. Co-convened with STAT 436.

STAT 537. Multivariate Analysis I. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: STAT 505. Multivariate regression, principal components analysis, exploratory and confirmatory factor analysis, discriminant and classification analysis, cluster analysis, classification and regression trees, basic structural equation modeling, along with bagging and boosting methods.

STAT 538. Multivariate Analysis II. 3 Credits. (3 Lec) F alternate years, to be offered every even years.
PREREQUISITE: STAT 537. Special topics in multivariate analysis including general latent variable methods, analysis of covariance structures, common principle components, robust and distribution free multivariate analysis.

STAT 539. Generalized Linear Models. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: STAT 422 and STAT 411/STAT 511. Analysis of categorical data including logistic regression, log-linear models, analysis of deviation, extrabinnomial variation, quasi-likelihood.

STAT 541. Experimental Design. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 411/STAT 511 and M 221 or M 333 or M 441. An introduction to the design and analysis of experiments: topics include analysis of variance methods, matrix forms, multiple comparisons, fixed and random effects, factorial designs, balanced complete and incomplete block designs, designs with nested effects, and split plot designs. Co-convened with STAT 441.

STAT 550. Advanced Mathematical Statistics. 3 Credits. (3 Lec) S alternate years, to be offered every even years.
PREREQUISITE: STAT 502 or M 502 and either M 384, M 505, or M 547. Sufficiency, completeness, ancillary statistics, invariance, likelihood-based inference, large sample theory, Edgeworth and saddlepoint approximations.

STAT 575. Professional Paper and Project. 1-4 Credits. (1-4 Lec; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

STAT 576. Internship. 2-12 Credits. (2-12 I; max cr unlimited) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

STAT 578. Response Surface Methodology. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: STAT 541 or STAT 505. Diagnostics; fractional-factorial designs; method of steepest ascent; canonical analysis; response optimization; ridge analysis; response surface design including central composite designs, orthogonal designs, rotatable designs, and optimal designs; mixture designs.

STAT 589. Graduate Consultation. 3 Credits. (3 Ind) F,S,Su
PREREQUISITE: Master’s standing. This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan) but who need additional faculty or staff time.

STAT 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max cr unlimited) F,S,Su
PREREQUISITE: Master’s standing.

STAT 591. Special Topics. 1-4 Credits. (1-4 Ind; 12 cr max) F
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

STAT 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

STAT 594. Seminar. 1 Credit. (1 Sem; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion materials.

STAT 689. Doc Reading & Research. 3-5 Credits. (3-5 Ind; 15 cr max) F,S,Su
PREREQUISITE: Doctoral standing. This course may be used by doctoral students who are reading research publications in the field in preparation for doctoral thesis research.

STAT 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral standing.
TE - Technology Education

TE 101. Intro to Technology Ed. 1 Credit. (1 Lec) F
Introduction to the rationale, principles, concepts, and philosophy of technology education. An overview of the Technology Education paradigm is provided through a variety of class activities.

TE 207. Materials and Processes. 4 Credits. (2 Lec, 2 Lab) On Demand
Exploration of technical competencies engineering, applications, processes, tools and equipment as they are employed by industry in the application of materials including but not limited to wood, metal, and composite materials.

TE 250CS. Technology and Society. 3 Credits. (1 Lec, 2 Lab) F,S,Su
Closely linked to the various sciences, technology has developed out of human need to solve real problems of society and to advance science. An exploration and examination of major technological periods, inventions, and innovations that have altered the course of humanity and their impact on the civilization process will lead to a perspective on technological literacy. This course will introduce students to the study of technology, not so much as a method for "doing technology," but as an impetus for social and cultural change related to technology.

TE 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

TE 294. Seminar. 1 Credit. (1 Sem; 4 cr max) F,S
Max 4 cr. Topics offered at the lower division level which are not covered in regular courses.

TE 330. Alternative Power/Energy Tech. 3 Credits. (2 Lec, 1 Lab) S alternate years, to be offered odd years.
LEC 1 LAB 2 PREREQUISITE: TE 101 and TE 207 Through a variety of research and applied learning activities, students will develop an understanding of various power/energy sources while at the same time gaining new perspectives on the feasibility and appropriateness of adopting and implementing a variety of power/energy systems to meet current societal needs.

TE 331. Electronic Communication Technology. 4 Credits. (2 Lec, 2 Lab) S
Students explore the technical and technological concepts of communication systems and sub-systems including audio/video production and web-based applications.

TE 353. Teaching Practices. 1 Credit. (1 Lab) F
COREQUISITE: EDU 497 (Methods: Ag and Tech Ed). Provides additional experiences in planning, teaching and evaluating lessons in Technology Education.

TE 360. Technology Practicum. 3 Credits. (3 Lab) F,S,Su
PREREQUISITE: Consent of Instructor. Self-selected, self-directed interdisciplinary field experience arranged with and supervised by an academic advisor. This practicum will pertain to the transfer of technological literacy in a variety of settings.

TE 406. Curriculum & Facilities Plan. 3 Credits. (3 Lec) F
PREREQUISITE: Acceptance in Teacher Education program; junior standing. COREQUISITE: EDU 497 (Methods: Ag and Tech Ed), or consent of instructor. Determining appropriate development of Technology Education and Agricultural Education programs based on an analysis of student and community needs. Organizing subject matter materials and laboratory resources to promote the development of standard based curricula.

TE 410. Computer Aided and Industrial Machining and Manufacturing. 4 Credits. (2 Lec, 2 Lab) S
PREREQUISITE: DDSN 114. Understanding of computer aided maching and manufacturing. Includes instruction in the use and operation of a complete CAM system including applications on a CNC milling machine. Course content includes machine tool technology practice related to traditional machining techniques.

TE 417. Manufacturing Technology. 3 Credits. (1 Lec, 2 Lab) F
PREREQUISITE: TE 207 and TE 230 and junior standing. Capstone course. Study and application of manufacturing concepts common to industry, including the stages of initial planning, prototype construction through the use of modern manufacturing techniques, market research, and analysis.

TE 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su Max 12 cr. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

TE 491. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
Max 12 cr. PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

TE 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. Directed research and study on an individual basis.

TE 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
Max 4 cr. PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level not covered in regular courses. Students participate in preparing and presenting discussion material.

TE 498. Internship. 2-12 Credits. (1 Lab; 12 cr max) F,S,Su Max 12 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in a technology field.

TE 501. History and Philosophy of Technology Education. 3 Credits. (3 Lec)
PREREQUISITES: Graduate standing. A review of national trends and issues in Technology Education and their implications for program development at the local, state and national level.

TE 530. 3D Modeling & Animation. 3 Credits. (1 Lec, 2 Lab) even years, alternate. PREREQUISITE: Graduate standing. This course is designed to provide the learner with experiences that build on previous Autodesk use and focuses primarily on the creation of 3D solid models.

TE 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
Max 4 cr. PREREQUISITE: Graduate standing / Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

THTR - Theatre

THTR 1221A. Acting for Non-Majors. 3 Credits. (3 Lec) F,S
S, Su, On Demand An introduction to the creative process engaged by a performer on a stage. Taught in a workshop format in which the individual student engages in exercises designed to convey stories and emotions through the understanding of human behavior as expressed on a stage.

THTR 304. Theatre Production. 4 Credits. (4 Sem) F
PREREQUISITE: FILM 212, FILM 251, and FILM 254. Exploration of the aesthetics and practice of creating a live theatrical performance. Students will work in teams to produce one act plays resulting in a public performance.

THTR 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S,Su Max 12 cr. PREREQUISITE: Senior standing in MPVT. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

THTR 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
May be repeated. Maximum 6 cr. total for FILM, PHOT & THTR 492 combined. PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed research and study on an individual basis.

THTR 494. Seminar/Workshop. 1-4 Credits. (1-4 Sem; 12 cr max) F,S,Su
Max 4 cr. SEM Maximum 12 cr. PREREQUISITE: Junior standing or permission of instructor and as determined for each offering. Topics offered at the upper division level that are not covered in regular courses. Students participate in preparing and presenting discussion material.

THTR 498. Career Internship. 2-12 Credits. (2-12 Ind; 12 cr max) F,S,Su
2-12 cr. IND, may be repeated, maximum 12 credits total for FILM, PHOT & THTR 498 combined. PREREQUISITE: Consent of School Director. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

UC - University College

UC 102. Leadership Explorations. 1 Credit. (1 Sem) F
One day prior to move-in day, this engaging and experiential leadership course provides first-year students with the opportunity to discuss theory and practice leadership in a small team setting.
UC 121US. Leadership Foundations. 3 Credits. (3 Lec) F,S
This face-to-face and web-enhanced course provides students with the opportunity to understand and develop leadership skills by examining individual and organizational leadership effectiveness through experiential learning in and out of the classroom. This is an introductory course for students interested in obtaining the MSU Leadership Fellows Certificate, but all students interested in leadership and leader development are welcome.

UC 191. Special Topics. 1-4 Credits. (1-4 Lec) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

UC 221. Critical Thinking & Leadership. 3 Credits. (3 Seminar) F,S
In this seminar students discover, evaluate and apply Critical Thinking and its relationship to Leadership. Using various techniques, including Socratic Questioning, they develop and practice effective Critical Thinking skills. Participants are challenged to "think about how they think" i.e. Metacognition.

UC 291. Special Topics. 1-4 Credits. (1-4 Sem; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

UC 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of Director. Directed research and study on an individual basis.

UC 298. Internship. 1-6 Credits. (1-6 Int; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

UC 302. Leadership Capstone. 1 Credit. (1 Sem) F,S
PREREQUISITE: UC 202: Junior standing, and permission of instructor. Capstone course for students completing the requirements of the MSU Leadership Fellows Certificate. Emphasizes leadership development to empower students to become effective agents of change.

UC 491. Special Topics. 1-4 Credits. (1-4 Lec) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

UC 498. Internship. 1-6 Credits. (1-6 Int; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

UNIV - University

UNIV 125CS. Microbes in the Environment. 3 Credits. (3 Lec) F
During the semester, students will explore contemporary issues related to microorganisms in the environment through a series of lectures and hands-on activities. Topics will include microbes in environmental, industrial, and medical settings. Examples include the beneficial role microbes play in treating waste water and making beer, wine, cheese and other food products as well as problems caused by microbes in medical infections, hot tubs, drinking water, and other industrial systems. Completing this course will advance a student’s awareness and appreciation of scientific thought and critical thinking and will improve communication skills.

US - University Studies

US 101US. First Year Seminar. 3 Credits. (3 Sem)
PREREQUISITE: First year students (less than 30 credits) only. This multi-disciplinary course, presented in seminar format, draws from the disciplines of sociology, psychology, literature, and philosophy to examine questions of place, identity, and justice. The course emphasizes verbal communication, critical thinking, intellectual development, and academic choices. US 101US fulfills the university seminar requirement of the core curriculum. This course is only open to first year students. This course cannot be repeated.

US 102. Career Connections. 1 Credit. (1 Sem) On Demand
Course is designed to assist students in the selection of a major in accordance with their interests and abilities. This course does not cover the US (University Seminar) CORE requirement.

US 103. Learning Strategies. 1 Credit. (1 Rcr) F,S
Co-Requisite: US 101US for the specified sections only. In this course, students will “learn how to learn” and develop critical thinking skills to solve problems. Study skills for effective reading, note taking, and test preparation are covered, as well as time management, organization, preventing procrastination, improving motivation, and reducing anxiety. Awareness and effective use of campus resources are also emphasized. The overarching purpose is to help students apply this information to their college coursework and be more effective and engaged students. This course is open to First year students only. The course cannot be repeated.

US 121US. Humanity, Society & Culture in the Digital Landscape. 3 Credits. (3 Lec) F
PREREQUISITE: Successful completion of at least 12 credits, and WRIT 101W or its equivalent. This multi-disciplinary course, delivered in an online seminar format, draws from psychology, sociology, history, and philosophy and asks students to consider the role of education in their lives and the social responsibilities of educated, engaged individuals living in the digital age. The course emphasizes critical thinking, communication and support of ideas, and intellectual development. US 121US fulfills the university seminar requirement of the core curriculum. This course is open to First year students only. The course cannot be repeated.

US 135. Veteran Academic Strategies. 1 Credit. (1 Lec) F,S
Study skills for student veterans that targets developing and applying the academic strategies necessary for persistence and degree completion. Topics include utilizing campus resources, continuing federal educational benefits, and generalizing skills to new academic situations.

US 140. Intro to Law and Legal Prof. 1 Credit. (1 Lec) F
Introduction to the study of law and an overview of the legal profession, including civil law, criminal prosecution, defense and the judiciary. Students will evaluate their interest in pursuing a legal education and career in law. This course does not cover the US (University Seminar) CORE requirement.

US 191. Special Topics. 1 Credit. (1 Sem) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

US 210. Education, World of Work, and You. 3 Credits. (1 Lec) F,S
Provides selected upper division students an opportunity to develop leadership and mentoring skills through the involvement with the US 101US First Year Seminar course. Includes training in group leadership and includes topics such as counseling and communication skills, student development, problem solving, and conflict resolution. Peer leaders work closely with faculty to enhance the academic, cultural, and social experiences of students in the seminar course.

US 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind; max unlimited) F,S
Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

US 291. Special Topics. 1-3 Credits. (1 Rcr) On Demand
Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

US 292. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of the Director of University Studies. Directed study on an individual basis.

US 391. Special Topics. 1 Credit. (1 Sem) F,S
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

US 460. Peer Leadership. 3 Credits. (1 Lec; 6 cr max) F,S
Max 6 cr. PREREQUISITE: Accepted Peer Leader Status, Restricted Entry. Provides selected upper division students an opportunity to develop leadership and mentoring skills through the involvement with the US 101US First Year Seminar course. Includes training in group leadership and includes topics such as counseling and communication skills, student development, problem solving, and conflict resolution. Peer leaders work closely with faculty to enhance the academic, cultural, and social experiences of students in the seminar course.

US 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind; 12 cr max) F,S
Max 12 cr. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

US 491. Special Topics. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.
US 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of the Director of University Studies. Directed study on an individual basis.

US 494. Advocat Seminar. 1 Credit. (1 Sem; max unlimited) F,S
PREREQUISITE: Accepted Advocat status, Sophomore standing, and consent of instructor. As student ambassadors on campus, Advocats are trained to market the programs and activities at MSU to prospective students and their families.

US 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of the Director of University Studies. An individual assignment arranged with an agency, business, or other organization to provide guided experience in the field.

USP - Undergraduate Scholars Program

USP 191. Special Topics. 1 Credit.

USP 290R. Undergraduate Scholars Program. 1-4 Credits. (1 Lex; max unlimited) On Demand
PREREQUISITE: 1st or 2nd year student and consent of collaborating faculty member. First and second year students in this course will conduct research in collaboration with a faculty member which may culminate in a research paper, a journal article, or an oral presentation. Course will address responsible conduct of research.

USP 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of Undergraduate Scholars Program Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

WGSS - Women's, Gender and Sexuality Studies

WGSS 120D. Why Diversity Matters. 3 Credits. (3 Lec) S
An interdisciplinary examination of the ways that social diversity can be important and valuable to a variety of institutional and professional contexts as well as obstacles to, and potential strategies for, increasing diversity within communities.

WGSS 201H. Intro to Feminist Theories. 3 Credits. (3 Lec) F
Major directions in feminist scholarship. Examination of the various schools of thought which have addressed gender inequities, and review of the strategies of cultural criticism which incorporate gender.

WGSS 301RH. Integrative Seminar in Women's Studies. 3 Credits. (3 Sem; 9 cr max) S
Max 9 cr. The seminar builds on the theoretical issues in women's studies and addresses special topics each year from a variety of disciplines.

WGSS 378. LGBTQ Studies. 3 Credits. (3 Lec) S
PREREQUISITE: Sophomore standing or consent of instructor. Examines issues, questions, and interdisciplinary approaches that characterize the field of lesbian/gay/bisexual/trans/queer (LGBTQ) studies. It explores the formation of LGBTQ politics and cultures in the United States; theories of sexual and gender diversity; and sexuality and sexual identity as key categories for understanding knowledge and the self.

WGSS 454. The Study of Men & Masculinity. 3 Credits. (3 Lec) S
PREREQUISITE: WSS 201 or PSYX 101 or 230 or 235 or 335 or SOCI 101 This course explores masculine gender role socialization and its impact on individuals/society, with emphasis on men's development and mental health. Systems of patriarchy, privilege, and oppression and their impact on men, women, and society are also discussed. WSSUS/SUS.

WGSS 491. Special Topics. 3 Credits. (1 Lex, 2 Sem.) S
PREREQUISITE: Sophomore standing or consent of instructor. Examines issues, questions, and interdisciplinary approaches that characterize the field of lesbian/gay/bisexual/trans/queer (LGBTQ) studies. It explores the formation of LGBTQ politics and cultures in the United States; theories of sexual and gender diversity; and sexuality and sexual identity as key categories for understanding knowledge and the self.

WGSS 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
Max 6 cr. PREREQUISITE: Junior standing, consent of instructor, and approval of the Director of University Studies. Directed study on an individual basis.

WGSS 494. Seminar. 3 Credits. (3 Sem) S
PREREQUISITE: Junior standing and as determined for each offering Timely and applied topics drawing on expert feminist voices from the field. Topics at the upper division level that are not covered in regular courses. Students prepare and present discussion material, read original research, and hear presentations by guest speakers.

WILD - Fish & Wildlife Science & Mgmt

WILD 201. Intro to Fish and Wildlife. 1 Credit. (1 Sem) F
An introduction to the career opportunities and current issues associated with management of fisheries and wildlife. For Fish and Wildlife Majors or those interested in the profession.

WILD 290R. Undergraduate Research. 1-6 Credits. (1 Ind; 6 cr max) F,S
PREREQUISITE: Consent of instructor and approval of department head. Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

WILD 291. Special Topics. 1-4 Credits. (1 Lec; 12 cr max) On Demand
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in an curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

WILD 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

WILD 298. Internship. 1-4 Credits. (1-4 Ind. Study. Max Repeat 8) F,S,Su
PREREQUISITE: Approval of intern program by consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience. May be repeated.

WILD 301. Princ of Fish & Wildlife Mgmt. 3 Credits. (3 Lec) S
PREREQUISITE: BIO 160 and BIO 170IN and junior standing. Overview of history and ecological principles underlying fish and wildlife management. In-depth discussion of current issues.

WILD 325. Wildlife-Livestock Nutrition. 3 Credits. (3 Lex) S
PREREQUISITE: ANSC 100 and NRSM 101 and NRSM 102. Nutrition of free ranging ungulates including deer, elk, antelope, bison, sheep, cattle and feral horses. Topics will include digestive systems, intake, food habits, feeding behavior and management on rangelands.

WILD 355. Wildlife and Livestock Habitat Restoration. 3 Credits. (1 Lex, 2 Lab) F
PREREQUISITE: NRSM 101 or ENSC 110 or WILD 301, and BIOO 230, and NRSM 240 or BIOE 370. Improves the understanding and management of man-made structures and habitat used for wildlife and free-range livestock in the western United States. Topics include methods used to improve wildlife habitat as well as livestock forage. Design criteria for stock ponds, off-site water development, construction of bird/ small mammal guzzlers, use of prescribed fire, mechanical, chemical and biological techniques to rehabilitate and improve rangeland, forest, and desert vegetation communities.

WILD 373. Wildlife Techniques. 3 Credits. (1 Lex, 2 Lab) On Demand
PREREQUISITE: Junior standing and minimum 3.0 GPA or consent of instructor. The goal of this class is to introduce students to a suite of techniques routinely employed by natural resource professionals for gaining knowledge of the ecology and status of wildlife populations.

WILD 401RN. Fish and Wildlife Capstone. 4 Credits. (2 Lex, 2 Lab) S
PREREQUISITE: Completion of STAT 216Q or BIO 318, and BIOE 370, and WILD 301, and Fish and Wildlife Ecology and Management option, or consent of instructor. Senior capstone course. Course emphasizes solving problems related to management of fish and wildlife. Students will be introduced to field techniques, analysis approaches, and scientific literature used to answer questions related to conservation and management of terrestrial and aquatic vertebrates.

WILD 420. Range & Wildlife Policy and Planning. 3 Credits. (3 Lex) S
PREREQUISITE: BIOE 103 or NRSM 101 or ENSC 110 and Junior Standing. Course explores primary rangeland and wildlife policy in North America, how it developed and how it is currently administered. Emphasis will be on the multidisciplinary application of policy for land resource and wildlife management planning. Animal & Range Sciences.

WILD 426. Wildlife Habitat Management. 3 Credits. (3 Lex) S
PREREQUISITE: NRSM 240 or BIOE 370 or consent of instructor. Emphasis is placed on wildlife habitat management in coordination with other land uses (i.e. agriculture, recreation, and development). Students gain insight into the details of wildlife habitat management by delving into historic and contemporary literature. Students develop proficiency in applied wildlife management through consideration of the three components (animal, habitat, human) common to all successful wildlife management efforts. Real world issues and solutions based on case study examples are emphasized.
WILD 429. Yellowstone Wildlife Habitat Ecology. 2 Credits. (2 Lec) Su
PREREQUISITES: Junior standing and a Biology course or consent of instructor. This course will describe the native communities of the internationally prominent northern Yellowstone winter range for wild ungulates. The ecology of many organisms, both plant and animal will be studied. Plant identification skills will be incorporated with an emphasis on the recognition of the Yellowstone northern range's flora and its importance as wildlife habitat. Ecosystem interrelationships will form the basis for understanding the ecology of the range and interpreting the consequences of management alternatives.

WILD 438. Wildlife Habitat Ecology. 3 Credits. (3 Lec) S
PREREQUISITE: NSRM 240 or BIOE 370 or consent of instructor. Principles of habitat importance and management. Habitat requirements within wildlife population constraints will be emphasized with consideration of other natural resource demands. Students will be required to learn the ecological characteristics and gain proficiency in the identification of 40 important woody plants.

WILD 490R. Undergrad Research. 1-6 Credits.
(1 Ind; 12 cr max) PREREQUISITES: Junior standing, consent of instructor and approval of department head. Directed graduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

WILD 491. Special Topics. 1-3 Credits. (1-3 Ind; 12 cr max) On Demand
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

WILD 492. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructors, and approval of department head. Directed research and study on an individual basis.

WILD 494. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

WILD 498. Internship. 1-4 Credits. (1-4 Ind; 8 cr max) On Demand
PREREQUISITE: Junior standing, approval of intern program by consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field. May be repeated.

WILD 501. Applied Population Ecology. 3 Credits. (2 Lec, 1 Lab) S
PREREQUISITE: BIOE 370 or WILD 301. An in-depth review of the (1) key theories of population ecology, (2) the application of theory in contemporary population management, and (3) managing populations in the face of uncertainty.

WILD 502. Population & Habitat Data. 3 Credits. (2 Lec, 1 Lab) 3 credits, Lecture 2, Lab 1 Offered in alternate fall semesters in odd numbered years PREREQUISITE: Completion of or concurrent enrollment in a five-hundred level statistics course. Study of the theory and methods of sampling and analyzing population data for vertebrates. Estimation of population size, survival, and recruitment using competing models that relate population states and rates to habitat conditions and other covariates of interest. Computer lab.

WILD 504. Wildlife-Habitat Relationships. 3 Credits. (2 Lec, 1 Lab) Offered in alternate spring semesters in even numbered years PREREQUISITE: Completion of a 500-level statistics course. This course will help students develop a conceptual and practical understanding of wildlife-habitat relationships and the use, application, and limitations of the analytical tools used to analyze these data. Course will be a blend of discussion and lecture; students will be responsible for written assignments based on readings and data sets.

WILD 510. Fisheries Science. 3 Credits. (2 Lec, 1 Lab) Offered in alternate spring semesters in even numbered years PREREQUISITE: BIOE 415, WILD 301. An in-depth review of fisheries data types and the analysis and interpretation of those data as it relates to freshwater fisheries research and management.

WILD 513. Fisheries Habitat Management. 3 Credits. (3 Lec) F alternate years to be offered even years PREREQUISITE: Graduate standing or consent of instructor. Assessment and application of ecological principles and methods used to protect and restore stream, lake and reservoir habitats for management of fishes and other aquatic organisms.

WILD 525. Human Dimensions of Fisheries and Wildlife Management. 3 Credits. (3 Lec) S, alternate years, to be offered even years.
PREREQUISITE: Graduate standing. This course provides fisheries and wildlife management graduate students with an understanding of how social, cultural, behavioral, and demographic characteristics of humans affect fisheries and wildlife management.

WILD 548. Research Perspectives. 2 Credits. (2 Lec) S
PREREQUISITE: Graduate standing or consent of instructor. An introduction to the philosophical underpinnings of resource science and management, with the goal of helping students to develop their own ideological perspective. A broad array of interdisciplinary readings is used to survey philosophical worldviews and explore their influence on science.

WILD 575. Professional Paper and Project. 1-4 Credits. (1 Ind; 4 cr max) F,S,Su
Max 4 cr. Graduate standing and committee approval and consent of instructor. A research or professional paper or project dealing with a topic in the field. The topic must be mutually agreed upon by the student and his or her major advisor and graduation committee.

WILD 591. Special Topics. 1-3 Credits. (1-3 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

WLDG - Welding Technology

WLDG 103. Welding Fund for Const Trades. 2 Credits. (2 Lab) F
Prerequisites: CSTN 135, CSTN 145, CSTN 161, CSTN 171 Corequisites: CSTN 230, CSTN 260 This course is specifically designed to teach students the basic welding methods that a carpenter might face (i.e. steel stud). Students will cover basic welding processes used in the trade applications.

WLDG 104. Technical Mathematics. 3 Credits. (3 Lec) F
This course presents basic mathematical topics as they are applied in a trades program. Topics covered include: use of measuring tools, measurement systems, dimensional arithmetic, percent, proportion, applied geometry, and basic trigonometry. This course is intended for CAS and AAS-degree seeking students and does NOT provide sufficient Pre-Algebra material as a pre-requisite for subsequent mathematics courses.

WLDG 106. Welding Fabrication Methods. 3 Credits. (3 Lec) F
Prerequisites: WLDG 110, WLDG 111, WLDG 121, WLDG 205 Corequisites: WLDG 120, WLDG 122 This course provides an introduction to basic fabrication of structural steel in accordance with industry standards.

WLDG 110. Welding Theory I. 1 Credit. (1 Lec) F,S
COREQUISITE: WLDG 111 This course covers welding safety, oxy-fuel and shielded metal arc welding (SMAW), definitions covering joining common metals, joint and weld classifications, welding positions, power source selection, plus manual and semiautomatic cutting principles, and terminology.

WLDG 111. Welding Theory I Practical. 3 Credits. (1 Lec, 2 Lab) F,S
COREQUISITE: WLDG 110 Oxy-fuel practical work will involve fusion welding, burning, and cutting. Shielded metal arc welding (SMAW) practical work will involve fillet and horizontal welding skills using a variety of electrodes.

WLDG 117. Blueprint Reading and Welding Symbols. 2 Credits. (2 Lec) F
This course will introduce blueprints and emphasize reading and interpreting welding symbols. Topics covered include basic blueprint reading for welders: basic lines, basic views, title block information, dimensions, structural shapes, auxiliary views, section views, detail prints, welding symbols and other various blueprint information.

WLDG 120. Welding Theory II. 2 Credits. (2 Lec) S
Prerequisites: WLDG 110, WLDG 111, WLDG 121 Corequisites: WLDG 122 This course will concentrate on the processes which use inert and/or inert and active gas mixtures for shielding during welding. Gas metal arc welding (GMAW) or MIG, gas tungsten arc welding (GTAW) or TIG, and plasma welding and cutting (PAW/PAC) operations will be thoroughly covered. Process selection and use for welding ferrous and nonferrous metals will be covered.

WLDG 121. Welding Theory II Practical. 3 Credits. (3 Lec) F
Corequisites: WLDG 110, WLDG 111 Practical work involves the application of GMAW and GTAW as it is used in industry today. Use of the various modes of metal transfer, joint styles, welding positions, welding of carbon and stainless steels, and aluminum alloys on various joint styles and in various welding positions, and manipulation techniques will be emphasized.

WLDG 122. Welding Theory III Practical. 3 Credits. (3 Lec) S
Prerequisites: WLDG 110, WLDG 111, WLDG 121 Corequisites: WLDG 120 This course continues skill development from WLDG 121. Practical work involves the application of GMAW and GTAW as it is used in industry today. Use of the various modes of metal transfer, joint styles, welding positions, welding of carbon and stainless steels, and aluminum alloys on various joint styles and in various welding positions, ad manipulation techniques will be emphasized.
The goal of this course is to develop confidence and the ability to write clear and writing for academic purposes by focusing on the development of the paragraph. Offered by Gallatin College. Building Basic Writing Skills introduces students to material. Writing, drafting, revision, and editing. Composing in-class paragraphs gives students practice with the writing process and engages students with the WRIT 101 course material.

WRIT 091. Sp: College Writing Co-Req. 2 Credits. (2 Lec)FS
PREREQUISITES: WRIT 080 COREQUISITES: WRIT 101-098 The College Writing Co-req course (WRIT 091) supports college writing students on all core literacy skills needed to be successful college level reading and composition students. Students must complete WRIT 091 with at least a C- to pass the paired College Writing (WRIT 101) course. The course introduces students to critical reading practices on assigned College Writing non-fiction texts, fosters students' critical thinking based on textual analysis, and engages students in composition processes: pre-writing, drafting, revision and editing. Composing in-class paragraphs gives students practice with the writing process and engages students with the WRIT 101 course material.

WRIT 095. Developmental Writing. 4 Credits. (4 Lec)FS
Offered by Gallatin College. Developmental Writing introduces students to critical reading practices within thematic non-fiction, fosters students’ critical thinking based on textual analysis, and encourages questioning and exploration. Composing paragraphs and short essays provides a review and reinforcement of principles of English grammar and punctuation associated with successful college-level writing. Ability to write clear sentences is assumed.

WRIT 100. Composing Mindfully. 3 Credits. (1 Lab, 2 Recitation)Su
PREREQUISITES: Admission to the Hilleman Scholars Program. COREQUISITES: Participation in the Hilleman Scholars Program’s Summer Success Academy. Assists new college students’ transition from high-school to college writing situations by focused inquiry into the concepts of writing ecology, multimodality, process, and revision.

WRIT 101W. College Writing I. 3 Credits. (3 Lec)FS,Su
Studies the nature and practice of reading and writing as human interaction, with particular attention to elements of writing process and craft, to present new conceptions of writing as students enter the university writing environment.

WRIT 104. Workplace Communications. 2 Credits. (2 Lec)F
Offered by Gallatin College. This course reviews the basic elements of grammar and language arts skills in business writing. Emphasis is placed on writing business letters, memos, emails, and reports for a variety of business applications as well as giving oral presentations. Letters of application and resumes are also covered.

WRIT 201. College Writing II. 3 Credits. (3 Lec)FS
PREREQUISITE: WRIT 101W. Studies writing as a practice, process, and tool of inquiry in various academic domains. Bridges general study of writing in WRIT 101 and later discipline-specific study of writing. Emphasizes how to conduct inquiry through writing, and how to learn to write in new situations.

WRIT 205. Intro to Writing Studies. 3 Credits. (3 Sem)F
PREREQUISITE: WRIT 101W or equivalent. Overviews the Writing Option and the disciplines and with attention to the social implications of technology.

WRIT 221. Intermediate Tech Writing. 3 Credits. (3 Lec)FS
PREREQUISITE: WRIT 101W. Focuses on kinds of writing done in technical or business environments: business letters, proposals, formal reports, technical presentations, user manuals, etc. Prepares students for technical writing in a range of disciplines and with attention to the social implications of technology.

WRIT 291. Special Topics. 1-4 Credits. (1-4 Lab; 12 cr max) On Demand
Maximum 12 cr. PREREQUISITE: None required but some may be determined necessary by the department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

WRIT 292. Independent study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
Maximum 6 cr. PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

WRIT 326. Advanced Writing. 3 Credits. (3 Lec)F
PREREQUISITE: WRIT 101 or equivalent. Advanced writing study and practice, with attention to topics like research writing and style.

WRIT 371. Digital Rhetorics and Multimodal Writing. 3 Credits. (3 Rct)F
PREREQUISITE: Junior standing or consent of instructor. Covers topics concerned with rhetoric and writing in digital environments. Students will study theories, principles, and techniques of writing in blended modes and alternative (usually electronic) genres, e.g., web writing and other digital formats that integrate alphabetic-print, image, and audio texts.
WRIT 372. Science Writing for Popular Non-Fiction. 3 Credits. (3 Rct) F, alternate years to be offered even years PREREQUISITES: WRIT 101 and one IS, RS, RN, or CS Core course; and by enrollment in the English major or Writing minor, or by consent of the instructor. Study of science journalism and nonfiction that reports scientific research to non-specialist audiences. Students will study research, reporting, and narrative writing techniques and consider ethical challenges and industry practices in professional science writing.

WRIT 373. News and Pub Relations Writing. 3 Credits. (3 Rct) S PREREQUISITE: WRIT 101 and enrollment in English major or Writing minor, or consent of instructor. Familiarizes students with the professional news and public relations writing environment. In writing breaking and feature news stories and press releases, students will master processes by which written information is disseminated to the public, both through news media and government and corporate public information operations.

WRIT 374. Magazine Editing. 3 Credits. (2 Lab, 1 Rct) Su PREREQUISITE: One WRIT course 300-level or above Magazine Editing and Production creates a studio-driven experience for students to walk through editorial considerations, design, and production of themed periodical publications such as magazines, journals, and websites.

WRIT 376. Public Rhetorics and Writing. 3 Credits. (3 Lec) F,S PREREQUISITES: WRIT 101 or equivalent, and by enrollment in the Writing option Study of ways citizens compose and use writing and rhetoric for civic ends. Students will study theories, principles, and practices of public discourse, including publics, countercultures, and community; public discourse; and visual rhetorics pertaining to public memory and social movements.

WRIT 429. Professional Writing. 3 Credits. (3 Lec) S alternate years, to be offered odd years. Intended for students who already have considerable skill and experience in expository writing. Focuses on professional writing designed to be read by the general public or a specialized audience.

WRIT 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 6 cr max) F,S,Su Max 12 cr. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

WRIT 491. Writing, Rhetoric, and Printing of the Artist’s Book. 4 Credits. (1 Lec. 2 Lab. 1 Rec) F PREREQUISITES: Sophomore, Junior or Senior status in Writing, Graphic Design, Art, or Art Education, and 2.5 or above GPA, permission of the instructor. WRIT 491 Writing, Rhetoric and Printing of the Artist’s Book is a studio in the research, writing, design, composition, and production of a nonfiction craft book combining hand typesetting, printing, and hand binding. The book will focus on living history.

WRIT 492. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand Max 6 cr. PREREQUISITE: Junior standing, consent of instructor and approval of department chair. Directed research and study on an individual basis. May not be used in lieu of another required course in the English curriculum.

WRIT 494RH. Seminar: Writing Research and Publications. 3 Credits. (3 Sem) F,S PREREQUISITE: Senior standing and consent of instructor. Senior capstone course for writing majors. Integration and assessment of students’ cumulative experiences as English writing majors. Offered alternately as Research in Writing and Rhetoric, emphasizing expository writing and scholarly practice; Critique and Publication, emphasizing creative writing. Restricted entry.

WRIT 498. Internship. 1-12 Credits. (1-12 Ind; 12 cr max) On Demand PREREQUISITE: Junior standing, consent of instructor and approval of department chair. An individual assignment arranged with an agency, business or other organization to provide guided experience in the field.

WS - Women's Studies

WS 491. Special Topics. 1-12 Credits. (1-12 Lec; 12 cr max) On Demand Max 12 cr. PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
Aamot, Kirk  
Associate Professor, Music  
M.A. - University of Colorado-Boulder (2001)  
M.A. - University of Minnesota (1996)  
B.A. - St Olaf College (1992)

Ackerman, Kimberly Lynn  
Instructor, Nursing - Billings  
M.N. - Montana State University (2006)  
B.A. - Carroll College (2000)

Adams, Alexandra King  
Professor  
http://www.montana.edu/cairhe

Adams, Dean Sheldon  
Associate Professor, Art  
M.F.A. - University of Iowa (1995)  
B.A. - Montana State University (1992)

Adams, Edward Eagan  
Professor, Civil Engineering  
B.S. - Montana State Univ-Bozeman (1979)  
B.A. - Mount Saint Mary's College (1972)  
http://www.montana.edu/ce/instructors_professors/faculty/AdamsEd.html

Adams, Katie Stan  
Instructor, Mathematical Sciences

Aebly, Andrew Henry  
Instructor, Chemistry Biochemistry  
B.A. - Saint Johns University (2010)

Agindotan, Bright Ogheneovo  
Assistant Research Professor, Plant Sciences Plant Pathology

Ahmed, Selena  
Assistant Professor, Health Human Development  
M.A. - Tufts University (2013)  
Ph.D. - City University of New York (2011)  
M.S. - University of Kent (2004)  
B.A. - Columbia University (2001)  
http://www.montana.edu/food-health-lab/

Ahn, Angella  
Assistant Professor, Music  
http://www.ahntrio.com/

Aig, Dennis Ira  
Professor, Film Photography  
Ph.D. - Ohio State University (1983)  
M.A. - Ohio State University (1973)  
B.A. - Queens College of the City University of New York (1971)

Akin, Michelle  
Professional, Education, Mathematical Sciences  
M.S. - Montana State University (2006)  
B.S. - Humboldt State University (2004)

Al Kaiser, Ahmed  
Professor, Civil Engineering  
http://www.montana.edu/ce/instructors_professors/faculty/Ahmed.html

Albertson, Lindsey K.  
Assistant Professor, Ecology  
Ph.D. - University of California - Santa Barbara (2013)  
B.S. - Brown University (2006)

Albin, Debbie Jean  
Extension, Health Human Development  
http://www.montanagrandparents.org

Allen, Christopher Robert  
Instructor, Civil Engineering  
M.S. - Montana State University (2012)  
B.S. - Montana State University (2009)

Allen, Sarah  
Instructor, CLS, Honors College

Alsayed Suliman, Anas  
Assistant Professor, Modern Languages Literature  
http://www.montana.edu/mll/arabic/

Alzheimer, Tim  
Associate Teaching Professor, Finance  
M.S. - Montana State Univ-Bozeman (1993)  
B.S. - Montana State Univ-Northern (1980)

Amende, Kevin  
Assistant Professor, Mechanical Industrial Engineering  
M.S. - Montana State Univ-Bozeman (2009)  
B.S. - Montana State Univ-Bozeman (2001)  
http://www.coe.montana.edu/meet/faculty/amende/default.htm

Amendola, Roberta  
Assistant Professor, Mechanical Industrial Engineering  
Ph.D. - University of Genoa (2010)  
M.S. - University of Genoa (2006)  
http://www.montana.edu/ramendola/

Ament, Robert  
Research Scientist

Amin, Ruhul  
Professor, Mechanical Industrial Engineering  
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