Civil Engineering Programs

To prepare students for the quickly evolving field of engineering and construction practice, the Montana State University Department of Civil Engineering programs focus on fundamental engineering basics and the application of modern engineering tools. Our civil and environmental engineering programs provide rigor in engineering science, design, and applications. Our construction programs emphasize engineering and management skills and the application of those skills to the construction industry.

As a land grant institution, the Department emphasizes undergraduate education coupled with a contemporary broad-based graduate program at the master's level and specialty doctorate degrees. These graduate programs prepare students for future changes in professional degree requirements and provide opportunities for students interested in research experiences across all levels of the curriculum.

Mission

- 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 focused on professional practice in a majority of traditional civil engineering areas and provide graduatae research opportunities in focused areas 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 objectives of the Civil Engineering program are to prepare students with a Bachelor of Science degree to, in the first years after graduation:

- 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.

Students receiving a Bachelor of Science degree in Civil Engineering will have attained the following outcomes at time of graduation:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- An ability to communicate effectively with a range of audiences
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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.

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.

Environmental Engineering

The Environmental Engineering (ENVE) degree program merges principles from engineering, biology and chemistry in preparation of students to address the complex environmental challenges of today. Environmental engineering has, and continues to be, a critical expertise needed to address all forms of environmental challenges encountered in contemporary society. Notably, fully one-third of the fourteen grand challenges in engineering in the 21st century identified by the National Academy of Engineering significantly involve environmental engineering, from supplying clean drinking water to all the world's inhabitants, to renewing our urban infrastructure, to managing the nitrogen cycle, to sequestering carbon. Environmental engineers perform an essential function for society, working on a myriad of issues at the interface between the natural and built environments. There are, and will continue to be, strong career opportunities and a high demand for environmental engineering services in the marketplace.

MSU's Environmental Engineering program provides a strong foundation in engineering mechanics with a further focus in upper division classes specifically on fluid mechanics and hydraulics, which underpin analysis and design of many environmental engineering solutions. The program also incorporates the traditional physical, chemical and biological processes applied in water and wastewater treatment and ground water contamination. The program has a broad-based biological/microbiological process emphasis which addresses contemporary environmental problems including wetland treatment systems and treatment of wastes from energy and resource extraction industries. The degree program closely collaborates with MSU's internationally recognized Center for Biofilm Engineering, providing basic and applied research opportunities for students.

The objectives of the Environmental Engineering program are to prepare students with a Bachelor of Science degree to in the first years after graduation:

- enter the profession of Environmental Engineering and advance in the profession to become registered professional engineers and leaders in the field of Environmental Engineering;
- work on multi-disciplinary teams and effectively communicate with Environmental Engineers of various sub-disciplines, architects, contractors, the public and public agents, scientists and others to design and construct Environmental Engineering projects;
- begin to develop expertise in one of the sub-disciplines of Environmental Engineering and engage in the life-long learning necessary to advance in the Environmental Engineering profession;
- contribute to society and the Environmental 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 Environmental Engineering or other fields.

Students receiving a Bachelor of Science degree in Environmental Engineering will have attained the following outcomes at time of graduation:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- An ability to communicate effectively with a range of audiences
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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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.

The objectives of the Construction Engineering Technology program are to prepare students with a Bachelor of Science degree to, in the first years after graduation:

- 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.

Students receiving a Bachelor of Science degree in Construction Engineering Technology will have attained the following outcomes at time of graduation:

- An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline;
- An ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline
- An ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature
- An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and
- An ability to function effectively as a member as well as a leader on technical teams.

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 eligible 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. Repeating a course more than twice requires department approval.
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 (http://catalog.montana.edu/undergraduate/engineering/civil-engineering/civil-engineering/)
- Construction Engineering Technology (http://catalog.montana.edu/undergraduate/engineering/civil-engineering/construction-engineering-technology/)
- Environmental Engineering (http://catalog.montana.edu/undergraduate/engineering/environmental-engineering/)
- Land Surveying Minor (http://catalog.montana.edu/undergraduate/engineering/civil-engineering/land-surveying-minor/)

Graduate Programs

- M.S. in Civil Engineering (http://catalog.montana.edu/graduate/engineering/civil-engineering/ms-civil-engineering/)
- M.S. in Environmental Engineering (http://catalog.montana.edu/graduate/engineering/environmental-engineering/)
- M.Eng. in Civil Engineering (http://catalog.montana.edu/graduate/engineering/m.eng-civil-engineering/)
- M.Eng. in Environmental Engineering (http://catalog.montana.edu/graduate/engineering/m.eng-environmental-engineering/)
- Ph.D. in Engineering (http://catalog.montana.edu/graduate/engineering/engineering-phd/)

The department offers graduate study leading to the Master of Science and Master of Engineering degrees in Civil Engineering and 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., M Eng. and Ph.D. degrees, major study is offered in various combinations of the subject areas of transportation engineering, geotechnical engineering, water resources engineering, structural engineering, engineering mechanics, and environmental engineering.