Civil Engineering Programs

Montana State University’s Department of Civil Engineering anticipates that engineering and construction practice will continue to evolve quickly with several very fundamental precepts for success. Among these is the premise that the engineers and constructors will continue to rely on fundamental engineering science coupled with contemporary computational tools to meet the engineering and construction challenges of the future. We therefore choose to focus our curriculum on fundamental engineering basics and the application of modern engineering tools. Our civil and environmental engineering programs will be acknowledged for their strong emphasis and rigor in engineering science, design, and applications. Our construction programs will be acknowledged for their emphasis on engineering and management skills and the application of those skills to the construction industry. The emphasis of these programs will continue to be preparation of students for professional practice in the engineering and construction industries.

Incorporating our vision into the traditional mission of a land grant institution leads to a strong emphasis on undergraduate education. However, in making this a substantial portion of our mission, we also look beyond the undergraduate classroom. To ensure a quality faculty, and up-to-date curricula, we have a vibrant broad-based graduate program at the master’s level and a smaller subset of specialty areas at the doctorate level. A strong master’s program also positions the department favorably for the possibility of future changes in professional degree requirements and is consistent with our vision for education at MSU. The graduate program is essential to stimulate research activity and thus provide opportunities for students interested in research experiences across all levels of the curriculum, and to offer opportunity for formal study beyond the baccalaureate degree.

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. Graduates that pursue the Land Surveying minor are prepared to become registered land surveyors engaged in measurement 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 and engage in 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.

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 have a vital role in ensuring a sustainable future - designing green treatment systems, remediating past contamination, and protecting natural ecosystems.

The unique and complementary features of the MSU Environmental Engineering program are:

1) It 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. In addition, the program will embody the traditional physical/chemical/biological processes applied specifically to environmental issues encountered in water and wastewater treatment and ground water contamination.

2) It has a broad-based biological/microbiological process emphasis which addresses contemporary environmental problems including wetland treatment systems, treatment of produced water from oil and gas operations (i.e. fracking), and innovative solutions to resource extraction (coal bed methane and carbon sequestration).

3) The ENVE degree program complements MSU’s internationally recognized Center for Biofilm Engineering, providing basic and applied research opportunities for students.

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 there is a high demand for environmental engineering services in the marketplace.

Upon graduating with a Bachelor of Science in Environmental Engineering all students can expect to be able to:

- enter the profession of environmental engineering with the potential to advance in the profession to become registered professional engineers and leaders in the field;
- work on multi-disciplinary teams and effectively communicate with environmental and other engineers, contractors, the public and public agents, scientists and others to design and construct environmental engineering projects;
- begin to the lifelong learning process essential to maintain and advance the profession of environmental engineering;
- 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.

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**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 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.
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.S. in Land Rehabilitation (http://catalog.montana.edu/graduate/agriculture/land-resources-environmental-sciences/ms-land-rehabilitation)
• Ph.D. in Engineering (http://catalog.montana.edu/graduate/engineering/engineering-phd)

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
Civil Engineering Programs

engineering, structural engineering, engineering mechanics, and environmental engineering.
Font Notice

This document should contain certain fonts with restrictive licenses. For this draft, substitutions were made using less legally restrictive fonts. Specifically:

Times was used instead of Adobe Garamond Pro.

The editor may contact Leepfrog for a draft with the correct fonts in place.