

### Civil Engineering

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Civil Engineering, as defined by the American Society of Civil Engineers, is a profession in which a knowledge of the mathematical and physical science gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the progressive well-being of humanity in creating, improving and protecting the environment, in providing facilities for community living, industry and transportation, and in providing structures for the use of humanity.

Civil engineers design and supervise, among others, the construction of roads, buildings, airports, tunnels, dams, bridges, and water supply and water and wastewater treatment systems. Major specialties within civil engineering are: structural, geotechnical, water resources, transportation, environmental, and construction engineering.

Many civil engineers hold administrative positions, from city engineers to deputy commissioner of state department of transportation. Others may work in design, construction, research, and teaching. Most civil engineers hold supervisory positions such as project engineers.

**Accreditation.** The Civil Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700.

**Program Objectives.** The Mission of the Civil Engineering Program at Minnesota State Mankato, is to provide a broad-based education that will enable graduates to enter practice in the civil engineering profession, serving the needs of the State of Minnesota and the Nation.

Graduates of the civil engineering program at Minnesota State Mankato will be prepared:

1. with a strong technical foundation to practice civil engineering, or to pursue graduate studies, particularly in four major disciplines: geotechnical, structural, transportation, and water resources engineering;
2. to become registered professional engineers;
3. to communicate technical information effectively with the public, their peers, and clients;
4. with an understanding of the need for life-long learning and of the importance for community and professional involvement; and
5. with an awareness of cultural, societal, and professional issues.

The program mission and educational objectives are fully compatible with the mission of Minnesota State Mankato and the College of Science, Engineering, and Technology. Program objectives are monitored by the constituencies (civil engineering profession through the program's Industrial Advisory Board and employers, alumni, students, and faculty of the program).

Other important features of an education in civil engineering at Minnesota State Mankato include:

- Senior students work together as a design team in a full academic year course incorporating multiple civil engineering disciplines in comprehensive design project.

- Students work closely with engineers from design firms and government agencies and with faculty and students from other engineering courses in the senior design project.
- Students are required to take a department-administered diagnostic test in their junior year. The purpose of this test is to provide feedback which will be used to strengthen the curriculum and to improve the preparation of students.
- Students are required to take the Fundamentals of Engineering exam in their senior year – the first step towards professional registration.
- The flexible curriculum allows the students to have either a diverse or focused civil engineering study.
- The faculty maintains ties to industry, thereby keeping current with new technologies, design methodologies, and the world of civil engineering practice – a valuable resource for students.

**Preparation.** Recommended high school preparation is two years of algebra, one year of geometry, one-half year of trigonometry, one-half year of college algebra, and a year each of physics and chemistry. Computer skills such as word processing, spreadsheets, and presentations are also recommended. Without this background it may take longer than four years to earn the degree.

**Program Admission.** Admission to the Civil Engineering Program is granted by the department, and is necessary before enrolling in 300- and 400-level courses. Near the end of the sophomore year, students must submit an application for admission to the civil engineering program. Applications to the program may be obtained from the Department of Mechanical and Civil Engineering or downloaded from the department homepage.

Before being admitted to upper-division civil engineering courses, a student must complete a minimum of 48 credits, for grade, including the following core courses: calculus-based physics, 8 credits; calculus and differential equations, 16 credits; introduction to engineering, 2 credits; computer graphics, 2 credits; introduction to problem solving and civil engineering design, 2 credits; engineering mechanics (statics, dynamics, and mechanics of materials), 9 credits; chemistry, 5 credits; and english composition, 4 credits. Provisional admission to the program for one semester may be granted in limited cases.

To be considered for admission a grade of C or better must be achieved in each course listed above, and a student must have a cumulative GPA of 2.50 in the core courses. All core courses (including those for repeated courses) will be considered in the computation of the GPA for admission to the program.

**Transfer Students.** The department makes a special effort to accommodate transfer students. Transfer students are encouraged to contact the department as soon as possible to facilitate a smooth transition. Please feel free to write, call, or visit the department. Generally, no transfer credits are allowed for upper division civil engineering courses. For exceptions to this policy, special written permission must be obtained and will be reviewed by the department. Transfer students must take a minimum of 12 credits at Minnesota State Mankato prior to being considered for full admission to the program.

For transfer students the distribution of credits specified for the core courses may vary, but the total credits must satisfy departmental transfer requirements. Transfer credits are not normally used in the computation of the GPA for admission to the program. Transfer students should refer to the Supplemental Information in the Undergraduate Bulletin for information about procedures to be followed when applying for admission to the University.

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#### POLICIES/INFORMATION

**Satisfactory Progress.** Once admitted to the civil engineering program, a student must maintain satisfactory progress by: (1) maintaining a cumulative GPA of at least 2.30 for all upper-division engineering courses; and (2) achieving a GPA of at least 2.00 each semester for all courses required for the major. All courses, including repeated courses will be used in the GPA calculations above.

**P/N Grading Policy.** P/N credit will not be applied to any course used to meet civil engineering degree requirements.

## CIVIL ENGINEERING

**Probation Policy.** Once admitted to the program, a student who does not maintain satisfactory progress as defined above will be placed on program probationary status for a maximum of one semester. During the probationary period, the student (a) must complete at least 8 credits, approved by the department, of upper-division engineering courses for grade from the prescribed Civil Engineering curriculum; and (b) shall not receive a degree without first conforming to the satisfactory progress criteria. A student who fails to meet satisfactory progress for a second semester (consecutive or non-consecutive) will not be allowed to continue in the program. The student may later reapply for admission to the program. If readmitted, only probationary status will be granted, and continuation in the program will be based on performance in courses specified in a contract with the department.

**Appeals.** A student may appeal any departmental decision in writing. The department will consider such appeals individually.

### CIVIL ENGINEERING BSCE

#### **Required Special General Education (23 credits):**

The Bachelor of Science in Civil Engineering degree does not adhere to the standard general education program required by other majors. Rather, it requires a special distribution of communication, humanities, and social science courses. Courses may be chosen to satisfy the university cultural diversity requirement concurrently.

#### **Required Humanities and Social Science Courses (minimum of 16 credits):**

To satisfy this requirement, the courses selected must provide both breadth and depth and not be limited to a selection of unrelated introductory courses. Each student should discuss with his/her civil engineering advisor on the selection of courses to meet this requirement early in their academic career. A current list of acceptable courses is posted in the department office and on the department web site.

Specifically, the minimum requirements consist of (a) at least 6 credits in the humanities area, and (b) at least 9 credits in the social science area, of which 3 credits must be either microeconomics or macroeconomics; (a) and (b) must total at least 16 credits.

To provide the measure of depth to the course of study, at least 3 credits at the 300-level or above must be included in the 16 credit requirement. At least one upper division course must follow a course in the same subject area.

#### **Required Communication Courses (7 credits)**

ENG 101 Composition (4) **AND**  
CMST 102 Public Speaking (3) **OR**  
ENG 271 Technical Communication (4)

#### **Science and Mathematics (33 credits)**

MATH 121 Calculus I (4)  
MATH 122 Calculus II (4)  
MATH 223 Calculus III (4)  
MATH 321 Ordinary Differential Equations (4)  
CHEM 201 General Chemistry I (5)  
PHYS 221 General Physics I (4)  
PHYS 222 General Physics II (3)  
PHYS 232 General Physics II Lab (1)  
Science Elective from approved list (4)

#### **Basic Engineering Science (25 credits)**

CIVE 101 Introduction to Engineering-Civil (2)  
CIVE 145 CAD for Civil Engineering (2)  
CIVE 201 Intro. to Problem Solving and Civil Engineering Design (2)  
CIVE 271 Civil Engineering Measurements (2)  
ME 206 Materials Science (3)  
CIVE 212 Statics (3) **OR**  
ME 212 Statics (3)  
CIVE 214 Dynamics (3) **OR**  
ME 214 Dynamics (3)

CIVE 223 Mechanics of Materials (3) **OR**  
ME 223 Mechanics of Materials (3)  
ME 299 Thermal Analysis (2) **OR**  
ME 241 Thermodynamics (3)  
ME 291 Engineering Analysis (3)

#### **Upper Division (45 credits)**

CIVE 321 Fluid Mechanics (3) **OR**  
ME 321 Fluid Mechanics (3)  
CIVE 340 Structural Analysis (3)  
CIVE 350 Hydraulics and Hydrology (4)  
CIVE 360 Geotechnical Engineering (4)  
CIVE 370 Transportation Engineering (4)  
CIVE 380 Environmental Engineering (3)  
CIVE 401 Civil Engineering Design I (2)  
CIVE 402 Civil Engineering Design II (3)  
CIVE 435 Civil Engineering Experimentation I (2)  
CIVE 436 Civil Engineering Experimentation II (2)  
CIVE 446 Reinforced Concrete Design (3) **OR**  
CIVE 448 Steel Design (3)  
CIVE electives (minimum 9 credits)

Technical electives from approved list (minimum 2 credits)

#### **Required Minor: None.**

#### **Civil, Science and Technical Electives**

A civil engineering student is required to choose a minimum of 18 credits in civil, science and technical electives: science elective (minimum 4 credits), technical electives (minimum 2 credits), and CIVE electives (minimum 9 credits). The science and technical electives are recommended to be taken after the student has identified his/her area of interest and in consultation with his/her academic advisor. Science and technical electives must be selected from the approved list below.

#### **Approved Science Electives**

BIOL 105 General Biology I (5)  
CHEM 202 General Chemistry II (5)  
ENVR 101 Perspectives in Environmental Science (4)  
GEOL 121 Physical Geology (4)

#### **Approved Technical Electives**

All CIVE courses except required courses

All EE courses 300-level and above and EE 230 (Circuit Analysis I)

All ME courses 300-level and above except required courses

BIOL 270 Microbiology (4)  
BLAW 450 Contracts, Sales and Professional Responsibility (3)  
BLAW 453 International Legal Environment of Business (3)  
BLAW 474 Environmental Regulation and Land Use (3)  
BLAW 476 Construction and Design Law (3)  
CHEM 305 Analytical Chemistry (4)  
CHEM 407 Water Chemistry (3)  
ENVR 440 Environmental Regulations (3)  
ENVR 450 Environmental Pollution & Control (3)  
ENVR 460 Analysis of Pollutants (4)  
GEOL 330 Structural Geology (4)  
GEOL 351 Engineering Geology (2)  
GEOL 450 Hydrogeology (3)

#### **COURSE DESCRIPTIONS**

##### **CIVE 101 (2) Introduction to Engineering - Civil**

To prepare the students for a career in engineering with some emphasis in civil; introduce the engineering fundamentals and the skills necessary to have a successful learning experience; and to prepare students for engineering education and profession through interactions with upper-class engineering students and practicing engineers.

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## CIVIL ENGINEERING

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### **CIVE 145 (2) CAD for Civil Engineering**

Basic computer applications for drafting and designing civil engineering projects. Structure and use of standard CAD software. Basic orthographic construction and projections, and development of different types of drawings - sections, plan and profile, and construction details.

### **CIVE 201 (2) Intro. to Problem Solving and Civil Engineering Design**

Introduction to the design concepts of civil engineering projects including presentations, codes and standards, construction drawings, and public hearing; problem solving skills for civil engineering analysis and design including the use of appropriate computational tools and programming logic. This course includes laboratory component.

Pre: CIVE 101, Co-Req: CIVE 145, MATH 121

Fall, Spring

### **CIVE 212 (3) Statics**

Same as ME 212.

### **CIVE 214 (3) Dynamics**

Same as ME 214.

### **CIVE 223 (3) Mechanics of Materials**

Same as ME 223.

### **CIVE 271 (2) Civil Engineering Measurements**

Basic civil engineering measurements as relates to construction layout, including distances, angles, bearings, elevations, mapping, and positioning. The course includes laboratory component.

Pre: MATH 115

Co-req: MATH 121 or instructor consent

### **CIVE 293 (1) MAX Scholar Seminar**

This class provides MAX scholars with an opportunity to explore a set of topics related to achieving success in academic, professional and personal realms. Speakers will include faculty, graduate students, visiting researchers and industry members as well as student participants. Students will be required to participate in mentoring of lower division MAX scholarship recipients and provide written and oral presentations of various topics during the semester. This course may be repeated and will not count towards graduation requirements.

Pre: Recipient of a MAX scholarship or instructor consent.

Fall, Spring

### **CIVE 321 (3) Fluid Mechanics**

Same as ME 321.

### **CIVE 340 (3) Structural Analysis**

Analysis of determinate and indeterminate structural systems using classical methods such as consistent displacements, energy method, slope-deflection and moment distribution. Use of computer software is expected.

Pre: ME 223 / CIVE 223

### **CIVE 350 (4) Hydraulics and Hydrology**

Concept of hydraulics such as pipe flow and open channel flow. Hydrologic principles such as weather patterns; precipitation measurement and distribution, abstractions, and runoff; storm hydrograph and peak flow analysis. Design includes flood design, reservoir and channel routing.

Pre: ME 321 / CIVE 321

### **CIVE 360 (4) Geotechnical Engineering**

Study of soil behaviors and their classifications; index properties. Applications of mechanics principles to soils as an engineering material, consolidation theory, compaction theory, effective stresses, shear strength; earth pressure and slope stability. Elements of foundation designs.

Pre: ME 223 / CIVE 223 and Co-req.: ME 321 / CIVE 321

### **CIVE 370 (4) Transportation Engineering**

Introduction to Transportation systems; land use and transportation interaction, planning, and traffic operations; transportation decision making using economic

analysis. Introduction to design, construction, maintenance, and operation of various transportation modes.

Co: CIVE 271

### **CIVE 380 (3) Environmental Engineering**

Introduction of the fundamental chemical, biological and physical principles of environment engineering for water and wastewater treatment and distribution systems, solid waste management, air pollution control, and the analysis of air quality, surface water, and ground water.

Pre: CHEM 201, MATH 321, and Coreq: ME 321 or instructor consent.

### **CIVE 401 (2) Civil Engineering Design I**

Practical civil engineering design project with "real world" constraints. This course focuses on the planning and formulation of project, and the presentation of the preliminary findings to the public.

Pre: senior civil engineering standing

### **CIVE 402 (3) Civil Engineering Design II**

Practical civil engineering design project with "real world" constraints. Focuses on the engineering analysis, design, and economic analysis of the project. Includes a design lab.

Pre: CIVE 401

### **CIVE 432 (3) Properties of Concrete**

Selected studies in the properties and design of concrete mixtures, cement chemistry, concrete durability, specialty concrete construction, admixtures, and quality control.

Pre: CIVE 435 or consent of instructor

### **CIVE 435 (2) Civil Engineering Experimentation I**

To provide students with hands-on experience in the testing of civil engineering materials such as concrete and metals and structural systems. The course also provides students with experiments in transportation. This course includes a laboratory.

Pre: CIVE 340 & CIVE 370

### **CIVE 436 (2) Civil Engineering Experimentation II**

To provide students with hands-on experience in testing civil engineering materials such as soil and asphalt. The course also provides students with experiments in fluid mechanics, hydraulics, and hydrology. This course includes laboratory.

Pre: CIVE 350, CIVE 360

### **CIVE 446 (3) Reinforced Concrete Design**

Design of reinforced concrete beams, columns, slabs and structural foundations. Use of standard specifications is required. Use of computer software is expected

Pre: CIVE 340

### **CIVE 448 (3) Steel Design**

Behavior and properties of structural steel; proportionality of tension members, beams, and columns and design of connections using LRFD specifications.

Pre: CIVE 340

### **CIVE 450 (3) Finite Element Method**

Same as ME 450

### **CIVE 452 (3) Open Channel Flow**

Analysis of open channel flow systems. Includes natural channels, designed channels, flow transitions, steady flow, unsteady flow, uniform flow, and non-uniform flow.

Pre: CIVE 350

### **CIVE 454 (3) Hydraulic Structures**

Analysis and design of water regulating structures. Includes dams, spillways, gates, dikes, levees, stilling basins, water distribution systems, and various simpler structures. Environmental impacts of hydraulic structures are discussed throughout the course.

Pre: CIVE 350

**CIVE 458 (3) Stormwater Management**

Application of fluid mechanics and hydrology to the design of stormwater management facilities.

Pre: CIVE 350

**CIVE 461 (3) Fundamentals of Pavement Design**

Performance and design of rigid, flexible, and composite pavement structures with emphasis on modern pavement design procedures. Principles of pavement maintenance and rehabilitation, and pavement management systems. Materials characterization, tests, quality control, and life cycle cost analysis.

Pre: ME 223 / CIVE 223, CIVE 360, and CIVE 370

**CIVE 465 (3) Foundation Design**

Classification of foundations; applications of fundamental soil mechanics to design and analysis of soil-structure systems; design and computer application of shallow and deep foundations, piles and caissons, retaining structures. Introduction to rock mechanics.

Pre: CIVE 360

**CIVE 467 (3) Earth Structures**

Design and construction of traditional embankments, including slope stability analysis; earth and rockfill dams, including introduction to seepage analysis; excavations, earth retaining structures, and other geotechnical structures. Geotechnical software application in analysis and design.

Pre: CIVE 360

Fall

**CIVE 470 (3) Traffic Engineering**

Elements of traffic engineering including road use, vehicle and roadway systems; traffic flow theory; traffic studies and data collections; traffic control devices; principles of intersecting signalization; capacity and level of service; analysis of freeways, rural highways and intersections using computer software for traffic operations and management.

Pre: CIVE 370

**CIVE 471 (3) Highway Planning and Design**

Introduces the classification and design process of highways; development and use of design controls, criteria, and highway design elements; design of vertical and horizontal alignment, and establishment of sight distances; design of cross-sections, intersections, and interchanges.

Pre: CIVE 145 and CIVE 370

**CIVE 476 (3) Planning and Design of Airports**

Development and design of airport facilities and the integration of multiple disciplines including runway orientation and capacity, terminal facilities, forecasting, planning, noise, airspace utilization, parking, lighting, and construction.

Pre: CIVE 370

**CIVE 481 (3) Water & Wastewater Treatment, Collection & Distribution**

Overview of municipal water and wastewater treatment and distribution practices. Application of chemical, biological and physical principles to design and the operation of water and wastewater treatment and distribution systems.

Pre: CIVE 380

**CIVE (3) Utility Pipeline Inspection, Repair and Rehabilitation**

Design and implementation of inspection plans, repairs and rehabilitation of sewer, storm drainage and drinking water supply pipelines. Consideration of performance, logistics and cost implications of all available methods.

Pre: CIVE 380

Variable

**CIVE 493 (1) MAX Scholar Seminar**

This class provides MAX scholars with an opportunity to explore a set of topics related to achieving success in academic, professional and personal realms. Speakers will include faculty, graduate students, visiting researchers and industry members as well as student participants. Students will be required to participate in mentoring of lower division MAX scholarship recipients and provide written

and oral presentations of various topics during the semester. This course may be repeated and will not count towards graduation requirements.

Pre: Recipient of a MAX scholarship or instructor consent.

Fall, Spring

**CIVE 497 (1-6) Internship**

Variable

**CIVE 499 (1-6) Individual Study**