

## 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 judgement 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: structures, geotechnical engineering, water resources, transportation, environmental engineering, and construction.

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 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.

### Preparations

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 processors, spreadsheets, and PowerPoint presentation or similar are also recommended. Without this background it may take longer than four years to earn the degree.

Admission to Program is necessary before enrolling in 300- and 400-level courses. Admission to the program is granted by the department. Near the end of the sophomore year, students should 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.

Admission to the program is based on GPA and performance in selected courses and is subject to approval by the Department of Mechanical and Civil Engineering. Only students admitted to the program are permitted to enroll in upper-division civil engineering courses. Generally, no transfer credits are allowed for upper-division civil engineering courses. For any exceptions to this policy, special written permission must be obtained and will be reviewed by the department. 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.

Before being admitted to upper-division civil engineering courses, a student must complete a minimum of 50 credits, including the following courses: General Physics (calculus based) 10 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. Moreover, students are required to take a diagnostic test. The purpose of the test is to identify areas of weakness so that we can provide future improvements in those areas.

For transfer students the distribution of credits specified in the previous paragraph may vary, but the total credits must satisfy departmental transfer requirements. Transfer students should contact the department for individual evaluation.

All courses and credits shown above must be completed before enrollment in 300-level engineering courses. All of the above courses except internship credits must be taken for "grade". It is not acceptable for the student to take any of these courses on a pass/no credit basis. A grade of "C" or better must be achieved in each course. To be considered for admission, the student must have a cumulative GPA of 2.5 for all science, math, ME, and CIVE courses. Admission to the Civil Engineering Program is selective and subject to approval of the Civil Engineering Academic Standards Committee. Failure to submit an application could result in the student being denied admission to the program and registration in junior or higher level classes in the Civil Engineering Program. If a student is denied admission to the Civil Engineering Program, he/she can reapply to the Civil Engineering Program for admission in subsequent years. If the applicant has attended Minnesota State Mankato only the application form is submitted to the Department of Mechanical and Civil Engineering along with

a copy of that student's Minnesota State Mankato transcript obtained from "The Hub". If the applicant has transfer credits from another college or university, or expects to be admitted as a transfer student, all transfer courses/credits must be evaluated by the Office of Admissions at Minnesota State Mankato. The transfer student will need to refer to the Supplemental Information and/or the Minnesota State Mankato, Undergraduate Bulletin for information about procedures that need to be followed when making application for admission as a transfer student. Applicants for admission to the program must also submit a complete plan of study.

#### CIVIL ENGINEERING BSCE

Required (Special General Education, 23 credits):

The Bachelor of Science in Civil Engineering degree does NOT adhere to the 44 credits of general education required by other programs. Rather it requires a special distribution of communication, humanities, and social science courses. Courses should be chosen to simultaneously satisfy the university cultural diversity requirement.

Required Communication Courses (7 credits):

ENG	101	Composition (4) AND
SPEE	102	Public Speaking (3) OR
SPEE	233	Public Speaking for Technical Professionals (3) OR
ENG	271	Technical Communication (4)

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. Not all courses in humanities and social sciences are acceptable. Courses should be chosen to simultaneously satisfy the university cultural diversity requirement. Each student should discuss with his/her civil engineering advisor on the selection of courses to meet this requirement. All students are urged to discuss this plan with their civil engineering advisors early in their academic career. An updated list of acceptable courses is posted in the department office and on the web.

Specifically, the minimum requirements consist of (a) three credits of micro-economics or macroeconomics, (b) at least 6 credits in the humanities area, and (c) at least 6 credits in the social science area; again (a), (b), and (c) 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 for Major (Prerequisites, 62-63 credits):

Mathematics (16 credits):

MATH	121	Calculus I (4)
MATH	122	Calculus II (4)
MATH	223	Calculus III (4)
MATH	321	Ordinary Differential Equations (4)

Basic Science (19-20 credits):

CHEM	201	General Chemistry I (5)
PHYS	221	General Physics I (5)
PHYS	222	General Physics II (5)

Science Elective from approved list (4-5)

Engineering Science (27 credits):

CIVE	101	Introduction to Engineering-Civil (2)
CIVE	145	CAD for Civil Engineering (2)
EE	230	Circuit Analysis I (3)
ME	206	Materials Science (3)
ME/CIVE	212	Statics (3)
ME/CIVE	214	Dynamics (3)
ME	291	Engineering Analysis (3)
ME/CIVE	223	Mechanics of Materials (3)
ME	299	Thermal Analysis (2) OR
ME	241	Thermodynamics (3)
ME/CIVE	321	Fluid Mechanics (3)

Required for Major (42-43 credits):

CIVE	201	Intro. to Problem Solving and Civil Engineering Design (2)
CIVE	271	Civil Engineering Measurements (2)

CIVE	340	Structural Analysis (3)
CIVE	350	Hydraulics & Hydrology (4)
CIVE	360	Geotechnical Engineering (4)
CIVE	370	Transportation Engineering (4)
CIVE	401	Civil Engineering Design I (2)
CIVE	402	Civil Engineering Design II (2)
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 (7-10 credits)

Technical electives from approved list (2-4 credits)

Required Minor: None.

Civil, Science and Technical Electives

A civil engineering student is required to choose a minimum of 16 credits in CIVE, science and technical electives: science elective (4-5 credits), technical electives (2-4 credits), and CIVE electives (7-10 credits). The science and technical electives are recommended to be taken after the student has identified his/her area of interest in consultation with his/her academic advisor. Science elective must be selected from the approved list (shown below) which would complement the student's area of interest in civil engineering. Technical electives must be selected from the approved list (shown below) which would enhance the student's experience in civil engineering.

Approved Science Electives:

BIOL	105W	General Biology I (5)
CHEM	202	General Chemistry II (5)
ENVR	101	Persp. in Environ. 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 250 (Engineering Economics)

All ME courses 300-level and above except required courses

BIO	270	Microbiology (4)
BLAW	450	Contracts, Sales & Prof. Responsibility (3)
BLAW	453	International Legal Environ. of Business (3)
BLAW	474	Environ. Regulation & 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	270	Structural Geology (4)
GEOL	351	Engineering Geology (2)
GEOL	450	Hydrogeology (3)

#### POLICIES/INFORMATION

**GPA Policy.** To maintain satisfactory progress in the upper-division Civil Engineering Program, a student must: (1) maintain a GPA of 2.3 for all upper-division engineering courses required for the major; and (2) achieve a GPA of at least 2.0 each semester.

**P/N Grading Policy.** P/N credit may not be applied to any course in the civil engineering curriculum except for internship credits and courses designated as P/N only.

**Probation Policy.** A student who does not maintain satisfactory progress as defined above will be placed on academic probationary status for a maximum of one semester. During the probationary period, the student must maintain satisfactory progress in addition: (a) must complete at least 8 credits 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 does not maintain satisfactory progress during the probationary period will not be allowed to continue in the program. The student may later reapply for admission to the program.

Refer to the College policies regarding advising for students on academic proba-

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tion.

Appeals. A student has the right to appeal a department decision in writing. The department will consider such appeals individually.

Course Repeat Policy: Only the first 12 semester credits of repeated classes will be exempted from GPA calculation.

For the most up-to-date list of Civil Engineering courses, please visit our web site at [ce.mnsu.edu](http://ce.mnsu.edu). Also see the Mechanical Engineering program for detailed description of ME courses and ME/CIVE dual listing courses, that are required for the Civil Engineering Program.

### 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.

#### 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) Introduction 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.

Pre-req: CIVE 101, Co-Req: CIVE 145, MATH 121 F, S

#### 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.

Co-req: MATH 121 or instructor consent

#### 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/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/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/CIVE 223 and Co-req.: ME/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.

Pre-req: CIVE 271 or consent of instructor.

#### 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.

Prereq: 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-req: 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-req: 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-req: 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.

Pre-req.: CIVE 340 & 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.

Pre-req: CIVE 350, 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-req: 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-req: CIVE 350

CIVE 458 (3) Stormwater Management

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

Pre-req: 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-req: ME/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 F

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-req: 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-req: 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-req: CIVE 380

CIVE 497 (1-6) Internship

Variable

CIVE 499 (1-6) Individual Study