Civil Engineering

College of Science, Engineering and Technology
Department of Mechanical and Civil Engineering
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Accreditation. The Civil Engineering program is accredited by the Engineering Accreditation Commission of ABET, www.ABET.org.

Civil Engineering, as defined by the American Society of Civil Engineers, is a profession in which a knowledge of the mathematical and physical sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the 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 the construction of roads, buildings, airports, tunnels, dams, bridges, water supply, water and wastewater treatment, and many other systems. Major specialties within civil engineering include structural, geotechnical, water resources, transportation, environmental, and construction engineering.

The Mission of the Civil Engineering Program at Minnesota State University, Mankato, is to provide an exceptional, practice-based engineering education with ties to industry, keeping current with new technologies, and to society by achieving the following.

• 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.
• Senior students work together as a design team in a full academic year course incorporating multiple civil engineering disciplines in a comprehensive design project.
• Become a licensed professional engineer, mindful of the safety, health, and welfare of the public.
• Further their education through professional development and/or postgraduate studies.

Other important features of a civil engineering education 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 a 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 take the Fundamentals of Engineering exam in their senior year — the first step towards professional registration.
• The faculty maintain ties to industry, 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 one year each of precalculus, physics and chemistry. Without this background it may take longer than four years to earn the degree. Computer skills such as programming, word processing, spreadsheets, and presentations are also recommended.

CIVIL ENGINEERING BSCE

Degree completion = 128 credits

Required General Education

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 15 credits] To satisfy this requirement, the courses selected must provide breadth and depth and should not be limited to a selection of unrelated introductory courses. Each student should discuss with his/her academic 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 at least 6 credits in the humanities area, and at least 6 credits in the social sciences area in addition to the Required General Education courses.

To provide a measure of depth to the course of study, at least 3 credits at the 300-level or above must be included in either the humanities or the social sciences requirement. At least one upper division course must follow a course in the same subject area as a course at the 100 or 200 level.

ENG 101 Composition [4]
ENG 271W Technical Communication (4) (choose 3 credits)
CIVIL ENGINEERING CONTINUED

ECON 201 Principles of Macroeconomics (3)
ECON 202 Principles of Microeconomics (3)

Prerequisites to the Major
CHEM 201 General Chemistry I (5)
CIVE 201 Introduction to Problem Solving and Civil Engineering Design (2)
MATH 121 Calculus I (4)
MATH 122 Calculus II (4)
MATH 223 Calculus III (4)
MATH 321 Ordinary Differential Equations (4)
ME 212 Statics (3)
ME 214 Dynamics (3)
ME 223 Mechanics of Materials (3)
ME 291 Engineering Analysis (3)
PHYS 221 General Physics I (4)

Major Common Core
CIVE 101 Introduction to Engineering - Civil (2)
CIVE 145 CAD for Civil Engineering (2)
CIVE 235 Properties of Civil Engineering Materials (3)
CIVE 271 Civil Engineering Measurements (2)
CIVE 321 Fluid Mechanics (3)
CIVE 340 Structural Analysis (3)
CIVE 350 Hydraulics and Hydrology (4)
CIVE 360 Geotechnical Engineering (4)
CIVE 370W Transportation Engineering (4)
CIVE 380 Environmental Engineering (3)
CIVE 401W Civil Engineering Design I (2)
CIVE 402W Civil Engineering Design II (3)
CIVE 435 Civil Engineering Experimentation I (2)
CIVE 436 Civil Engineering Experimentation II (2)
GEOL 121 Physical Geology (4)

[choose 2 - 3 credits]
ME 241 Thermodynamics (3)
ME 299 Thermal Analysis (2)

[choose 3 credits]
CIVE 446 Reinforced Concrete Design (3)
CIVE 448 Steel Design (3)

Major Restricted Electives

Physics II or III
Choose one group
College Physics II
PHYS 222 General Physics II (3)
PHYS 232 General Physics II Laboratory (1)

College Physics III
PHYS 223 General Physics III (3)
PHYS 233 General Physics III Laboratory (1)

Civil and Technical Electives
Choose a minimum of 14 credits in civil (minimum 9) and technical (minimum 2) electives. Elective courses are selected from the list below, and are recommended to be taken after identifying an area of interest and consultation with an academic advisor.

Civil Engineering Electives [choose 9 - 12 credits]
CIVE 432 Properties of Concrete (3)
CIVE 446 Reinforced Concrete Design (3)
CIVE 447 Prestressed Concrete Design (3)
CIVE 448 Steel Design (3)
CIVE 450 Finite Element Method (3)
CIVE 452 Open Channel Flow (3)
CIVE 454 Hydraulic Structures (3)
CIVE 458 Stormwater Management (3)
CIVE 461 Fundamentals of Pavement Design (3)
CIVE 465 Foundation Design (3)
CIVE 467 Earth Structures (3)
CIVE 470 Traffic Engineering (3)
CIVE 471 Highway Planning and Design (3)
CIVE 476 Planning and Design of Airports (3)
CIVE 481 Water & Wastewater Treatment, Collection & Distribution (3)
CIVE 482 Utility Pipeline Inspection, Repair and Rehabilitation (3)
CIVE 484 Landfill and Hazardous Waste Engineering (3)

Technical Electives [choose 2 - 5 credits]
BIOL 270 Microbiology (4)
BLAW 450 Contracts, Sales, and Professional Responsibility (3)
BLAV 453 International Legal Environment of Business (3)
BLAV 474 Environmental Regulation and Land Use (3)
BLAV 476 Construction and Design Law (3)
CHEM 202 General Chemistry II (5)
CHEM 305 Analytical Chemistry (4)
CHEM 407 Environmental Chemistry (3)
CIVE 300 - 489 Except Required Courses
CM 310 Estimating I (3)
CM 330 Planning and Scheduling (3)
CM 340 Construction Project Management (3)
EE 300 - 489
EE 230 Circuit Analysis I (3)
ENVR 440 Environmental Regulations (3)
ENVR 450 Environmental Pollution & Control (3)
ENVR 460 Analysis of Pollutants (4)
GEOG 315 Geomorphology (3)
GEOG 373 Introduction to Geography Information Systems (4)
GEOG 439 Transportation Modeling & GIS (4)
GEOL 330 Structural Geology (4)
GEOL 350 Environmental Geology (4)
GEOL 351 Engineering Geology (2)
GEOL 450 Hydrogeology (3)
ME 300 - 489

Required Minor: None.

COURSE DESCRIPTIONS

CIVE 100 (1) Explorations in Engineering
This course offers an introduction to the various disciplines of engineering and their relationship to the principles of physics and mathematics. Students are prepared for academic success and the transition into an engineering program.
Fall
GE-12

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 upperclass engineering students and practicing engineers.
Prerequisite: MATH 113 or MATH 115 or MATH 121
Fall

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.
Fall, Spring

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. Includes laboratory component.
Prerequisite: CIVE 101
Fall, Spring

CIVE 235 (3) Properties of Civil Engineering Materials
Co-requisite: ME 223
Fall

CIVE 271 (2) Civil Engineering Measurements
Basic civil engineering measurements as relates to construction layout, including distances, angles, bearings, elevations, mapping, and positioning. Includes laboratory component.
Co-requisite: MATH 121
Fall
CIV E 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. Prerequisite: Recipient of a MAX scholarship or instructor consent. Fall, Spring

CIV E 321 (3) Fluid Mechanics
Introduction to fluid properties, fluid statics, buoyancy, fluid kinematics, Bernoulli's equation, control volume and differential approach to flow conservation equations, dimensional analysis, similitude, viscous flow in pipes, flow over immersed bodies, and pumps. Includes significant design component. Prerequisite: CIVE 214 or ME 214. Corequisite: ME 241 or ME 299. Fall

CIV E 340 (3) Structural Analysis
Minimum design loads for buildings using ASCE 7 guidelines and load distribution. Analysis of determinate structural systems including the case of moving loads. Analysis of indeterminate structures using the flexibility and moment distribution methods. Use of software to enhance the analysis. Prerequisite: CIVE 223 or ME 223. Fall

CIV E 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. Includes significant design component. Prerequisite: CIVE 321 or ME 321, ME 291. Spring

CIV E 360 (3) 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. Includes significant design component. Prerequisite: CIVE 321 or ME 321. Corequisite: CIVE 321 or ME 321. Spring

CIV E 370W (4) Transportation Engineering
Introduction to Transportation systems; land use and transportation interaction, analysis, and traffic operations; transportation decision making using economic analysis. Introduction to design, construction, maintenance, and operation of various transportation modes. Includes significant design component. Prerequisite: CIVE 145. Corequisite: CIVE 271, ME 291. Fall, Winter

CIV E 380 (3) Environmental Engineering
Introduction of the fundamental chemical, biological and physical principles of environmental 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. Includes significant design component. Prerequisite: CHEM 201, MATH 321. Fall

CIV E 398 (0) CPT: Co-Operative Experience
Curricular Practical Training: Co-Operative Experience is a zero-credit full-time practical training experience for one summer and on adjacent fall or spring term. Special rules apply to preserve full-time student status. Please contact an advisor in your program for complete information. Prerequisite: CIVE 201. At least 60 credits earned; in good standing; instructor permission; co-op contract; other prerequisites may also apply. Fall, Spring, Summer

CIV E 401W (2) Civil Engineering Design I
Practical civil engineering design project with real world constraints. This course focuses on the planning and formulation of a project, and the presentation of preliminary findings to the public. Includes significant design component. Prerequisite: CIVE 340, CIVE 350, CIVE 360, CIVE 370. Co-requisite: CIVE 380. Fall

CIV E 402W (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 significant design component. Prerequisite: CIVE 401. Spring

CIV E 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. Includes laboratory and significant design components. Prerequisite: ME 223. Variable

CIV E 435 (2) Civil Engineering Experimentation I
Provides students with hands-on experience in the testing of civil engineering materials including concrete, metals and structural systems. Includes laboratory component. Prerequisite: CIVE 340 & CIVE 370. Fall

CIV E 436 (2) Civil Engineering Experimentation II
Provides students with hands-on experience in the testing of civil engineering materials including soil and asphalt, fluid mechanics, hydraulics, and hydrology. Includes laboratory component. Prerequisite: CIVE 350, CIVE 360. Spring

CIV E 446 (3) Reinforced Concrete Design
Design of reinforced concrete beams, columns, slabs, and structural foundations according to ACI 318 Building Code requirements. Includes significant design component. Prerequisite: CIVE 340. Alt-Spring

CIV E 447 (3) Prestressed Concrete Design

CIV E 448 (3) Steel Design
Behavior and properties of structural steel. Design of tension members, compression members, beams, and connections using the LRFD method. Use of the AISC Steel Construction Manual is required. Includes significant design component. Prerequisite: CIVE 340. Alt-Spring

CIV E 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. Includes significant design component. Prerequisite: CIVE 350. Variable

CIV E 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. Includes significant design component. Prerequisite: CIVE 350. Variable

CIV E 457 (3) Stormwater Management
Application of fluid mechanics and hydrology to the design of stormwater management facilities. Environmental impacts of stormwater management are discussed throughout the course. Includes significant design component. Prerequisite: CIVE 350. Variable
CIV E 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, rehabilitation, and pavement management systems. Materials characterization, tests, quality control, and life cycle cost analysis. Includes significant design component.
Prerequisite: CIVE 370, CIVE 223 or ME 223
Co-requisite: CIVE 360
Variable

CIV E 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. Includes significant design component.
Prerequisite: CIVE 360
Variable

CIV E 467 (3) Earth Structures
Design and construction of traditional embankments, including slope stability analysis; earth and rockfill dams, introduction to seepage analysis; excavations, earth retaining structures, and other geotechnical structures. Geotechnical software application in analysis and design. Includes significant design component.
Prerequisite: CIVE 360
Variable

CIV E 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. Includes significant design component.
Prerequisite: CIVE 370
Variable

CIV E 471 (3) Highway Planning and Design
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. Extensive use of CAD software. Includes significant design component.
Prerequisite: CIVE 145 and CIVE 370
Variable

CIV E 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. Includes significant design component.
Prerequisite: CIVE 370
Variable

CIV E 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. Includes significant design component.
Prerequisite: CIVE 380
Variable

CIV E 484 (3) Landfill and Hazardous Waste Engineering
This course will be taught as a classroom based course with a combination of lecture, individual and group projects, reading, homework, discussion, review, and examinations. The goal of the course is to develop competency in the design and implementation of landfill design and hazardous waste remediation, with understanding of both performance and cost implications to all choices.
Prerequisite: CIVE 380
Variable

CIV E 491 (1-4) In-Service
May be repeated for credit on each different topic.
Variable

CIV E 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.
Prerequisite: Recipient of a MAX scholarship or instructor consent.
Fall, Spring

CIV E 494 (1) Global Experience in Engineering and Technology
This class provides students pursuing a minor in “Global Solutions in Engineering and Technology” with an opportunity to explore a set of topics related to achieving success in advance of and following an international experience (internship, study abroad, etc.). Speakers will include faculty, graduate students, visiting researchers and industry members as well as student participants. Returning students will be required to participate in mentoring of students preparing for their international experience and provide written and/or oral presentations of various topics during the semester. This course is required both before and after participation in the international experience [min. 2 cr.]
Variable

CIV E 497 (1-6) Internship
Variable

CIV E 499 (1-6) Individual Study
Variable