Twin Cities Campus

Civil Engineering B.C.E.

CSENG Civil, Envrn & Geo-Eng (CEGE)

College of Science and Engineering

- Program Type: Baccalaureate
- Requirements for this program are current for Fall 2020
- Required credits to graduate with this degree: 125
- Required credits within the major: 108
- Degree: Bachelor of Civil Engineering

Civil engineering deals with the science and art of engineering applied to solving problems and designing systems related to infrastructure and the environment. Civil engineers analyze, design and supervise the construction of roads, buildings, water supply systems, airports, tunnels, dams, bridges, and wastewater treatment systems. They must consider many factors in the design process including regulations and policy issues, sustainability, fabrication costs and constructibility, expected lifetime of a project, and risk assessment of natural events and potential hazards.

Civil engineering is a broad area of engineering and has a tangible impact on the quality of life, human health, and safety. The advances that civil engineers have made in providing clean water supply systems have had a greater impact on human health and longevity than many advances in the medical field. The structures we live and work in, the roads and bridges we drive on, the clean water we drink, and wastewater treatment systems we use, are all designed by civil engineers. Major specialties within civil engineering include construction, environmental, geotechnical, municipal, structural, transportation, and water resources engineering.

Civil engineering jobs are available in both the private and public sector through consulting firms and in government agencies at the local, state, and federal levels. Employment can be found in nearly any region, from small communities and remote areas to the largest cities in the world. Graduates of the program have worked on the design of the tallest building and largest dams in the world. Civil engineering is considered to have one of the highest levels of job satisfaction of all professions. Civil engineers can enjoy a fulfilling technical career and also have opportunities for administrative and leadership positions. Many opportunities are available that allow civil engineers to spend time outdoors. The infrastructure required to sustainably maintain modern society ensures the continued demand for civil engineers.

The upper division civil engineering program requires students to take introductory courses in the major areas. In addition, students may emphasize in an area by selecting appropriate technical electives in consultation with their advisor. The infrastructure required to sustainably maintain modern society ensures the continued demand for civil engineers.

The program is accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Admission Requirements

Students must complete 10 courses before admission to the program.

Freshmen students are usually admitted to pre-major status before admission to this major

It is recommended that students take CEGE 1101, but this course is not required to be admitted to the program.

For information about University of Minnesota admission requirements, visit the Office of Admissions website.

Required prerequisites

Mathematics

Calculus I

MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
or MATH 1271 - Calculus I [MATH] (4.0 cr)
or MATH 1571H - Honors Calculus I [MATH] (4.0 cr)

Calculus II

MATH 1372 - CSE Calculus II (4.0 cr)
or MATH 1272 - Calculus II (4.0 cr)
or MATH 1572H - Honors Calculus II (4.0 cr)

Multivariable Calculus

MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)

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or MATH 2263 - Multivariable Calculus (4.0 cr)
or MATH 2573H - Honors Calculus III (4.0 cr)

Physical Science and Engineering Science
Chemical Principles I
CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
or **Honors Chemistry I**
CHEM 1071H - Honors Chemistry I [PHYS] (3.0 cr)
CHEM 1075H - Honors Chemistry I Laboratory [PHYS] (1.0 cr)
Chemical Principles II
CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
or **Honors Chemistry II**
CHEM 1072H - Honors Chemistry II [PHYS] (3.0 cr)
CHEM 1076H - Honors Chemistry II Laboratory [PHYS] (1.0 cr)
Physics I
PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
or PHYS 1401V - Honors Physics I [PHYS, WI] (4.0 cr)
Physics II
PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
or PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)
Statics
AEM 2011 - Statics (3.0 cr)

General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the liberal education requirements.Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

Program Requirements

All freshmen in the College of Science and Engineering must complete CSE 1001: First-Year Experience.
At least 32 upper division credits in the major must be taken at the University of Minnesota Twin Cities Campus.

CEGE Core
CEGE 3101 - Computer Applications I (3.0 cr)
CEGE 3102 - Uncertainty and Decision Analysis (3.0 cr)
CEGE 3103 - Engineering Ethics and Professional Practice (1.0 cr)
CEGE 3201 - Transportation Engineering [TS] (3.0 cr)
CEGE 3301 - Soil Mechanics I (3.0 cr)
CEGE 3401 - Linear Structural Analysis (3.0 cr)
CEGE 3402 - Civil Engineering Materials (3.0 cr)
CEGE 3501 - Introduction to Environmental Engineering [ENV] (3.0 cr)
CEGE 3502 - Fluid Mechanics (4.0 cr)
CEGE 4101W - Project Management and Engineering Economics [WI] (3.0 cr)
CEGE 4102W - Capstone Design for Civil Engineering [WI] (4.0 cr)
CEGE 4301 - Soil Mechanics II (3.0 cr)
CEGE 4401 - Steel and Reinforced Concrete Design (4.0 cr)
CEGE 4501 - Hydrologic Design (4.0 cr)
CEGE 4502 - Water and Wastewater Treatment (3.0 cr)

Mathematics
MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
or MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
or MATH 2574H - Honors Calculus IV (4.0 cr)

Mechanics
AEM 3031 - Deformable Body Mechanics (3.0 cr)
Dynamics or Substitute
AEM 2012 - Dynamics (3.0 cr)
or CHEM 2301 - Organic Chemistry I (3.0 cr)
or MATS 2001 - Introduction to the Science of Engineering Materials (3.0 cr)

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or CSCI 1113 - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
or ME 3331 - Thermodynamics (3.0 cr)

Electives

Although most civil engineers in practice need to be well versed in a number of specialty fields, some specialization (17 cr technical electives) is included in the BCE degree program, as follows:

Take 17 or more credit(s) from the following:

Civil Engineering Technical Electives

Students must take a minimum of 6 credits of 4xxx or higher electives offered by the Department of Civil, Environmental, and Geo-Engineering. All 4xxx or higher CEGE courses that are not required can be used as technical electives.

Take 6 or more credit(s) from the following:

- CEGE 4xxx
- CEGE 5xxx

- **Technical Electives**

The remainder of the 17 credit technical elective requirement can be satisfied by taking courses listed below. All 4xxx or higher courses from the College of Science and Engineering (including CEGE) are acceptable as technical electives. Other courses not in the list can be used as technical electives with specific approval from a CEGE advisor. The CEGE Undergraduate Handbook Appendix A identifies recommended electives by area of emphasis.

Take 0 or more credit(s) from the following:

- AEM 4501 - Aerospace Structures (3.0 cr)
- AEM 4502 - Computational Structural Analysis (3.0 cr)
- AEM 4511 - Mechanics of Composite Materials (3.0 cr)
- AEM 4581 - Mechanics of Solids (3.0 cr)
- AEM 4xxx
- AEM 5501 - Continuum Mechanics (3.0 cr)
- AEM 5503 - Theory of Elasticity (3.0 cr)
- AEM 5xxx
- AST 4xxx
- AST 5xxx
- BBE 4301 - Applied Surface and Colloid Science (3.0 cr)
- BBE 4523 - Ecological Engineering Design (3.0 cr)
- BBE 4533 - Sustainable Waste Management Engineering (3.0 cr)
- BBE 4733 - Renewable Energy Technologies [TS] (3.0 cr)
- BBE 4xxx
- BBE 5xxx
- BMEN 4xxx
- BMEN 5xxx
- CEGE 1101 - Introduction to Civil, Environmental, and Geo-Engineering (1.0 cr)
- CEGE 3111 - CADD for Civil Engineers (2.0 cr)
- CEGE 3202 - Surveying & Mapping (2.0 cr)
- CEGE 3541 - Environmental Engineering Laboratory (3.0 cr)
- CEGE 4000H - Honors Research Seminar (1.0 cr)
- CEGE 4160 - Special Topics (1.0 - 4.0 cr)
- CEGE 4094H *{Inactive}*(2.0 cr)
- CEGE 4121 - Computer Applications II (3.0 cr)
- CEGE 4170 - Independent Study I (1.0 - 4.0 cr)
- CEGE 4180 - Independent Study II (1.0 - 4.0 cr)
- CEGE 4190 *{Inactive}*(4.0 cr)
- CEGE 4201 *{Inactive}*(3.0 cr)
- CEGE 4253 - Pavement Design, Engineering, and Management (4.0 cr)
- CEGE 4311 - Rock Mechanics (4.0 cr)
- CEGE 4351 - Groundwater Mechanics (3.0 cr)
- CEGE 4352 - Groundwater Modeling (3.0 cr)
- CEGE 4411 - Matrix Structural Analysis (3.0 cr)
- CEGE 4412 - Reinforced Concrete II (3.0 cr)
- CEGE 4413 - Steel Design II (3.0 cr)
- CEGE 4511 - Hydraulic Structures (3.0 cr)
- CEGE 4512 - Open Channel Hydraulics (3.0 cr)
- CEGE 4561 - Solids and Hazardous Wastes (3.0 cr)
- CEGE 4562 - Environmental Remediation Technologies (3.0 cr)
- CEGE 4563 - Pollutant Fate and Transport: Processes and Modeling (3.0 cr)
- CEGE 4582 *{Inactive}*(3.0 cr)
- CEGE 4xxx
- CEGE 5094 - Directed Research (1.0 - 4.0 cr)
- CEGE 5180 - Special Topics (1.0 - 4.0 cr)
- CEGE 5212 - Transportation Policy, Planning, and Deployment (3.0 cr)

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- CEGE 5214 - Infrastructure Systems Engineering (3.0 cr)
- CEGE 5341 - Wave Methods for Nondestructive Testing (3.0 cr)
- CEGE 5342 - Introduction to Inverse Problems (3.0 cr)
- CEGE 5351 - Advanced Engineering Mathematics I (3.0 cr)
- CEGE 5411 - Applied Structural Mechanics (3.0 cr)
- CEGE 5414 - Prestressed Concrete Design (3.0 cr)
- CEGE 5415 - Masonry Structures (3.0 cr)
- CEGE 5511 - Urban Hydrology and Water Quality (4.0 cr)
- CEGE 5512 - Stochastic Ecohydrology (3.0 cr)
- CEGE 5541 - Environmental Water Chemistry (3.0 cr)
- CEGE 5542 - Experimental Methods in Environmental Engineering (3.0 cr)
- CEGE 5543 - Introductory Environmental Fluid Mechanics (4.0 cr)
- CEGE 5551 - Environmental Microbiology (3.0 cr)
- CEGE 5552 - Environmental Microbiology Laboratory (1.0 cr)
- CEGE 5xxx
- CHEM 2301 - Organic Chemistry I (3.0 cr)
- CHEM 4xxx
- CHEM 5xxx
- CHEN 3102 - Reaction Kinetics and Reactor Engineering (4.0 cr)
- CHEN 4xxx
- CHEN 5xxx
- CMGT 4xxx
- CMPE 4xxx
- CMPE 5xxx
- CSCI 1103 - Introduction to Computer Programming in Java (4.0 cr)
- CSCI 1113 - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
- CSCI 4203 - Computer Architecture (4.0 cr)
- CSCI 4707 - Practice of Database Systems (3.0 cr)
- CSCI 4xxx
- CSCI 5xxx
- EE 4xxx
- EE 5xxx
- EEB 3407 - Ecology (3.0 cr)
- EEB 3408W - Ecology [WI] (4.0 cr)
- EEB 5601 - Limnology (3.0 cr)
- ESCI 3303W - Geochemical Principles [WI] (4.0 cr)
- ESCI 3402 - Science and Politics of Global Warming [ENV] (3.0 cr)
- ESCI 4203 - Environmental Geophysics (3.0 cr)
- ESCI 4501 - Structural Geology (3.0 cr)
- ESCI 4602 - Sedimentology and Stratigraphy (3.0 cr)
- ESCI 4701 - Geomorphology (4.0 cr)
- ESCI 4702 - General Hydrogeology (4.0 cr)
- ESCI 4703 - Glacial Geology (4.0 cr)
- ESCI 4801 - Geomicrobiology (3.0 cr)
- ESCI 4xxx
- ESCI 5204 - Geostatistics and Inverse Theory (3.0 cr)
- ESCI 5xxx
- ESPM 3111 - Hydrology and Water Quality Field Methods (3.0 cr)
- ESPM 4216 - Contaminant Hydrology (3.0 cr)
- ESPM 4295W - GIS in Environmental Science and Management [WI] (4.0 cr)
- ESPM 5605 - Recycling: Extending Raw Materials Supplies (3.0 cr)
- FNRM 3131 - Geographical Information Systems (GIS) for Natural Resources [TS] (4.0 cr)
- GEOG 3531 - Numerical Spatial Analysis (4.0 cr)
- GEOG 3561 - Principles of Geographic Information Science (4.0 cr)
- GEOG 5563 - Advanced Geographic Information Science (3.0 cr)
- GEOG 5564 - Urban Geographic Information Science and Analysis (3.0 cr)
- IE 3521 - Statistics, Quality, and Reliability (4.0 cr)
- IE 4xxx
- IE 5111 - Systems Engineering I (2.0 cr)
- IE 5113 - Systems Engineering II (4.0 cr)
- IE 5531 - Engineering Optimization I (4.0 cr)
- IE 5545 - Decision Analysis (4.0 cr)
- IE 5553 - Simulation (4.0 cr)
- IE 5xxx
- LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
- MATH 4242 - Applied Linear Algebra (4.0 cr)

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•MATH 4428 - Mathematical Modeling (4.0 cr)
•MATH 4512 - Differential Equations with Applications (3.0 cr)
•MATH 4567 - Applied Fourier Analysis (4.0 cr)
•MATH 4xxx
•MATH 5485 - Introduction to Numerical Methods I (4.0 cr)
•MATH 5486 - Introduction To Numerical Methods II (4.0 cr)
•MATH 5583 - Complex Analysis (4.0 cr)
•MATH 5587 - Elementary Partial Differential Equations I (4.0 cr)
•MATH 5588 - Elementary Partial Differential Equations II (4.0 cr)
•MATH 5xxx
•MATS 2001 - Introduction to the Science of Engineering Materials (3.0 cr)
•MATS 4xxx
•MATS 5xxx
•ME 3331 - Thermodynamics (3.0 cr)
•ME 4xxx
•ME 5228 - Introduction to Finite Element Modeling, Analysis, and Design (4.0 cr)
•ME 5247 - Applied Stress Analysis (4.0 cr)
•ME 5248 - Vibration Engineering (4.0 cr)
•ME 5xxx
•MICB 3301 - Biology of Microorganisms (5.0 cr)
•PA 4200 - Urban and Regional Planning (3.0 cr)
•PA 5013 - Law and Urban Land Use (1.5 cr)
•PA 5204 *{Inactive}*(3.0 cr)
•PA 5231 - Transit Planning and Management (3.0 cr)
•PHYS 4xxx
•PHYS 5xxx
•STAT 4xxx
•STAT 5021 - Statistical Analysis (4.0 cr)
•STAT 5302 - Applied Regression Analysis (4.0 cr)
•STAT 5xxx
•WRS 5101 - Water Policy (3.0 cr)
•CEGE 4211 - Highway Design and Traffic Operations (4.0 cr)
or CEGE 5211 - Highway Design & Traffic Operations (4.0 cr)
•CEGE 4416 - Sensors in Infrastructure (3.0 cr)
or CEGE 5416 - Sensors in Infrastructure (3.0 cr)
or BBE 4023W - Process Control and Instrumentation [WI] (3.0 cr)
or BBE 5023 - Process Control and Instrumentation (3.0 cr)
•CEGE 4417 - Structural Engineering Design of Wood Buildings (3.0 cr)
or CEGE 5417 - Structural Engineering Design of Wood Buildings (3.0 cr)
•CEGE 4513 - Energy Conversion from Wind Hydro and Solar Resources (3.0 cr)
or CEGE 5513 - Energy Conversion from Wind, Hydro and Solar Resources (3.0 cr)
or BBE 4733 - Renewable Energy Technologies [TS] (3.0 cr)
•CEGE 4581 - Design for Sustainable Development - India [GP, TS] (3.0 cr)
or CEGE 5570 *{Inactive}*(3.0 - 9.0 cr)
•CEGE 4583 *{Inactive}*[GP, TS] (3.0 cr)
or ME 4583 - Design for Life: Water in Tanzania [GP, TS] (3.0 cr)
•CEGE 5212 - Transportation Policy, Planning, and Deployment (3.0 cr)
or PA 5232 - Transportation Policy, Planning, and Deployment (3.0 cr)
•CEGE 5213 - Transit Planning and Management (3.0 cr)
or PA 5231 - Transit Planning and Management (3.0 cr)

Other Basic Science

Take any one Biological Science or ESCI course 3 credits or higher. A course taken to fulfill the Biological Sciences Liberal Education requirement will also fulfill this major requirement.

Upper Division Writing Intensive within the major

Students are required to take one upper division writing intensive course within the major. If that requirement has not been satisfied within the core major requirements, students must choose one course from the following list. Some of these courses may also fulfill other major requirements.

Take 0 - 1 course(s) from the following:

•CEGE 4101W - Project Management and Engineering Economics [WI] (3.0 cr)
•CEGE 4102W - Capstone Design for Civil Engineering [WI] (4.0 cr)

Program Sub-plans

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A sub-plan is not required for this program.

Civil Engineering B.C.E./Civil Engineering M.S.

The Department of Civil, Environmental, and Geo- Engineering offers an integrated Bachelors and Masters Degree program. Students accepted into the integrated program will be guaranteed admission to the Civil Engineering MS as long as they complete their undergraduate program. Accepted students will not need to take the GRE exam as part of their graduate application, unlike other students applying to our graduate program. Applicants must be enrolled in the University of Minnesota Twin Cities Civil Engineering undergraduate program. Applicants should meet a technical GPA minimum of 3.5 (as defined by the College of Science and Engineering).

Applicants must have completed at least 75 credits at the time of their application.

Courses that will be used to fulfill Masters degree requirements must appear in this sub-plan by the tenth day of the semester in which the student is enrolled in the courses.

Any final edits or updates to this sub-plan must be reflected on the APAS no later than the last day of instruction in the semester in which the undergraduate degree will be awarded. Courses not in this sub-plan by that time cannot be updated at a later time and therefore will not be eligible for use towards the Masters degree.

Students can transfer a maximum of 16 credits to the graduate program taken during their integrated senior undergraduate year. Students must spend a minimum of two semesters as a graduate student after the completion of their undergraduate degree. Most coursework applied to the graduate degree should be taken at the graduate level (i.e., 5xxx or above). No more than 9 credits of 4xxx-level technical elective credits can count towards your masters degree*. Credits cannot also be applied to the undergraduate degree. (i.e., no double dipping).

Credits applied to the Civil Engineering or Geoengineering Masters taken while the student is an undergraduate for use in the integrated program can also be applied later to the Civil Engineering Ph.D. within our department if a student applies and is admitted.

Students should consider taking the following courses/requirements to apply toward their graduate degree as an undergraduate integrated program student (16 credits max): CEGE 5xxx level course that fits your interests and background or an approved graduate level elective. We recommend waiting to take CEGE 8xxx level courses for your graduate year, but this level of coursework is still available to you if you have the appropriate prerequisites, advisor approval, or instructor approval.

*Please refer to your advisor or the CEGE program coordinator (cegesps@umn.edu) for more details on which courses count towards a graduate degree.

Students in this program should graduate with their Bachelor's in Civil Engineering at end of Year 4 and graduate with their M.S. at end of year 5.

Civil Engineering B.C.E./Geoengineering M.S.

The Department of Civil, Environmental, and Geo- Engineering offers an integrated Bachelors and Masters Degree program. Students accepted into the integrated program will be guaranteed admission to the Geoengineering MS as long as they complete their undergraduate program. Accepted students will not need to take the GRE exam as part of their graduate application, unlike other students applying to our graduate program. Applicants must be enrolled in the University of Minnesota Twin Cities Civil Engineering undergraduate program. Applicants should meet a technical GPA minimum of 3.5 (as defined by the College of Science and Engineering).

Applicants must have completed at least 75 credits at the time of their application.

Courses that will be used to fulfill Masters degree requirements must appear in this sub-plan by the tenth day of the semester in which the student is enrolled in the courses.

Any final edits or updates to this sub-plan must be reflected on the APAS no later than the last day of instruction in the semester in which the undergraduate degree will be awarded. Courses not in this sub-plan by that time cannot be updated at a later time and therefore will not be eligible for use towards the Masters degree.

Students can transfer a maximum of 16 credits to the graduate program taken during their integrated senior undergraduate year. Students must spend a minimum of two semesters as a graduate student after the completion of their undergraduate degree. Most coursework applied to the graduate degree should be taken at the graduate level (i.e., 5xxx or above). No more than 9 credits of 4xxx-level technical elective credits can count towards your masters degree*. Credits cannot also be applied to the undergraduate degree. (i.e., no double dipping).

Credits applied to the Civil Engineering or Geoengineering Masters taken while the student is an undergraduate for use in the integrated program can also be applied later to the Civil Engineering Ph.D. within our department if a student applies and is admitted.

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Students should consider taking the following courses/requirements to apply toward their graduate degree as an undergraduate integrated program student (16 credits max): CEGE 5xxx level course that fits your interests and background or an approved graduate level elective. We recommend waiting to take CEGE 8xxx level courses for your graduate year, but this level of coursework is still available to you if you have the appropriate prerequisites, advisor approval, or instructor approval.

*Please refer to your advisor or the CEGE program coordinator (cegesps@umn.edu) for more details on which courses count towards a graduate degree.

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