***Twin Cities Campus***

# Environmental Engineering B.Env.E

*CSENG Civil, Envrn & Geo-Eng (CEGE)*

**College of Science and Engineering**

- Program Type: Baccalaureate
- Requirements for this program are current for Fall 2019
- Required credits to graduate with this degree: 125
- Required credits within the major: 108
- Degree: Bachelor of Environmental Engineering

Environmental engineers design and apply technologies to resolve issues of environmental concern. They design systems that produce safe drinking water, treat wastewater so that it can be reused and/or safely returned to the environment, accommodate municipal and hazardous waste, mitigate air pollution, and protect public health. They use engineering and ecological principles to protect and enhance the natural environment, including erosion and sediment control, pollution abatement, watershed management, impaired waters diagnostics, and wetland and ecological restoration.

Focus areas of the program include water chemistry; water and wastewater treatment; water quality; hydrology; groundwater remediation; environmental microbiology; pollutant fate and transport; stream restoration, sustainable design, and air pollution. Environmental engineering is a broad and interdisciplinary field, and the program emphases are chemistry, microbiology, water resources, and fluid mechanics.

## Program Delivery

This program is available:

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

## Admission Requirements

Students must complete 11 courses before admission to the program.

Freshman and transfer students students are usually admitted to pre-major status before admission to this major

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)
*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)

**Organic Chemistry**

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CHEM 2301 - Organic Chemistry I (3.0 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)
*or* PHYS 1501V *{Inactive}*[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)
*or* PHYS 1502V *{Inactive}*[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.

**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 3301 - Soil Mechanics I (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 3541 - Environmental Engineering Laboratory (3.0 cr)
CEGE 4101W - Project Management and Engineering Economics [WI] (3.0 cr)
CEGE 4102W - Capstone Design for Civil Engineering [WI] (4.0 cr)
CEGE 4501 - Hydrologic Design (4.0 cr)
CEGE 4502 - Water and Wastewater Treatment (3.0 cr)

**Biological Sciences**

Students should take one 3 credit class or higher. A course taken to fulfill the Biological Sciences Liberal Education requirement will also fulfill this major requirement. Students whose Biological Sciences Liberal Education requirement is waived can choose from the following courses, which would also count toward the Selective Elective requirement.

BBE 4608 - Environmental and Industrial Microbiology (3.0 cr)
*or* BIOL 1001 - Introductory Biology: Evolutionary and Ecological Perspectives [BIOL] (4.0 cr)
*or* PMB 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
*or* CEGE 5551 - Environmental Microbiology (3.0 cr)
*or* EEB 3407 - Ecology (3.0 cr)
*or* ESCI 4801 - Geomicrobiology (3.0 cr)

**ESCI**

Take any one ESCI course 3 credits or higher.
Courses used to meet this requirement may not be used to meet another major requirement.
Take 3 or more credit(s) from the following:

- ESCI 1001 - Earth and Its Environments [PHYS, ENV] (4.0 cr)
- ESCI 1003 - Dinosaurs and Our World [BIOL, ENV] (4.0 cr)
- ESCI 1005 - Geology and Cinema [PHYS, ENV] (4.0 cr)
- ESCI 1006 - Oceanography [PHYS, ENV] (4.0 cr)
- ESCI 1007 - From Microbes to Mammoths: History of Life on Earth [BIOL] (4.0 cr)
- ESCI 1012 - Natural Disasters [TS] (3.0 cr)
- ESCI 1101 - Introduction to Geology (lecture only) [ENV] (3.0 cr)
- ESCI 1105 - Geology and Cinema (lecture only) [ENV] (3.0 cr)
- ESCI 1106 - Oceanography [ENV] (3.0 cr)
- ESCI 2201 - Solid Earth Dynamics (4.0 cr)
- ESCI 2202 - Earth History (4.0 cr)
- ESCI 2203 - Earth Surface Dynamics (4.0 cr)
- ESCI 2301 - Mineralogy (3.0 cr)

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•ESCI 2302 - Petrology (3.0 cr)
•ESCI 3002 - Climate Change and Human History [ENV] (3.0 cr)
•ESCI 3004 - Water and Society [ENV] (3.0 cr)
•ESCI 3005 - Earth Resources (3.0 cr)
•ESCI 3006 - Rocks and Stars: Introduction to Planetary Science (3.0 cr)
•ESCI 3202 - Fluid Earth Dynamics (4.0 cr)
•ESCI 3303W - Geochemical Principles [WI] (4.0 cr)
•ESCI 3402 - Science and Politics of Global Warming [ENV] (3.0 cr)
•ESCI 3911 - Introductory Field Geology (4.0 cr)
•ESCI 4010 - Undergraduate Seminar: Current Topics in Earth & Environmental Sciences (1.0 - 4.0 cr)
•ESCI 4102W - Vertebrate Paleontology: Evolutionary History and Fossil Records of Vertebrates [WI] (3.0 cr)
•ESCI 4103W - Fossil Record of Mammals [WI] (3.0 cr)
•ESCI 4203 - Environmental Geophysics (3.0 cr)
•ESCI 4204 - Geomagnetism and Paleomagnetism (3.0 cr)
•ESCI 4211 *{Inactive}*(3.0 cr)
•ESCI 4212 - Geodynamics (3.0 cr)
•ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
•ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
•ESCI 4501 - Structural Geology (3.0 cr)
•ESCI 4502 - Tectonic Styles (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 4911 - Advanced Field Geology (4.0 cr)
•ESCI 4971W - Field Hydrogeology [WI] (4.0 cr)
•ESCI 5102 - Climate Change and Human History (3.0 cr)
•ESCI 5201 - Time-Series Analysis of Geological Phenomena (3.0 cr)
•ESCI 5203 - Mineral and Rock Physics (3.0 cr)
•ESCI 5204 - Geostatistics and Inverse Theory (3.0 cr)
•ESCI 5302 - Isotope Geology (3.0 cr)
•ESCI 5351 *{Inactive}*(3.0 cr)
•ESCI 5353 - Electron Microprobe Theory and Practice (3.0 cr)
•ESCI 5402 - Science and Politics of Global Warming (3.0 cr)
•ESCI 5502 *{Inactive}*(3.0 cr)
•ESCI 5503 - Advanced Petrology (3.0 cr)
•ESCI 5504W *{Inactive}*[WI] (3.0 cr)
•ESCI 5601W *{Inactive}*[WI] (4.0 cr)
•ESCI 5705 - Limnogeology and Paleoenvironment (3.0 cr)
•ESCI 5980 - Seminar: Current Topics in Earth Sciences (1.0 - 4.0 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)

**Thermodynamics**
CHEM 4501 - Introduction to Thermodynamics, Kinetics, and Statistical Mechanics (3.0 cr)
*or* ME 3331 - Thermodynamics (3.0 cr)

**Electives**
As part of the elective requirements for environmental engineering, students must take a minimum of 9 credits from the Engineering Science and Design category and a minimum of 3 credits from the Engineering Science and Policy category. Including these categories, the program requires a minimum of 21 electives
Take 21 or more credit(s) including 3 or more sub-requirements(s) from the following:
**Engineering Science and Design (ESD) Electives**
Students must take a minimum of 9 credits from this category.
Take 9 or more credit(s) from the following:
•BBE 4523 - Ecological Engineering Design (3.0 cr)
•BBE 4535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
•BBE 4753 - Air Quality and Pollution Control Engineering (3.0 cr)
•CEGE 4351 - Groundwater Mechanics (3.0 cr)

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- CEGE 4511 - Hydraulic Structures (3.0 cr)
- CEGE 4512 - Open Channel Hydraulics (3.0 cr)
- CEGE 4562 - Environmental Remediation Technologies (3.0 cr)
- CEGE 4563 - Pollutant Fate and Transport: Processes and Modeling (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 5543 - Introductory Environmental Fluid Mechanics (4.0 cr)
- CEGE 4561 - Solids and Hazardous Wastes (3.0 cr)
  *or* BBE 4533 - Sustainable Waste Management Engineering (3.0 cr)
- CEGE 5551 - Environmental Microbiology (3.0 cr)
  *or* BBE 4608 - Environmental and Industrial Microbiology (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)

- **Environmental Sciences and Policy (ESP) Electives**

Students must take a minimum of 3 credits from this category.
Take 3 or more credit(s) from the following:

- 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 4702 - General Hydrogeology (4.0 cr)
- ESPM 3245 - Sustainable Land Use Planning and Policy [ENV] (3.0 cr)
- ESPM 3425 - Atmospheric Pollution: From Smog to Climate Change (3.0 cr)
- ESPM 3603 - Environmental Life Cycle Analysis (3.0 cr)
- ESPM 3777 - Climate Change- Physics, Myths, Mysteries, and Uncertainties (3.0 cr)
- LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
- PA 5711 - Science, Technology & Environmental Policy (3.0 cr)
- WRS 5101 - Water Policy (3.0 cr)
  *or* PA 5723 - Water Policy (3.0 cr)
- EEB 3407 - Ecology (3.0 cr)
  *or* EEB 3408W - Ecology [WI] (4.0 cr)
- ESCI 4801 - Geomicrobiology (3.0 cr)
  *or* PMB 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
- GCC 3005 - Innovation for Changemakers: Design for a Disrupted World [GP] (3.0 cr)
  *or* GCC 5005 - Innovation for Changemakers: Design for a Disrupted World [GP] (3.0 cr)

- **Technical Electives**

The remainder of the 21 credit technical elective requirements 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. Courses offered at other levels (3xxx-level or lower) or by other colleges (especially, but not limited to CFANS and CBS) need approval from your CEGE faculty advisor. The CEGE Undergraduate Handbook Appendix A identifies recommended electives.
Take 0 or more credit(s) from the following:

- AEM 4xxx
- AEM 5xxx
- AST 4xxx
- AST 5xxx
- BBE 4xxx
- BBE 5xxx
- BMEN 4xxx
- BMEN 5xxx
- CEGE 3xxx
- CEGE 4xxx
- CEGE 5xxx
- CHEM 4xxx
- CHEM 5xxx
- CHEN 4xxx
- CHEN 5xxx
- CMPE 4xxx
- CMPE 5xxx
- CSCI 4xxx
- CSCI 5xxx
- EE 4xxx
- EE 5xxx
- ESCI 4xxx
- ESCI 5xxx
- IE 4xxx
- IE 5xxx

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Information current as of March 28, 2024

- MATH 4xxx
- MATH 5xxx
- MATS 4xxx
- MATS 5xxx
- ME 4xxx
- ME 5xxx
- PHYS 4xxx
- PHYS 5xxx
- STAT 4xxx
- STAT 5xxx

**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 3402 - Civil Engineering Materials (3.0 cr)
- CEGE 4102W - Capstone Design for Civil Engineering [WI] (4.0 cr)
- EEB 3408W - Ecology [WI] (4.0 cr)
- ESCI 3303W - Geochemical Principles [WI] (4.0 cr)

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