ENVIRONMENTAL ENGINEERING, B.S.

The Department of Civil and Environmental Engineering offers a B.S. Environmental Engineering (BSEnvE) degree program, an excellent degree choice for students who are interested in the sustainable design, construction, and operation of systems and facilities that:

- Treat and distribute safe and reliable drinking water
- Recover material, nutrient, and energy resources from wastewater and solid waste
- Protect and restore wetlands, streams, lakes, and groundwater
- Allocate water resources for urban, rural, and recreational use
- Protect and develop coastal shorelines and stream banks
- Manage stormwater and minimize risk of flood events
- Reduce, reuse, and recycle solid wastes
- Minimize the production of and provide treatment of industrial and agricultural wastes
- Minimize the production of and provide treatment of industrial air emissions
- Prepare society for the impacts of climate change
- Slow down or reverse climate change via
  - Alternative sources of energy such as solar, wind, geothermal and biofuels
  - Recovery of carbon and other greenhouse gases from industrial air emissions

The operation of these facilities is being rapidly integrated into the Internet of Things with real-time “big data” collection systems for automated control. This makes it possible for society to rely on smart infrastructure, including systems that will reduce water consumption, save energy, and improve community resiliency in the wake of natural and human-caused disasters.

All of the above items require a core knowledge in mathematics, statistics, physics, chemistry, biology, geology, computer science and computer design tools, as well as breadth in different environmental engineering disciplines. Environmental engineers perform their work in a multidisciplinary setting requiring strong written and verbal communication skills, understanding of professional and ethical obligations coupled with risk management and decision-making, and commitment to lifelong learning and professional licensure. Their daily work also requires a commitment to sustainability – the need to meet today’s needs while also allowing future generations to meet their human and ecological needs.

To meet accreditation policies, eligibility for the program is limited to those students who

- matriculated into UW-Madison’s College of Engineering in the Fall 2020 semester or later, and
- expect to graduate no sooner than December 2023.

Students not meeting the above criteria are encouraged to consider the Environmental Engineering Option of the BS Civil Engineering degree program. Additional options for these students include the BS Geological Engineering degree program and the Natural Resources and Environmental Engineering Option of the BS Biological Systems Engineering degree program.

VISION

Develop and maintain a learning community that pursues new knowledge and understanding, and provides innovative and sustainable solutions to human and ecological needs.

MISSION OF BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING (BSEnvE) PROGRAM

Create, integrate, and transfer environmental engineering knowledge and practice in the development of professionals, leaders, and citizens that help define and serve societal and environmental needs by applying this knowledge and practice in an effective and sustainable manner.

ENVIRONMENTAL ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES

Prepare BSEnvE graduates to contribute to their communities through the following career and professional accomplishments:

1. Design and construct both natural and built processes and systems to efficiently meet determined needs using technical knowledge, modern tools, design principles, ethical practice, and communication, leadership, and team skills.
2. Utilize measurement and analysis tools along with experimental data in investigating natural and built systems.
3. Understand and incorporate economic, environmental, political, social, safety and global considerations in design, investigation and construction of natural and built systems.
4. Engage in lifelong learning to keep pace with the continuous evolution of policies, procedures, technologies and tools for engineering analysis, design, and decision making.
5. Serve others through participation in professional and/or civic activities and responsibilities.

HOW TO GET IN

ADMISSION TO THE COLLEGE AS A FRESHMAN

Students applying to UW–Madison (https://www.admissions.wisc.edu/apply/) need to indicate an engineering major (https://www.engr.wisc.edu/academics/undergraduate-academics/choosing-a-major/) as their first choice in order to be considered for direct admission to the College of Engineering. Direct admission to a major means students will start in the program of their choice in the College of Engineering and will need to meet progression requirements (https://www.engr.wisc.edu/academics/student-services/academic-advising/first-year-undergraduate-students/progression-requirements/) at the end of the first year to guarantee advancement in that program.

CROSS-CAMPUS TRANSFER TO ENGINEERING

UW–Madison students in other schools and colleges on campus must meet the course and credit requirements for admission to engineering degree granting classifications specified in the general college requirements (https://www.engr.wisc.edu/academics/student-services/academic-advising/cross-campus-students/). The requirements are the minimum for admission consideration. Cross-campus admission is competitive and selective, and the grade point average expectations may increase as demand trends change. The student’s overall academic record at UW–Madison is also considered. Students apply to their intended engineering program by submitting the online application.
by stated deadlines for spring and fall. The College of Engineering offers an online information tutorial and drop-in advising (https://www.engr.wisc.edu/academics/student-services/academic-advising/cross-campus-students/) for students to learn about the cross-campus transfer process.

OFF-CAMPUS TRANSFER TO ENGINEERING

With careful planning, students at other accredited institutions can transfer coursework that will apply toward engineering degree requirements at UW–Madison. Off-campus transfer applicants are considered for direct admission to the College of Engineering by applying to the Office of Admissions with an engineering major listed as their first choice. Those who are admitted to their intended engineering program must meet progression requirements (https://www.engr.wisc.edu/academics/student-services/academic-advising/transfer-students/) at the point of transfer or within their first two semesters at UW–Madison to guarantee advancement in that program. A minimum of 30 credits in residence in the College of Engineering is required after transferring, and all students must meet all requirements for their major in the college.

Transfer admission to the College of Engineering is competitive and selective, and students who have earned more than 80 transferable semester credits at the time of application are not eligible to apply. The College of Engineering has dual degree programs with select four-year UW System campuses. Eligible dual degree applicants are not subject to the 80 credit limit.

Off-campus transfer students are encouraged to discuss their interests, academic background, and admission options with the Transfer Coordinator in the College of Engineering: ugtransfer@engr.wisc.edu or 608-262-2473.

SECOND BACHELOR’S DEGREE

The College of Engineering does not accept second undergraduate degree applications. Second degree students (https://www.engr.wisc.edu/admissions/undergraduate-admissions/returning-adults-second-degree-students/) might explore the Biological Systems Engineering program at UW–Madison, an undergraduate engineering degree elsewhere, or a graduate program in the College of Engineering.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (http://guide.wisc.edu/undergraduate/#requirementsforundergraduatetestudytext) section of the Guide.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MATH 221</td>
<td>Calculus and Analytic Geometry 1</td>
<td>5</td>
</tr>
<tr>
<td>or MATH 217</td>
<td>Calculus with Algebra and Trigonometry II</td>
<td></td>
</tr>
<tr>
<td>or MATH 275</td>
<td>Topics in Calculus I</td>
<td></td>
</tr>
<tr>
<td>MATH 222</td>
<td>Calculus and Analytic Geometry 2</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 276</td>
<td>Topics in Calculus II</td>
<td></td>
</tr>
<tr>
<td>MATH 234</td>
<td>Calculus–Functions of Several Variables</td>
<td></td>
</tr>
<tr>
<td>MATH 319</td>
<td>Techniques in Ordinary Differential Equations</td>
<td>3</td>
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One of the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>STAT 324</td>
<td>Introductory Applied Statistics for Engineers</td>
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</tbody>
</table>
### Basic Science

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<tr>
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<tr>
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<td><strong>One of the following:</strong></td>
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<tr>
<td>CHEM 109</td>
<td>Advanced General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 103 &amp; CHEM 104</td>
<td>General Chemistry I and General Chemistry II</td>
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<td><strong>One of the following:</strong></td>
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<tr>
<td>PHYSICS 202</td>
<td>General Physics</td>
<td>5</td>
</tr>
<tr>
<td>PHYSICS 208</td>
<td>General Physics</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>One of the following:</strong></td>
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</tr>
<tr>
<td>GEOSCI 100</td>
<td>Introductory Geology: How the Earth Works</td>
<td>3</td>
</tr>
<tr>
<td>GEOSCI/ENVIR ST 106</td>
<td>Environmental Geology</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>One of the following:</strong></td>
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<tr>
<td>ZOOLOGY/BIOLOGY/BOTANY 151</td>
<td>Introductory Biology</td>
<td>3</td>
</tr>
<tr>
<td>ZOOLOGY 153</td>
<td>Introductory Biology</td>
<td></td>
</tr>
<tr>
<td>ZOOLOGY/BOTANY/ENVIR ST 260</td>
<td>Introductory Ecology</td>
<td></td>
</tr>
<tr>
<td>MICROBIO 101</td>
<td>General Microbiology</td>
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</tbody>
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**Total Credits:** 16

### Engineering Mechanics

<table>
<thead>
<tr>
<th>Code</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>E M A 201</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 202</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENGR 310</td>
<td>Fluid Mechanics</td>
<td>3</td>
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</tbody>
</table>

**Total Credits:** 9

### Engineering Tools

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CIV ENGR/G L E 291</td>
<td>Problem Solving Using Computer Tools</td>
<td>4</td>
</tr>
<tr>
<td>M E 170</td>
<td>Civil Engineering Graphics</td>
<td>2</td>
</tr>
</tbody>
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**Total Credits:** 6

### Fundamental Environmental Engineering Principles

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CIV ENGR 311</td>
<td>Hydrosience</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENGR 320</td>
<td>Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENGR 324</td>
<td>Environmental Engineering Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENGR 325</td>
<td>Environmental Engineering Materials</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENGR 494</td>
<td>Civil and Environmental Engineering Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENGR 498</td>
<td>Construction Project Management</td>
<td>3</td>
</tr>
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</table>

**Total Credits:** 18

### Advanced Principles and Practices

#### Environmental Engineering Experiments

Note: Courses taken to meet this requirement may not be used to meet the environmental engineering breadth requirement.

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CIV ENGR 322</td>
<td>Environmental Engineering Processes</td>
<td></td>
</tr>
<tr>
<td>CIV ENGR 410</td>
<td>Hydraulic Engineering</td>
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</tr>
<tr>
<td>BSE 365</td>
<td>Measurements and Instrumentation for Biological Systems</td>
<td></td>
</tr>
<tr>
<td>GEOSCI/G L E 627</td>
<td>Hydrogeology</td>
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</table>

**Total Credits:** 3

### Senior Capstone Design

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<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CIV ENGR 578</td>
<td>Senior Capstone Design</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total Credits:** 4

### Environmental Engineering Breadth Electives

At least one class in at least four of the following sub-disciplines. At least two of the courses must be designated as an engineering design course (*). If more than one course is taken from a sub-discipline, then the additional course(s) will be counted towards the Technical and Professional Electives Requirement.

- **Environmental Chemistry**
  - CIV ENGR 500 | Water Chemistry
  - ATM OCN 638 | Atmospheric Chemistry
  - SOIL SCI 621 | Soil Chemistry

- **Health Hazards and Risk Assessment**
  - CIV ENGR 422 | Elements of Public Health Engineering
  - POP HLTH/ENVIR ST 471 | Introduction to Environmental Health
  - POP HLTH/ENVIR ST 502 | Air Pollution and Human Health

- **Hydraulics**
  - CIV ENGR 410 | Hydraulic Engineering
  - CIV ENGR 411 | Open Channel Hydraulics

- **Surface Water Resources and Hydrology**
  - BSE 473 | Water Management Systems
  - BSE 571 | Small Watershed Engineering

- **Groundwater, Soils, and Sediments**
  - CIV ENGR 414 | Hydrologic Design *
  - CIV ENGR 415 | Hydrology
  - CIV ENGR 412 | Groundwater Hydraulics
### Professional Electives

*Note: Courses taken to meet this requirement may not be used to meet the environmental engineering breadth requirement.*

Select 14 credits of coursework that meets at least one of the following criteria:

- Any engineering course numbered 300 or higher. Up to six credits of independent study (e.g., CIV ENGR 699 Independent Study and others) may be counted.
- Any intermediate or advanced-level course\(^1\) from atmospheric and oceanic sciences, botany, chemistry, geography, geoscience, mathematics\(^2\), microbiology, molecular and environmental toxicology, physics, population health sciences, soil science, statistics\(^2\), or zoology.
- Up to three credits of any intermediate or advanced-level course from agricultural and applied economics, economics, general business, or management and human resources.
- Up to three credits of CIV ENGR 1 Cooperative Education Program.
- Courses with social science, humanities, or literature breadth (H, S, L, W, X, Y, Z) cannot be used.
- Transfer/test math elective credits for calculus or STAT 301 Introduction to Statistical Methods may not be used to fulfill Professional Electives.

### LIBERAL STUDIES

**College of Engineering Liberal Studies Requirements**

Complete Requirements ([http://guide.wisc.edu/undergraduate/engineering/#requirementstext](http://guide.wisc.edu/undergraduate/engineering/#requirementstext))

**Requirements specific to Environmental Engineering:**

An economics course must be selected from the following list:

- ECON 101 Principles of Microeconomics
- ECON 102 Principles of Macroeconomics
- ECON 111 Principles of Economics—Accelerated Treatment

A minimum of three credits of environmental studies course that meets the breadth designations of Humanities, Literature, and/or Social Studies. Courses that also carry breadth designations of Biological Sciences, Natural Sciences, or Physical Sciences will not count towards this requirement.

### UNIVERSITY DEGREE REQUIREMENTS

To receive a bachelor’s degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.
Residency: Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.

Quality of Work: Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.

LEARNING OUTCOMES

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

FOUR-YEAR PLAN

First Year

Fall
MATH 221 5 MATH 222 4
CHEM 109 5 STAT 324 3
GEOSCI 100 or 106 3 INTEREGR 170 3
Communications A 3 M E 170 Environmental Studies 3

Spring

Total Credits 16

Second Year

Fall
MATH 234 4 MATH 319 3
E M A 201 3 E M A 202 3
CIV ENGR 320 3 CIV ENGR 325 3
Biology 3 ECON 101 4
Ethnic Studies 3 Liberal Studies 3

Spring

Total Credits 16

Third Year

Fall
CIV ENGR 310 3 CIV ENGR 311 3
CIV ENGR 324 3 CIV ENGR/G L E 291 4
PHYSICS 202 or 208 5 CIV ENGR 498 3
Liberal Studies 3 Lab Course 3
E P D 275 2 Env Engr Breadth #1 3

Spring

Total Credits 16

Fourth Year

Fall
CIV ENGR 494 3 CIV ENGR 578 4
INTEREGR 397 3 Env Engr Breadth #4 3
Env Engr Breadth #2 3 Professional Elective 3
Env Engr Breadth #3 3 Professional Elective 3
Professional Elective 3 Professional Elective 3
Professional Elective 2

Spring

Total Credits 16

Total Credits 128

ADVISING AND CAREERS

ADVISING

Each College of Engineering program has academic advisors dedicated to serving its students. Program advisors can help current College of Engineering students with questions about accessing courses, navigating degree requirements, resolving academic issues and more. Students can find their assigned advisor on the homepage of their student center.

ENGINEERING CAREER SERVICES

Engineering Career Services (ECS) assists students in identifying pre-professional work-based learning experiences such as co-ops and summer internships, considering and applying to graduate or professional school, and finding full-time professional employment during their graduation year.

ECS offers two major career fairs per year, assists with resume writing and interviewing skills, hosts workshops on the job search, and meets one-on-one with students to discuss offer negotiations.

Students are encouraged to utilize the ECS office early in their academic careers. For comprehensive information on ECS programs and workshops, see the ECS website or call 608-262-3471.

PEOPLE

PROFESSORS
Greg Harrington (Director)
Robert Anex
Tracey Holloway
James Hurley
Krishnapuram Karthikeyan
William Likos
Steven Loheide
Katherine McMahon
Daniel Noguera
Jim Park
Certification/Licensure

Licensure as a Professional Engineer is expected of environmental engineers. Information on steps needed to obtain licensure is available from the National Council for the Examination of Engineers and Surveyors (NCEES) at https://ncees.org/engineering/.

Accreditation

This new program will seek accreditation from the Engineering Accreditation Commission of ABET, http://www.abet.org. Application for accreditation will be made at the earliest opportunity, in 2024, with an ABET decision in 2025. If accreditation is awarded, it may be retroactively applied to those who graduated in Academic Year 2023-24.

Note: Undergraduate Program Educational Objectives and Student Outcomes are made publicly available at the Departmental website. (In this Guide, the program's Student Outcomes are designated by our campus as "Learning Outcomes.")