MISSION STATEMENT FOR ENVIRONMENTAL ENGINEERING PROGRAM

- Educate the next generation of environmental engineering professionals and assist in the education of other engineers and environmental scientists;
- Discover and develop new knowledge in environmental engineering;
- Share cutting edge research and new information and ideas through scientific media and outreach programs.

As part of a world-class university, Cornell’s Environmental Engineering Program inspires students and provides opportunities to engage with the local community, the nation and global society. The focus of the undergraduate program is to educate the leaders of the next generation’s environmental engineering professionals working in industry and in government. However, we recognize the need for direct engagement in research and outreach to inform the undergraduate program, to help it to remain cutting-edge and to provide those leaders with an appreciation of scientific and public issues.

PROGRAM EDUCATIONAL OBJECTIVES

The educational goals for the Environmental Engineering major are consistent with those of the College of Agriculture and Life Sciences, the College of Engineering and Cornell University. We are committed to providing an excellent undergraduate engineering program in a nurturing learning environment so that our graduates acquire knowledge and develop the needed skills for successful professional careers.

The Educational Objectives of the Environmental Engineering Major are to

1. Produce graduates who pursue careers in Environmental Engineering based on a background in mathematics, physical and life sciences, liberal studies and engineering.

2. Produce graduates who pursue advanced degrees in engineering and related professional fields.

3. Produce graduates who assume leadership positions and contribute to solutions of societal problems involving environmental systems.

In the assessment of the program, the three learning objectives are supplemented by 12 desirable student outcomes, which are listed in the appendix.

This engineering degree program is offered jointly by the Department of Biological & Environmental Engineering (in the College of Agriculture and Life Sciences) and the School of Civil & Environmental Engineering (in the College of Engineering).

Cornell University is an equal opportunity, affirmative action educator.
INTRODUCTION

The Department of Biological and Environmental Engineering (BEE) in the College of Agriculture and Life Sciences (CALS) and the School of Civil and Environmental Engineering (CEE) in the College of Engineering (CoE) jointly offer a B.S. degree program in Environmental Engineering. The Cornell B.S. in Environmental Engineering degree is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. The program is administered by the EnvE Program Committee made up of faculty from the two departments, in cooperation with the offices’ of the BEE Director of Undergraduate Programs and the CEE Associate Director. Information about the program, student status information, and student records can be obtained from those offices.

This handbook presents a description of the undergraduate program and the curricular requirements for this degree.

We welcome your interest in our program, whether that interest is as a prospective or continuing student, alumnus/alumna, or as a prospective employer of our students.

More information is available on our website: http://enve.cornell.edu/

If you have questions about the BS Environmental Engineering major, please contact:

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The rules and regulations stated in this handbook are for information only and in no way constitute a contract between the student and Cornell University. The University reserves the right to change any regulations or requirement at any time.

It is the policy of Cornell University to actively support equality of educational and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, marital status, citizenship, sex, sexual orientation, gender identity or expression, age, disability or protected veteran status. The University is committed to maintenance of affirmative action programs that will assure the continuation of such equal opportunity. Sexual harassment is an act of discrimination and, as such, will not be tolerated. Inquiries concerning the application of Title IX may be referred to Cornell’s Title IX coordinator (see [http://hr.cornell.edu/diversity/reporting/](http://hr.cornell.edu/diversity/reporting/) or contact the Office of Workforce Policy and Labor Relations, 391 Pine Tree Rd., Ithaca, NY 14850; Phone: (607) 254-7232; e-mail [equalopportunity@cornell.edu](mailto:equalopportunity@cornell.edu).

Cornell University is committed to assisting those persons with disabilities who have special needs. Information for accommodations for faculty, staff, students and visitors may be found at [www.cornell.edu/diversity](http://www.cornell.edu/diversity).
WHAT IS ENVIRONMENTAL ENGINEERING?

We live at a time when no part of the natural environment is untouched by human activities. Although we have made great strides in addressing many of the natural resources and environmental problems caused by human activities, growth in the world population and rising standards of living continue to stress the natural environment and generate a spectrum of environmental problems that need to be addressed. Environmental engineers are called upon to understand, arrange, and manipulate the biological, chemical, ecological, economic, hydrological, physical, and social processes that take place in our environment in an effort to balance our material needs with our impacts on the environment. The challenges of sustainability and global climate make these tasks all the more important.

The Environmental Engineering major is structured to provide students with appropriate background in the physical, chemical and biological sciences together with the mathematical, planning, analysis and design tools necessary to address complex environmental engineering concerns. The graduate and research programs in BEE and CEE focus on water and wastewater treatment processes, fate and transport of contaminants in natural aquatic systems, design and management of environmental and water resource systems, environmental fluid mechanics, and hydraulics and hydrology.

The collaborative BEE/CEE major in Environmental Engineering is supported by excellent teaching and research facilities including: laboratories for the analysis of water chemistry, physical/chemical/biological processes, biochemistry and microbiology. Cornell University is also the home of the Cornell Center for Advanced Computing, the Institute of Biotechnology, and the Atkinson Center for a Sustainable Future that oversees and supports many interdisciplinary environmental research programs. The wide variety of teaching and research activities, the world-class research facilities and the interdisciplinary centers at Cornell University provide students with excellent opportunities for study and research in Environmental Engineering.
PROGRAM DETAILS

There are two administrative pathways Cornell students may use to complete the Environmental Engineering major. They may matriculate in the College of Engineering and affiliate with the Environmental Engineering major in the CEE department, or they may matriculate in the College of Agriculture and Life Sciences and major in Environmental Engineering in the BEE department. The curriculum and degree requirements are the same for all students in the Environmental Engineering major regardless of the administrative pathway a student selects, except for minor differences in the freshman year. Faculty advisors are assigned to each undergraduate at the time they formally enter the major.

Affiliation (College of Engineering Enrolled Students)
Students who matriculate in the College of Engineering (CoE) may affiliate with the Environmental Engineering major in their second year of study. (Transfer students entering the CoE typically affiliate with their major program at the time of transfer.) Affiliated students pay endowed tuition and complete all Environmental Engineering requirements while enrolled in the engineering college.

Joint Program (College of Agriculture and Life Sciences Enrolled Students)
Students who enroll in the College of Agriculture and Life Sciences (CALS) as freshmen majoring in Environmental Engineering complete a joint degree program with the College of Engineering. In the joint degree program, students register in CALS for their freshmen and sophomore years and then are registered jointly with CALS and CoE for their junior and senior years. The primary college in the junior year and senior year continues to be with CALS Students in the joint degree program pay state contract college tuition all four years of their program.

Oversight of the Environmental Engineering major is provided by an EnvE Program Committee composed of faculty from BEE and CEE.
WHAT DO OUR GRADUATES DO?

Career opportunities for Environmental Engineering graduates cover the spectrum of private industry, public agencies, NGOs, and educational institutions. Environmental Engineers may work as designers, planners, operators of pollution control plants, and water supply systems, educators, consultants to private and public businesses, government regulatory agency officials, or program managers in profession and technical engineering societies. Environmental Engineers design systems to prevent, reduce, or repair environmental damage caused by human activities. They work to contain, reduce, or prevent hazardous waste, air pollution, and contaminated streams and groundwater.

Environmental Engineers design water treatment plants to deliver safe drinking water to municipal residents and also design pollution control systems for industries and cities. They help in the reconstruction of wetlands and estuaries to preserve the environment and to maintain habitat for fish and wildlife. In recent years graduates have pursued careers in engineering consulting, management and business, teaching, research, and international development.

Many graduates with an Environmental Engineering degree continue their education at the finest graduate schools around the world. They pursue Master of Engineering (M. Eng.), Master of Science (M.S.), or Doctoral (Ph.D.) programs in various related engineering disciplines, or they sometimes complement their engineering degrees with a Master of Business Administration (MBA) or Doctor of Law (LLD) degree. Because of the requirements for coursework in biology and chemistry, the undergraduate major in Environmental Engineering is also an excellent choice for students interested in a broad range of environmental sciences.
ENVIRONMENTAL ENGINEERING MAJOR

DEGREE REQUIREMENTS
# ENVIRONMENTAL ENGINEERING MAJOR

## DEGREE REQUIREMENTS

A student earning a Bachelor of Science degree in the Environmental Engineering major must complete the following academic requirements, which apply to students matriculating in the fall semester of 2015 or later. A minimum of 125 credit hours is required.

<table>
<thead>
<tr>
<th>Group</th>
<th>Subject Matter</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mathematics</td>
<td>16</td>
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<tr>
<td></td>
<td>(1910, 1920, 2930, 2940)</td>
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<tr>
<td></td>
<td>All math courses in this sequence must be completed with a grade of C- or better.</td>
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<tr>
<td>2.</td>
<td>Chemistry</td>
<td>7</td>
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<tr>
<td></td>
<td>General Chemistry (2090, 2070 or 2150)</td>
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<tr>
<td></td>
<td>Organic Chemistry (1570 recommended or 3530, 3570)</td>
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<tr>
<td>3.</td>
<td>Physics</td>
<td>8</td>
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<tr>
<td></td>
<td>Calculus-based physics (1112, 2213 or 2217)</td>
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<tr>
<td>4.</td>
<td>Computer Programming</td>
<td>4</td>
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<tr>
<td></td>
<td>Intro to Computing (CS 1110 or CS 1112 and students who matriculated Fall 2011 or earlier must also take CS 1130 or CS 1132)</td>
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<td>5.</td>
<td>Biological Sciences</td>
<td>3-4</td>
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<td></td>
<td>Introductory Biology (BIOEE/BIOSM 1610, BIOMG 1350, BIOEE/BIOSM 1780, BIOG 1440, or BIOG 1445)</td>
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<tr>
<td>6.</td>
<td>Written Expression</td>
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<td></td>
<td>First Year Writing Seminars</td>
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<tr>
<td>7.</td>
<td>Engineering Distribution and Field Courses (all must be taken for letter grade)</td>
<td>57</td>
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<tr>
<td></td>
<td>Introduction to Engineering</td>
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<td></td>
<td>ENGRI XXXX (3 credits) (ENGRI 1130 is recommended), or The BEE Experience - BEE 1200 [required for students matriculating in CALS] (1 credit)</td>
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<td></td>
<td>Engineering Processes for Environmental Sustainability - ENGRD/BEE 2510 (3 credits)</td>
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<td></td>
<td>ENGRD XXXX - (ENGRD 2020, 2210, or 3200 are recommended) (3-4 credits)</td>
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<td></td>
<td>Engineering Management - BEE 4890 or CEE 3230 (3 credits)</td>
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<td></td>
<td>Fluid Mechanics - CEE 3310 (4 credits)</td>
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<td></td>
<td>Earth Science (select one course) - (see list of approved courses on page 10) (3 or 4 credits)</td>
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<td></td>
<td>Environmental Quality Engineering - CEE 3510 (3 credits)</td>
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<td></td>
<td>Microbiology for Environmental Engineering - CEE 4510 (3 credits)</td>
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<td></td>
<td>Engineering Laboratory (select one course) - (see list of approved courses on page 10) (3 or 4 credits)</td>
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<td></td>
<td>Environmental Systems Analysis - BEE 4750 (3 credits)</td>
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<td></td>
<td>Environmental Engineering Design Electives (9 credits) (see list of approved courses on page 10; at least three credits must be from Capstone Design Electives, with any remaining credits coming from Design Electives)</td>
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<td></td>
<td>Environmental Engineering Major-Approved Electives (6 credits) (see list of approved courses on page 11)</td>
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<td></td>
<td>Other Environmental Engineering Electives to bring total category to 57 credits. These will generally consist of technical engineering courses at 2000 level or above from BEE or College of Engineering. A maximum of 4 credits of BEE 4970-4990 or CEE 3090, 4010 may be used in this category.</td>
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<td></td>
<td>Technical Writing Course. Approved technical communication courses are listed in the Courses of Study, College of Engineering section. BEE 4730 or BEE 4890 (required to be co-registered with ENGRC 4890) are on the approved list.</td>
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</table>
**DEGREE REQUIREMENTS (CONTINUED)**

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<thead>
<tr>
<th>Group</th>
<th>Subject Matter</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>8.</td>
<td>Liberal Studies (6 courses)</td>
<td>18</td>
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</table>

Liberal Studies courses are listed in the *Courses of Study*, College of Engineering section. At least six courses must be completed, including at least three of the seven categories:

1. Cultural Analysis (CA)
2. Historical Analysis (HA)
3. Literature and the Arts (LA)
4. Knowledge, Cognition, and Moral Reasoning (KCM)
5. Social & Behavioral Analysis (SBA)
6. Foreign Language (not literature) (FL)
7. Communications in Engineering (CE)

*At least 2 courses must be 2000 level or higher.*

| 9. | Advisor Approved Electives | 6 |

These courses are selected by the student with approval of the Faculty Advisor.

**TOTAL MINIMUM ............... 125**

*aSubstitution for Distribution Course. Students using any of the required courses ENGRD 2020, 2210, 3200, or CEE 3040 to also fulfill the second engineering distribution requirement, must take an additional 3-credit major-approved elective in order to accrue the necessary number of Engineering Distribution and Field Course credits in their program. Such substitutions are common and increase students’ flexibility to choose courses that interest them. Because this major-approved elective is substituting for what would otherwise be a distribution course, advisors will often accept as a substitute 3000-level engineering course, courses that are not as advanced as those on the general MAE list.

*bCS 1112 and BEE 1200 together (5 credits) satisfy the ENGRI requirement for CALS matriculated first-year students. Students using CS 1112 and BEE 1200 to satisfy the ENGRI requirement must make up the 2 credit difference with engineering coursework.

*cENGRD 2700 is accepted (by petition) to substitute for CEE 3040 if taken prior to affiliation with the Environmental Engineering Major, or if necessary because of scheduling conflicts caused by Co-op or Study Abroad.

*dStudents may take BIOMI 2900 in place of CEE 4510.

*eStudents meeting the technical communications requirement with a course that fulfills another requirement (e.g. Liberal Studies, Major-Approved Elective), may use it to satisfy both requirements.*

**Physical Education**

Two semesters of physical education are required. All students must pass a swim test prior to graduation. Transfer students are exempted from one semester of PE for each full-time semester they transfer into Cornell.

**Special Courses**

Courses such as PHYS 1012 do not count toward graduation requirements.

**Letter and S/U Grading**

All courses must be taken for letter grade except for Liberal Studies and Advisor Approved Electives.

Additional program information is provided in the College of Engineering section of the *Courses of Study* and in the College of Engineering Undergraduate Handbook including descriptions of allowable minors.
APPROVED LABORATORY AND EARTH SCIENCE COURSES
Updated lists of approved courses are on-line at: http://enve.cornell.edu/

Laboratory Courses
BEE 4270 Water Measurement and Analysis Methods (3 cr, Fall)
CEE 4370/6370 Experimental Methods in Fluid Dynamics
   (3/4 cr, Spring, Offered Alternate Years)¹
CEE 4530 Lab Research in Envir. Eng. (3 cr, Spring, Not Offered 2017-2017)

Earth Science Courses
BEE/EAS 4800 Our Changing Atmosphere: Global Change and Atmospheric Chemistry
   (3 cr., Spring)
BEE/EAS 4940 Terrestrial Hydrology in a Changing Climate
   (3 cr, Spring, Offered Alternate Years; Next Offered 2017-2018)²
EAS 2250 The Earth System (4 cr, Spring)
EAS 2680 Climate and Global Warming (3 cr, Spring)
EAS 3010 Evolution of the Earth Systems (4 cr., Fall)
EAS 3030 Introduction to Biogeochemistry (4 cr, Fall)
EAS 3050/5051 Climate Dynamics (3 cr, Fall)
EAS 4830 Environmental Biophysics (3 cr., Fall, Offered Alternate Years, )
PLSCS 2600 Soil Science (4 cr, Fall)
PLSCS 3650 Environmental Chemistry: Soil, Air, and Water (3 cr, Spring)
NTRES 3240 Sustainable, Ecologically Based Management of Water Resources (3 cr. Spring)

Note: More advanced Earth Science courses generally accepted by petition.

DESIGN AND MAJOR APPROVED ELECTIVES
A total of 5 Capstone Design, Design and Major-Approved Electives must be selected from among the courses in the list below. At least three of these five courses must be Capstone Design or Design Electives. At least one of the three design electives must be a capstone design elective. Capstone design courses are designated with an asterisk (*).

Design and Capstone Design Electives
   BEE 4010 Renewable Energy Systems (3 cr, Spring)
* BEE 4730 Watershed Engineering (4 cr, Fall)
* BEE 4740 Water and Landscape Engineering Applications (3 cr, Spring)
   BEE 4760 Solid Waste Engineering (3 cr, Spring)
* BEE 4870 Sustainable Bioenergy Systems (3 cr, Fall, Next Offered 2017-2018)
* CEE 4540 Sustainable Municipal Drinking Water Treatment (3 cr, Fall)
   CEE 4550 AguaClara: Sustainable Water Supply Project (3 cr, Fall, Spring)
   CEE 6370 Experimental Methods in Fluid Mechanics (4 cr, Spring, Offered Alternate Years)¹
CEE 4650/6650 Transportation, Energy, and Environmental Systems for Sustainable Development
   (3 cr, Spring, Next Offered 2018-2019)
Major-Approved Electives
BEE 3299 Sustainable Development (3 cr, Fall, Spring)
BEE 3710 Physical Hydrology for Ecosystems
  (3 cr, Spring, Offered Alternate Years)
BEE 4200/6200 Surface Chemistry of Particles in Natural and Engineered Processes (3 cr. Fall)
BEE/EAS 4710 Introduction to Groundwater
  (3 cr, Spring; Offered Alternate Years, Next Offered 2017-2018)
BEE/EAS 4800 Our Changing Atmosphere: Global Change and Atmospheric Chemistry
  (3 cr. Spring)
BEE 4880 Applied Modeling and Simulation for Renewable Energy Systems (3 cr, Spring,)
BEE/EAS 4940 Terrestrial Hydrology in a Changing Climate
  (3 cr, Spring, Offered Alternate Years; Next Offered 2016-2017)  
CEE 3410 Introduction to Geotechnical Engineering and Analysis (4 cr, Fall)
CEE/PLSCS 4110 Applied Remote Sensing and GIS for Resource Inventory and Analysis (3 cr, Fall)
CEE 4320/6320 Hydrology (3 cr. Fall, Next Offered 2017-2018)
CEE 4370 Experimental Methods in Fluid Mechanics (3 cr, Spring, Offered Alternate Years)
CEE/TOX 5970 Risk Analysis and Management (3 cr, Spring)
CEE 6000 Numerical Methods for Engineers (3 cr, Fall)
CEE/CSS 6100 Remote Sensing Fundamentals (3 cr, Fall)
CEE 6300 Spectral Methods for Incompressible Fluid Flows (3 cr, Fall, Next Offered 2017-2018)
CEE 6310 Computational Simulation of Flow and Transport in the Environment (3 cr, Spring, Offered Alternate Years, Next Offered 2017-2018)
CEE 6530 Water Chemistry (3 cr, Fall)
CEE 6550 Transport, Mixing and Transformation in the Environment (3 cr, Fall)
CEE 6560 Physical/Chemical Processes (3 cr, Fall)
CEE 6570 Biological Processes (3 cr, Spring)
CHME 6610 Air Pollution Control (3 cr, Spring)
CHME 6660 Analysis of Sustainable Energy Systems ( 3 cr, Fall)
EAS 4570 Atmospheric Air Pollution (3 cr, Fall, Offered Alternate Years)
EAS/MAE 6480 Air Quality & Atmospheric Chemistry (3 cr, Fall, Offered Alternate Years)

\(^1\)CEE 6370 can be used to fulfill both lab and design requirement, but students must then take an additional major approved elective from list.

\(^2\)BEE/EAS 4940, Terrestrial Hydrology, may be counted by petition as either an Earth Science or a Major Approved Elective, but not both.

Note:
Note: EnvE Major Approved Electives are 3 or 4 credit environmental engineering-related technical courses that support the professional objectives of the student and which have either (1) a technical prerequisite that is a required engineering course in the EnvE curriculum, or (2) an advanced rank limited to juniors or above.
ENVIRONMENTAL ENGINEERING 2016-2017

ENVE ELECTIVE COURSES FOR UNDERGRADUATES OFFERED BY BEE AND CEE

Energy and Sustainable Development
BEE 3299 Sustainable Development - M. Walter
BEE 4010 Renewable Energy Systems - Timmons
BEE 4760 Solid Waste Engineering - Haith
BEE 4870 Sustainable Bioenergy Systems - Hunter
BEE 4880 Applied Modeling & Simulation for Renewable Energy Systems - Anderson
CEE 4650 Urban Transportation and Environmental/Energy Systems Planning and Sustainable Development – Gao

Environmental Treatment Processes
BEE 4200 Surface Chemistry of Particles in Natural and Engineered Processes - Aristilde
BEE 4760 Solid Waste Engineering - Haith
CEE 1130 Sustainable Engineering of Energy, Water, Soil and Air Resources – Reid
CEE 4550 AguaClara: Sustainable Water Supply Project - Weber-Shirk
CEE 4530 Laboratory Research in Environmental Engineering - Helbling
CEE 4540 Sustainable Municipal Drinking Water Treatment - Weber-Shirk
CEE 6530 Water Chemistry for Environmental Engineering – Lion
CEE 6560 Physical/Chemical Processes - Helbling
CEE 6570 Biological Processes – Gossett

Modeling and Systems Analysis
BEE 4880 Applied Modeling & Simulation for Renewable Energy Systems - Anderson
CEE 4110 Remote Sensing for Environmental Resource Inventory – DeGloria
CEE 5970 Risk Analysis and Management - Stedinger
CEE 6200 Water Resources Systems Engineering - Reed
CEE 6930 Public Systems Modeling – Loucks
CEE 6550 Transport, Mixing and Transformation in the Environment - Albertson

Hydrology and Fluid Mechanics
BEE 3710 Physical Hydrology for Ecosystems - T. Walter
BEE 4270 Water Measurement and Analysis Methods - Geohring
BEE 4710 Introduction to Groundwater - Cathles, T. Walter & Steenhuis
BEE 4730 Watershed Engineering - T. Walter
BEE 4740 Water and Landscape Engineering Applications - Geohring
BEE 4800 Our Changing Atmosphere: Global Change & Atmospheric Chemistry - Hess
BEE 4940 Terrestrial Hydrology in a Changing Climate – Hess & T. Walter
CEE 4320 Hydrology – Albertson
CEE 4350 Coastal Engineering - Liu
CEE 4360 Case Studies in Environmental Fluid Mechanics - Cowen
CEE 4370 Experimental Methods in Fluid Dynamics - Cowen
Environmental Engineering Major (EnvE) Roadmap
a Students matriculated in CALS usually take CS 1112 for the computing requirement. Engineering students may take CS 1110, 1112, or 1114. (Students who matriculated Fall 2011 or earlier must also take CS 1130 or CS 1132)
b Engineering matriculates must enroll in CHEM 2090 (fall, spring); CALS matriculates must enroll in CHEM 2070 (fall). Students in either college may also substitute CHEM 2150 for CHEM 2090 or CHEM 2070.
c In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, approved elective or major course. An approved COMM or ENGR course, or BEE 4730, or BEE 4890 (required to be co-registered with ENGR 4890), will satisfy this requirement. Students meeting the technical communications requirement with a course that fulfills another requirement (e.g. Liberal Studies, Lab, Design) can use that one course to satisfy both requirements.
d BEE 1200 combined with CS 1112: Introduction to Computing Using MATLAB (5 credits total) satisfies the ENGRI requirement for CALS matriculated students. Students using BEE 1200 and CS 1112 to satisfy the ENGRI requirement must make up the 2-credit difference with engineering course work.
e Choose one of the following biology courses: BIOEE/BIOSM 1610, BIOMG 1350, BIOEE/BIOSM 1780, BLOG 1440, BLOG 1445. Complete before semester 5. If you received a 4 on AP BIO, you will receive 4 credits of intro bio. If you received a 5 on AP BIO, you will receive 8 credits of intro bio and 4 credits will satisfy the intro bio requirement.
f ENGRD 2020 (fall and spring) and 2210 (fall and summer), 3200 (spring) or BEE 2220 (spring) are recommended. Students electing to use ENGRD 2020, 2210, or 3200 as a second engineering distribution must take an additional Major-approved elective to make up the credits.
g CHEM 1570 (spring), CHEM 3530 (Fall), CHEM 3570 (fall).
h ENGRD 2700: Basic Engineering Probability and Statistics is accepted (by petition) to substitute for CEE 3040 if taken prior to affiliation with Environmental Engineering, or if necessary because of scheduling conflicts caused by co-op or study abroad programs.
i Students may take BIOMI 2900 General Microbiology Lectures, in place of CEE 4510.
j The lists of suggested courses are published in the Undergraduate Handbook for Environmental Engineering. At least one design elective must be chosen from the list of Capstone design courses.
k CEE 3230 (spring), BEE 4890 (fall).

Student Program Progress Form

The progress of each student toward completion of degree requirements is charted on a Program Progress Form. A blank report appears on the following pages. Courses that have been completed are shown in their appropriate categories on this form. Students are encouraged to examine their Program Progress Form and to report errors and desired adjustments to the Undergraduate Coordinator in either 207 Riley-Robb Hall (BEE) or 221 Hollister Hall (CEE). It is important that the record be complete and accurate, because it is used to determine a student’s eligibility for graduation.
ENVIRONMENTAL ENGINEERING PROGRAM PROGRESS FORM
(Appplies to students matriculating in the Fall Semester of 2015 or later)

<table>
<thead>
<tr>
<th>Name:</th>
<th>Email:</th>
<th>Advisor:</th>
<th>CU ID:</th>
<th>2nd Major:</th>
<th>Minor:</th>
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<tr>
<th>COURSE</th>
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<th>GRADE</th>
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<th>COMMENTS</th>
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1) **Math, Chemistry, Physics, Computing, Biology (38 credits)**
- MATH 1910 4
- MATH 1920 4
- MATH 2930 4
- MATH 2940 4
- CHEM 2090, 2070 or 2150 4
- CHEM 1570 or 3570, 3530 3
- PHYS 1112 4
- PHYS 2213 or 2217 4
- CS 1110 or 1112 4
- BIOG 1XXX 3

2) **Engineering Distribution & Major Courses -- all letter grade (42 credits)**
- ENGRI 1XXX 3 or BEE 1200 (+CS 1112)
- ENGRD 2510 3
- ENGRD XXXX 3
- ENGRD 2020 4
- ENGRD 3200 or 2210 or BEE 2220 3
- CEE 3040 4
- CEE 3230 or BEE 4890 3
- CEE 3310 4
- CEE 3510 3
- CEE 4510 3
- BEE 4750 3
- Earth Science 3
- Lab course 3

3) **Design Courses & Major-Approved Electives (See approved List; 15 credits)**
- Design Course - Capstone
- Design Course
- M-A Elective
- M-A Elective

4) **Courses to Bring Total Env Program Credits in Section 2 & 3 to 57 Because of Substitutions**

5) **Freshman Writing Seminars (6 credits)**
- 3

6) **Liberal Studies: 6 courses (at least 2 courses at 2000 level or above and 3 categories; 18 total credits)**

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<tr>
<td>CA: Cultural Analysis</td>
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<tr>
<td>HA: Historical Analysis</td>
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<tr>
<td>LA: Literature and the Arts</td>
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<td>CE: Communications in Engineering</td>
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7) **Advisor Approved Electives (6 cr. Minimum)**

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8) **Additional Courses (Not required for graduation)**

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**TOTAL CREDITS:** 125

*CS 1130 or 1132 is required for students who matriculated Fall 2011 or earlier.*
MINORS

Environmental Engineering majors may choose to complete one or more of the 70 minors offered by different departments and colleges. Most students can complete a minor within their Environmental Engineering program in 8 semesters provided they work closely with their faculty advisor to carefully plan and schedule their courses. Completion of a minor is noted on the final Cornell transcript as official recognition of academic achievement above and beyond the student’s Bachelor of Science degree requirements. The Minor in Environmental Engineering offered by BEE and CEE is NOT available to Environmental Engineering majors.

Minors are listed on-line at: http://www.cornell.edu/academics/fields.cfm. More detailed information on engineering minors can be found in the Engineering Undergraduate Handbook http://www.engineering.cornell.edu/academics/undergraduate/curriculum/handbook/

OTHER SPECIAL PROGRAMS

Please consult the Engineering Undergraduate Handbook for information on the following additional special programs: the Independent Major, Double Majors, Dual Degree, Study Abroad, and the Undergraduate Research Program.

Information on the Exchange Program with the Universidad de Cantabria in Santander, Spain is available at http://www.engineering.cornell.edu/cee/academics/undergraduate/exchange.cfm

GOOD ACADEMIC STANDING

Undergraduates in Environmental Engineering are in *Good Standing* if they are making acceptable progress toward completion of the requirements for graduation. Acceptable progress in EnvE is defined as meeting the following requirements:

- Semester GPA ≥ 2.0.
- Cumulative GPA ≥ 2.0.
- A semester GPA ≥ 2.0 in Core EnvE Courses, Design Courses, Major-approved Electives, and Engineering Distribution Courses (Tech GPA).
- 12 credit hours each semester.
- No failing grades.
- *At most one grade below C- can be used to fulfill the EnvE degree requirements in the following four categories: required Core Courses, Design Courses, Major-approved Electives, and Engineering Distribution Courses.*

*Grade(s) below C– in these courses, beyond the first, will require that one or more course(s) be repeated. (The College of Engineering also requires that each course in the required mathematics sequence - 1910, 1920, 2930, 2940 - be passed with a grade of C- or better.)
Students who fail to achieve good-standing status receive a warning, required to take a leave of absence for one or more terms, or required to withdraw. The specific action in each case is based upon the pertinent circumstances as well as the student's previous academic record.

EnvE’s policy about academic action procedures provides for two separate reviews of the student's record by the Program’s Committee on Academic Standards, Petitions and Credits (CASPAC). The first review is to identify those students who have not made satisfactory progress during the term and to assign academic actions where deemed appropriate. Students who receive actions are notified by letter sent to both their home and email addresses. This letter includes a request for information about possible extenuating circumstances and an invitation to appeal the committee’s action. Appeals must be in writing. If an appeal is made, CASPAC will review the appeal and render its decision.

**HONORS PROGRAM**

The environmental engineering honors program consists of at least nine credits beyond the minimum required for graduation in the environmental engineering major. These nine credits must be drawn from one or more of the following categories with at least 3 credit hours in the first category:

1. A significant research experience or honors project under the direct supervision of an Environmental Engineering faculty member using BEE 4990 Undergraduate Research (3 credits), BEE 4993 Honors Thesis (3 credits) or CEE 4000: Senior Honors Thesis (1 to 6 credits per semester). A significant written report or senior honors thesis must be submitted as part of this component. Letter grade only.

2. A significant teaching experience under the direct supervision of a faculty member using a regularly recognized Engineering College course (i.e., Undergraduate Engineering Teaching, BEE 4980 or CEE 4010 [1 to 4 credits per semester]).

3. Advanced or graduate courses at the 4000 level or above.

No research, independent study, or teaching for which the student is paid may be counted toward the honors program.

*Eligibility:* students must enter with and maintain a cumulative GPA equal or greater than 3.50.

*Application:* students must apply no later than the beginning of the first semester of their senior year but are encouraged to apply as early as the first semester of their junior year. All honors program students must be in the program for at least two semesters before graduation.
Note – Latin Honors

- Cum laude is awarded to all engineering students with an overall GPA > 3.50. Cum laude is also awarded to all engineering students who received a semester GPA > 3.50 in each of the last four semesters of attendance at Cornell; in each of these semesters, at least 12 letter-grade credits must be taken with no failing, unsatisfactory, missing, or incomplete grades. If the student is an Engineering Co-op student, then the Engineering Co-op summer term will count as one of the last four. Students who were approved for prorated tuition in their final semester will be awarded cum laude if they received a semester GPA > 3.50 in their last semester and meet the conditions above in the prior four semesters.

- Magna cum laude is awarded to all engineering students with a GPA > 3.75 (based on all credits taken at Cornell).

- Summa cum laude is awarded to all engineering students with a GPA > 4.0 (based on all credits taken at Cornell).

- All GPA calculations are minimums and are not rounded.

AWARD

The Walter Lynn Medal is given annually to an outstanding graduating senior majoring in Environmental Engineering of admirable character whose scholastic achievement is most distinguished over the four consecutive years of study at Cornell. The award consists of a gold medal and a certificate. This award was established in 2011 in honor of Professor Walter Lynn, an active Cornell faculty member for fifty years, founder of the environmental and water resources systems engineering program at Cornell, and Director of the School of Civil and Environmental Engineering from 1970-1978. During his tenure at Cornell, he was the founding Director and head of the Cornell Center for Environmental Quality Management; Director for the Program on Science, Technology, and Society; Director of the Center for the Environment; and Dean of the Cornell Faculty. Professor Lynn was known nationally as a leader on environmental issues and was founding chair of the U.S. National Research Council's Board on Natural Disasters.

DOUBLE MAJOR WITH CIVIL ENGINEERING OR BIOLOGICAL ENGINEERING

Students in Environmental Engineering wishing to pursue a double major with Civil Engineering or with Biological Engineering must have a program plan that reflects distinct thrusts in the two areas. Among the five courses used for Design and Major-approved Electives, the five used for the BSCE or the BSBE degree should include four courses not used for the core program or Design and Major-approved elective for the Environmental degree program, and vice versa. The extra courses may be used as advisor approved electives. If interested please complete the double major form available in Engineering Advising (167 Olin Hall) or at the undergraduate coordinator’s office (HLS 221 or RRB 207).
**SELECTED ENVIRONMENTAL ENGINEERING COURSE DESCRIPTIONS**

**BEE 1200**  The BEE Experience  
Spring  1 credit  
J. B. Hunter  
Letter grade only. Requirement for CALS BEE freshman. Not required for students who have completed an ENGRI course. Prerequisite: BEE majors or permission of instructor. Lec T 3:35-4:25.  
Forum covering the career opportunities for engineering students and the activities and curricula that lead to these opportunities. A series of seminars are given by practicing engineers, Cornell faculty members, alumni, staff from the Cornell Career Offices, and students. Students develop their undergraduate course plans; complete a web search assignment to locate jobs and internships, and select future courses to meet their academic objectives and career goals.

**BEE 2000**  Perspectives on Climate Change  
Spring  1 credit  
P.G. Hess, N.M. Mahwold  
This university-wide seminar series provides critically important perspectives on the grand challenge of climate change. Speakers from Cornell University and other institutions will cover a range of topics including the science of climate change, implications for ecosystems, oceans, forests, agriculture and communities, the important ethical, philosophical and legal insights on the issue, and provide thoughts on societal responses through international mechanisms, economic drivers and communication tools. This seminar series counts towards the requirements of the climate change minor.

**BEE 2220**  Bioengineering Thermodynamics and Kinetics  
Spring  3 credits  
J. B. Hunter  
Letter grade only. Prerequisite: MATH 1920, PHYS 2213 and chemistry course completed or concurrent. Lec M W F 11:15-12:05.  
Living systems rely on chemical and phase equilibria, precise coordination of biochemical pathways, and the release of chemical energy as heat, all of which are governed by the laws of thermodynamics and the rates of chemical reactions. The course covers concepts and laws of thermodynamics as applied to phase transformations, work, heat, and chemical reactions; and reaction kinetics applied to industrial processes and living systems, all with a focus on biological examples.

**BEE 2510**  Engineering Processes for Environmental Sustainability (ENGRD 2510)  
Fall  3 credits  
L. Aristilde  
Letter grade only. Pre- or co-requisite: MATH 2930. Lec T R 10:10-11:25.  
Case studies of contemporary environmental issues including pollutant distribution in natural systems, air quality, hazardous waste management and sustainable development. Emphasis is on the application of math, physics and engineering sciences to solve energy and mass balances in environmental sciences. Introduces students to the basic chemistry, ecology, biology, ethics and environmental legislation relevant to the particular environmental problem. BEE students must complete either BEE 2510 or BEE 2600 according to their academic plan. BEE students who complete both BEE 2510 and BEE 2600 receive engineering credit for only one of these courses.

**BEE 3299**  Sustainable Development  
Fall, Spring  3 credits  
M. F. Walter  
S-U or Letter grade. Prerequisite: at least sophomore standing. Course is web based.  
Sustainable development is the dominant economic, environmental and social issue of the 21st century. This course develops the concepts of sustainable development as an evolutionary process, demanding the integration of the physical sciences and engineering with the biological and social sciences for design of systems. Topics include the nature of ecosystems, global processes, sustainable communities, and industrial ecology, renewable energy and life cycle analysis.

**BEE 3710**  Physical Hydrology for Ecosystems (Offered alternate years)  
Spring  3 credits  
M. T. Walter  
Letter grade only. Prerequisite: MATH 1920 or permission of instructor. Lec T R 9:05-9:55; Lab R 2:30-4:25.
This is an introduction to physical hydrology with an emphasis on roles and interactions between hydrological processes and, ecological, biogeochemical, and human systems. www.hydrology.bee.cornell.edu/BEE371Index.htm

BEE 4010 Renewable Energy Systems
Spring 3 credits
M. B. Timmons
Letter grade only. Prerequisite: BEE 2220 or ENGRD 2210, or BEE 3310 or CEE 3310. Lec T R 10:10-11:25.

Introduces energy systems with emphasis on quantifying costs and designing/optimizing renewable energy systems to convert environmental inputs into useful forms of energy. Covers solar energy, small scale hydropower, wind, house energy balances, and psychrometric principles as applied to biomass drying. Focuses on the technologies and small-scale system design, not policy issues. Use of spreadsheets is extensive. Personal laptop computers are required for each class. Class time is often focused on solving weekly homework problems. Required term project that student selects a client and develops a project proposal on a self-selected renewable energy project.

BEE 4270 Water Measurement and Analysis Methods
Fall 3 credits
L. D. Geohring, T. S. Steenhuis
Letter grade only. Satisfies BE and EnvE laboratory experience requirement. Prerequisites: CEE 3310 or hydrology course. Lec T 9:05-9:55; Lab T 1:25-4:25.

Get wet and muddy learning how to monitor and characterize water and soil management problems in the natural environment. This is a field based lab course that integrates science and engineering technologies, using various measurement equipment and analytical techniques to quantify water flow and quality parameters in surface and subsurface environments. Measurement accuracy, water sampling quality assurance protocols, and interpretation of watershed contaminants are addressed.

BEE 4710 Introduction to Groundwater (EAS 4710; offered alternate years; next offered 2017-2018)
Spring 3 credits
T. S. Steenhuis, L. M. Cathles, M. T. Walter
S-U or Letter grade. Prerequisites: fluid mechanics or hydrology course. Lec F 1:25-4:25, Field Trip.

Fresh water is a limited resource that is under pressure worldwide because of increasing populations and a changing climate. Water in general and groundwater in specific is an important source of drinking water that we need to conserve for future generations. In this course, you will learn how to apply theory of groundwater flow and contaminant transport to real world groundwater pollution problems, simplifying the problem in such a way that it is easily solvable. The focus of many hydrology courses is theory, and deriving analytical equations. This is not the case in Introduction to groundwater. Although the theory is important, a good engineer knows the answer to a problem beforehand and then finds ways to calculate the solution. We will practice this by putting conceptual, analytical and simulation models in the broader context of past, current, and potential future groundwater quantity and quality issues triggered by natural, human, or combined actions. This elective course is intended for seniors and graduate students interested in environmental processes, and essential for those wanting to learn how to use their knowledge to solve real world problems.

BEE 4730 Watershed Engineering
Fall 4 credits
M. T. Walter
Letter grade only. Satisfies BE and EnvE capstone design requirement. Satisfies College of Engineering technical writing requirement. Prerequisite: CEE 3310 or hydrology course. Lec T R 10:10-11:00; Disc R 1:25-4:25.

This course teaches basic design and analysis as practiced for water control and nonpoint source pollution prevention. We will discuss the origins of design approaches including their theoretical bases but this is not a theory course. Most of the course is dedicated to practicing applied design. Assignments are generally representative of real-life engineering problems and will involve as much hands-on experience as possible. Some example topics include risk analysis, water conveyance, nonpoint source pollution control, stream restoration, stormwater management, and erosion control.

BEE 4740 Water and Landscape Engineering Applications
Spring 3 credits
L. D. Geohring, T. S. Steenhuis
Letter grade only. Satisfies BE and EnvE capstone design requirement. Prerequisite: CEE 3310 or hydrology course or permission of instructor. Lec M W F 12:20-1:10.

This course will focus on how water moves in soil and the implications for design of drainage and irrigation systems in the landscape. The course addresses aspects of soil physics, flow in porous media, water quality and water supply or disposal in regard to drainage and irrigation applications. Emphasis is on problem solving of actual situations, and a major site-design project is required.
**BEE 4750 Environmental Systems Analysis**  
(next offered 2017-2018)  
Fall 3 credits  
C. L. Anderson  
Letter grade only. Prerequisites: BEE 2510 or BEE 2600 or permission of instructor. Lec T R 11:40-12:55.

Applications of mathematical modeling, simulation, and optimization to environmental-quality management. Fate and transport models for contaminants in air, water, and soil. Optimization methods to evaluate alternatives for solid-waste management and water and air pollution control. Introduction to hydrologic simulation (runoff and streamflow). Software packages for watershed analyses of point and nonpoint source water pollution.

**BEE 4760 Solid Waste Engineering**  
Spring 3 credits  
D. A. Haith  
Letter grade only. Prerequisite: BEE 3500 or CEE 3510 or permission of instructor. Lec T R 11:40-12:55.

Planning and design of processes and facilities for management of municipal solid wastes. Source characterization and reduction; collection and transport systems; waste-to-energy combustion; sanitary landfills composting; recycling and materials recovery facilities; and hazardous waste management. Emphasizes quantitative analyses.

**BEE 4800 Our Changing Atmosphere: Global Change and Atmospheric Chemistry (EAS 4800)**  
Spring 3 credits  
P. G. Hess  
S/U or Letter grade. Prerequisites: CHEM 2070 or CHEM 2090, MATH 1920, PHYS 1112 or equivalent, or permission of instructor. Lec T R 1:25-2:40.

This course investigates the science behind changes in our atmosphere's composition and its relation to global change. We will examine the chemistry and physics that determines atmospheric composition on global scales including the effects of biogeochemistry and atmospheric photochemistry.

**BEE 4870 Sustainable Bioenergy Systems**  
Fall 3 credits  
J. B. Hunter  
Letter grade only. Satisfies BE and EnvE capstone design requirement. Intended for upper-level undergraduates and graduate students. Prerequisites: BEE 2220 or an equivalent thermodynamics course. Lec T R 9:05-9:55; Lab W 1:25-4:25.

Offers a systems approach to understanding renewable bioenergy systems (biomass) and their conversion processes, from various aspects of biology, engineering, environmental impacts, economics, and sustainable development. A large part of the course deepens students' understanding of bioprocessing with undefined mixed cultures of microbes.

**BEE 4880 Applied Modeling and Simulation for Renewable Energy Systems**  
Spring 3 credits  
C. L. Anderson  
Letter grade only. Prerequisite: senior in engineering, graduate standing or permission of instructor. Lec M W 10:10–11:25.

This course will provide an applied introduction to modeling, simulation and optimization techniques for various renewable energy systems. The course will be modular in nature. Each module will focus on a particular renewable energy application and relevant modeling/simulation tools. Some modules are independent and some will build on previous modules. The instructional format of the course will include lectures, scientific paper reviews, and some MATLAB™ programming. Students will have an opportunity to apply new techniques to a relevant modeling project. The course will culminate with a modeling project relevant to renewable energy. Undergraduates will work in teams of 2-3 students to complete the team project.

**BEE 4890 Entrepreneurial Management for Engineers**  
Fall 3 credits, 1 additional credit required as ENGRC 4890  
M. B. Timmons  
Letter grade only. Enrollment is limited to: junior standing or higher. ENGRC 4890 satisfies College of Engineering technical writing requirement. No one is allowed to add the course after 2nd week. Lecture M W 2:30-3:20 and 3:35-4:25.

The course focuses on how to start a new company centered on engineering or biological technologies. Course objectives include coverage of: entrepreneurship principles, fund raising, negotiation, financial calculations (internal rate of return, time value of money, proforma statements); legal structures of businesses; project management; and technical writing and communication. Majority of work done in teams including a complete business plan that is presented to angel investors. Business plans should represent an opportunity one member of the group is willing to pursue upon leaving Cornell. Intention is to make the team project as real-world as possible, meaning that the Phase I start up funds are < $100,000.
The Wednesday lab time is devoted to working on business plan components. The engineering economics coverage is in the context of entrepreneurship but covers all topics that are included in the Fundamentals of Engineering Exam (FE), which is the first step towards professional licensing. The overall goal of the course is to move the student towards being prepared to function in a professional work world.

BEE 4940 Special Topics in Biological and Environmental Engineering
Fall, Spring 4 credits (maximum)
Staff
S-U or Letter grade.

The department teaches “trial” courses under this number. Offerings vary by semester and will be advertised by the department. Course offered under this number will be approved by the department curriculum committee, and the same course will not be offered twice under this number. Each 4940 has a unique course ID for enrollment.

BEE 4940 Climate Change Solutions (EAS 4940)
Spring 2 credits
P.G. Hess, N.M. Mahowald

The course will consider the technical, physical climate, ecological, economic, human health, ethical and governance issues associated with different climate change “solutions” including mitigation, adaptation and geoengineering. No specific background is assumed for students, as long as they are willing to learn across disciplines. Students will form groups and chose a solution to climate change as their group focus. Each group will consider their solution across a relevant disciplines related to climate change and its solution.

BEE 4940 Terrestrial Hydrology in a Changing Climate (EAS 4940; offered alternate years)
Spring 3 credits
P. G. Hess, M. T. Walter
S-U or Letter grade. Prerequisite: one hydrology course (e.g., BEE 3710) or climate course (e.g., EAS 3050) at the 2000 level or higher. Lec T R 11:40-12:55. Next offered 2016-2017.

Explore the impact of climate change on hydrology and the resulting impacts and uncertainty in future water management practices. Course activities will include lectures, seminars, readings, and student lead presentations, discussions and project related to climate change and hydrology.

BEE 4940 Cross Scales Biogeochemical Modeling (EAS 4940; next offered 2017-2018)
Fall 3 credits
P. G. Hess
S-U or Letter grade. Prerequisite: graduate student standing; undergraduate junior or senior with MATH 2930 and PHYS 1112; or permission of instructor. Lec T R, 10:10-11:25.

The course will teach the basic principles of biogeochemical modeling from the process level to the global earth system and will include hands-on computer programming.

BEE 4970 Individual Study in Biological and Environmental Engineering
Fall, Spring 1-4 credits
Staff
Letter grade only. Prerequisites: written permission of instructor and adequate ability and training for work proposed. Students from all colleges must register with an Independent Study Form (available online at: https://dust.cals.cornell.edu/IndStudyPolicy.aspx).

Special work in any area of Biological and Environmental Engineering on problems under investigation by the department or of special interest to the student, provided, in the latter case, that adequate facilities can be obtained.

BEE 4971 Engineers Without Borders Independent Study
Fall, Spring 1-4 credits
P. G. Hess
S/U or letter grade. Prerequisite: students need to be members of Engineers Without Borders. Students from all colleges must register with an Independent Study Form (available online at: https://dust.cals.cornell.edu/IndStudyPolicy.aspx).

The course content must relate directly to goals of Engineers Without Borders (EWB) and can be taken for 1 to 4 credits under supervision of a College of Engineering faculty member with approval of the EWB faculty advisor (currently P. G. Hess). Internships can consist of on- or off-campus research or work experiences. The independent study should be purposeful, provide opportunities for reflection, present a continual challenge to the student, and incorporate active learning. The student is expected to be an active participant in all stages of the experience from
planning to evaluation. Students taking this course must be members of Cornell EWB.

**BEE 4980 Undergraduate Teaching**

Fall, Spring 1-4 credits  
Staff  
Letter grade only. Prerequisite: written permission of instructor. Students from all colleges must register with an Independent Study Form (available online at: https://dust.cals.cornell.edu/IndStudyPolicy.aspx).

The student assists in teaching a Biological and Environmental Engineering course appropriate to his/her previous training. The student meets with a discussion or laboratory section, prepares course materials, grades assignments, and regularly discusses objectives and techniques with the faculty member in charge of the course.

**BEE 4990 Undergraduate Research**

Fall, Spring 1-4 credits  
Staff  
Letter grade only. Prerequisites: adequate training for work proposed; written permission of instructor. Students from all colleges must register with an Independent Study Form (available online at: https://dust.cals.cornell.edu/IndStudyPolicy.aspx).

Research in any area of Biological and Environmental Engineering on problems under investigation by the department or of special interest to the student, provided that adequate facilities can be obtained. The student must review pertinent literature, prepare a project outline, carry out an approved plan, and submit a formal final report.

**BEE 4993 Honors Thesis**

Spring 3-6 credits  
Staff  
Letter grade only. Students must be enrolled in BEE 4990 in the previous term and are expected to complete this course during their final term before graduation. Intended for, and open to, BEE students already accepted into the BEE honors program. Students from all colleges must register with an Independent Study Form (available online at: https://dust.cals.cornell.edu/IndStudyPolicy.aspx).

Intended for students pursuing the research honors program in BEE. This course is the culmination of the program’s honors project requirement. Students enrolled in the BEE Honors program will prepare an honors thesis based on the subject matter of a BEE 4990 project from the previous semester, under the supervision of their BEE 4990 research mentor. A preliminary draft and the final copy will be submitted according to the deadline and formatting requirements of the Honors program.

**BEE 5330 Engineering Professionalism**

Spring 1 credit  
M. B. Timmons, J. R. Stedinger, other Engineering Faculty  
S/U or Letter grade. Prerequisite: graduate student with an accredited engineering degree or senior who will graduate with an accredited engineering degree. Four required lectures (weeks 1, 2, 3 and 11). The other weeks are Wednesday evening working sessions where a professor is present along with two TA’s who work primarily one-on-one with students on the weekly homework assignments. Group interaction and teaching is encouraged. Lec W 7:30-8:45 PM.

Course prepares the student for the general national FE Examination. FE review homework addresses FE exam preparation, and students complete a formal comprehensive review of engineering subjects associated with the Fundamentals of Engineering Exam. The NY FE exam is valid in any state and does not expire. Students should sign up to take the NY Fundamental of Engineering (FE) exam held throughout the year in consecutive months starting each January & February with one month between the next pair of active months, i.e., no exams given in March, but April & May, not June, etc. Students sign up directly with the NCEES site (see www.ncees.org). Each state has Pearson testing centers (similar to GRE exam or SAT’s); in NY, the closest are: 421-423 E. Main Street, Endicott, NY, and 6700 Kirkville Rd, E. Syracuse, NY.

There are fees paid to NCEES and NY State associated with the registration (~$200). Once the nationally conducted FE exam is passed, it is valid forever and is valid in any state for Professional Engineering registration (requires an additional 4 years of experience under another registered engineer).

**BEE 7540 Water Management in an Era of Growing Water Scarcity (IARD 7540)**

Spring 2-3 credits  
S-U or Letter grade. Prerequisite: graduate standing or permission of instructors. Lec M 2:40-4:25.

Scarcity of water might be well overtake climate change as the main issue limiting future development. In fact in many water-short areas in the world, such as the Mediterranean, much of Sub-Saharan Africa, and India, it is already a main cause of the prevailing poverty. Management of water in water scarce regions demands tradeoffs between a wide range of goals: preservation or enhancement of the environment, enhancement of social equity, preservation of cultural identity, and economically efficient utilization of water. Water management also requires consideration of a wide range of factors, some physical other socio/cultural, economic,
legal, and political. The end result is seldom perfect since the goals are often are in conflict with one another.

A principal goal of this course is to identify the specific factors that should be considered in the management of water in different situations and to explore the areas where trade-offs in achieving these goals must be made. The context of this course will be the issues facing the following water-scarce regions: the Mediterranean, the Nile basin and India, and the South-West of the United States with an emphasis on the largest water user—irrigation for food production. This will include discussion of related issues such as land acquisition for food production and virtual water use throughout the world.

**BEE 7710 Soil & Water Engineering Seminar**  
Fall, Spring  
1 credit  
T. S. Steenhuis, M. F. Walter, M. T. Walter.  
S-U or letter grade. Prerequisite: graduate standing or permission of instructor. Sem M 3:30-4:25.

Study and discussion of research or design procedures related to selected topics in watershed management, erosion control, hydrology, colloid transport and water quality.

**CEE 1130 Sustainable Engineering of Energy, Water, Soil, and Air Resources** (ENGRI 1130)  
Spring  
3 credits  
M. Reid  
S-U or Letter grade. Note: Students must register under ENGRI 1130. Lec M W F 10:10-11:00.

Course introduces concepts and tools required for the sustainable management of energy, water, soil, and air resources in our modern society. Semester is organized into four modules, each concentrating on one resource area and including a case study of local or regional significance. Students work in teams to address sustainability problems that arise in the case studies. Each module also includes presentations of technical approaches used in environmental engineering analyses. Project teams will be expected to apply those methods in their case study evaluations and management proposals. Technical approaches include life cycle analysis, mass balance computations, and mathematical modeling of pollutant dynamics in the environment.

**CEE 2550 AguaClara: Sustainable Water Supply Project**  
Fall, Spring  
3 credits  
M. L. Weber-Shirk  

Student teams conduct research, build working models, design full-scale prototypes, create design algorithms, and create educational materials for technology transfer to improve drinking water quality in the Global South. Students in CEE 2550 learn in an apprenticeship role on teams led by students in CEE 4550 or CEE 5051/5052. For more information see: aguaclara.cee.cornell.edu

**CEE 3040 Uncertainty Analysis in Engineering**  
Fall  
4 credits  
J. R. Stedinger  
S-U or Letter grade. Prerequisites: first-year calculus. Lec M W F 12:20-1:10, Sec 1 W 1:25-2:15, Sec 2 R 10:10-11:00, Sec 3 R 1:25-2:15, Sec 4 R 2:30-3:20, Sec 5 W 2:30-3:20.

Introduction to probability theory and statistical techniques, with examples from civil, environmental, biological, and related disciplines. Covers data presentation, commonly used probability distributions describing natural phenomena and material properties, parameter estimation, confidence intervals, hypothesis testing, simple linear regression, and nonparametric statistics. Examples include structural reliability, windspeed/flood distributions, pollutant concentrations, and models of vehicle arrivals.

**CEE 3090 Special Topics in Civil and Environmental Engineering**  
Fall, Spring  
1-6 credits  
Staff  
S-U or Letter Grade

Supervised study by individuals or groups of upper-division students on an undergraduate research project or on specialized topics not covered in regular courses.

**CEE/ENGRD 3200 Engineering Computation**  
Spring  
4 credits  
P. J. Diamessis  
S-U or Letter grade. Prerequisites: CS 1112 and MATH 2930. Co-requisite: MATH 2940. Recommended: completion of MATH 2940. Lec 1 T R 8:40-9:55, Sec 1 F 10:10-11:00, Sec 2 11:15-12:05, Sec 3 12:20-1:10, Sec 4 1:25-2:15.

Introduction to numerical methods, computational mathematics, and probability and statistics. Development of programming and graphics proficiency with MATLAB and spreadsheets. Topics include: Taylor-series approximations, numerical errors, condition numbers, operation counts, convergence, and stability, probability
distributions, hypothesis testing. Included are numerical methods for solving engineering problems that entail roots of functions, simultaneous linear equations, statistics, regression, interpolation, numerical differentiation and integration, and solution of ordinary and partial differential equations, including an introduction to finite difference methods. Applications are drawn from different areas of engineering. A group project uses these methods on a realistic engineering problem.

CEE 3230    Engineering Economics and Management (ENGRG 3230)
Spring, Summer Co-op  3 credits
R. Daziano
Letter grade only. Note: Primarily for Juniors and Seniors. Lec M W 10:10-11:00; Sec F 10:10-11:00.

Introduction to Engineering and business economics and to project management. Intended to give students a working knowledge of money management and how to make economic comparisons of alternative engineering designs or projects. The impact of inflation, taxation, depreciation, financial planning, economic optimization, project scheduling, and legal and regulatory issues are introduced and applied to economic investment and project-management problems.

CEE 3310    Fluid Mechanics
Fall  4 credits
E. A. Cowen

Covers hydrostatics, the basic equations of incompressible fluid flow, potential flow and dynamic pressure forces, viscous flow and shear forces, steady pipe flow, turbulence, dimensional analysis, laminar and turbulence boundary layer, flows around obstacles, and open-channel flow. Includes small-group laboratory assignments.

CEE 3410    Introduction to Geotechnical Engineering
Fall  4 credits
H. E. Stewart
Letter grade only. Prerequisite: ENGRD 2020 or permission of instructor. Lec M W F 11:15-12:05; Lab M 2:30-4:25, T 2:30-4:25, or W 2:30-4:25.

Fundamentals of geotechnical engineering. Topics include origins and descriptions of soil and rock as engineering materials, subsurface exploration methods, principles of effective stresses, stress distribution and ground settlements from surface loads, steady-state and time-dependent subsurface fluid flow, soil strength and failure criteria, geoenvironmental applications, and introduction to hazardous waste containment systems.

CEE 3510    Environmental Quality Engineering
Spring  3 credits
Staff
Letter grade only. Lec M W F 11:15-12:05.

Introduction to engineering aspects of environmental quality control. Quality parameters, criteria, and standards for water and wastewater. Elementary analysis pertaining to the modeling of pollutant reactions in natural systems, and introduction to design of unit processes for wastewater treatment.

CEE 4010    Undergraduate Engineering Teaching in CEE
Fall, Spring  1-3 credits
Staff
S-U or Letter grade. Prerequisite: permission of instructor.

Methods of instruction developed through discussions with faculty and by assisting with the instruction of undergraduates under the supervision of faculty.

CEE 4110    Applied Remote Sensing and GIS for Resource Inventory and Analysis
Fall  3 credits
M. Laba

Survey of resource inventory methods applied to field-based studies of environmental systems. Laboratory emphasizes using maps, spatial databases, global positioning systems, and aerospace imagery to discriminate, measure, inventory, and monitor environmental resources.

[CEE 4350    Coastal Engineering
Spring  4 credits
Staff
Letter grade only. Prerequisite: CEE 3310. Satisfies EnvE capstone design requirement. Offered Alternate Years. Lec TBA. Next Offered 2017-2018.

Covers the following topics: review of hydrodynamics; small-amplitude wave theory; wave statistics; wave-structure interactions; coastal processes.]
CEE 4370  Experimental Methods in Fluid Dynamics  
Spring  3 credits  
E. A. Cowen  
Letter grade only. Pre- or co-requisites: CEE 3310 or equivalent and CEE 3040 or equivalent. Satisfies EnvE Laboratory experience requirement. Lec M W 1:25-2:40.

Introduction to experimental data collection and analysis, in particular as they pertain to fluid flows. Covers computer-based experimental control, analog and digital data acquisition, discrete sampling theory, digital signal processing, and uncertainty analysis. Also covers analog transducers, acoustic and laser Doppler velocimetry, full-field (2-D) quantitative imaging techniques. Includes laboratory experiments.

[CEE 4510  Microbiology for Environmental Engineering]  
Fall  3 credits  
R. Richardson  
Letter grade only. Prerequisites: two semesters of college chemistry; organic chemistry or permission of instructor. Lec M W F 11:15-12:05. Next Offered 2017-2018

Introduction to the fundamental aspects of microbiology and biochemistry that are pertinent to environmental engineering and science. Provides an overview of the characteristics of bacteria, Archaea, unicellular Eukaryotes (protozoa, algae, fungi), and viruses. Includes discussions of cell structure, bioenergetics and metabolism, and microbial genetics. Focus is then applied to topics pertinent to environmental engineering: pathogens; disease and immunity; environmental influences on microorganisms; roles of microbes in the carbon, nitrogen, and sulfur cycles; enzymes; molecular microbiology; and microbial ecology. This is an introductory course and is inappropriate for those who have taken BIOMI 290 or equivalent.

[CEE 4530  Lab Research in Environmental Engineering]  
Spring  3 credits  
D. Helbling  
Letter grade only. Prerequisite: CEE 3510 or permission of instructor. Satisfies EnvE laboratory experience requirement. Offered Alternate Years. Lec M 1:25-2:40; Lab W 1:25-4:25. Next Offered 2017-2018

Laboratory investigations of reactor flow characteristics; acid rain/lake chemistry; contaminated soil-site assessment and remediation; and wastewater treatment. Design of laboratory experiments, data analysis, computerized process control, and model development are emphasized.

CEE 4540  Sustainable Municipal Drinking Water Treatment  
Fall  3 credits  
M. L. Weber-Shirk  
Pre- or co-requisite of CEE 3310. Letter grade only. Satisfies EnvE capstone design requirement. Lec M W F 12:20-1:10.

This course covers the theory and design of municipal drinking water treatment processes used for removing turbidity and pathogens with a focus on the resilient technologies used by AguaClara. We explore the technical, economic, and social constraints that determine the set of viable technologies that could be adopted to improve the availability and quality of water. Students work in teams to design water supply and treatment systems.

CEE 4550  AguaClara: Sustainable Water Supply Project  
Fall, Spring  3 credits  
M. L. Weber-Shirk  
Pre- or co-requisite of CEE 4540 or (prerequisite of CEE 3310 with permission of instructor). Meets with CEE 2550. Letter grade only. Lec M 7:30-9:25pm Sec M W 2:55-4:10 or TR 2:55-4:10;

Student teams conduct research, build working models, design full-scale prototypes, create design algorithms, and create educational materials for technology transfer to improve drinking water quality in the Global South. For more information see: aguaclara.cee.cornell.edu.  
Note: CEE 4550 can only be taken once for program credit.

CEE 4560  Environmental Engineering in an International Context I  
Fall (multi-semester).  3 credits. A grade of R will be assigned.  
M. L. Weber-Shirk  
Prerequisite or corequisite: CEE 2550, CEE 4540, CEE 4550, CEE 5051, or CEE 5052. Permission of instructor required. Students selected by application. Satisfies Liberal Arts Requirement. This is the first part of a multi-semester course. The second part will be offered as CEE 4561 in the spring. Students must take both CEE 4560 and CEE 4561 to receive a final grade. Lec F 2:55-4:10.

The course connects the themes of culture, society, and water infrastructure in the context of the global south. The goal of the course is to offer students an experiential learning experience, working with AguaClara partner organizations and civil society organizations in emerging markets and economically disadvantaged communities.
Students will learn about the challenges and opportunities of creating sustainable infrastructure, institutional networks, and technical backstopping for water, sanitation, and hygiene. Students will read about development theory and the social, political, and historical context of Honduras. During the January intersession students travel to Honduras for an intensive engineering in context experience.

CEE 4561 Environmental Engineering in an International Context II

Spring (multi-semester). 3 credits. Letter grade only.
M. L. Weber-Shirk
Prerequisite: CEE 4560. Permission of instructor required.
Students selected by application. Satisfies Liberal Arts Requirement. This is the second part of a multi-semester course. Students who took CEE 4560 must take CEE 4561 to complete the course and receive a grade.

The course connects the themes of culture, society, and water infrastructure in the context of the global south. The goal of the course is to offer students an experiential learning experience, working with AguaClara partner organizations and civil society organizations in emerging markets and economically disadvantaged communities. Students will learn about the challenges and opportunities of creating sustainable infrastructure, institutional networks, and technical backstopping for water, sanitation, and hygiene. Students synthesize the readings and their observations to develop a clearer understanding of the challenges of cross cultural collaboration designed to make the world a better place.

CEE 5970 Risk Analysis and Management (TOX 5970)

Spring 3 credits
J. R. Stedinger
S-U or Letter grade. Prerequisite introduction to probability and statistics (e.g., CEE 3040, ENGRD 2700, ILSRT 2100, BTRY 3010, or AEM 2100); two semesters of calculus; senior or graduate standing or permission of instructor. Lec M W F 10:10-11:00.

Develops a working knowledge of risk terminology and reliability engineering, analytic tools and models used to analyze environmental and technological risks, and social and psychological risk issues. Discussions address life risks in the United States historical accidents, natural hazards, threat assessment, transportation risks, industrial accidents, waste incineration, air pollution modeling, public health, regulatory policy, risk communication, and risk management.

CEE 6000 Numerical Methods for Engineers
Fall 3 credits
P. J. Diamessis
The primary focus is algorithm implementation within the context of engineering applications (spanning fluid and solid/fracture mechanics and beyond). Student projects will include parallel implementation using resources at the Theory Center. Course topics will include: Sources of error and error propagation, eigenvalue/eigenvector computation, solution of linear systems via direct or iterative methods and issues of parallel implementation, least squares approximation of lab/simulation data, solution of non-linear equations, interpolation in one and two dimensions, fast Fourier transforms (serial vs. parallel) and wavelets.

CEE 6100 Remote Sensing Fundamentals (CSS 6100)

Fall 3 credits
W. D. Philpot
Letter grade only. Lec M W 11:15-12:05; Lab F 11:15-12:05; F 12:20-1:10.

Introduction to the equipment and methods used in obtaining information about earth resources and the environment from aircraft or satellite. Coverage includes sensors, sensor and ground-data acquisition, data analysis and interpretation, and project design.

CEE 6210 Stochastic Hydrology
Fall 3 credits
J. R. Stedinger
Letter grade only. Prerequisites: CEE 3040 or permission of instructor. Offered on Demand.

Course exams statistical, time series and stochastic optimization methods used to address water resources planning and management problems involving uncertainty objectives and hydrologic inputs. Statistical issues include: maximum likelihood and moments estimators: censored data sets and historical information; probability plotting; Bayesian inference; regionalization methods; ARMA models; multivariate stochastic stream flow models; stochastic simulation; and stochastic reservoir-operation optimization models.

CEE 6300 Spectral Methods for Incompressible Fluid Flows
Fall 3 credits
P. J. Diamessis
Higher order spatial discretization schemes (spectral and compact-finite difference). One-dimensional non-linear partial differential equations (Burgers eqn., Korteweg-DeVries eqn. and Shallow Water eqns.) and implications for environmental fluid flow simulations. Two-dimensional problems and fast iterative solvers. Numerical solution of the incompressible Navier-Stokes equations in an environmental/geophysical context. Advanced topics may include: Introduction to turbulence subgrid scale modeling in stratified/rotating flow, free surface flow modeling and representation of complex topography.]

[CEE 6310 Computational Simulation of Flow and Transport in the Environment
Spring 3 credits
P. L.-F. Liu
Letter grade only. Prerequisites: MATH 2940 or equivalent, ENGRD 3200 or experience in numerical methods and programming, and elementary fluid mechanics. Lec T R 10:10-11:25. Next Offered 2017-2018.
Covers fundamental equations of saturated and unsaturated flow in porous media; flow in fractured media; numerical modeling of transport in porous media; diffusion and advective diffusion in one, two, and three dimensions; anisotropy; and additional terms for reactive substances. Teaches various numerical methods including finite difference, finite elements, and boundary elements.]

[CEE 6350 Small and Finite Amplitude Water Waves
Spring 3 credits
Staff
Letter grade only. (Offered on Demand. Please contact the professor if interested in taking this course.)
Reviews linear and nonlinear theories of ocean waves. Discusses the applicability of different wave theories to engineering problems.]

[CEE 6360 Environmental Fluid Mechanics
Spring 3 credits
E. A. Cowen
Letter grade only. Lec M W 1:25-2:40. (Offered on Demand. Please contact the professor if interested in taking this course.) Next Offered 2017-2018
Covers analytic and modeling perspectives of environmental flows; mechanics of layered and continuously stratified fluids: internal waves, density currents, baroclinic motions, and turbulence; jets and plumes and their behavior in the environment; turbulent diffusion, shear flow dispersion, and wave-induced mixing processes; and applications to mixing processes in rivers, lakes, estuaries, and the coastal ocean.]

CEE 6370 Experimental Methods in Fluid Dynamics (M&AE 6272)
Spring 4 credits
E. A. Cowen
Letter grade only. Pre- or co-requisite: CEE 3310 or equivalent and CEE 3040 or equivalent. Satisfies EnvE Laboratory experience and design requirement. Lec M W 1:25-2:40.
Introduction to experimental data collection and analysis, in particular as they pertain to fluid flows. Covers computer-based experimental control, analog and digital data acquisition, discrete sampling theory, digital signal processing, uncertainty analysis. Also covers analog transducers, acoustic and laser Doppler velocimetry, full-field (2-D) quantitative imaging techniques. Includes laboratory experiments and a project.

CEE 6530 Water Chemistry for Environmental Engineering
Fall 3 credits
L. W. Lion
Letter grade only. Prerequisite: one semester of college chemistry or permission of instructor. Lec M W F 10:10-11:00.
Covers principles of chemistry applicable to the understanding, design, and control of water and wastewater treatment processes and to reactions in receiving waters. Topics include chemical thermodynamics, reaction kinetics, acid-base equilibria, mineral precipitation/dissolution, and electrochemistry. Focuses on the mathematical description of chemical reactions relevant to engineered processes and natural systems, and the numerical or graphical solution of these problems.

CEE 6550 Transport, Mixing, and Transformation in the Environment
Fall 3 credits
J. D. Albertson
Letter grade only. Prerequisite: CEE 3310. Lec T R 10:10-11:25.
Application of fluid mechanics to problems of transport, mixing, and transformation in the water environment. Introduction to advective, diffuse, and dispersive processes in the environment. Boundary interactions: air-water and sediment-water processes. Introduction to chemical and biochemical transformation processes. Applications to
transport, mixing, and transformation in rivers, lakes, and coastal waters.

**CEE 6560 Physical/Chemical Process**
Fall 3 credits
D. Helbling
Letter grade only. Pre- or co-requisites: CEE 6530 or permission of instructor. Lec M W F 9:05-9:55.

Theoretical and engineering aspects of chemical and physical phenomena and processes applicable to the removal of impurities from water, wastewater, and industrial wastes and to their transformation in the environment. Analysis and design of treatment processes and systems.

**CEE 6570 Biological Processes**
Spring 3 credits
M. C. Reid
Letter grade only. Prerequisites: introductory microbiology and CEE 6560, or permission of instructor. Lec M W F 11:15-12:05.

Theoretical and engineering aspects of biological phenomena and processes applicable to the removal of impurities from water, wastewater, and industrial wastes and to their transformation in the environment. Bioenergetics analysis, stoichiometry, biokinetic, and design of biological treatment process.

**CHEME 6610 Air Pollution Control**
Spring 3 credits
P. H. Steen
Letter Grade Only. Lec M W F 9:05-9:55;

Covers origin of air pollutants, U.S. Emission standards, dispersion equations; design of equipment for removal of particulate and gaseous pollutants formed in combustion and chemical processing.

**CHEME 6660 Analysis of Sustainable Energy Systems**
Fall 3 credits
J. W. Tester
Letter Grade Only. Prerequisites: MATH 2930, CHEM 3090, PHYS 2213, MAE 2210, CHEM 3130, Thermodynamics or equivalent. Lec M W F 9:05-9:55; TR 8:40-9:55

Quantitative methods of engineering and life cycle analysis for energy choices in a contemporary sustainability context. Fundamental principles of thermodynamics, transport, and reaction kinetics applied to representative energy supply and end use technologies. Topics include resource assessment, energy extraction/capture, conversion, distribution, storage, and consumption; environmental and economic consequences; local to global scales.

**PLSCS 2600 Soil Science**
Fall 4 credits
J. Anelli-Russell
Student Option. Prerequisites: CHEM 2070–2080 or CHEM 1560. Lec M W F 9:05-9:55; Lab M T W or R 1:25-4:25.

Designed for students interested in a comprehensive introduction to soil science from both an environmental and plant management perspective. Divided into three units: (1) soil information unit introduces students to soil characterization, testing, mapping, classification, GIS, and land evaluation; (2) soil management unit addresses fertility, pest management, water, and microclimate, as well as erosion, conservation, pollution, and soil health; and (3) unit on the role of soils in ecosystems considers topics such as biodiversity, soils as sinks and sources of greenhouse gases, and the impact of soils on land use. Labs are initially field-oriented with an emphasis on learning practical skills needed to evaluate and manage soils. Subsequent labs focus on accessing, interpreting, and applying soil information.

**PLSCS 3650 Environmental Chemistry: Soil, Air, and Water**
Spring 3 credits
M. B. McBride
Letter grade only. Prerequisites: CHEM 2070–2080 or CHEM 1560. Lec M W F 10:10-11:00.

Overview of the chemistry of the biosphere and biogeochemical processes that control the fluxes, concentrations, and bioavailability of essential elements and pollutants in soil, air, and water. Gives particular attention to soil’s function as a filter for contaminants. Describes the history of environmental contamination by xenobiotics and heavy metals, with emphasis on behavior and properties of pollutants that pose the greatest risk to human and ecological health.

**EAS 2250 The Earth System**
Spring 4 credits
W. M. White and A. Moore
Letter grade only. Prerequisites: MATH 1110/1910. Lec TR 10:10-11:25; Lab R 2:00-4:25.

An integrated introduction to the earth system stressing the biological, chemical, geological, and physical interactions among the atmosphere, ocean, and solid earth. Topics covered will include biogeochemical cycles, climate
dynamics, and the evolution of the atmosphere, biosphere, cryosphere (ice), hydrosphere (oceans and inland waters), and lithosphere (solid earth).

**EAS 2680  Climate and Global Warming (PBS)**
Spring 3 credits
A. T. DeGaetano
S-U or Letter grade. Prerequisite: basic college math. Lec M W F 10:10-11:00.

Familiarizes students from a range of disciplines with such contemporary issues in climatology as global warming and El Niño. Introduces the natural greenhouse effect, past climates, observed and projected climate changes and impacts. Also covers natural climate variations (e.g., El Niño) and their consequences and predictability. Readings focus on recent scientific findings to climate change.

**EAS 3010  Evolution of the Earth System**
Fall 4 credits
W. Allmon, S. Riha, W. White
S-U or Letter grade. Prerequisite: EAS, 2200, Math 1110 or Math 1910, and one course in chemistry (high school or college). Two field trips, either Saturday or Sunday. Lec M W F 11:15-12:05; Lab T 1:25-4:25.

Life activities alter the physical and chemical environment and are altered by that environment. This interaction over very long times constitutes a coevolution of earth and life. Course uses modern systems, tens-of-thousands-year-old systems, and hundreds-of-millions-year-old systems to illustrate principles, methods of reconstructing deep history, and the context of natural change inherent to life and earth.

**EAS 3030  Introduction to Biogeochemistry**
(NTRES 3030)
Fall 4 credits
J. Yavitt and L. Derry
Letter grade only. Prerequisites: CHEM 2070 or equivalent, MATH 1120, plus a course in biology and/or geology. Lec T R 12:20-1:10; Dis1: M 2:00-4:25; Disc2: R 2:00-4:25.

Control and function of the Earth’s global biogeochemical cycles. Begins with a review of the basic inorganic and organic chemistry of biologically significant elements, and then considers the biogeochemical cycling of carbon, nutrients, and metals that take place in soil, sediments, rivers, and the oceans. Topics include weathering, acid-base chemistry, biological redox processes, nutrient cycling, trace gas fluxes, bio-active metals, the use of isotopic tracers, controls on atmospheric carbon dioxide, and mathematical models. Interactions between global biogeochemical cycles and other components of the Earth system are discussed.

**EAS 3050  Climate Dynamics**
Fall 3 credits
T. Ault,
Prerequisite: two semesters of calculus and one semester of physics. Co-meets EAS 5051. Lec MWF 12:20-1:10

Discusses process that determine climate and contribute to its change including atmospheric radiation, ocean circulation, and atmospheric dynamics. Investigates contemporary climate change issues and discusses them in the context of natural variability of the system.

**EAS 4800  Our Changing Atmosphere: Global Change and Atmospheric Chemistry**
(BEE 4800)
Spring 3 credits
P. G. Hess
S-U or Letter grade. Prerequisite: CHEM 2070 or CHEM 2090, MATH 1920, PHYS 1112 or equivalent, or permission of instructor. Lec T R 1:25-2:40.

This course investigates the science behind changes in our atmosphere’s composition and its relation to global change. Students examine the chemistry and physics that determines atmospheric composition on global scales including the effects of biogeochemistry and atmospheric photochemistry.

**EAS 4830  Environmental Biophysics**
Fall 3 credits
H. van Es, S. J. Riha
S-U or Letter grade. Prerequisite: CS 2600 or equivalent. Offered Alternate Years. Lec T R 8:40-9:55. Next Offered 2017-2018.

This course focuses on energy and mass transfers in the soil-plant-atmosphere system, including water, heat and gas flows, energy budgets and nutrient dynamics. Implications for sustainable management of different land use systems, and for research approaches and instrument design for monitoring transfers will be discussed. Students will be introduced to the use of simulation models for enhancing understanding and management of soil-plant-atmosphere systems.

**EAS 6480  Air Quality and Atmospheric Chemistry**
(MAE 6480)
Fall 3 credits
K. Zhang
S-U or Letter grade. Prerequisite: first year chemistry and thermodynamics (or equivalent); graduate standing or permission of instructor. Offered Alternate Years. Lec T 2:55-4:10.

Factors determining air quality and effects of air pollutants on public health, ecological systems and global climate change. Students examine the source-to-receptor relationship of major air pollutants with an emphasis on the physical and chemical fundamentals of atmospheric transport and transformation. Topics include photochemical smog, atmospheric aerosols, atmospheric transport and deposition, emissions from energy systems, introduction to air quality monitoring and modeling, and air quality management.

**NTRES 3240 Sustainable, Ecologically Based Management of Water Resources**

Spring 3 credits
R. Schneider
Enrollment limited to: junior, senior or graduate student standing. Freshmen and sophomores need instructor permission. Lec MWF 9:05-9:55

In-depth analyses of those ecological and biological principles relevant to the sustainable management of global fresh and marine water resources. Lectures and discussion integrate scientific literature with current management issues, including water supply, dams, irrigation, and groundwater overdraft, and coastal development. Topics include linkages between hydrologic variability and communities, groundwater-surface connections, flow paths for dispersal, patchily distributed water resources, and water quality controls on organisms, and adaptations to climate change.
BEE AND CEE FACULTY AFFILIATED WITH ENVE UNDERGRADUATE MAJOR AND THEIR INTERESTS

Beth A. Ahner (BEE)
Biogeochemistry of trace metals in aquatic ecosystems and soil, plant-based biomediation, plant and algae-based production of raw materials and energy.

John D. Albertson (CEE)
Hydrology, Boundary Layer Meteorology, Land-Atmosphere Interaction, Turbulent transport processes, Wind energy.

Louis D. Albright (BEE, Emeritus)
Energy conservation and management, indoor environment quality, sustainable food production systems, and renewable energy systems analysis and design.

C. Lindsay Anderson (BEE)
Renewable energy systems and integration with existing markets and power systems. Mathematical modeling and systems simulation.

Ludmilla Aristilde (BEE)
Molecular environmental chemodynamics of organic contaminants, environmental chemistry, environmental toxicology, chemical interactions with inorganic and organic natural particles, molecular biochemical controls in toxicological targets of contaminants, environmental biochemistry, engineering of natural particles for contaminant remediation.

James J. Bisogni, Jr. (CEE, Emeritus)
Environmental engineering, biological wastewater treatment processes, aquatic chemistry, remediation of acid lakes.

Wilfried H. Brutsaert (CEE, Emeritus)
Hydrology, land-atmosphere interactions, hydraulics, groundwater flow.

Edwin A. Cowen (CEE)
Environmental fluid mechanics, wave hydrodynamics, coupled air-water transfer processes, mixing and transport processes in the environment, experimental methods.

Peter J. Diamessis (CEE)
Environmental fluid mechanics, hydrodynamics of the coastal/open ocean and lakes, turbulence modeling, hydrodynamic instability theory, spectral methods in scientific and engineering computation, high performance parallel scientific computing.

Richard I. Dick (CEE, Emeritus)
Water and wastewater treatment, residue management, sludge treatment/disposal

H. Oliver Gao (CEE)
Environment/energy and transportation systems, transportation energy consumption and emissions inventory estimation and impact analysis, statistical and mathematical modeling.

Kifle G. Gebremedhin (BEE)
Timber engineering and mechanics, engineering livestock thermal environments, and modeling from bio-energetics to population dynamics of single or multiple species of animals for a sustainable ecosystem in terms of energy (feed and water) budget.

Larry D. Geohring (BEE)
Hydrologic and hydraulic applications to soil and water resources management, soil and water conservation engineering, fate and transport processes of nutrients and other potential agricultural pollutants.

**James M. Gossett** (CEE, Emeritus)
Water and waste treatment, microbiological phenomena and processes, treatment of contaminated groundwater.

**Douglas A. Haith** (BEE, Emeritus)
Environmental systems analysis, nonpoint source pollution, solid waste management, watershed modeling, risk assessment.

**Damian E. Helbling** (CEE)
Water quality, chemical and biological processes, transport and fate of emerging contaminants, sustainable water and wastewater treatment technologies.

**Peter G. Hess** (BEE)
Understanding how anthropogenic and natural processes affect the chemical composition of the atmosphere. The composition of the atmosphere affects air quality and the response of the climate system to global change. The coupling between atmospheric chemistry and climate and in predicting future changes.

**Jean B. Hunter** (BEE)
Bioprocess engineering, fermentation and enzyme technology, biospearations, food engineering

**James T. Jenkins** (CEE)
Fluid mechanics, mechanics of continuous media and discrete aggregates, and dense-shearing flows of inelastic particles

**William J. Jewell** (BEE, Emeritus)
Ecological engineering, biological and chemical mechanisms of pollution control and energy generation.

**Leonard W. Lion** (CEE)
Aquatic chemistry, biogeochemical fate of toxic pollutants, interfacial reactions of pollutants in aqueous systems.

**Philip L-F. Liu** (CEE)
Fluid mechanics, water wave dynamics, coastal oceanography and engineering, tsunami dynamics and numerical methods

**Daniel P. Loucks** (CEE, Emeritus)
Environmental and water resource systems planning and management modeling, and predicting the impacts of water management on ecosystems.

**Thomas D. O’Rourke** (CEE)
Geotechnical and geoenvironmental engineering, environmental site remediation, water supply performance during extreme events.

**Jean-Yves Parlange** (BEE, Emeritus)
Analysis of infiltration, surface runoff, denitrification and solute transport, groundwater movement, erosion and sediment transport, and watershed models.

**William D. Philpot** (CEE)
Remote sensing, digital image processing, radiative transfer.

**Patrick M. Reed** (CEE)
Environmental and water resources systems; multi-objective planning and management, evolutionary computation; high-performance computing; uncertainty in decision making.

**Matthew C. Reid** (CEE)
Environmental biogeochemistry; coupled biological and physiochemical processes in soil-water systems; engineered ecosystems for sustainable water quality improvement

**Ruth E. Richardson** (CEE)
Microbiology of water and soil systems, molecular techniques, fate and transport of contaminants.

**Norman R. Scott** (BEE, Emeritus)
Bioengineering, sustainable development, bio-fuels, renewable energy, recycling, energy conservation, and managed ecosystems.

**Christine A. Shoemaker** (CEE)
Modeling groundwater contamination and remediation, pesticide source reduction, optimization algorithms, supercomputing.

**Scott Steinschneider** (BEE)
Water resources risk management, sustainable design and management of integrated water resource systems.

**Jery R. Stedinger** (CEE)
Stochastic hydrology, water resource systems operations and planning, risk analysis.

**Tammo S. Steenhuis** (BEE)
Management of soil and water resources, fate of agricultural toxics and nutrients.

**Michael B. Timmons** (BEE)
Aquaculture, water quality and management systems, biological filtration.

**Michael F. Walter** (BEE, Emeritus)
International development, sustainable development, ecological engineering and water management.

**M. Todd Walter** (BEE)
Ecohydrology, hydrological controls on environmental transport, and watershed modeling.

**Monroe L. Weber-Shirk** (CEE)
Sustainable drinking water treatment (global applications).
YOUR FACULTY ADVISOR

Each Environmental Engineering student is assigned a faculty advisor. The primary role of the advisor is to guide you through your academic program and to assist with questions or problems you may have along the way. You will pre-register for each semester’s classes in the middle of the previous semester using the Student Center. You should plan on meeting with your faculty advisor early in the pre-enrollment process to discuss your progress and course selections. Advisors do not select your courses for you and you are responsible for meeting all graduation requirements. (The program does track your progress and alert you of your progress toward graduation in each semester of the junior and senior year.)

Your advisor will also enjoy getting to know you and will appreciate hearing about your successes in academics and in life. Your advisor will talk with you about career plans, provide letters of recommendation and assist you with applying to graduate or professional schools if this is what you want to do next. Faculty advisors help students applying for internships, study abroad, and provide advice as you look for summer jobs and undergraduate research. Therefore, you are encouraged to make opportunities to visit with your advisor at times other than during the scramble of pre-enrollment.

Everyone (especially students) at Cornell is busy juggling different responsibilities and activities. The following suggestions will allow you to maximize the help your advisor can offer with regard to your academics. If you follow them, you will get the most out of your relationship with your advisor.

- **Plan ahead!** Schedule routine appointments ahead of time.
- When you need to see your Environmental Engineering advisor, use E-mail to **schedule an appointment in advance** and indicate why you wish to meet. If your advisor is unavailable or **if you are experiencing an emergency**, in BEE contact Brenda Marchewka (255-2173; bls19) or Professor Hunter (255-2297; jbh5) and in CEE contact Nadine Porter (255-3412, ndp5) or Professor Philpot (255-9230, wdp2) They will work with you and bring your advisor into the loop as quickly as possible.
- **Be prepared to think about the big picture.** Your future plans may change, but it helps both you and your advisor to see in the beginning where you think you are headed.
- **Always have a copy of your schedule** or a list of courses with you when you meet with your advisor to discuss pre-enroll.
- **Make a list of questions and concerns** that you want to discuss with your advisor before you meet so you remember everything that is important.
- **Share good news and personal accomplishments** with your advisor. This helps them get to know you and gives you another good reason to say hello.

If you have questions about your academic focus or decide to make some changes in the direction of your education, you may change faculty advisors (or majors) if your interests shift. To change advisors in BEE or CEE, contact Professor Hunter or Professor Philpot to discuss your situation. Contact the Counseling and Advising Office in Roberts Hall at 255-2257 if you are seeking a new major in CALS. Contact the College of Engineering Advising Office in Olin Hall at 255-7414 if you are seeking to transfer to a different Engineering field. Environmental Engineering Advisors are knowledgeable about other majors in both colleges, and will talk with you even if you feel you might want to change majors. Our interest is in your education and what is best for you!
ACADEMIC SUPPORT SERVICES

Having problems managing your workload or your time? Have you been sleeping more but still feel tired all the time? Having problems getting out of bed and getting motivated? Each year, many students in the College and the University find that they are having problems academically, socially, and/or personally. Deciding how you respond to these obstacles can profoundly affect your level of success at Cornell.

Cornell offers several resources to help students with their academic work. The best time to visit is as soon as you identify a problem – don’t wait until it’s overwhelming.

**Biology Advising Center**
8:00am-4:30pm Monday-Thursday and 8:00am -4:00pm on Friday; 216 Stimson Hall
Tel: 607.255.5233; Fax: 607.255.0470; Email: bioadvising@cornell.edu
https://biology.cornell.edu/advising

**Engineering Advising Office**
8:00am-4:30pm Monday-Friday; 167 Olin Hall
Tel: 607.255.7414; Fax: 607.255.9297; Email: adv_engineering@cornell.edu
http://www.engineering.cornell.edu/resources/advising/index.cfm

**Learning Strategies Center**
8:30am-4:30pm Monday-Thursday, 8:30am-4pm Friday; 420 Computing and Communications Center (CCC) Tel: 607.255.6310; Email: learningstrategiescenter@cornell.edu   http://lsc.cornell.edu/

**Math Support Center**
Open during Academic Year – see web site for specific hours; 256 Malott Hall
Tel: 607.255.4658; Email: mst1@cornell.edu
http://www.math.cornell.edu/Courses/FSM/
http://www.math.cornell.edu/twiki/bin/view/MSC/

**Writing Workshop**
8:30am-5pm Monday-Friday – see website to schedule an appointment; 174 Rockefeller Hall
Tel: 607.255.6349; Fax: 607.255.4010; Email: thc33@cornell.edu
http://www.arts.cornell.edu/knight_institute/walkin/walkin.htm

**Minority & Women’s Programs in Engineering**
8am-4:30pm; 146 Olin Hall
Tel: 607.255.6403; Fax: 607.255.2834; Email: dpeng@cornell.edu
http://www.engineering.cornell.edu/diversity/

**Free Tutoring Services**
Tau Beta Pi (http://www.rso.cornell.edu/tbp/tutoring.html) and
Ho-Nun-De-Kah (http://cornellhndk.wordpress.com/about/)
Peer Tutoring
http://www.engineering.cornell.edu/academics/undergraduate/assistance/tutor/index.cfm

**Student Disability Services**
(sds.cornell.edu/index.html) Tel: 607.254-4545; Email: sds_cu@cornell.edu
MENTAL WELLNESS SUPPORT

Sometimes obstacles aren’t rooted in study habits but in medical or psychological problems. These range from low iron or blood sugar to depression or anxiety. For many students this is the first time they are living away from home and are responsible for their own well-being. Although many people see you each day and may genuinely care about you, no one is making sure that you are eating well, getting regular exercise, and are healthy. Indeed, it is less likely that people will recognize if you’re facing some minor or major emotional problem, especially if you are living off-campus. It is important that you care for yourself, and ask for help and direction from your Resident Advisor, faculty advisor, or other campus or community office/agency.

Cornell offers mental wellness support to students through the following services, among others:

**CAPS (Counseling and Psychological Services)** at Gannett: Cornell University Health Services; Tel: 607.255.5155; Email: gannett@cornell.edu
http://www.gannett.cornell.edu/services/counseling/caps/index.cfm
CAPS has noted a trend that engineering students tend to wait a long time before they seek assistance. This behavior results from the—usually mistaken—belief that the problem solving skills of engineers extend to emotional and psychological issues. Failure to seek help usually ends up putting the student in more academic and personal risk. If you are really stressed, tired all the time, having trouble getting yourself to class, not able to complete assignments on time, confused about life in general, sad, anxious, or just want someone to talk to so you can decompress, contact CAPS. Oftentimes just talking with a trained professional can help you feel better. Note: each student is limited to 12 individual counseling sessions per year, this is not long-term counseling. Let’s Talk:
http://www.gannett.cornell.edu/cms/services/counseling/caps/talk/index.cfm

**EARS (Empathy, Assistance, and Referral Service);** Tel: 607.255.3277
Free and confidential.
http://ears.dos.cornell.edu/

**General Medical Problems**
Gannett Health Center; Tel: 607.255.5155; Email: gannett@cornell.edu
http://www.gannett.cornell.edu
If you’ve had a lingering health concern, please have it checked out. Even minor illnesses can detract from your overall enjoyment of ‘the college experience’.
**PROFESSIONAL REGISTRATION**

Engineers must have a professional engineering license (obtained after passing two examinations and also having 4 years of suitable experience) to practice engineering in each state of the U.S. While not required for all Environmental Engineering jobs, licensure is important for environmental engineers because they are responsible for public safety in much of their work. Most states and communities require that a registered engineer give final approval to all plans and specifications for engineering projects. Students can take the first step towards obtaining their Professional Engineering (PE) license while still a senior at Cornell. Students are eligible during their last term to take Part A of the nationwide examination, the “Fundamentals of Engineering (FE) Examination.” Successful completion earns the title "Intern Engineer" (often also called “Engineer-in-Training”). Because Part A emphasizes fundamental knowledge gained in engineering distribution courses and core courses, there is a comparative advantage in taking this exam during your last term, while this material is still relatively “fresh” in your memory. Please be sure to have BEE or CEE notified of your exam results so we receive the feedback we need to document the success of our graduates. Success or failure in this examination has no bearing on your academic standing at Cornell.

Students can sign up to take the Fundamental of Engineering (FE) exam held throughout the year in consecutive months starting each January & February with one month between the next pair of active months, i.e., no exams given in March, but April & May, not June, etc. Students sign up directly with the NCEES site (see www.ncees.org). Each state has Pearson testing centers (similar to GRE exam or SAT’s); in NY, the closest exam sites are: 421-423 E. Main Street, Endicott, NY, and 6700 Kirkville Rd, E. Syracuse, NY. There are fees paid to both NCEES and NY State associated with the registration (total ~$200). Once the nationally conducted FE exam is passed, it is valid forever and is valid in any state for Professional Engineering registration (requires an additional 4 years of experience under another registered engineer). More details on New York licensure can be found at http://www.op.nysed.gov/prof/pels/.

Part B of the examination may be taken after four years for engineering students who have suitable engineering experience after passing Part A. Successful completion of Part B will give you the title "Professional Engineer" in the state where you took the Part B exam. With some exceptions registration in other states may usually be obtained by reciprocity rather than taking another exam.

BEE 5330, Engineering Professionalism, prepares the student for the general national FE Examination. FE review homework addresses FE exam preparation, and students complete the formal comprehensive review of engineering subjects associated with the Fundamentals of Engineering Exam.
GRADUATE EDUCATION

It’s not too early to consider additional study beyond your bachelor’s degree. For students who wish to continue their graduate program at Cornell, there are several options, as described below, leading to a Master of Engineering, Master of Science, or a Doctor of Philosophy degree.

MASTER OF ENGINEERING
B.S. degree holders in engineering from Cornell who have a minimum grade point average of 2.7 are generally eligible for admission to the three Master of Engineering programs outlined below. However, each application is evaluated individually, and BEE and CEE faculty reserve the right to make a final admission decisions. To apply visit: http://www.gradschool.cornell.edu/

All MEng students must register for a minimum of one semester in the Graduate School. When enrolled in the graduate school, BEE Master of Engineering students advised by a member of the BEE graduate major, are charged statutory graduate tuition.

1. MASTER OF ENGINEERING (BIOLOGICAL AND ENVIRONMENTAL ENGINEERING) PROGRAM
The Master of Engineering (MEng) degree builds on the foundation of the engineering BS degree to prepare candidates for a professional career. The program integrates technical engineering with the biological and life sciences, enabling graduates to solve technical problems on a scale ranging from molecular to whole organism to eco system depending on their interests. Graduates assume positions in production companies, consulting firms, government and agencies, and in the public service sector. The degree may also be used as a pathway to advanced study in science and engineering or professional study in business, law and medicine.

2. MASTER OF ENGINEERING (CIVIL AND ENVIRONMENTAL ENGINEERING) PROGRAM
A report prepared by a task force of the American Society for Engineering Education (ASEE) recommended that baccalaureate students who plan to pursue careers in engineering practice be encouraged to complete, on a full-time basis, an advanced degree program focused upon engineering practice. Our School has long believed that the four-year B.S. program is limited in preparing young engineers for the rigors of engineering practice and to provide them with sufficient meaningful, significant, design experience. CEE’s solution to this problem has been the fifth-year Master of Engineering Program in Civil and Environmental Engineering or Engineering Management. Professionally-oriented, the Master of Engineering (Civil) degree programs are particularly popular graduate degrees for CEE seniors and represents the fifth year of an integrated five-year Civil Engineering program leading to a Master of Engineering degree.

The Master of Engineering degree is a course work and project-oriented program. It is normally completed in two semesters of (civil) intensive study. Thirty credit hours consisting of course work in major and supporting areas and a project are required. Master of Engineering students in Environmental Engineering may focus their studies in one of the following subject areas: environmental processes, environmental fluid mechanics and hydrology, and environmental and water resource systems.
engineering. For the M.Eng. program in Environmental Engineering, each program typically consists of course work in a subject area and supporting areas as well as a project.

3. MASTER OF ENGINEERING (ENGINEERING MANAGEMENT) PROGRAM

The M.Eng. program in engineering management is aimed at engineers who want to stay in a technical environment, but focus on managerial roles. Students learn to identify problems, formulate and analyze models to understand these problems, and interpret the results of analyses for managerial action. Projects in the management area focus on integrating technical and economic analysis to create results that can support effective management decisions.

Each student’s program of study is designed individually in consultation with an academic adviser and then submitted to the Chair of the Engineering Management Program for approval. Graduates of this program are in demand by environmental engineering consulting firms, management consultants, industrial companies, and other organizations that focus on the efficient management of projects and technical systems.

COOPERATIVE PROGRAMS WITH THE JOHNSON GRADUATE SCHOOL OF MANAGEMENT

There are several special programs that allow a student to earn a degree from the Engineering College and the Johnson Graduate School of Management in less time than if the degrees were pursued sequentially. Here we describe two programs that start with a Cornell Engineering B.S. degree, and one than considers a joint MEng. Degree from the Engineering College with an M.B.A. from the Johnson School.

JOINT B.S./M.ENG. (ENVIRONMENTAL) /M.B.A. AND JOINT B.S./M.B.A.

Two special programs make it possible for students to earn degrees from both a bachelors degree from the College of Engineering and an M.B.A. from Johnson Graduate School of Management. One program, completed in five years, leads to a B.S. degree in engineering and a Master of Business Administration (M.B.A.) degree. The other program, which takes six years, earns three degrees: the B.S. in engineering, the Master of Engineering (M.Eng.), and the M.B.A.

Both programs require taking a specific set of courses at the undergraduate level; these curricula allow for a shortening of the combined programs by one academic year. Information about the specific requirements for each area is available from the appropriate undergraduate major coordinator and graduate program coordinator. The curriculum must include nine core courses required for the M.B.A. or allowed substitutes. See the Engineering Undergraduate Handbook.

Students who decide to pursue either of these programs should take the GMAT exam, which is required by the Johnson School of Management, in March of their junior year (or earlier).
The joint B.S./M.Eng. (Environmental) /M.B.A. program is very attractive in that both Masters degrees are received within two years after the B.S. This program must be initiated in the junior year. This special program requires early planning so those electives taken during the junior and senior year can be used to meet requirements of the M.B.A. degree. By March 1 of the sixth term of enrollment, a student must apply for admission to the M.B.A. program through the Johnson Graduate School of Management. Application to the M.Eng. program should take place by February 1 in the student’s senior year at Cornell. Students are encouraged to go to Engineering Advising and the Johnson School for more information.

**JOINT M.ENG./M.B.A. PROGRAM**

For those interested in both the M.Eng. and M.B.A. degrees, but who do not participate in the six-year joint program described above, an alternative opportunity is the five-semester joint program. Application to this program can begin as late as the first few weeks of enrollment in the M.Eng. program. The five-semester program is open to students with B.S. degrees from Cornell or elsewhere.

**MASTER OF SCIENCE AND PH.D. PROGRAMS**

Some students pursue a research-oriented Master of Science (M.S.) program either here or elsewhere. An increasing percentage of our students continue on to the Ph.D. for careers in research, teaching, or consulting. A Ph.D. degree can be pursued after earning a M.S. or an M.Eng. degree. Some students prefer to take a job immediately after receiving the B.S. and then return for graduate study a few years later. Ask your advisor, professors, or the BEE or CEE Director of Graduate Studies for information about graduate study.

**EARLY ADMISSION PROGRAM**

Cornell undergraduates who have between one and eight credit hours to earn towards completion of their undergraduate degree in the last semester of their senior year may apply for "early admission" to the Master of Engineering program. If approved, the student may begin earning credits towards their Master of Engineering degree while completing their undergraduate degree. (Double-counting of credits will not be allowed; credits used towards undergraduate requirements may not also be used towards M.Eng. requirements.) Admitted applicants must spend a minimum of one semester registered with the Graduate School.

There are two advantages to starting the M.Eng. Program early: (1) students may take a slightly heavier course load and complete the M.Eng. degree in one Graduate School semester after completion of the undergraduate degree; or (2) students may either take a lighter course load over two Graduate School semesters upon completion of the undergraduate degree or take extra courses they are interested in that do not count towards the M.Eng. Degree. Courses taken as part of a graduate program can also be transferred to other graduate programs. A special form and guidance are required before submitting the Graduate School application for Early Admission; therefore you need to see the Graduate Program Coordinator of the Field to which you intend to apply for this form and instructions.
ACADEMIC INTEGRITY AND PLAGIARISM

Absolute integrity is expected of every Cornell student in all academic undertakings. Integrity entails a firm adherence to values most essential to an academic community, including honesty with respect to the intellectual efforts of oneself and others. Both students and faculty at Cornell assume the responsibility of maintaining and furthering these values. However, a Cornell student's submission of work for academic credit implies that the work is the student's own. Outside assistance should be acknowledged, and the student's academic position truthfully reported. In addition, Cornell students have the right to expect academic integrity from each of their peers. It is plagiarism for anyone to represent another person’s work as his or her own. As stated in the University Code of Academic Integrity, "The maintenance of an atmosphere of academic honor . . . is the responsibility of the student and faculty . . ." Gray areas sometimes exist when students study and work together. It is important that faculty state clearly what is expected, and that students understand what authorship citations an instructor expects. To become better acquainted with academic integrity responsibilities, each student should read the Code of Academic Integrity available on the web at http://cuinfo.cornell.edu/aic.cfm. A hard may be obtained from the Engineering Advising Office, 167 Olin Hall, or from the Dean of the Faculty, 315 Day Hall. Guide to AI can be found at: https://provost.cornell.edu/files/2014/12/2016-essential-guide-academic-integrity-t7slma.pdf which includes the Code of Academic Integrity, Acknowledging the Work of Others, Dealing with Online Sources, Working Collaboratively, and Beware of Businesses Buying and Selling Course Materials Without Authorization.

FREEDOM FROM SEXUAL HARASSMENT

The College feels it is essential for the well being of the University community that every individual be treated with respect. Sexual harassment and sexist comments are incompatible with this goal.

Unwelcome sexual advances, requests for sexual favors, or other verbal or physical contact or written communication of a sexual nature is sexual harassment when any of the following occurs:

1. Submission to such conduct is made either explicitly or implicitly a term or condition of employment or academic standing; or
2. Submission to or rejection of such conduct is used as the basis for employment or academic decisions affecting the individual; or
3. Such conduct has the purpose or effect of unreasonably interfering with an individual’s work, academic performance, or participation in extracurricular activities; or creating an intimidating, hostile, or offensive working or learning environment.

Any student, staff employee, or faculty member who believes she/he has been victimized by sexual harassment is encouraged to promptly contact a title IX coordinator via the Office of Workforce Policy and Labor Relations at (607) 254-7232 or equalopportunity@cornell.edu. Individuals may also contact the University Ombudsman at (607) 255-4321 in 118 Stimson Hall, 8:30am-4:30pm Monday-Friday or other times by appointment.
APPENDIX—STUDENT OUTCOMES

Program Educational Objectives are listed on the first page of this Handbook. The following Student Outcomes (SOs) are assessed in the evaluation of our Environmental Engineering BS degree program. Our success in achieving these outcomes is periodically reviewed by our faculty, and by the Engineering Accreditation Commission of ABET, http://www.abet.org as part of its accreditation process.

We advise EnvE students to think about these desirable outcomes and consider how through their choice of electives and co-curricular activities they can develop these abilities, and desired knowledge and understanding. Some students may want to emphasize particular issues or skills. But, none should be neglected – the successful environmental engineer needs to have a broad understanding of social and technical issues and the ability to communicate, as well as being outstanding technically.

As result of their completion of the BS EnvE program, students should acquire:
(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
(l) an ability to create sustainable solutions in the context of a complex natural environment