

# UNDERGRADUATE HANDBOOK FOR ENVIRONMENTAL ENGINEERING

## 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 the scientific media and outreach programs.

These efforts will be conducted in the context of a world-class university bringing benefits to our students, the nation and global society. While the focus of the undergraduate program is to educate the leaders of the next generation of environmental engineering professionals, the statement in total recognizes the need for research and outreach to inform the undergraduate program, to help it to remain cutting edge and to provide those leaders with an appreciation of research 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.

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

**2012-2013**

Cornell University is an equal opportunity, affirmative action educator.

*Handbook cover designed by Mona Kelkar and Katherine Komaromi.*

## 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 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 or as a prospective employer of our students.

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

If you have questions about this major, you may 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, sex, age, or handicap. 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/>) 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 the desire for sustainable environmental quality.

At Cornell University, research and teaching activities related to environmental engineering are found in many of the traditional engineering fields. For example undergraduate majors in Biological Engineering and in Civil Engineering are offered by the Department of Biological and Environmental Engineering (BEE) and by the School of Civil and Environmental Engineering (CEE), respectively. BEE offers a concentration in Bioenvironmental Engineering and CEE offers a focus in Environmental Engineering. The major leading to a B.S. degree in Environmental Engineering is discussed in this handbook. 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 for Biotechnology and Life Science Technologies, 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 either the BEE or 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 almost the same for all students in the Environmental Engineering major regardless of the administrative pathway a student selects. 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 freshman and sophomore years and then are registered jointly with CALs and CoE for their junior and senior years (the registration process in years 3 and 4 is facilitated by the BEE department administration). The primary college in the junior year is CALs and in the senior year, the students' primary college is the College of Engineering. Starting with the freshman class entering in Fall 2007 (the graduating class of 2011), students in the joint degree program will pay state contract college tuition all four years of their program.

Oversight of the Environmental Engineering major is provided by a 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, and educational institutions. In recent years graduates have pursued careers in engineering consulting, management and business, and international development.

Many graduates from the Environmental Engineering major 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 medical school.

# **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 2012 or later. A minimum of 125 credit hours is required.

Group	Subject Matter	Credit Hours
1.....	<b>Mathematics</b> ..... (1910, 1920, 2930, 2940) All math courses in this sequence must be completed with a grade of C- or better.	16
2.....	<b>Chemistry</b> ..... General Chemistry (2090, 2070 or 2150) Organic Chemistry (1570 recommended or 3570)	7
3.....	<b>Physics</b> ..... Calculus-based physics (1112, 2213 or 2217)	8
4.....	<b>Computer Programming</b> ..... Intro to Computing (CS 1110, CS 1112 or BEE 1510 and COE students who matriculated Fall 2011 or earlier must also take CS 1130 or CS 1132)	4
5.....	<b>Biological Sciences</b> ..... Introductory Biology (BIOEE 1610, BIOMG 1350, BIOEE 1780, BIOG 1440, BIOG 1105, BIOG 1106, BIOG 1107, or BIOG 1108)	3-4
6.....	<b>Written Expression</b> ..... First Year Writing Seminars	6
7.....	<b>Engineering Distribution and Field Courses</b> (all must be taken for letter grade)..... <i>Introduction to Engineering</i> ENGRI XXXX (3 credits) (ENGRI 1130 or 1131 is recommended) <sup>b</sup> , or The BEE Experience - BEE 1200 [required for students matriculating in CALS] (1 credit) <i>Engineering Distribution Courses</i> <sup>a</sup> Engineering for a Sustainable Society - ENGRD/BEE 2510 (3 credits) ENGRD XXXX <sup>a</sup> - (ENGRD 2020, 2210, or 3200 are recommended) (3-4 credits) <i>Environmental Engineering Core Courses</i> Mechanics of Solids <sup>a</sup> - ENGRD 2020 (4 credits) Thermodynamics - ENGRD 2210 (3 credits) or Bioengineering Thermodynamics – BEE 2220 (3 credits) or Engineering Computation - CEE/ENGRD 3200 (3 credits) <sup>a</sup> , Uncertainty Analysis in Engineering - CEE 3040 (4 credits) <sup>a, c</sup> Engineering Management - BEE 4890 or CEE 3230 (3 or 4 credits) Fluid Mechanics - CEE 3310 (4 credits) Earth Science (select one course) - (see list of approved courses on page 10) (3 or 4 credits) Environmental Quality Engineering - CEE 3510 (3 credits) Microbiology for Environmental Engineering - CEE 4510 (3 credits) <sup>d</sup> Engineering Laboratory (select one course) - (see list of approved courses on page 10) (3 or 4 credits) Environmental Systems Analysis - BEE 4750 (3 credits) 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) Environmental Engineering Major-Approved Electives (6 credits) (see list of approved courses on page 10) 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. Technical Writing Course. Approved technical communication courses are listed in the <i>Courses of Study</i> , College of Engineering section. BEE 4730 or BEE 4890 are on the approved list. <sup>e</sup>	57

**DEGREE REQUIREMENTS (CONTINUED)**

<b>Group</b>	<b>Subject Matter</b>	<b>Credit Hours</b>
8.....	<b>Liberal Studies</b> (6 courses)..... Liberal Studies courses are listed in the <i>Courses of Study</i> , 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) <i>At least 2 courses must be 2000 level or higher.</i>	18
9.....	<b>Approved Electives</b> ..... These courses are selected by the student with approval of the Faculty Advisor.	6
<b>TOTAL MINIMUM .....</b>		<b>125</b>

<sup>a</sup>Students using any of the required courses ENGRD 2020, 2210, 3200, 2700, 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.

<sup>b</sup>BEE 1510 and BEE 1200 together (5 credits) satisfy the ENGRI requirement for CALS matriculated first-year students. Students using BEE 1510 and BEE 1200 to satisfy the ENGRI requirement must make up the 2 credit difference with engineering coursework.

<sup>c</sup>ENGRD 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.

<sup>d</sup>Students may take BIOMI 2900 in place of CEE 4510.

<sup>e</sup>Students 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.

Additional program information is provided in the College of Engineering section of the Courses of Study and in the College of Engineering Undergraduate Handbook.

Updated lists of approved courses are on-line at: <http://enve.cornell.edu/>

## **APPROVED LABORATORY AND EARTH SCIENCE COURSES**

### **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)<sup>1</sup>
- CEE 4530 Lab Research in Environmental Engineering (3 cr, Spring, Offered Alternate Years, Next Offered 2013-2014)
- CEE 6580 Biodegradation and Biocatalysis (3 cr, Spring, Offered Alternate Years)

### **Earth Science Courses**

- BEE/EAS 4800 Our Changing Atmosphere: Global Change and Atmospheric Chemistry (3 cr, Fall)
- BEE 4940 Terrestrial Hydrology in a Changing Climate (3 cr, Spring, Offered Alternate Years; Next Offered 2013-2014)<sup>2</sup>
- CSS 2600 Soil Science (4 cr, Fall)
- CSS 3650 Environmental Chemistry (3 cr, Spring)
- EAS 2200 The Earth System (4 cr, Fall or 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 (EAS 3030, 4 cr, Fall)
- EAS 4830 Environmental Biophysics (3 cr, Fall)

Note: More advanced Earth Science courses may be 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 4360 Engineering Design of Aquacultural 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)
- \*CEE 4350 Coastal Engineering (4 cr, Spring, Offered Alternate Years, Next Offered 2013-2014)
- \*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)<sup>1</sup>

**Major-Approved Electives**

BEE 3299 Sustainable Development (3 cr, Spring, Summer)  
BEE 3710 Physical Hydrology for Ecosystems (3 cr, Spring)  
BEE 4010 Renewable Energy Systems (3 cr, Spring)  
BEE 4710 Introduction to Groundwater (EAS 4710, 3 cr, Spring)  
BEE 4800 Our Changing Atmosphere: Global Change and Atmospheric Chemistry (EAS 4800, 3 cr, Fall)  
BEE 4880/6880 Applied Modeling and Simulation for Renewable Energy Systems (3 cr, Spring)  
BEE 4940 Terrestrial Hydrology in a Changing Climate (3 cr, Spring, Offered Alternate Years; Next Offered 2013-2014)<sup>2</sup>  
BEE 6580 Biofuels Topics (3 cr, Spring, Offered Alternate Years)  
CEE 3410 Introduction to Geotechnical Engineering and Analysis (4 cr, Fall)  
CEE 4110 Remote Sensing for Environmental Resource Inventory (CSS 4110, 3 cr, Fall)  
CEE 4370 Experimental Methods in Fluid Mechanics (3 cr, Spring)  
CEE 4920 Engineers for a Sustainable World (3 cr, Fall, Next Offered 2013-2014)  
CEE 5970 Risk Analysis and Management (TOX 5970, 3 cr, Spring)  
CEE 6000 Numerical Methods for Engineers (3 cr, Fall, Next Offered 2013-2014)  
CEE 6100 Remote Sensing Fundamentals (CSS 6100, 3 cr, Fall)  
CEE 6230 Environmental Quality Systems Engineering (3 cr, Fall, Next Offered 2013-2014)  
CEE 6300 Spectral Methods for Incompressible Fluid Flows (3 cr, Fall, Next Offered 2014-2015)  
CEE 6310 Computational Simulation of Flow and Transport in the Environment (3cr, Spring)  
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)  
CEE 6580 Biodegradation and Biocatalysis (3 cr, Spring, Offered Alternate Years)  
CHEME 6610 Air Pollution Control (3 cr, Spring)  
CHEME 6660 Analysis of Sustainable Energy Systems (3 cr, Fall)  
EAS/MAE 6480 Air Quality & Atmospheric Chemistry (3 cr, Fall, Next Offered 2013-2014)  
EAS 4570 Atmospheric Air Pollution (3 cr, Fall)

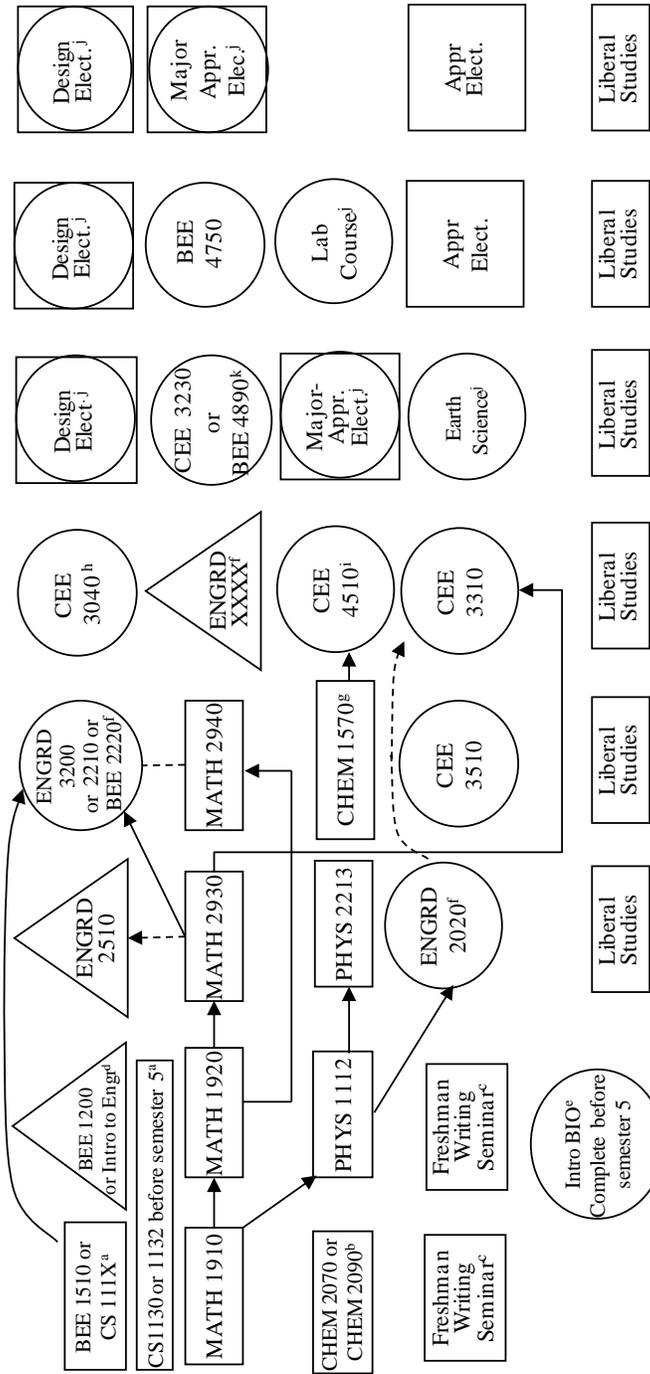
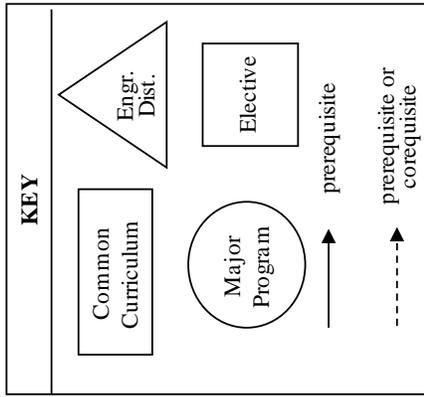
<sup>1</sup>CEE 6370 can be used to fulfill both the lab and design requirement, but students must then take an additional major approved elective from the list.

<sup>2</sup>BEE/EAS 4940 may be counted by petition as either an Earth Science or a Major Approved Elective, but not both.

**Note:**

EnvE Major Approved Electives are 3 or 4 credit environmental engineering-related technical courses that support the professional objectives of the student which have either (1) a technical prerequisite beyond the common curriculum or (2) an advanced rank limited to juniors or above. These courses are selected and approved for use in the curriculum by the EnvE Program Committee.

# Environmental Engineering Major (EnvE) Roadmap





- <sup>a</sup> Students matriculated in CALS usually take BEE 1510 for the computing requirement. COE students may take CS 1110, 1112, or 1114. (COE students who matriculated Fall 2011 or earlier must also take CS 1130 or CS 1132)
- <sup>b</sup> COE 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. .
- <sup>c</sup> 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 ENGRG course, or BEE 4730, or BEE 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.
- <sup>d</sup> BEE 1200 combined with BEE 1510: Introduction to Computer Programming (5 credits total) satisfies the ENGRI requirement for CALS matriculated students. Students using BEE 1200 and BEE 1510 to satisfy the ENGRI requirement must make up the 2-credit difference with engineering course work.
- <sup>e</sup> Choose one of the following: BIOEE 1610, BIOMG 1350, BIOEE 1780, BIOG 1440, BIOG 1105, BIOG 1106, BIOG 1107, or BIOG 1108. Complete before semester 5.
- <sup>f</sup> 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.
- <sup>g</sup> CHEM 1570 (spring), CHEM 3570 (fall).
- <sup>h</sup> 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.
- <sup>i</sup> Students may take BIOMI 2900 General Microbiology Lectures, in place of CEE 4510.
- <sup>j</sup> 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.
- <sup>k</sup> 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**  
 (Applies to students matriculating in the Fall Semester of 2012 or later)

Name: \_\_\_\_\_ Email: \_\_\_\_\_ Advisor: \_\_\_\_\_  
 CU ID: \_\_\_\_\_ Last Revised: \_\_\_\_\_  
 2nd Major: \_\_\_\_\_ Minor: \_\_\_\_\_ Antic. Grad Date: \_\_\_\_\_

COURSE	#	CR	GRADE	TERM	COMMENTS
--------	---	----	-------	------	----------

**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	3	_____	_____	_____
PHYS	1112	4	_____	_____	_____
PHYS	2213 or 2217	4	_____	_____	_____
CS	1110, 1112 or BEE 1510	4	_____	_____	_____
CS	1130 or 1132*	1	_____	_____	_____
BIOG	1XXX	3	_____	_____	_____

**2) Engineering Distribution & Major Courses -- all letter grade (42 credits)**

ENGRI	1XXX	3	_____	_____	or BEE 1200 (+BEE 1510)
ENGRD	2510	3	_____	_____	BEE 2510
ENGRD	XXXX	3	_____	_____	or M-A Elective
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	_____	_____	See Approved List on Page 10
Lab Course		3	_____	_____	See Approved List on Page 10

**3) Design Courses & Major-Approved Electives (See approved List; 15 credits)**

	3	_____	_____	_____	Design Course - Capstone
	3	_____	_____	_____	Design Course
	3	_____	_____	_____	Design Course
	3	_____	_____	_____	M-A Elective
	3	_____	_____	_____	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	_____	_____	_____	_____
	3	_____	_____	_____	_____

				Name:	
COURSE	#	CR	GRADE	TERM	COMMENTS
<b>6) Liberal Studies: 6 courses (at least 2 courses at 2000 level or above and 3 categories; 18 total credits)</b>					
(CA)	Cultural Analysis		(KCM)	Knowledge, Cognition, and Moral Reasoning	
(HA)	Historical Analysis		(SBA)	Social & Behavioral Analysis	
(LA)	Literature and the Arts		(FL)	Foreign Language (not literature)	
(CE)	Communications in Engineering				
		3			
		3			
		3			
		3			
		3			
		3			
		3			
<b>7) Approved Electives (6 cr. Minimum)</b>					
		3			
		3			
<b>8) Additional Courses (Not required for graduation)</b>					

**TOTAL CREDITS: 125**  
*Min. Credits for Graduation: 125*

- Tech Writing
- PE
- PE

\*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 minors offered in any college. There are 70 to choose from. 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/minors.cfm>

## 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  $\geq 2.0$ .
- Cumulative GPA  $\geq 2.0$ .
- A semester GPA  $\geq 2.0$  in Core 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 may be warned, 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 Academic Standards, Petitions and Credits Committee (ASPAC). 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, ASPAC 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 a Environmental Engineering faculty member using BEE 4991-4992: BEE Honors Research 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 or as part of a regularly recognized course in the College of Engineering (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 the 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 ENGR 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 1510      Introduction to Computer Programming**

Fall      4 credits

C. L. Anderson

Letter grade only. Limited to 18 students per lab and rec. No previous programming experience assumed. Pre- or co-requisite: MATH 1910 or equivalent. Lec M W 10:10-11:25; Lab W R 12:20-2:15, 2:30-4:25.

Introduction to computer programming and concepts of problem analysis, algorithm development and data structure in an engineering context. The structured programming language MATLAB™ is used, implemented on interactive personal computers, and applied to problems of interest in biological and environmental engineering.

## **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 10:10-11:00.

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 for a Sustainable Society (ENGRD 2510)**

Fall      3 credits

B. A. Ahner

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**

Spring, Summer 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](http://www.hydrology.bee.cornell.edu/BEE371Index.htm)

**BEE 4010 Renewable Energy Systems**

Spring 3 credits

M. B. Timmons

Letter grade only. Prerequisite: college physics and chemistry. 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, bio-conversion processes, 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 4360 Engineering Design of Aquacultural Systems**

Spring 3 credits

M. B. Timmons

Letter grade only. Satisfies BE and EnvE Capstone design requirement Prerequisite: at least junior standing and one semester of physics and chemistry in a non-engineering discipline.

No-one is allowed to add the course after the 2<sup>nd</sup> lecture. Two required field trips require class to return to campus at 7 p.m. Lectures are web based with required reading from course text, "Recirculating Aquaculture", Timmons and Ebeling (2<sup>nd</sup> Ed., 2010, Cayuga AquaVentures, LLC. Ithaca, NY). Lecture W 1:25-2:15.

An in-depth treatment of the principles of aquaculture: fish biology, waste treatment, engineering design, fish health, nutrition, processing, etc. This course is intended to build upon the undergraduate's previous course background and interests. Includes supervised "hands-on" laboratory experiences.

**BEE 4710 Introduction to Groundwater (EAS 4710; offered alternate years)**

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.

Intermediate-level study of aquifer geology, and water and contaminant transport in the groundwater and unsaturated zone. Includes description and properties of natural aquifers, groundwater hydraulics, soil water, and solute transport. The class is taught as a special problem course in which readings and problem sets are assigned and then discussed once a week.

**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**

Fall 3 credits

D. A. Haith

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 (search techniques, linear programming) 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. Prerequisites: 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)**

Fall 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 atmospheres 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

L. Angenent

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<sup>TM</sup> 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 4 credits

M. B. Timmons

Letter grade only. Satisfies College of Engineering technical writing requirement. Prerequisite: junior standing or higher. No one is allowed to add the course after 2<sup>nd</sup> 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 Terrestrial Hydrology in a Changing Climate (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 2013-2014.

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**

Spring 3 credits

P. G. Hess, N. Mahowald, L. Derry

S-U or Letter grade. Prerequisite: graduate student standing; undergraduate junior or senior with math 2930 and physics 1112; or permission of instructor. Lec T R, TBD

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; normally reserved for seniors in upper two-fifths of their class. Students from all colleges must register with an Independent Study Form (available on line 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 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 on line 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: normally reserved for seniors in upper two-fifths of their class; adequate training for work proposed; written permission of instructor. Students from all colleges must register with an Independent Study Form (available on line 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 4991-4992 BEE Honors Research**Fall and Spring 1-6 variable credits  
Staff

Letter grade only. Prerequisites: enrollment in BEE research honors program. Students must be eligible for Latin honors and complete honors program application by 3rd week of the Fall semester, senior year. Students from all colleges must register with an Independent Study Form (available on line at: <https://dust.cals.cornell.edu/IndStudyPolicy.aspx>).

Intended for students pursuing the research honors program in BEE.

**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. Students enrolling in the FE 1-credit review portion must register to take the Fundamentals of Engineering Exam\*\*. Three required lectures (weeks 1, 2, 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. Lectures and Section W 7:30-8:45 final exam required that mimics the real FE 8-hour exam held in mid-April on the Cornell campus.

Course prepares the student for the general national FE Examination taught in a team-based format. FE review homework addresses FE exam preparation, and students complete the 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 must file their NY FE Exam application by either November 1 of the previous year or by May 1 of the spring semester to be enrolled in BEE 5330. The FE exam registration and sitting fees total \$205 and are paid to the NY State Education Department and the testing service, not to Cornell. The NY FE Exam is offered in April and October. The April exam may be taken at Cornell and other NY locations. The October exam is not offered at Cornell. 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 6200 Approaches to Analytical Characterization of Biological Macromolecules**

Spring 1 credit

K. Edwards

Letter grade only. Prerequisites: permission of instructor. Lec T R 11:15-12:05, 1<sup>st</sup> 8 weeks of semester.

Survey of modern biological macromolecule characterization techniques (surface plasmon resonance, light scattering, calorimetry, and separation methods). Emphasis on applications for protein analysis and their integration, along with theory, instrumental design, and quantitative analysis. Intended for practical understanding of these techniques in a research setting for upper level undergraduates and graduate students without a strong background in analytical chemistry.

**BEE 6580 Biofuels Topics (Offered alternate years)**

Spring 3 credits

L. Angenent

S/U or letter grade. Prerequisites: graduate standing. Lec T R 10:10-11:25.

The specific topic changes each year, and will be chosen with the input from graduate students at the beginning of the course, but will be within the area of biofuels or bioenergy generation. This class is highly participation-oriented and each student is expected to actively participate. During each lecture we will review a single paper selected by a student and go in depth. Within the biofuels topic, we will not only discuss the research and science, but also the application and evaluation. For example, we will examine the economic analysis and the life cycle assessment. The student choosing the paper will be expected to lead the discussion after a small lecture. The others will provide a summary of each paper possibly with additional sources.

**BEE 6880 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. Graduate students will be required to complete the term project on an individual basis.

**BEE 7540 The Right to Water**

Spring 2 credits

T. S. Steenhuis, G. Holst-Warhaft, et al.

S-U or Letter grade. Prerequisite: graduate standing or permission of instructors. Lec M 1:25-3:20.

The course addresses the crisis of water in the Mediterranean region, through case studies situated in watershed basins, especially the Nile. It focuses on attitudes, conflicts, and relationships of local people and nations toward water, expressed in culture, environmental laws and watershed management practices.

**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 Design for Appledore Island (ENGRI 1130)**

Spring 3 credits

J. J. Bisogni

S-U or Letter grade. Note: Students must register under ENGRI 1130. Lec M W F 9:05-9:55. (Next Offered 2011-2012)

Students learn how to design: reservoirs to provide water during droughts, aqueducts to transport water, and water treatment plants to prevent waterborne diseases. The course includes field trips, building a computer-controlled miniature water treatment plant, and exploring new technologies for making safe drinking water.

**CEE 1131 Water Treatment Design (ENGRI 1131)**

Fall 3 credits

M. L. Weber-Shirk

Letter grade only. Note: Students must register under ENGRI 1131. Lec T R 10:10-11:25; Lab T 2:55-4:25.

Students learn how to design: reservoirs to provide water during droughts, aqueducts to transport water, and water treatment plants to prevent waterborne diseases. The course includes field trips, building a computer-controlled miniature water treatment plant, and exploring new technologies for making safe drinking water.

**CEE 2550 AguaClara: Sustainable Water Supply Project**

Fall, Spring 3 credits

M. L. Weber-Shirk

Letter grade only. Co-meet with CEE 4550. Lec T R 1:25-2:40.

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](http://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 (ENGRD 3200)**

Spring 3 credits

C. A. Shoemaker

S-U or Letter grade. Prerequisites: CS 1112 and MATH 2930. Co-requisite: MATH 2940. Recommended: completion of MATH 2940. Lec 1 T R 10:10-11:00, 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

Staff

Letter grade only. Note: Primarily for Juniors and Seniors. Lec M W 10:10-11:00; Lab F 9:05-9:55, 10:10-11:00, 11:15-12:05.

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

Letter grade only. Prerequisite or co-requisite: ENGRD 2020. Lec M W F 10:10-11:00; Lab R 12:20-1:10, 1:25-2:15, F 1:25-2:15.

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

L. W. Lion

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 Environmental Information Science**

Fall 3 credits

S. DeGloria

Letter grade only. Lec TR 9:05-9:55; Lab T 1:25-4:25, W 1:25-4:25; W 1:25-4:25.

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

P. L-F Liu

Letter grade only. Prerequisite: CEE 3310. Satisfies EnvE capstone design requirement. Offered Alternate Years. Lec TBA (Next Offered 2013-2014)

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. E. Richardson

Letter grade only. Prerequisites: two semesters of college chemistry; organic chemistry or permission of instructor. Lec M W F 11:15-12:05.

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

R. E. Richardson

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 2013-2014)

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 corequisite of CEE 4540 or (prerequisite of CEE 3310 with permission of instructor). Meets with CEE 2550. Letter grade only. Lec T R 1:25-2:40.

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](http://aguaclara.cee.cornell.edu).

**Note:** CEE 4550 can only be taken once for program credit.

**[CEE 4920 Engineers for a Sustainable World: Engineering in International Development**

Fall 3 credits

R. E. Richardson, P. Doing

Letter grade only. Prerequisite: Senior or Graduate Standing; Juniors need permission of instructor. Lec T R 10:10-11:00, Lab 1 M 7:30-9:25PM.,(Next Offered 2013-2014)

Engineering-based group service projects offer real-life engineering research and design experience, from problem formulation through implementation. They may be international or local, and may relate to any kind of engineering. Students work on interdisciplinary teams with a project supervisor and a partner community organization. Course readings and a writing assignment cover the relationship between engineering and international development, the philosophy and politics of technology, and ethics in engineering practice.]

**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

Letter grade only. Lec M W 2:55-4:10. (Next Offered 2013-2014)

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 6230 Environmental Quality Systems Engineering]**

Fall 3 credits

C. A. Shoemaker

Letter grade only. Prerequisites: MATH 2940, optimization, and graduate standing or permission of instructor. (Next Offered 2013-2014.)

Application of optimization, simulation methods, and uncertainty analysis to the prevention and remediation of pollution. Case studies include: regional waste and wastewater treatment, restoration of dissolved oxygen levels in rivers, and reclamation of contaminated groundwater. Application use linear programming, integer, dynamic, nonlinear programming, and sensitivity analysis.]

**[CEE 6300 Spectral Methods for Incompressible Fluid Flows]**

Fall 3 credits

P. J. Diamessis

Letter grade only. Lec M W 2:55-4:35. Next Offered 2014-2015)

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.

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

P. L. Liu

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 2013-2014)

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. J. Bisogni

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

J. M. Gossett

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

J. M. Gossett

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.

**[CEE 6580 Biodegradation and Biocatalysis**

Spring 3 credits

R. E. Richardson

Letter grade only. Prerequisites: CEE 4510 or BIOMI 2900 or equivalent; CEE 3510 or CHEME 3900 or permission of instructor. Satisfies EnvE laboratory experience requirement. Offered Alternate Years. Lec T 1:25-2:40; Lab R 1:25-4:30. (Next Offered 2012-2013)

Students explore the use of microbes in biodegradation and biocatalysis as well as the molecular techniques (i.e., analysis of DNA, RNA, and proteins) commonly used in these applications. Lectures cover enzyme classes and kinetics, selective isolation of organisms with desired bioconversion capabilities, effects of environmental parameters and cell-to-cell communication on gene expression, methods in microbial molecular biology, and contemporary case studies in biodegradation and biocatalysis. Laboratory sessions give students hands-on experience in molecular and analytical methods. Student teams design and then construct a bioreactor employing their own environmental isolates that degrade a selected contaminant or produce a desired compound.]

**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 8:00-8:50; TR 11:40-12:55;

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.

**CSS 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.

**CSS 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 2200 The Earth System**

Fall, Spring 4 credits

W. M. White and A. Moore

Letter grade only. Prerequisites: MATH 1110/1910. Lec T R 11:40-12:55; 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 4800 Our Changing Atmosphere: Global  
Change and Atmospheric Chemistry**

Fall 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.

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

Staff.

S-U or Letter grade. Prerequisite: first year chemistry and thermodynamics (or equivalent); graduate standing or permission of instructor. Offered Alternate Years. (Next Offered 2013-2014).

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.]

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## **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.

**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.

**Largus T. Angenent (BEE)**

Conversion of organic materials into bioenergy with undefined mixed cultures of microbes.

**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.

**Antje J. Baeumner (BEE)**

Biosensors and microfluidic systems for clinical diagnostics, food safety and environmental protection.

**James J. Bisogni, Jr. (CEE)**

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)**

Water and waste treatment, microbiological phenomena and processes, treatment of contaminated groundwater.

**Douglas A. Haith (BEE)**

Environmental systems analysis, nonpoint source pollution, solid waste management, watershed modeling, risk assessment.

**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.

**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.

**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.

**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.

**Larry P. Walker (BEE)**

Processes for utilization of enzymes, microorganisms, and plants, enzymatic hydrolysis of polysaccharides, and high-solids aerobic decomposition (i.e., composting).

**Michael F. Walter (BEE)**

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 Jenkins (255-7185, jtj2) 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 Jenkins 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

<http://biology.cornell.edu/index.php/oub-advising-services>

### **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: jcb13@cornell.edu

<http://lsc.sas.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](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/>

**Tau Beta Pi** (<http://www.rso.cornell.edu/tbp/tutoring.html>) and

**Ho-Nun-De-Kah** (<http://www.rso.cornell.edu/hndk/request.html>)

Both offer a match-up service for free tutoring.

## 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](mailto: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](mailto: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'.

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## PROFESSIONAL REGISTRATION

Engineers are licensed (after examination and if they also have suitable experience) to practice engineering in each state of the U.S. While not required for all Environmental Engineering jobs, registration 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 toward getting a 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. **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.

The Part A exam is held at Cornell University in the Spring and at other locations in New York for the Fall exam. Application forms to apply for the Part A exam are available on-line at: <http://www.op.nysed.gov/prof/pels/> and in 116 Riley Robb, or in the Undergraduate Program Office in 221 Hollister Hall. In 1999, the State of New York Education Department contracted with an independent examination vendor to administer the exam and handle related activities. Because of this you are required to first apply for licensure and then you will be sent information regarding testing including application deadlines. Historically application deadlines have been Nov. 1<sup>st</sup> for the April exam, and May 1<sup>st</sup> for the October exam. There is a \$70.00 licensing fee for Part A of the exam plus a \$135 scheduling fee.

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 taught in a team-based format. 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/>

Cornell students who are between one and eight credits short of their engineering baccalaureate degree may initiate their Master of Engineering program as "Early Admit students." Early Admit students complete their Bachelors degree and spend at least one full time semester enrolled in the graduate school prior to the conferral of their Master of Engineering Degree. Early Admit students are classified as undergraduate students and pay undergraduate tuition during their Early Admit semester.

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 that 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.

## **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. A copy may be obtained from the Engineering Advising Office, 167 Olin Hall, or from the Dean of the Faculty, 315 Day Hall. Also available on the web at: <http://cuinfo.cornell.edu/Academic/AIC.html> with an explanation at <http://www.theuniversityfaculty.cornell.edu/AcadInteg/>

## **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](mailto: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.

# NOTES

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