

MEng in Environmental Engineering at Cornell

Master of Engineering Program within Civil and Environmental Engineering

Environmental Engineering (EnvE) represents one of the 3 major intellectual areas within Cornell's nationally-ranked School of Civil and Environmental Engineering. Educational and research activities in this area develop and apply experimental laboratory and quantitative systems methods to analyze, design, plan, and operate water resources, sustainable energy, and environmental systems. The focus of this document is the CEE Master of Engineering degree with an Environmental Engineering major.

Courses and research integrate environmental engineering, systems engineering and economic-policy analysis to design and operate sustainable energy projects and efficient water treatment systems, to manage water, land, air and human resources, and to address environmental remediation concerns. Such analyses are based upon a sound understanding of hydrology, hydraulics, environmental sciences, biology and environmental engineering. Projects often involve faculty in the other environmentally-orientated groups including the Dept. of Biological and Environmental Engineering, as well as with other departments in the Engineering College and the College of Agriculture and Life Sciences.

Within the MEng EnvE program, one can stress different subjects of inquiry. Individuals pursuing environmental processes focus more on laboratory and field analyses, using understanding of chemistry microbiology and fluid mechanics. Those pursuing a more systems view consider analytical methods that bridge fundamental environmental science and systems sciences, which include operations research, computer science, statistics, risk analysis, economics and engineering management. By examining engineering, socio-economics, ecology, and public policy issues using analytic model-oriented frameworks, environmental engineering projects strive to develop and communicate estimates of the impact and risks of alternative decisions to the many stakeholders associated with environmental management issues. Still others focus on environmental fluid mechanics and hydrology. There is a growing interest in the develop and construction of sustainable energy systems, and their integration with other sources of energy.

Cornell University offers 3 degree programs within the environmental area; these are the Master of Engineering (Civil), Master of Science, and Doctor of Philosophy. ME(C) is a compact and intense program that most students complete in one year. They can go on to a PhD program here or elsewhere. The orientation is often more toward engineering practice, and an engineering project is a key part of that program.

The MS program is orientated toward research and is generally a two-year program. The PhD program has a strong research emphasis. Most students in the MS/PhD and PhD programs currently receive financial support in the form of a fellowship, research assistant or teaching assistant. Two-year MS programs have more time than those in the 1-year ME(C) professionally-orientated degree, which allows for a wider range of courses and the experience of a research-orientated thesis. Funding is very limited for 2-year MS candidates, and such students are often directed to the 1-year ME(C) degree.

Additional information can be obtained on the Web at:
<https://www.cee.cornell.edu/cee/programs/graduate-programs>

Master of Engineering ME(C) Degree Program

The ME(C) degree program in Environmental Engineering is a professionally-oriented graduate program preparing students for careers in consulting firm, business or government service. It may be used as an entry program before a subsequent research degree, such as the PhD.

Candidates without a Civil or Environmental Engineering bachelor's degree may need to include courses that provide needed background. This is a way for individuals without an accredited engineering Bachelor of Science degree to earn a Master of Engineering degree.

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ME(C) degree requirements consist of 30 semester hours of graduate-level courses or courses beyond the equivalent of the typical undergraduate civil engineering curriculum. A MEng project is also required. ME(C) students can take one three-credit-hour project course, or six-credit-hours as a two-course engineering design project sequence. In total, students must take a minimum of 30 semester hours of technical course work, generally 5000, 6000 and 7000-level courses, though 4000-level are often acceptable. A strength of our ME(C) program is its roots in all of our environmental engineering programs, coupled with support from the engineering management program in the School of Civil and Environmental Engineering.

MEng Projects

In the design project, students work on a realistic engineering systems problem, often in cooperation with a consulting firm or government agency. Check the list of projects offered in both the fall and spring of your year in the program. You need to take at least one 3-credit project course. However, some students take a fall/spring sequence of two 3-credit course for projects that span 2 semesters. And then sometimes, a few students have participated in 2 project courses. Projects may focus narrowly on specific environmental engineering specialties. For example the AguaClara program has many teams that have specific environmental processes projects. Other projects may emphasize engineering management, energy and sustainability themes that require integration of a broad range of issues. Recently a new theme has been interdisciplinary projects addressing stream and wetland restoration goals. SEE: <https://www.cee.cornell.edu/cee/programs/graduate-programs/meng-civil-and-environmental-engineering/environmental-engineering>

Appropriate Courses for Master of Engineering ME(C) Degree

Master of Engineering students focusing on Environment Engineering should take 5 courses in a specialty area. Another five course (including the project) can be taken from different areas of environmental engineering, or outside of engineering addressing economics, policy, or rural development relevant to EnvE. Students are required to take at least 14 credits from a list of appropriate engineering course that support the EnvE area. Courses to consider include:

- CEE 5010/20** (Fall or Spring) Design Project
- CEE 5930** (Fall) Data Analytics for Engineering Managers
- CEE 5980** (Fall) Decision Analysis
- BEE 4110/6110** (Fall) Hydrologic Engineering in a Changing Climate is now
- CEE 6320** (Fall) Hydrology
- BEE 4730** (Fall) Watershed Engineering
- CEE 6550** (Fall) Transport, Mixing & Transformation in the Environment
- CEE 6790** (Fall) Time Series Data Analysis for Civil, Mechanical and Geophysical Applications
- ChemE 6660** (Fall) Analysis of Sustainable Energy Systems
- SYSEN 6800** (Fall) Computational Optimization
- CEE 4520** (Fall) Sustainable Safe Water on Tap
- CEE 4565** (Fall) Waste Water Processes and Resource Recovery
- CEE 6100** (Fall) Remote Sensing Fundamentals
- CEE 6530** (Fall) Water Chemistry for Environmental Engineering
- CEE 6560** (Fall) Physical/Chemical Process

- CEE 5970** (Spring) Risk Analysis and Management

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CEE 6200 (Spring) Water-Resources Systems Engineering
NTRES 3240 (Spring) Sustainable, Ecologically Based Management of Water Resources
CEE 6360 or 6370 (Spring) Environmental Fluid Mechanics
BEE 6880 (Spring) Applied Modeling and Simulation for Renewable Energy Systems
AEM 6510 (Spring) Environmental and Resource Economics
Students should also take fall & spring seminar series
CEE 6020-6021 Seminar - Water Resources and Environmental Engineering.

Paths are just examples and students are strongly encouraged to work with their MEng advisors to customize their program to meet their interests. Here are example programs for students interested in different specialties:

Environmental Fluid Mechanics & Hydrology (EFMH) Specialty

Fall:

BEE 4730 Watershed Engineering (4 cr.)
BEE 4110/6110 Hydrology in a changing climate (3 cr.)
CEE 6100 Remote Sensing Fundamentals (3 cr.)
CEE 6550 Transport, Mixing, and Transformation in the Environment (3 cr.)
CEE 6020 (Fall/Spring) Environmental Fluid Mechanics & Hydrology Seminar (1 cr.)
CEE 5021 Fall/Spring) EnvE Project in Restoration Wetlands/Streams (3 cr.)
Fall Total: 17 credits

Spring:

BEE 4710 Introduction to Groundwater (3 cr.)
CEE 43501 Coastal Engineering -or- CEE 63701 Experimental Methods in Fluid Dynamics (4 cr.)
CEE 6320 Hydrology (3 cr.)
BEE 6740 Ecohydrology (3 cr.)
CEE 6021 (Fall/Spring) Environmental Fluid Mechanics & Hydrology Seminar (1 cr.)
CEE 5022 EnvE Project in Restoration Wetlands/Streams (3 cr.)
Spring Total: 17 credits

Program total 34 credits

Environmental Processes (EP) Specialty

Fall:

CEE 4510 Microbiology for Environmental Engineering (3 cr.)
CEE 6530 Water Chemistry for Environmental Engineering (3 cr.)
CEE 6550 Transport, Mixing, and Transformation in the Environment (3 cr.)
CEE 6560 Physical/Chemical Process (3 cr.)
CEE 6020 Environmental Processes Seminar (1 cr.)
CEE 5021 EnvE Project in AguaClara (3 cr.)
Fall Total: 16 credits

Spring:

CEE 4530 Laboratory Research in Environmental Engineering (3 cr.)
CEE 6570 Biological Processes (3 cr.)
CEE 6590 Environmental Organic Chem. (3 cr.)
CEE 5970 Risk Analysis and Management (3 cr.)
CEE 6021 Environmental Processes Seminar (1 cr.)
CEE 5022 EnvE Project in AguaClara (3 cr.)
Spring Total: 16 credits

Program total 32 credits

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Environmental Water Resources ENGINEERING (EWRE) Specialty

Fall:

CEE 4520 (Fall) Sustainable Safe Water on Tap (3 cr.)
CEE 6550 Transport, Mixing, and Transformation in the Environment (3 cr.)
CEE 5930 Data Analytics for Engineering Managers (4 cr.)
BEE 4730 Watershed Engineering (3 cr.)
CEE 6020 Civil & Environmental Systems Seminar (1 cr.)
CEE 5050 Interdisciplinary Master of Engineering Project (2 cr.)
Fall Total: 16 credits

Spring:

CEE 5970 Risk Analysis and Management (3 cr.)
CEE 6200 Water-Resources Systems Engineering (3 cr.)
NTRES 3240 Sustainable, Ecologically Based Management of Water Resources -or-
BEE 6880 Applied Modeling & Simulation for Renewable Energy Systems (3 cr.)
AEM 6510 Environmental and Resource Economics (4 cr.)
CEE 6021 (Civil & Environmental Systems Seminar (1 cr.)
CEE 5050 Interdisciplinary Master of Engineering Project (4 cr.)
Spring Total: 18 credits

Program total 34 credits

¹Course offered every other year.

Sustainable Energy Systems (SES) Specialty

Fall:

BEE 4879 Sustainable Bioenergy Systems (3 cr.)
MAE 4021 Wind Power (4 cr.)
CEE 6550 Transport, Mixing, and Transformation in the Environment (3 cr.)
CHEME 6660 Analysis of Sustainable Energy Systems (3+ cr.)
CHEME 5870 Energy Seminar (1 cr.)
CEE 5910 Eng. Management Sustainable Energy Project (3 cr.)
Fall Total: 17 credits

Spring:

BEE 4010 Renewable Energy Systems (3 cr.)
CEE 43701 Experimental Methods in Fluid Dynamics -or- CEE 6790 Time Series Data Analy (3 cr.)
MAE 4121 Community Wind Energy Research (4 cr.)
CHEME 666X Modules in Energy Systems such as Bioenergy and Biofuels, Geothermal Hydrokinetic and Aerodynamic, Solar, Nuclear, Energy Metals, ... (3 cr.)
CHEME 5880 Energy Seminar (1 cr.)
CEE 5910 Eng. Management Project in Sustainable Energy Project (3 cr.)
Spring Total: 17 credits

Program total 34 credits

Sustainable Energy Systems

Sustainable energy systems is a growing area of concern in our society and new courses continue to be developed. Sustainable energy projects combine environmental analysis of pollution reduction and climate protection benefits of energy technologies, as well as economic feasibility assessment of investment in them. Reflecting the interdisciplinary nature of the field, key courses are offered by different departments with some coordination by the Cornell Engineering's Energy Institute. Mechanical design, properties of materials, electric power system operation, and environmental impacts are important, and such courses are offered in departments across the Engineering College.

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CEE 6650.....Transportation, Energy, and Environmental Systems for Sustainable Development

BEE 4010Renewable Energy Systems (3 cr, Spring)

BEE 4760Solid Waste Engineering

BEE 4870Sustainable Bioenergy Systems

BEE 6880Applied Modeling & Simulation for Renewable Energy

CHEM 6640.Energy Economics

CHEME 6650..... Energy Engineering

CHEME 6660.....Analysis of Sustainable Energy Systems

CHEME 6661-72.....Sustainable Energy Modules:

Bioenergy, Solar, Geothermal, Wind, Hydroelectric (1 cr. each)

MAE 4020.....Wind Power

MAE 4120.....Community Wind Energy Research

MAE 5010.....Future Energy Systems

EAS 4570Atmospheric Air Pollution

EAS 4570Atmospheric Air Pollution (3 cr, Fall, Alternate Years, Next 2018-2019)

EAS/MAE 6480Air Quality & Atmospheric Chemistry (Offered Alternate Years)

AguaClara and Sustainable Water Treatment

The AguaClara program is dedicated to the ongoing development of resilient, gravity-powered drinking water and wastewater treatment technologies. Many MEng EnvE students pursue projects with this program. The projects provide hands-on, real-world experience in humanitarian engineering and sustainable international development while simultaneously developing expertise in advanced water treatment and design methodologies. Cornell graduates who have participated in the AguaClara project teams are highly regarded by employers.

For a courses program in this area, students should look at the courses listed under Environmental Processes at the end of this brochure, particularly CEE 4520 and CEE 4565. Other core courses include CEE 6530, 6560 and 6570. See also <http://aguaclara.cornell.edu>

Engineering Management

For the professional engineering, engineering management and project management skills are critical. Engineers are needed who organize ideas and resources to make it happen. Designs do not magically become operating structures and systems.

The active management of many transportation, energy and water resources projects is key to their economic efficiency and the avoidance of adverse environmental impacts. For many wind and solar energy projects, the challenge is not the engineering or design, but the implementation including financing and construction of the facilities. Thus many students in the EnvE program take advantage of the course offering in the School's ME program in Engineering Management. CEE 5930 along with CEE 5970 and/or CEE 5980 are commonly taken by MEng-EnvE students.

CEE 5900 Project Management

CEE 5930 Engineering Management Methods

CEE 5970 Risk Analysis and Management

CEE 5980 Introduction to Decision Analysis

SYSEN 5100 Model-Based Systems Engineering

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Elective Courses by Field

One of the great strengths of Cornell's graduate program in EnvE is the abundance of supporting courses offered by other units across the University, as well as by CEE's faculty. See the on-line course catalog at www.cornell.edu/academics/courses.cfm. Please review the catalog to identify elective courses of possible interest. Courses of potential interest to graduate EnvE students include (courses with * taken more often):

Applied Economics and Management

*AEM 6510 Environmental and Resource Economics (S)
AEM 6600 Agroecosystems, Economic Development, and Environment (S)
AEM 7010 Econometrics I (S)
AEM 7110 Econometrics II (F)
AEM 7510 Environmental Economics (S)

Applied Systems Engineering

SYSEN 5100 ... Applied Systems Engineering (F)
SYSEN 5200 ... Systems Architecture, Behavior, and Optimization (S)
SYSEN 5300 ... Systems Engineering for Design of Reliable Systems (F)

Biological and Environmental Engineering

BEE 3710 Physical Hydrology for Ecosystems
BEE 4010 Renewable Energy Systems (S)
BEE 4200 Surface Chemistry of Particles in Natural and Engineered Processes
BEE 4730 Watershed Engineering (F)
BEE 4731 Watershed Modelling (Proposed for S)
BEE 4760 Solid Waste Engineering (S)
BEE 4870 Sustainable Bioenergy Systems (F)
BEE 4880 Applied Modeling and Simulation for Renewable Energy Systems
BEE 6510 Analysis of the Flow of Water and Chemicals in Soils (F)
BEE 6740 Ecohydrology (S)
BEE 6880 Applied Modeling and Simulation for Renewable Energy Systems (S)

City and Regional Planning

CRP 3800..... Environmental Politics (S)
CRP 4440..... Resource Management and Environmental Law
CRP 5190..... Urban Theory and Spatial Development (S)
CRP 5440..... Resource Management and Environmental Law (S)
CRP 6700..... Regional Planning and Development in Developing Nations (F,S)

Computer Science-Numerical Analysis

CEE 3200.....Engineering Computation (S)
CEE 6000.....Numerical Methods for Engineers (F)
CS 4210 Numerical Analysis and Differential Equations (F)
CS 6210 Matrix Computations (F)
CS 6220 Data-Sparse Matrix Computations (F)

Earth & Atmospheric Sciences

EAS 2680..... Climate and Global Warming (S)
EAS 3030..... Introduction to Biogeochemistry (F)
EAS 3150..... Geomorphology (S)
EAS 4570..... Atmospheric Air Pollution (F)
EAS 5051..... Climate Dynamics (F)

Economic & Econometrics

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ECON 3130 Intermediate Microeconomic Theory (F, S)
ECON 3140 Intermediate Macroeconomic Theory (F, S)
ECON 6090 Microeconomic Theory I (F)
ECON 6190 Econometrics I (F)
ECON 6200 Econometrics II (S)
ECON 7190 Advanced Topics in Econometrics I (F)

Sustainable Energy and Development

ORIE 2380 Urban Analytics (F)
BEE 3299 Sustainable Development (S)
BEE 4010 Renewable Energy Systems (S)
BEE 4760 Solid Waste Engineering (S)
BEE 4870 Sustainable Bioenergy Systems (F)
BEE 4880 Applied Modeling & Simulation for Renewable Energy Systems (F)
CEE 6650 Transportation, Energy, and Environ. Systems for Sustainable Development (S-2020)

CHEME 6640 Energy Economics (F)
CHEME 6650 Energy Engineering (S)
CHEME 6660..... Analysis of Sustainable Energy Systems (F)
CHEME 6661-73.... Energy Systems Modules: Bio-, Nuclear, Wind, Solar, Geothermal, Economics (F/S)

MAE 4021 Wind Power (F)
MAE 4121 Community Wind Energy Research (S)

Environmental Systems & Engineering Management/

BEE 4880 Applied Modelling and Simulation of Renewable Energy Systems (S)
BEE 4940 Hydrologic Engineering in a Changing Climate (F)
CEE 4770 Natural Hazards, Reliability, and Insurance
CEE 4630 Future Transportation Technologies and Systems (F)
CEE 5900 Project Management (F, S)
*CEE 5930 Data Analytics for Engineering Managers
*CEE 5970 Risk Analysis & Management (S)
*CEE 5980 Decision Analysis (F)
*CEE 6200..... Water Resource Systems Planning (S)
CEE 6770 Natural Hazards, Reliability, and Insurance (F)
CEE 6790 Time Series Data Analysis for Civil, Mechanical and Geophysical Applications (F)
SYSEN 6800....Computational Optimization (F)

Environmental Fluid Mechanics and Hydrology

BEE 4710 Intro Groundwater Hydrology (S)
CEE 4350 Coastal Engineering (S)
CEE 6320 Hydrology (F)
CEE 6360 Env. Fluid Mechanics (S; alternate years with 6370)
CEE 6370 Experimental Methods in Env. Fluid Dynamics (S)

Environmental Engineering

CEE 4510..... Microbiology for Environmental Engineering (F)
CEE 4520..... Sustainable Safe Water on Tap (F)
CEE 4565 Waste Water Processes and Resource Recovery (F)
CEE 4590 Water Treatment (S)
*CEE 6530..... Water Chemistry for Environmental Engineering (F)
*CEE 6550..... Transport, Mixing, and Transformation in the Environment (F)
CEE 6560..... Physical/Chemical Process (F)
CEE 6570..... Biological Processes (S)

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Natural Resources

** NTRES 3240..... Sustainable, Ecologically Based Management of Water Resources (S)
NTRES 3301..... Sustainability Science (F)
NTRES 3311/6310..... Environmental Governance (F)
NTRES 4220/4221..... Wetland Ecology Lecture/laboratory (F)
NTRES 4560..... Stream Ecology (F)
* NTRES 6200..... Spatial Modeling and Analysis (S)
NTRES 6700..... Spatial Statistics (S)
DSOC 3400..... Agriculture, Food, Sustainability and Social Justice (F)

Operations Research & Information Engineering

ORIE 5300 Operations Research 1: Optimization I (F)
ORIE 5310 Optimization II (S)
ORIE 5550 Applied Time-Series Analysis (F)
ORIE 5580 Simulation Modeling & Analysis (F)
ORIE 6300 Mathematical Programming I (F)
ORIE 6310 Mathematical Programming II (S)
ORIE 6510 Probability (S)
ORIE 6700 Statistical Principles (F)
ORIE 6780 Bayesian Statistics & Data Analysis (S)

Remote Sensing and Spatial Modeling

GIS technology and the digital processing of images and resource inventories is fundamentally changing how we understand and represent critical information. Be a leader in this revolution with your knowledge of the technology and the opportunities.

CEE 4150..... Applied Remote Sensing and GIS for Resource Inventory (F)
CEE 6100..... Remote Sensing Fundamentals (F)
CEE 6150..... Digital Image Processing (S)
PLSCS 2200..... Introduction to Mapping and Spatial Analysis with GIS (F)
PLSCS 4200..... Geographic Information Systems (GIS): Concepts and Application (S)
PLSCS 6200..... Spatial Modeling and Analysis (S)
EAS 4870..... Introduction to Radar Remote Sensing (S)

Application Forms and Information

Applications are available at the Graduate School's website: www.gradschool.cornell.edu. Additional information concerning graduate programs in Civil & Environmental Engineering can be obtained from the CEE web site <https://www.cee.cornell.edu/> or by contacting our Graduate Program Coordinator at:

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