Department of Civil and Environmental Engineering

David A. Dzombak, Head
Office: Porter Hall 119-D
http://www.cmu.edu/cee/

The role of civil and environmental engineers, in the broadest sense, is to apply technology to develop sustainable solutions to meet society's needs. Civil engineers plan, design, construct, and operate facilities used daily by the public and industry, such as buildings, transportation networks, and water and wastewater systems. They work at the intersection of the built, natural, and information environments. Today's civil and environmental engineers are also called upon by government and industry to provide leadership on complex technical and societal issues such as demands for infrastructure improvement, remediation of hazardous waste sites, energy production, transmission and use, climate change adaptation, provision of safe drinking water, and incorporation of environmental safeguards in new infrastructure designs.

Civil and environmental engineering requires broad technical training and strong communication skills because of the complexity of large projects and the interactions with engineers in other fields, lawyers, public officials, and stakeholders. Carnegie Mellon's curriculum provides this versatility for professional practice in civil and environmental engineering and as a strong foundation for other professional pursuits.

The Department of Civil and Environmental Engineering offers a wide spectrum of opportunities for entry into the engineering profession, for graduate education in engineering, or entry into various other graduate and professional fields, including business, law, and medicine. While maintaining its emphasis on the fundamental understanding of the behavior of constructed facilities through the application of the physical sciences, biology, mathematics, and computing, the curriculum has continually evolved in directions that exploit advances in technology. The curriculum introduces the methods of engineering design in the first year and continues to emphasize them throughout the curriculum in both traditional and open-ended project-oriented courses. The basic undergraduate degree program leads to a B.S. in Civil Engineering. Students with a specific interest in Environmental Engineering are advised to complete the Minor in Environmental Engineering and Sustainability.

Central to the evolution of technology and its impact on engineering practice is the increased emphasis on the use of computers in engineering. Several courses on computer methods are required in the curriculum, and most courses offered by the department require the use of computers in applications of either analysis or design.

Our curriculum emphasizes the development of scientific inquiry in the context of applications in civil and environmental engineering. For B.S. graduates who wish to enter the engineering profession directly in such specialties as structural engineering, construction engineering, or environmental engineering, this approach to teaching allows application of the most advanced technological developments. Others who wish to pursue graduate study are prepared to engage in research on the highest level, either in traditional specialties or in emerging fields such as smart infrastructure, climate change adaptation, and micromechanics.

The Civil Engineering curriculum is intended to allow ample opportunity for students to pursue areas of personal interest. A student may choose to concentrate in a specialty area in civil engineering, to pursue a minor in one of the designated minor programs offered in the College of Engineering, or to pursue an additional major. Information is expected to have completed the Restricted Technical Electives in the following list and 12-100 Introduction to Civil and Environmental Engineering.

Curriculum

Minimum units required for B.S. in Civil Engineering 379

Students entering the College of Engineering declare a major near the end of the first year. First-year students take two introductory engineering courses as well as some restricted technical electives within the common foundation specified for first-year engineering students. By the end of the sophomore year, a Civil Engineering major is expected to have completed the Restricted Technical Electives in the following list and 12-100 Introduction to Civil and Environmental Engineering.

Restricted Technical Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>09-101</td>
<td>Introduction to Experimental Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>09-105</td>
<td>Introduction to Modern Chemistry I</td>
<td>10</td>
</tr>
<tr>
<td>15-110</td>
<td>Principles of Computing</td>
<td>10</td>
</tr>
<tr>
<td>21-120</td>
<td>Differential and Integral Calculus</td>
<td>10</td>
</tr>
<tr>
<td>21-122</td>
<td>Integration and Approximation</td>
<td>10</td>
</tr>
<tr>
<td>21-259</td>
<td>Calculus in Three Dimensions</td>
<td>9</td>
</tr>
<tr>
<td>21-260</td>
<td>Differential Equations</td>
<td>9</td>
</tr>
<tr>
<td>33-141</td>
<td>Physics I for Engineering Students</td>
<td>12</td>
</tr>
<tr>
<td>33-142</td>
<td>Physics II for Engineering and Physics Students</td>
<td>12</td>
</tr>
</tbody>
</table>

Notes on Math Requirements

1. All mathematics (21-xxx) courses required for the engineering degree taken at Carnegie Mellon must have a minimum grade of C in order to be counted toward the graduation requirement for the BS engineering degree.
2. A minimum grade of C must be achieved in any required mathematics (21-xxx) course that is a pre-requisite for the next higher level required mathematics (21-xxx) course.

Sample Curriculum

This section shows the recommended four-year program of study for the BS in Civil Engineering following a typical path. The curriculum for transfer students, students with advanced placement credit, and students planning to study abroad will not follow the same path. Students need to consult the department for appropriate advising and formulation of a plan to complete the degree within eight semesters.

First Year

Fall

Units
Department of Civil and Environmental Engineering

2011-2012

Fall
12-100 Introduction to Civil and Environmental Engineering 9
21-120 Differential and Integral Calculus 10
33-141 Physics I for Engineering Students 12
99-10x Computing @ Carnegie Mellon 3
xx-xxx General Education Course 9

Spring
xx-xxx Introduction to Engineering (other than CEE) 12
21-122 Integration and Approximation 10
33-142 Physics II for Engineering and Physics Students 12
09-101 Introduction to Experimental Chemistry 3
xx-xxx General Education Course 9

Sophomore Year
Fall
12-212 Statics 9
21-259 Calculus in Three Dimensions 9
15-110 Principles of Computing 10
09-105 Introduction to Modern Chemistry I 10
39-210 Experiential Learning I 0
xx-xxx General Education Course 9
xx-xxx Elective 1 9

Spring
12-231 Solid Mechanics 9
12-232 Solid Mechanics Lab 3
21-271 Introduction to Computer Application in Civil & Environmental Engineering 9
21-260 Differential Equations 9
39-220 Experiential Learning II 0
xx-xxx General Education Course 9
xx-xxx Elective 2 9

Junior Year
Fall
12-301 Civil Environmental Engineering Projects 9
12-335 Soil Mechanics 9
12-336 Soil Mechanics Laboratory 3
12-355 Fluid Mechanics 9
12-356 Fluid Mechanics Lab 3
39-310 Experiential Learning III 0
xx-xxx General Education Course 9
xx-xxx Elective 3 9
xx-xxx Elective 4 9

Spring
12-351 Environmental Engineering 9
12-352 Environmental Engineering Lab 3
27-357 Introduction to Materials Selection 6
12-358 Materials Lab 3
36-220 Engineering Statistics and Quality Control 9
xx-xxx Elective 3 9
xx-xxx Elective 4 9

Senior Year
Fall
12-401 Civil & Environmental Engineering Design 15
12-411 Project Management for Construction 9
12-421 Engineering Economics 6
xx-xxx General Education Course 9
xx-xxx Elective 5 9

Spring
12-600 AutoCAD 3

Notes on Electives
1. One elective must be in the basic sciences, from the following list: 03-121 Modern Biology 9
12-201 Geology 9
Substitutions may be made only with the approval of the Department Head.
2. One elective course is restricted to a 600-level Civil Engineering course of at least 9 units, except 12-648 and 12-690. This Civil Engineering elective is a corequisite for 12-401.
3. Students are encouraged to take multiple 12-6xx courses to provide them with specific civil and environmental engineering domain depth in their field(s) of interest.

Specialty Areas in Civil Engineering
Students may select a set of civil engineering and technical electives in the junior and senior years that enable them to concentrate in a specialty area, if they so desire. Some examples for grouping electives into specialty areas, together with representative course selections, are indicated below. Other possible groupings may be discussed with a faculty mentor. These specialty areas are not noted on the official transcript.

Structural Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-600</td>
<td>AutoCAD</td>
<td>3</td>
</tr>
<tr>
<td>12-631</td>
<td>Structural Design</td>
<td>12</td>
</tr>
<tr>
<td>12-635</td>
<td>Structural Analysis</td>
<td>9</td>
</tr>
<tr>
<td>12-636</td>
<td>Geotechnical Engineering</td>
<td>9</td>
</tr>
<tr>
<td>12-638</td>
<td>Special Topics: Behavior of Structural Systems</td>
<td>9</td>
</tr>
<tr>
<td>12-676</td>
<td>Special Topics: Fundamental Concepts and Methods of Structural Mechanics</td>
<td>12</td>
</tr>
<tr>
<td>12-686</td>
<td>Special Topics: Computational Materials Modeling for Structures</td>
<td>12</td>
</tr>
<tr>
<td>21-241</td>
<td>Matrices and Linear Transformations</td>
<td>10</td>
</tr>
<tr>
<td>24-351</td>
<td>Dynamics</td>
<td>10</td>
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</tbody>
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Environmental Engineering - Air Quality

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>09-106</td>
<td>Modern Chemistry II</td>
<td>10</td>
</tr>
<tr>
<td>12-651</td>
<td>Air Quality Engineering</td>
<td>9</td>
</tr>
<tr>
<td>12-679</td>
<td>Special Topics: Intro to Meteorology</td>
<td>12</td>
</tr>
<tr>
<td>24-425</td>
<td>Combustion and Air Pollution Control</td>
<td>9</td>
</tr>
</tbody>
</table>

Environmental Engineering - Water Quality

<table>
<thead>
<tr>
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<th>Course Name</th>
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</tr>
</thead>
<tbody>
<tr>
<td>03-121</td>
<td>Modern Biology</td>
<td>9</td>
</tr>
<tr>
<td>09-106</td>
<td>Modern Chemistry II</td>
<td>10</td>
</tr>
<tr>
<td>12-629</td>
<td>Environmental Microbiology for Engineers</td>
<td>9</td>
</tr>
<tr>
<td>12-702</td>
<td>Fundamentals of Water Quality Engineering</td>
<td>12</td>
</tr>
</tbody>
</table>

Environmental Engineering - Water Resources

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-636</td>
<td>Geotechnical Engineering</td>
<td>9</td>
</tr>
<tr>
<td>12-657</td>
<td>Water Resource Systems Engineering</td>
<td>9</td>
</tr>
</tbody>
</table>

Environmental Engineering - Energy

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-221</td>
<td>Thermodynamics</td>
<td>9</td>
</tr>
<tr>
<td>09-106</td>
<td>Modern Chemistry II</td>
<td>10</td>
</tr>
<tr>
<td>24-292</td>
<td>Renewable Energy Engineering</td>
<td>9</td>
</tr>
<tr>
<td>24-424</td>
<td>Energy and the Environment</td>
<td>9</td>
</tr>
</tbody>
</table>

Computing in Civil Engineering

<table>
<thead>
<tr>
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<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-600</td>
<td>AutoCAD</td>
<td>3</td>
</tr>
</tbody>
</table>
Double Majors and Minors

Civil Engineering students may pursue double majors and minors in a variety of subjects, taking advantage of the free elective courses to satisfy the requirements for the major or minor. The College of Engineering has added designated minors to promote flexibility and diversity among engineering students. Many Civil Engineering undergraduates pursue designated minors in such areas as Global Engineering or Environmental Engineering and Sustainability.

Internships and Co-Operative Education Program

Students in Civil Engineering are encouraged to undertake professional internships during summer breaks. In addition, a cooperative internship program is possible for either Jan-Aug or May-Dec in the junior year. Students undertaking these 8-month professional internships would ordinarily graduate after an additional semester of study.

Integrated B.S./M.S. Program

Interested undergraduates may plan a course of study that leads to both the BS in Civil Engineering and the MS in Civil and Environmental Engineering. This course of study will ordinarily require ten semesters of study, although advanced placement or other study may reduce this time. Students can apply appropriate units earned as undergraduates for their MS program as long as they are beyond the 379 units required for the BS in Civil Engineering degree. In the ninth semester of study, students must register in graduate status. Interested students should consult their academic advisor or the CEE Department office for information about admission to the MS program.

Faculty

AMIT ACHARYA, Professor of Civil and Environmental Engineering – Ph.D., University of Illinois at Urbana-Champaign; Carnegie Mellon, 2000–.

PETER ADAMS, Professor of Civil and Environmental Engineering and Engineering and Public Policy – Ph.D., California Institute of Technology; Carnegie Mellon, 2001–.

BURCU AKINCI, Paul P. Christiano Professor of Civil and Environmental Engineering – Ph.D., Stanford University; Carnegie Mellon, 2000–.

MARIO BERGES, Associate Professor of Civil and Environmental Engineering – Ph.D., Carnegie Mellon University; Carnegie Mellon, 2010–.

JACOBO BIELAK, P.E., Hammerschlag University Professor of Civil and Environmental Engineering – Ph.D., California Institute of Technology; P.E.; Carnegie Mellon, 1997–.

SARAH J. CHRISTIAN, P.E., Assistant Teaching Professor, Civil and Environmental Engineering – Ph.D., Stanford; Carnegie Mellon, 2015–.

JARED L. COHON, President Emeritus, Carnegie Mellon University, University Professor of Civil and Environmental Engineering and Engineering and Public Policy – Ph.D., Massachusetts Institute of Technology; P.E.; Carnegie Mellon, 1997–.

KAUSHIK DAYAL, Professor of Civil and Environmental Engineering – Ph.D., California Institute of Technology; Carnegie Mellon, 2008–.

DAVID A. DZONIBA, Department Head and Hammerschlag University Professor of Civil and Environmental Engineering – Ph.D., Massachusetts Institute of Technology, P.E.; Carnegie Mellon, 1989–.

SUSAN FINGER, Professor of Civil and Environmental Engineering – Ph.D., Massachusetts Institute of Technology; Carnegie Mellon, 1989–.

JAMES H. GARRETT, P.E., JR., Dean, College of Engineering and Thomas Lord Professor, Civil and Environmental Engineering – Ph.D., Carnegie Mellon University, P.E.; Carnegie Mellon, 1990–.

KELVIN GREGORY, Professor of Civil and Environmental Engineering – Ph.D., University of Iowa; Carnegie Mellon, 2006–.

CHRIS T. HENDRICKSON, Hammerschlag University Professor Emeritus of Civil and Environmental Engineering – Ph.D., Massachusetts Institute of Technology; Carnegie Mellon, 1978–

ATHANASIOS KARAMALIDIS, Associate Research Professor of Civil and Environmental Engineering – Ph.D., Democritus University of Thrace; Carnegie Mellon, 2010–.

XUESONG (PINE) LIU, Assistant Research Professor – Ph.D., Carnegie Mellon University; Carnegie Mellon, 2015–.

GREGORY LOWNRY, Walter J. Blenko, Sr. Professor of Civil and Environmental Engineering – Ph.D., University of Illinois; Carnegie Mellon, 2002–.

H. SCOTT MATTHEWS, Professor of Civil and Environmental Engineering and Engineering and Public Policy – Ph.D., Carnegie Mellon University; Carnegie Mellon, 2014–.

MEAGAN S. MAUTER, Associate Professor, Civil and Environmental Engineering and Engineering and Public Policy – Ph.D., Yale University; Carnegie Mellon, 2015–.

HAE YOUNG NOH, Assistant Professor of Civil and Environmental Engineering – Ph.D., Stanford; Carnegie Mellon, 2013–.

IRVING J. OPPENHEIM, P.E., Professor of Civil and Environmental Engineering and Architecture – Ph.D., Cambridge University, P.E.; Carnegie Mellon, 1972–.

MATTEO POZZI, Assistant Professor of Civil and Environmental Engineering – Ph.D., University of Trento, Italy; Carnegie Mellon, 2012–.

ZHENG (SEAN) QIAN, Assistant Professor, Civil and Environmental Engineering – Ph.D., University of California, Davis; Carnegie Mellon, 2015–.

CONSTANTINE SAMARAS, Assistant Professor, Civil and Environmental Engineering – Ph.D., Carnegie Mellon University; Carnegie Mellon, 2014–.

MITCHELL J. SMALL, H. John Heinz Professor, Civil and Environmental Engineering and Engineering and Public Policy – Ph.D., University of Michigan; Carnegie Mellon, 1982–.

JAMES M. THOMPSON, P.E., Assistant Teaching Professor – Ph.D., Lehigh University; Carnegie Mellon, 2012–.

JEANNE VANBRIESEN, P.E., Duquesne Light Company Professor of Civil and Environmental Engineering – Ph.D., University of Iowa; Carnegie Mellon, 1999–.

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