Department of Civil and Environmental Engineering

James H. Garrett Jr., Head
Office: Porter Hall 119-D
www.ce.cmu.edu/

The role of civil and environmental engineers, in the broadest sense, is to apply technology to meet society's needs. Civil engineers plan, design, and manage facilities used daily by the public and industry, such as buildings, airports, water supply and waste management systems. They work at the intersection of the built, natural and virtual 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 in our cities, remediation of hazardous waste sites, provision of safe drinking water, and incorporation of environmental safeguards in new designs. Civil and Environmental Engineering requires broad technical training and strong communication skills because of the complexity of large projects and the attendant interactions with engineers in other fields, lawyers, politicians, and the public. Carnegie Mellon's curriculum is intended to provide this versatility for professional practice in civil and environ-mental engineering or as a foundation for other professional pursuits.

The Department of Civil and Environmental Engineering offers a wide spectrum of opportunities for direct entry into the engineering profession, for graduate education in engineering, or entry into various other professions. While maintaining its emphasis on the fundamental understanding of the behavior of constructed facilities through the application of the physical sciences and mathematics, the curriculum has continually evolved in directions that exploit ad-vances in technology. The methods of engineering design are introduced in the freshman year and are emphasized 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 undertake the Minor in Environmental Engineering.

Central to the evolution of technology and its impact on engineering practice is the increased emphasis on computer-aided engineering. Several courses on computer methods are required in the curricu-lum, and virtually every course offered by the department requires the use of computers in applications of either design or analysis. Our curriculum emphasizes the development of scientific inquiry with the perspective of social, economic and institutional developments. For graduates who wish to enter directly the engineering profession in such specialties as structural engineering, construction, 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 green design. Historically, some graduates also have found their undergraduate preparation highly suited for entry into graduate schools of business, law and medicine.

A student may choose to concentrate in one of the specialty areas in Civil Engineering, to pursue a minor in one of the CIT designated minor programs, or to design a double major or double degree program. The specialty areas offered by the Civil and Environmental Engineering Department are described in this section. The CIT designated minor programs can be found under the Carnegie Institute of Technology section. The double-major requirements with Biomedi-cal Engineering and with Engineering and Public Policy are described in the curriculum specified by those departments. Other double-major programs selected by recent graduates include computer science, economics, mathematics, business, architecture, history, and foreign languages. Each student should have well defined objectives in selecting courses leading to a specialty, a minor or a double major.

Educational Objectives

The objectives of the Bachelor of Science in Civil Engineering curriculum are to develop:

- Graduates effectively tackle both routine and cutting-edge professional challenges at the intersections of the built, natural, and information environments;
- Graduates are successful and recognized as innovative and adaptive leaders in academic research, government service and private sector activity, over a wide range of engineering and non engineering professions, both in the U.S. and internationally; and
- Graduates use skills learned during their undergraduate education as leaders of their profesional and social communities — problem finding/modeling/solving; critical and systems-level thinking; ethical reasoning; written, oral and graphical communications; collaborative team-building and problem solving; and self- and life-long learning.

The Civil Engineering curriculum is intended to allow ample opportunity for students to pursue areas of personal interest. The opportunity for self-exploration requires careful advising to gain meaningful educational experiences. We believe that design and team working experiences should occur at regular intervals in the curriculum, and that graduates should have appropriate "hands on" experience in laboratories and projects. Students are encouraged to participate in research projects and to pursue study or work abroad. By the end of the B.S. program, students should have a variety of abilities and skills:

A. an ability to apply knowledge of mathematics (specifically, differential equations and probability and statistics) science (specifically, calculus-based physics and general chemistry) and engineering to practice and problem solving

B. an ability to design and conduct experiments as well as to analyze critically and interpret data in environmental engineering, solid mechanics, fluid mechanics and soil mechanics

C. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

D. an ability to function on multi-disciplinary teams

E. an ability to identify, formulate and solve civil engineering problems

F. an understanding of professional and ethical responsibility

G. an ability to communicate effectively in graphics, speech and words

H. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context

I. recognition of the need for and an ability to engage in lifelong learning

J. knowledge of contemporary issues relevant to engineering practice

K. an ability to use the techniques, skills and modern engineering tools necessary for civil engineering practice

L. an ability to apply knowledge in environmental engineering

M. an ability to apply knowledge in structural engineering

N. an ability to apply knowledge in construction and managment

O. an ability to apply knowledge in civil engineering

P. an ability to explain basic concepts in management, business, public policy, leadership, and the importance of professional licensure

The curriculum has been designed, and is periodically evaluated and refined, to provide students instruction and experiences that lead to the development of these abilities and skills.

Curriculum

All students admitted to CIT are not required to declare a major until the end of the freshman year, and may have selected a variety of Introductory Engineering Electives and associated Restricted Technical Electives within the common foundation specified for freshmen in CIT. Regardless of this selection in the freshman year, a civil engineering major is expected to have completed, in addition to 12-100 Introduction to Civil and Environmental Engineering, the following Restricted Technical Electives by the end of the sophomore year:

09-105	Modern Chemistry I	10
09-101	Intro to Experimental Chemistry	3
15-100	Intro to Programming & Computer Science	10
21-120	Differential and Integral Calculus	10
21-122	Integration, Differential Equations & Approximations	10
33-106	Physics for Engineering Students I	12
33-107	Physics for Engineering Students II	12

Appearing below is the recommended four-year program of study for the BS in civil engineering. Advising and formulation of appropriate programs is available through the department for transfer students, students with advanced placement, or students wishing to study overseas.

Freshman Year

	Fall	Units
12-100	Introduction to Civil and Environmental Engineering	12
21-120	Differential and Integral Calculus	10
33-106	Physics for Engineering Students I	12
99-10x	Computing @ Carnegie Mellon	3
xx-xxx	H&SS Elective	9
		46
	Spring	
xx-xxx	Introduction to Engineering (other than CEE)	12
21-122	Integration, Differential Equations & Approximations	10
33-107	Physics for Engineering StudentsII	12
xx-xxx	H&SS Elective	9
		43

Sophomore Year

	Fall	Units
12-212	Statics	9
15-100	Introductory/Intermediate Programming	10
21-259	Calculus in Three Dimensions	9
09-101	Intro to Experimental Chemistry	3
09-105	Modern Chemistry I	10
xx-xxx	H&SS Elective	9
		50
	Spring	
12-231	Solid Mechanics	9
12-232	Solid Mechanics Lab	3
12-271	Intro Computer Apps in Civil & Environmental Engr	9
21-260	Differential Equations	9
xx-xxx	H&SS or CFA Elective	9
xx-xxx	Elective 1	9
		48

*Notes: If a student takes an Introduction to Engineering course which has a co-requisite other than Physics II, the co-requisite (either 15-100 or 09-105 and 09-101) should be taken in the freshman year while Physics II will fill the respective slot in the sophomore year.

Since CIT freshmen are not required to select a major, the above curriculum is based on the assumption that a potential CEE student is likely to select 12-100 as one of the two Introduction to Engineering courses in the freshman year. Otherwise, incoming sophomores should take 12-100 in the fall in lieu of Modern Chemistry or the H&SS elective.

Junior Year

	Fall	Units
12-301	Civil and Environmental Engineering Projects	9
12-335	Soil Mechanics	9
12-336	Soil Mechanics Lab	3
12-355	Fluid Mechanics	9
12-356	Fluid Mechanics Lab	3
xx-xxx	H&SS or CFA Elective	9
xx-xxx	Elective 2	9
		51
	Spring	
12-351	Introduction to Environmental Engineering	9
12-352	Environmental Engineering Lab	3
27-357	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
		48

Senior Year

	Fall	Units
12-401	Civil and Environmental Engineering Design	15
12-411	Project Management	9
12-421	Engineering Economics	6
xx-xxx	H&SS or CFA Elective	9
xx-xxx	Elective 5	9
		48
	Spring	
xx-xxx	H&SS or CFA Elective	9
xx-xxx	H&SS or CFA Elective	9
xx-xxx	Elective 6	9
xx-xxx	Elective 7	9
xx-xxx	Elective 8	9
		45

Minimum number of units required for degree: 379

Notes on Electives

1. One elective must be in the basic sciences, either :

03-121	Modern Biology
09-106	Modern Chemistry II or
33-104	Experimental Physics

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 except 12-648 and 12-690. The Civil Engineering elective is a co-requisite for 12-401.

Specialty Areas in Civil Engineering

Students are encouraged to 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 available options for grouping electives into specialty areas, together with representative course selections, are indicated below.

Infrastructure Systems

12-600	AutoCAD
12-605	Design and Construction
12-611	Project Management for Construction
12-631	Structural Design
12-636	Geotechnical Engineering
12-657	Water Resources Engineering
15-211	Fundamental Data Structures and Algorithms
18-100	Introduction to Electrical and Computer Engineering
21-228	Discrete Mathematics
21-241	Matrix Algebra

Environmental Engineering

12-611	Project Management for Construction
12-657	Water Resources Engineering
12-636	Geotechnical Engineering
12-658	Hydraulic Structures Design
12-651	Air Quality Engineering
06-221	Thermodynamics
06-620	Global Atmospheric Chemistry
09-510	Introduction to Green Chemistry
24-424	Energy and the Environment
48-596	LEED Buildings and Green Design

Structures, Mechanics and Geotechnical Engineering

12-600	Auto CAD
12-605	Design and Construction
12-611	Project Management for Construction
12-635	Structural Analysis
12-631	Structural Design
12-636	Geotechnical Engineering
21-228	Discrete Mathematics
21-241	Matrix Algebra
24-262	Stress Analysis
24-356	Engineering Vibrations
24-401	Engineering Analysis

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 for other requirements. The college of engineering has added designated minors to promote flexibility and diversity among engineering students. Many CEE undergraduates pursue designated minors in such areas as Engineering Design or Environmental Engineering.

Co-Operative Education Program

Students in civil engineering are encouraged to undertake professional internships during summer breaks. In addition, a formal cooperative internship program is available 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. Program details are available from the Career Center or the Civil and Environmental Engineering office.

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 373 units required for the BS in Civil Engineering degree. In the tenth semester of study, students should 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, Associate Professor of Civil and Environmental Engineering – PhD., California Institute of Technology; Carnegie Mellon, 2001—.

BURCU AKINCI, Associate Professor of Civil and Environmental Engineering — Ph.D., Stanford University; Carnegie Mellon, 2000—.

JACOBO BIELAK, Professor of Civil and Environmental Engineering — Ph.D., California Institute of Technology; Carnegie Mellon, 1978—.

LAWRENCE G. CARTWRIGHT, Teaching Professor of Civil and Environmental Engineering and Director of the Civil Engineering Laboratories — M.S., Carnegie Mellon University; Carnegie Mellon, 1977—.

JARED L. COHON, President and Professor of Civil and Environmental Engineering — Ph.D., Massachusetts Institute of Technology; Carnegie Mellon, 1997—.

CLIFF I. DAVIDSON, Professor of Civil and Environmental Engineering and Director, Environmental Institute — Ph.D., California Institute of Technology; Carnegie Mellon, 1977—.

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

DAVID A. DZOMBAK, Walter J. Blenko, Sr. Professor of Civil and Environmental Engineering; Associate Dean, Carnegie Institute of Technology — Ph.D., Massachusetts Institute of Technology; Carnegie Mellon, 1989—.

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

JAMES H. GARRETT, JR., Professor and Head, Civil and Environmental Engineering — Ph.D., Carnegie Mellon University; Carnegie Mellon, 1990—.

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

CHRIS T. HENDRICKSON, Duquesne Light Company Professor of Civil and Environmental Engineering — Ph.D., Massachusetts Institute of Technology; Carnegie Mellon, 1978—.

GREGORY LOWRY, Associate Professor of Civil and Environmental Engineering .— Ph.D., University of Illinios; Carnegie Mellon, 2002—.

H. SCOTT MATTHEWS, Associate Professor of Civil and Environmental Engineering .— Ph.D., Carnegie Mellon University; Carnegie Mellon, 2001—.

CRAIG MALONEY, Assistant Professor of Civil and Environmental Engineering — Ph.D., University of California, Santa Barbara; Carnegie Mellon, 2007—.

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

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

LUCIO SOIBELMAN, Professor of Civil and Environmental Engineering- Ph D., Massachusetts Institute of Technology; Carnegie Mellon, 2004—.

JEANNE VANBRIESEN, Professor of Civil and Environmental Engineering — Ph.D., Northwestern University; Carnegie Mellon, 1999—.

CHRISTOPHER WEBER, Research Professor of Civil and Environmental Engineering — Ph.D., Carnegie Mellon University; Carnegie Mellon, 2008—.