

Civil and Environmental Engineering

College of Engineering (<http://coe.berkeley.edu>)

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Overview

The mission of the Department of Civil and Environmental Engineering at UC Berkeley is to serve as the world's academic leader in civil and environmental engineering, defining the evolving domains of the field through teaching and scholarly research. The department educates undergraduate and graduate students to be knowledgeable, forward-thinking, and ethical professionals, so that they may pursue careers characterized by leadership and innovation. The faculty values professional and public service, and through research, seeks scientific and technological advances that address critical societal needs.

For more information, see the *College of Engineering Announcement: A Guide to Undergraduate and Graduate Study* (<http://coe.berkeley.edu/guide>) .

Undergraduate Program

Within the context of this broad objective, the Bachelor's of Science (BS) degree program provides a solid foundation in the scientific and engineering fundamentals along with exposure to humanities and social sciences. This foundation is essential for solving societal problems in the areas of public safety, resource protection, natural hazard mitigation, and the efficient functioning of urban and natural systems within the United States and worldwide.

The four-year undergraduate curriculum leading to the BS degree provides an education that is sufficiently comprehensive for students who wish to embark on a professional career directly after graduation and keep abreast of new developments in civil engineering practice. The program also serves as a preparation for graduate study in any of the specialized branches of civil and environmental engineering. The BS program in civil engineering is accredited by the Engineering Accreditation Commission of the ABET, Inc. (<http://www.abet.org/accreditation>)

Major Requirements

The undergraduate curriculum provides a broad general education in civil engineering. In addition, students with a specific interest within civil and environmental engineering may select an optional area of emphasis in Engineering and Project Management; Environmental Engineering; Geoengineering; Structural Engineering, Mechanics and Materials; or Transportation Engineering.

Students must complete a minimum of 120 units, in which they must satisfy the University of California and Berkeley campus requirements outlined in the *Berkeley Bulletin*. In addition, students must complete the requirements for the College of Engineering and the civil engineering

program. Full details on these requirements can be found in the *College of Engineering Announcement: A Guide to Undergraduate and Graduate Study* (<http://coe.berkeley.edu/guide>) . Please also see our optional areas of emphasis in the announcement for suggested programs of study.

Minor Requirements

The department offers three minors in structural engineering, geoengineering, and environmental engineering. The structural engineering minor is designed particularly for students in the Department of Architecture but is also available to any student who has met the prerequisites and who is enrolled in a non-civil and environmental engineering program. The environmental engineering minor is primarily for students majoring in physical, mathematical, social, or biological sciences but is open to non-civil and environmental engineering students. For details, contact the Civil and Environmental Engineering Academic Affairs Office, 750 Davis Hall, (510) 643-6640.

Graduate Program

The Department of Civil and Environmental Engineering is comprised of the following graduate programs: Engineering and Project Management; Environmental Engineering; Geoengineering; Structural Engineering, Mechanics and Materials (SEMM); and Transportation Engineering. The Civil Systems program and the Energy, Civil Infrastructure and Climate program are cross-disciplinary and span the other programs. Students may pursue the academic degrees of MS and PhD, and the professional degree of MEng. The MS program normally lasts one year and the MEng program, two years; the doctoral program requires at least two years after the attainment of a master's degree and includes a dissertation or an equivalent design project. The department also offers programs leading to dual degrees in the following areas: (1) MS in Engineering and Master of Architecture (SEMM and the Department of Architecture), (2) MS in Engineering and Master of City Planning (Transportation and the Department of City and Regional Planning), and (3) MS in Engineering and Master of Public Policy (Environmental and the School of Public Policy).

The Department of Civil and Environmental Engineering includes the following areas of professional specialization:

- **Civil systems:** Civil systems integrates engineering, science, and management tools and techniques for solving complex civil and environmental engineering problems. To understand the interdisciplinary nature and many scales of civil and environmental engineering problems, students take courses in technical tools (e.g., information management, control, modeling) and human dimensions (e.g., economics, public policy, management, city and regional planning), in addition to deepening and expanding their fundamental knowledge base in engineering and science as applied to the physical world.
- **Energy, Civil Infrastructure, and Climate:** This graduate program focuses on the application of engineering, environmental, economic, and management principles to the analysis and improvement of civil infrastructure from the perspective of energy and climate impacts. Example focus areas include energy efficiency of buildings, environmentally-informed design and operation of transportation systems, embodied energy of construction materials, biofuels, and adaptation of infrastructure to a changing climate.
- **Engineering and project management:** Engineering and project management deals with planning, organizing, leading, constructing, designing, operating, and financing projects during the life cycle of civil

engineered systems. This program is concerned with the fundamental principles and knowledge that underlie management and leadership, human organizational factors, quality and reliability assessments, life cycle engineering and management processes, engineering and the environment, construction engineering and management, and implementation processes and strategies.

- **Environmental engineering:** Environmental engineering involves the application of science and technology to manage environmental resources and prevent or limit environmental degradation. Specific subject areas include water and air quality engineering, hazardous waste management, ecological engineering, hydrology and water resources management, and environmental fluid mechanics.
- **Geoengineering:** Geoengineering is concerned with planning, design, and construction on, in, or with soil and rock, and with protection and enhancement of the environment. It includes the fields of soil mechanics, foundation engineering, geological engineering, rock mechanics, environmental geotechnics, groundwater, and geotechnical aspects of earthquake engineering. Also included is the field of engineering geosciences which adds geophysics, reservoir modeling, and petroleum engineering.
- **Structural engineering, mechanics, and materials:** Structural engineering, mechanics, and materials consists of several emphases. Structural engineering is concerned with the analysis and design of all types of structures, including earthquake-resistant design. Structural mechanics employs the disciplines of applied mathematics and the engineering sciences to examine a wide range of problems in the behavior of structural elements and systems, and to investigate the mathematical description of properties. Structural materials engineering is concerned with the development of construction materials for engineering projects, such as mechanical and thermal response, microstructure behavior and durability. Structural materials include steel, concrete, aluminum alloys, timber, plastic, and composite materials.
- **Transportation engineering:** Transportation engineering is concerned with the planning, design, construction, operation, performance, evaluation, maintenance, and rehabilitation of transportation systems and facilities, such as highways, railroads, urban transit, air transportation, logistic supply systems and their terminals.

For more details, please consult the *College of Engineering Announcement: A Guide to Undergraduate and Graduate Study* (<http://coe.berkeley.edu/students/guide>) or contact the department's Academic Affairs Office in 750 Davis Hall, (510) 643-6640.

Note: In addition to the courses listed on the courses tab, the Department of Civil and Environmental Engineering offers the following courses, found in the Engineering section of this bulletin (<http://bulletin.berkeley.edu/archive/2013-14/courses/engin>) : ENG 7, Introduction to Computer Programming for Scientists and Engineers, and ENG 10, Engineering Design and Analysis.

CIV ENG 11 Engineered Systems and Sustainability 3 Units

Department: Civil and Environmental Engineering

Course level: Undergraduate

Term course may be offered: Spring

Grading: Letter grade.

Hours and format: 3 hours of Lecture per week for 15 weeks.

Prerequisites: Chemistry 1A, Mathematics 1A.

An introduction to key engineered systems (e.g., energy, water supply, buildings, transportation) and their environmental impacts. Basic principles of environmental science needed to understand natural processes as they are influenced by human activities. Overview of concepts and methods of sustainability analysis. Critical evaluation of engineering approaches to address sustainability.

Formerly known as Engineering 11. Instructors: Harley, Horvath, Hunt, Nelson

CIV ENG 24 Freshman Seminars 1 Unit

Department: Civil and Environmental Engineering

Course level: Undergraduate

Terms course may be offered: Fall and spring

Grading: The grading option will be decided by the instructor when the class is offered.

Hours and format: 1 hour of Seminar per week for 15 weeks.

The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley seminars are offered in all campus departments, and topics vary from department to department and semester to semester.

Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

CIV ENG C30/MEC ENG C85 Introduction to Solid Mechanics 3 Units

Department: Civil and Environmental Engineering; Mechanical Engineering

Course level: Undergraduate

Terms course may be offered: Fall, spring and summer

Grading: Letter grade.

Hours and format: 3 hours of lecture and 1 hour of discussion per week.

4.5 hours of lecture and 1.5 hours of discussion per week for 10 weeks.

7.5 hours of lecture and 2.5 hours of discussion per week for 6 weeks.

Prerequisites: Mathematics 53 and 54 (may be taken concurrently); Physics 7A.

A review of equilibrium for particles and rigid bodies. Application to truss structures. The concepts of deformation, strain, and stress. Equilibrium equations for a continuum. Elements of the theory of linear elasticity. The states of plane stress and plane strain. Solution of elementary elasticity problems (beam bending, torsion of circular bars). Euler buckling in elastic beams.

Instructors: Armero, Papadopoulos, Zohdi

CIV ENG 60 Structure and Properties of Civil Engineering Materials 3 Units

Department: Civil and Environmental Engineering

Course level: Undergraduate

Terms course may be offered: Fall and spring

Grading: Letter grade.

Hours and format: 2 hours of Lecture and 3 hours of Laboratory per week for 15 weeks.

Introduction to structure and properties of civil engineering materials such as asphalt, cements, concrete, geological materials (e.g. soil and rocks), steel, polymers, and wood. The properties range from elastic, plastic and fracture properties to porosity and thermal and environmental responses. Laboratory tests include evaluation of behavior of these materials under a wide range of conditions.

Students may receive two units of credit for 60 after taking Engineering 45. One unit of a deficient grade may be removed in Engineering 45 with