# CIVIL ENGINEERING UNDERGRADUATE MAJOR

See the "Department of Civil and Environmental Engineering (http://exploreddegrees.stanford.edu/schoolofengineering/civilandenvironmentalengineering)" section of this bulletin for additional information on the department, and its programs and faculty.

The department offers a B.S. as well as a minor in Civil Engineering (see following), as well as a B.S. in Environmental Systems Engineering (http://exploreddegrees.stanford.edu/soe-ug-majors/ese) and a minor in Environmental Systems Engineering (http://exploreddegrees.stanford.edu/schoolofengineering/civilandenvironmentalengineering/#minortext).

## Civil Engineering (CE)

Completion of the undergraduate program in Civil Engineering leads to the conferral of the Bachelor of Science in Civil Engineering.

### Mission of the Undergraduate Program in Civil Engineering

The mission of the undergraduate program in Civil Engineering is to provide students with the principles of engineering and the methodologies necessary for civil engineering practice. This preprofessional program balances the fundamentals common to many specialties in civil engineering and allows for concentration in structures and construction or environmental and water studies. Students in the major learn to apply knowledge of mathematics, science, and civil engineering to conduct experiments, design structures and systems to creatively solve engineering problems, and communicate their ideas effectively. The curriculum includes course work in structural, construction, and environmental engineering. The major prepares students for careers in consulting, industry and government, as well as for graduate studies in engineering.

### Requirements

#### Mathematics and Science

- 45 units minimum; see Basic Requirements 1 and 2

#### Technology in Society

- One course; course chosen must be on the SoE Approved Courses list at <ughb.stanford.edu> the year taken; see Basic Requirement 4

#### Engineering Fundamentals

- Two courses required
  - ENGR 14 Intro to Solid Mechanics
  - ENGR 90/CEE 70 Environmental Science and Technology

#### Engineering Depth

- Minimum of 68 Engineering Fundamentals plus Engineering Depth; see Basic Requirement 5
  - CEE 100 Managing Sustainable Building Projects
  - CEE 101A Mechanics of Materials
  - CEE 101B Mechanics of Fluids
  - CEE 101C Geotechnical Engineering
  - CEE 146S Engineering Economics and Sustainability
  - Environmental and Water Studies (see below)
  - Structures and Construction (see below)

#### Specialty courses in either:

1. Mathematics must include CME 100 Vector Calculus for Engineers and CME 102 Ordinary Differential Equations for Engineers (or Math 51 Linear Algebra and Differential Calculus of Several Variables and MATH 53 Ordinary Differential Equations with Linear Algebra) and a Statistics course. Science must include Physics 41 Mechanics, either ENGR 31 Chemical Principles with Application to Nanoscale Science and Technology, CHEM31A Chemical Principles I or CHEM 31X Chemical Principles; two additional quarters in either chemistry or physics, and GEOLSCI 1 Introduction to Geology; for students in the Environmental and Water Studies track, the additional chemistry or physics must include CHEM 33; for students in the Structures and Construction track, it must include PHYSICS 43 or 45. Please note that the only quarter GEOLSCI 1 is offered for AY 2018-19 is Spring Quarter.

2. Chosen TIS class must specifically include an ethics component, as indicated in Figure 3-3 in the Engineering Undergraduate Handbook (http://web.stanford.edu/group/ughb/cgi-bin/handbook/index.php/Handbooks)

3. CEE 100 meets the Writing in the Major (WIM) requirement

4. A course may only be counted towards one requirement; it may not be double-counted. All courses taken for the major must be taken for a letter grade if that option is offered by the instructor. Minimum Combined GPA for all courses in Engineering Fundamentals and Depth is 2.0.

### Environmental and Water Studies Focus

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 30</td>
<td>3</td>
<td>Engineering Thermodynamics</td>
</tr>
<tr>
<td>CEE 101D</td>
<td>3</td>
<td>Computations in Civil and Environmental Engineering (or CEE 101S)</td>
</tr>
<tr>
<td>CEE 102</td>
<td>3</td>
<td>Legal and Ethical Principles in Design, Construction, and Project Delivery (or CEE 175A (alt years) or CEE 171 (no longer offered))</td>
</tr>
<tr>
<td>CEE 162E</td>
<td>3</td>
<td>Rivers, Streams, and Canals</td>
</tr>
<tr>
<td>CEE 166A</td>
<td>4</td>
<td>Watersheds and Wetlands</td>
</tr>
<tr>
<td>CEE 166B</td>
<td>4</td>
<td>Floods and Dams, Dams and Aqueducts</td>
</tr>
<tr>
<td>CEE 172</td>
<td>3</td>
<td>Air Quality Management</td>
</tr>
<tr>
<td>CEE 177</td>
<td>4</td>
<td>Aquatic Chemistry and Biology</td>
</tr>
<tr>
<td>CEE 179A</td>
<td>3</td>
<td>Water Chemistry Laboratory</td>
</tr>
<tr>
<td>CEE 179C</td>
<td>5</td>
<td>Environmental Engineering Design</td>
</tr>
</tbody>
</table>

(continued)
Civil Engineering Undergraduate Major

## Structures and Construction Focus

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 102</td>
<td>Legal and Ethical Principles in Design, Construction, and Project Delivery</td>
<td>3</td>
</tr>
<tr>
<td>CEE 120A</td>
<td>Building Information Modeling Workshop (or CEE 120S)</td>
<td>3</td>
</tr>
<tr>
<td>CEE 156</td>
<td>Building Systems</td>
<td>4</td>
</tr>
<tr>
<td>CEE 180</td>
<td>Structural Analysis</td>
<td>4</td>
</tr>
<tr>
<td>CEE 181</td>
<td>Design of Steel Structures</td>
<td>4</td>
</tr>
<tr>
<td>CEE 182</td>
<td>Design of Reinforced Concrete Structures</td>
<td>4</td>
</tr>
<tr>
<td>CEE 183</td>
<td>Integrated Civil Engineering Design Project</td>
<td>4</td>
</tr>
<tr>
<td>CEE 199</td>
<td>Undergraduate Research in Civil and Environmental Engineering</td>
<td>1-4</td>
</tr>
</tbody>
</table>

Select one of the following (beyond the 2 required Engineering Fundamentals): 4 units

- **ENGR 50** Introduction to Materials Science, Nanotechnology Emphasis
- **ENGR 50E** Introduction to Materials Science, Energy Emphasis
- **ENGR 50M** Introduction to Materials Science, Biomaterials Emphasis

Remaining specialty units from:

- **ENGR 15** Dynamics
- **CME 104** Linear Algebra and Partial Differential Equations for Engineers
- **CEE 101D** Computations in Civil and Environmental Engineering (or CEE 101S)
- **CEE 112A** Industry Applications of Virtual Design & Construction
- **CEE 112B** Industry Applications of Virtual Design & Construction
- **CEE 122A** Computer Integrated Architecture/Engineering/Construction
- **CEE 122B** Computer Integrated A/E/C
- **CEE 131A** Professional Practice: Mixed-Use Design in an Urban Setting (not offered AY 18-19)
- **CEE 131B** Financial Management of Sustainable Urban Systems
- **CEE 141A** Infrastructure Project Development
- **CEE 141B** Infrastructure Project Delivery
- **CEE 151** Negotiation
- **CEE 155** Introduction to Sensing Networks for CEE
- **CEE 161C** Natural Ventilation of Buildings
- **CEE 162E** Rivers, Streams, and Canals
- **CEE 171** Environmental Planning Methods (no longer offered)
- **CEE 176A** Energy Efficient Buildings
- **CEE 176B** 100% Clean, Renewable Energy and Storage for Everything
- **CEE 199** Undergraduate Research in Civil and Environmental Engineering

## General Guidelines

- Civil Engineering (CE) Minor

The civil engineering minor is intended to give students a focused introduction to one or more areas of civil engineering. Departmental expertise and undergraduate course offerings are available in the areas of Architectural Design, Construction Engineering and Management, and Structural and Geotechnical Engineering. Students interested in Environmental and Water Studies should refer to the Environmental Systems Engineering minor.

The minimum prerequisite for a civil engineering minor is MATH 19 Calculus (or MATH 20 Calculus or MATH 21 Calculus); however, many courses of interest require PHYSICS 41 Mechanics and/or MATH 51 Linear Algebra, Multivariable Calculus, and Modern Applications as prerequisites. The minimum prerequisite for a Civil Engineering minor focusing on architectural design is MATH 19 Calculus (or MATH 20 Calculus or MATH 21 Calculus). Students should recognize that a minor in civil engineering is not an ABET-accredited degree program.

Since undergraduates having widely varying backgrounds may be interested in obtaining a civil engineering minor and the field itself is so broad, no single set of course requirements will be appropriate for all students. Instead, interested students are encouraged to propose their own set of courses within the guidelines listed below. Additional information, including example minor programs, are provided on the CEE web site (http://cee.stanford.edu/prospective/undergrad/minorOverview.html) and in Chapter 6 of the Handbook for Undergraduate Engineering Programs (http://ughb.stanford.edu).

### General Guidelines:

1. A civil engineering minor must contain at least 24 units of course work not taken for the major, and must consist of at least six classes.

## Honors Program

This program leads to a B.S. with honors for undergraduates majoring in Civil Engineering or in Environmental Systems Engineering. It is designed to encourage qualified students to undertake a more intensive study of civil and environmental engineering than is required for the normal majors through a substantial, independent research project.

The program involves an in-depth research study in an area proposed to and agreed to by a Department of Civil and Environmental Engineering faculty adviser and completion of a thesis of high quality. A written proposal for the research to be undertaken must be submitted and approved by the faculty adviser in the fourth quarter prior to graduation. At the time of application, the student must have an overall grade point average (GPA) of at least 3.3 for course work at Stanford; this GPA must be maintained to graduation. The thesis is supervised by a CEE faculty adviser and must involve input from the School of Engineering writing program by means of ENGR 202S Directed Writing Projects or ENGR 199W Writing of Original Research for Engineers. The written thesis must be approved by the thesis adviser. Students are encouraged to present their results in a seminar for faculty and students.

Up to 10 units of CEE 199H Undergraduate Honors Thesis may be taken to support the research and writing (not to duplicate ENGR 202S or ENGR 199W). These units are beyond the normal Civil Engineering or Environmental Systems Engineering major program requirements.

## Civil Engineering (CE) Minor

This program leads to a B.S. with honors for undergraduates majoring in Civil Engineering or in Environmental Systems Engineering. It is designed to encourage qualified students to undertake a more intensive study of civil and environmental engineering than is required for the normal majors through a substantial, independent research project.

The program involves an in-depth research study in an area proposed to and agreed to by a Department of Civil and Environmental Engineering faculty adviser and completion of a thesis of high quality. A written proposal for the research to be undertaken must be submitted and approved by the faculty adviser in the fourth quarter prior to graduation. At the time of application, the student must have an overall grade point average (GPA) of at least 3.3 for course work at Stanford; this GPA must be maintained to graduation. The thesis is supervised by a CEE faculty adviser and must involve input from the School of Engineering writing program by means of ENGR 202S Directed Writing Projects or ENGR 199W Writing of Original Research for Engineers. The written thesis must be approved by the thesis adviser. Students are encouraged to present their results in a seminar for faculty and students. Up to 10 units of CEE 199H Undergraduate Honors Thesis may be taken to support the research and writing (not to duplicate ENGR 202S or ENGR 199W). These units are beyond the normal Civil Engineering or Environmental Systems Engineering major program requirements.

## Course Requirements

- **CEE 10** Legal and Ethical Principles in Design, Construction, and Project Delivery 3 units
- **CEE 120A** Building Information Modeling Workshop (or CEE 120S) 3 units
- **CEE 156** Building Systems 4 units
- **CEE 180** Structural Analysis 4 units
- **CEE 181** Design of Steel Structures 4 units
- **CEE 182** Design of Reinforced Concrete Structures 4 units
- **CEE 183** Integrated Civil Engineering Design Project 4 units
- **CEE 199** Undergraduate Research in Civil and Environmental Engineering 1-4 units

### Honors Program

For additional information and sample programs see the Handbook for Undergraduate Engineering Programs (UGHB) (http://ughb.stanford.edu).
of at least 3 units each of letter-graded work, except where letter grades are not offered.

2. The list of courses must represent a coherent body of knowledge in a focused area, and should include classes that build upon one another. Example programs are given on the CEE webpage.

Professor Anne Kiremidjian (kiremidjian@stanford.edu) is the CEE undergraduate minor adviser in Structural Engineering and Construction Engineering and Management. John Barton (jhbarton@stanford.edu (http://www.stanford.edu/dept/registrar/bulletin/jhbarton@stanford.edu)), Program Director for Architectural Design, is the undergraduate minor adviser in Architectural Design. Students must consult the appropriate adviser when developing their minor program, and obtain approval of the finalized study list from them.