Civil Engineering, BSE

More Information: https://engineering.case.edu/civil-and-environmental-engineering
Degree: Bachelor of Science in Engineering (BSE)
Major: Civil Engineering

Program Overview

The faculty of the Civil and Environmental Engineering Department believes very strongly that undergraduate education should prepare students to be productive professional engineers. For this reason, particular emphasis in undergraduate teaching is placed on the application of engineering principles to the solution of problems. After completing a set of core courses in general engineering and civil engineering, undergraduate students choose a sequence in one of the areas of civil engineering of particular interest: Structural (S), Geotechnical (G), or Environmental (E) engineering; Construction Engineering and Management (C), or Pre-architecture (P).

In order to provide undergraduates with experience in the practice of civil engineering, the department attempts to arrange summer employment for students during the three summers between their semesters at Case Western Reserve University. By working for organizations in areas of design and construction, students gain invaluable knowledge about how the profession functions. This experience helps students gain more from their education and helps them be more competitive when seeking future employment.

A cooperative education program is also available. This allows the student to spend time an extended period of time working full-time in an engineering capacity with a contractor, consulting engineer, architect, or materials supplier during the course of his or her education. This learning experience is designed to integrate classroom theory with practical experience and professional development.

The civil engineering curriculum has been designed so that students take a set of core civil engineering courses, a set of required courses in their chosen sequence, and a minimum of six (6) approved elective courses. The sequence gives students the opportunity to pursue a particular area of practice in more depth. In addition, all civil engineering students participate in a team senior capstone design course which provides them experience with solving multidisciplinary problems.

Most classes in the Civil and Environmental Engineering Department have an enrollment of fewer than 25 students to encourage the development of close professional relationships with the faculty. Students also have opportunities to gain practical experience as well as earn a supplemental income by assisting faculty members in consulting work or a funded research project.

Computer use is an integral part of the curriculum. From required courses in computer programming and numerical analysis to the application of civil and environmental engineering programs as a planning, analysis, design, and managerial tool.

All sequences are constructed to provide a balance of marketable skills and theoretical bases for further growth. With departmental approval, other sequences can be developed to meet students’ needs.

The Bachelor of Science in Engineering degree program with a major in Civil Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org/.

Program Educational Objectives

a. Graduates of the program will enter the profession of Civil Engineering and advance to positions of greater responsibility and leadership, in line with ASCE Professional Grade Descriptions.
b. Graduates of the program will enter and successfully progress in, or complete, advanced degree programs within their fields of choice.
c. Graduates of the program will progress toward or complete professional registration and licensure.

Learning Outcomes

As preparation for achieving the above educational objectives, the Bachelor of Science in Engineering degree program with a major in Civil Engineering is designed so that students attain:

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, economic, and environmental factors
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Co-op and Internship Programs

Opportunities are available for students to alternate studies with work in industry or government as a co-op student, which involves paid full-time employment over seven months (one semester and one summer). Students may work in one or two co-ops, beginning in the third year of study. Co-ops provide students the opportunity to gain valuable hands-on experience in their field by completing a significant engineering project while receiving professional mentoring. During a co-op placement, students do not pay tuition but maintain their full-time student status while earning a salary. Learn more at engineering.case.edu/coop. Alternatively or additionally, students may obtain employment as summer interns.

Undergraduate Policies

For undergraduate policies and procedures, please review the Office of Undergraduate Studies section of the General Bulletin.
**Accelerated Master’s Programs**

Undergraduate students may participate in accelerated programs toward graduate or professional degrees. For more information and details of the policies and procedures related to accelerated studies, please visit the Office of Undergraduate Studies section of the General Bulletin.

**Program Requirements**

Students seeking to complete this major and degree program must meet the general requirements for bachelor’s degrees and the general requirements of the Case School of Engineering. Students completing this program as a secondary major while completing another undergraduate degree program do not need to satisfy the latter set of requirements.

The major requires the following courses:

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tr>
<td></td>
<td><strong>Required Courses (all sequences)</strong></td>
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<tr>
<td>ECIV 160</td>
<td>Surveying and Computer Graphics</td>
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<td>ECIV 310</td>
<td>Strength of Materials</td>
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<td>ECIV 315</td>
<td>Introduction to Structural Engineering and Analysis</td>
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<td>ECIV 330</td>
<td>Soil Mechanics</td>
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<td>ECIV 340</td>
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<td>ECIV 360</td>
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<td>ECIV 368</td>
<td>Environmental Engineering</td>
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<td>Civil Engineering Senior Project</td>
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<td><strong>Structural (S) and Geotechnical (G) Required Courses</strong></td>
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<td>ECIV 311</td>
<td>Civil Engineering Materials</td>
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<td>ECIV 373</td>
<td>Reinforced Concrete Design</td>
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<td>or ECIV 374</td>
<td>Structural Steel Design</td>
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<td>EMAE 181</td>
<td>Dynamics</td>
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<td><strong>Construction Management (C) and Pre-Architecture (P) Required Courses</strong></td>
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<td>ECIV 311</td>
<td>Civil Engineering Materials</td>
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<td><strong>Environmental (E) Required Courses</strong></td>
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<tr>
<td>ECIV 351</td>
<td>Engineering Hydraulics and Hydrology</td>
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<td><strong>Basic Science/Math Electives (Environmental Sequence Only, 9 total cr. hrs. required)</strong></td>
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<td>BIOL 114</td>
<td>Principles of Biology</td>
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<td>BIOL 214</td>
<td>Genes, Evolution and Ecology</td>
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<td>BIOL 215</td>
<td>Cells and Proteins</td>
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<td>Dynamics of Biological Systems: A Quantitative Introduction to Biology</td>
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<td>EEPS 110</td>
<td>Physical Geology</td>
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<td>EEPS 117</td>
<td>Weather and Climate</td>
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<td>Global Environmental Problems</td>
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<td>EEPS 220</td>
<td>Environmental Geology</td>
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<td>EEPS 260</td>
<td>Introduction to Climate Change: Physics, Forecasts, and Strategies</td>
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<td>EEPS 352</td>
<td>Biogeochemistry</td>
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<td>CSDS 132</td>
<td>Programming in Java</td>
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<td>CSDS 133</td>
<td>Introduction to Data Science and Engineering for Majors</td>
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<td>CSDS 233</td>
<td>Introduction to Data Structures</td>
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<td>DSCI 351</td>
<td>Exploratory Data Science</td>
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<td>DSCI 353</td>
<td>Data Science: Statistical Learning, Modeling and Prediction</td>
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<td>Data Visualization and Analytics</td>
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<td>PQHS 426</td>
<td>An Introduction to GIS for Health and Social Sciences</td>
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<td>PQHS 431</td>
<td>Statistical Methods I</td>
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<td>Introduction to Probability</td>
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<td>STAT 312</td>
<td>Basic Statistics for Engineering and Science</td>
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<td><strong>Structural (S) Technical Electives</strong></td>
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<td>Undergraduate Research</td>
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<tr>
<td>ECIV 316/416</td>
<td>Matrix Analysis of Structures</td>
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<tr>
<td>ECIV 342</td>
<td>BIM and Computer Graphics</td>
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<td>ECIV 343</td>
<td>BIM Data Management &amp; Remote Sensing</td>
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<td>ECIV 411</td>
<td>Elasticity, Theory and Applications</td>
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<td>ECIV 415</td>
<td>Fracture Mechanics and Size Effect</td>
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<td>ECIV 417</td>
<td>Structural Dynamics</td>
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<td>ECIV 420</td>
<td>Finite Element Analysis</td>
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<td>ECIV 421</td>
<td>Advanced Topics in Reinforced Concrete Structures</td>
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<td>ECIV 422</td>
<td>Advanced Structural Steel Design</td>
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<td>ECIV 425</td>
<td>Structural Design for Dynamic Loads</td>
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<td>ECIV 426</td>
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<td>ECIV 430</td>
<td>Foundation Engineering</td>
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<td>ECIV 437</td>
<td>Pavement Analysis and Design</td>
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<td>ECIV 456</td>
<td>Intelligent Infrastructure Systems</td>
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<td>EMAE 250</td>
<td>Computers in Mechanical Engineering</td>
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<td>EMAE 401</td>
<td>Mechanics of Continuous Media</td>
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<tr>
<td>EMSE 276</td>
<td>Materials Properties and Design</td>
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### Environmental (E) Technical Electives

- **ECHE 352** Engineering Economics and Decision Analysis
- **ARTS 302** Architecture and City Design I
- **ENGR 225** Thermodynamics, Fluid Dynamics, Heat and Mass Transfer

### Geotechnical (G) Technical Electives

- **ECIV 300** Undergraduate Research
- **ECIV 342** BIM and Computer Graphics
- **ECIV 316/416** Matrix Analysis of Structures
- **ECIV 343** BIM Data Management & Remote Sensing
- **ECIV 351** Engineering Hydraulics and Hydrology
- **ECIV 372** Timber and Masonry Design
- **ECIV 373** Reinforced Concrete Design
- **ECIV 374** Structural Steel Design
- **ECIV 411** Elasticity, Theory and Applications
- **ECIV 415** Fracture Mechanics and Size Effect
- **ECIV 420** Finite Element Analysis
- **ECIV 430** Foundation Engineering
- **ECIV 432** Mechanical Behavior of Soils
- **ECIV 433** Soil Dynamics
- **ECIV 437** Pavement Analysis and Design
- **ECIV 456** Intelligent Infrastructure Systems
- **ENGR 225** Thermodynamics, Fluid Dynamics, Heat and Mass Transfer
- **EMAE 250** Computers in Mechanical Engineering
- **EEPS 110** Physical Geology
- **EEPS 119** Geology Laboratory
- **EEPS 220** Environmental Geology
- **EEPS 305** Geomorphology and Remote Sensing
- **EEPS 315** Structural Geology and Geodynamics
- **EEPS 321** Hydrogeology
- **DSCI 432** Spatial Statistics for Near Surface, Surface, and Subsurface Modeling

### Environmental (E) Technical Electives (continued)

- **ECIV 300** Undergraduate Research
- **ECIV 311** Civil Engineering Materials
- **ECIV 361** Water Resources Engineering
- **ECIV 362** Solid and Hazardous Waste Management
- **ECIV 427** Environmental Organic Chemistry
- **ECIV 373** Reinforced Concrete Design
- **ECIV 374** Structural Steel Design
- **ECIV 450** Environmental Engineering Chemistry
- **ECIV 461** Environmental Engineering Biotechnology
- **ENGR 210** Introduction to Circuits and Instrumentation
- **EMAE 181** Dynamics
- **EMAE 250** Computers in Mechanical Engineering
- **ECHE 260** Introduction to Chemical Systems
- **ECHE 360** Transport Phenomena for Chemical Systems
- **ECHE 361** Separation Processes
- **ECHE 362** Chemical Engineering Laboratory
- **ECHE 364** Chemical Reaction Processes

### Construction Management (C) Technical Electives

- **ECIV 300** Undergraduate Research
- **ECIV 341** Construction Scheduling and Estimating
- **ECIV 342** BIM and Computer Graphics
- **ECIV 343** BIM Data Management & Remote Sensing
- **ECIV 411** Elasticity, Theory and Applications
- **ECIV 373** Reinforced Concrete Design
- **ECIV 374** Structural Steel Design
- **ECIV 430** Foundation Engineering
- **ECIV 437** Pavement Analysis and Design
- **ECIV 456** Intelligent Infrastructure Systems
- **EMAE 250** Computers in Mechanical Engineering
- **ACCT 100** Foundations of Accounting I
- **BAFI 355** Corporate Finance
- **ECON 312** Entrepreneurial Finance
- **ECON 329** Game Theory: The Economics of Thinking Strategically
- **ECON 333** The Economics of Organizations and Employment Relationships
- **ECON 342** Public Finance
- **ECON 368** Environmental Economics
- **ECON 369** Economics of Technological Innovation and Entrepreneurship
- **ORBH 250** Leading People (LEAD I)
- **ORBH 251** Leading Organizations (LEAD II)
- **ORBH 303** Developing Interpersonal Skills for Leading
- **ORBH 330** Quantum Leadership: Creating Value for You, Business, and the World
- **ORBH 380** Managing Negotiations
- **ORBH 391** Leadership in Diversity and Inclusion: Towards a Globally Inclusive Workplace

### Pre-Architecture (P) Technical Electives

- **ECIV 300** Undergraduate Research
- **ECIV 316/416** Matrix Analysis of Structures
- **ECIV 342** BIM and Computer Graphics
- **ECIV 343** BIM Data Management & Remote Sensing
- **ECIV 351** Engineering Hydraulics and Hydrology
- **ECIV 372** Timber and Masonry Design
- **ECIV 373** Reinforced Concrete Design
- **ECIV 374** Structural Steel Design
- **ECIV 420** Finite Element Analysis
- **ECIV 426** Probabilistic Analysis
- **ECIV 430** Foundation Engineering
- **ECIV 437** Pavement Analysis and Design (both courses)
- **ARTS 106** Creative Drawing I
- **ARTS 206** Creative Drawing II
- **ARTS 302** Architecture and City Design I
Sample Plan of Study

The following is a suggested program of study. Current students should always consult their advisors and their individual graduation requirement plans as tracked in SIS.

First Year

**Fall**
- **CHEM 111** Principles of Chemistry for Engineers ** 4
- **ENGR 130** Foundations of Engineering and Programming ** 3
- **FSXX SAGES First Seminar** * 4
- **MATH 121** Calculus for Science and Engineering I ** 4
- **PHED (two half semester classes)** 3

**Hours** 18

**Spring**
- **SAGES University Seminar I** * 3
- **ENGR 145** Chemistry of Materials ** 4
- **MATH 122** Calculus for Science and Engineering II ** 4
- **PHYS 121** General Physics I - Mechanics ** 4
- **PHED (two half semester classes)** 3

**Hours** 15

Second Year

**Fall**
- **ECIV 160** Surveying and Computer Graphics 3
- **ENGR 200** Statics and Strength of Materials ** 3
- **MATH 223** Calculus for Science and Engineering III ** 3
- **PHYS 122** General Physics II - Electricity and Magnetism ** 4

**Hours** 16

**Spring**
- **Breadth elective** ** 3
- **ECIV 310** Strength of Materials 3
- **ENGR 398** Professional Communication for Engineers ** 3
- **ENGL 398** Professional Communication for Engineers ** 2
- **Approved Natural Science Elective** 3
- **MATH 224** Elementary Differential Equations ** 3
- **Open Elective** 3

**Hours** 18

Third Year

**Fall**
- **ECIV 311** Civil Engineering Materials $^S,G,C,P$ 3
- **ECIV 315** Introduction to Structural Engineering and Analysis 3
- **ENGR 210** Introduction to Circuits and Instrumentation **S,G,C,P 4
- **ENGR 225** Thermodynamics, Fluid Dynamics, Heat and Mass Transfer **E 3
- **EMAE 181** Dynamics $^G$ 3
- **Basic Science/Math Elective** $^S, G$ 3
- **Open Elective** $^C,P$ 3
- **ECIV 340** Construction Management 3

**Hours** 15

**Fourth Year**

**Fall**
- **ECIV 398** Civil Engineering Senior Project $^E$ 3
- **Appr Technical Elective** $^S, G, C,P$ 3
- **Appr Technical Elective** $^S, G, C,P$ 3
- **Appr Technical Elective** $^S, G, C,P$ 3
- **Breadth Elective** 3

**Hours** 15

**Spring**
- **Breadth Elective** 3
- **ECIV 360** Civil Engineering Systems 3
- **Appr Technical Elective** 3
- **Appr Technical Elective** 3
- **Breadth Elective** 3

**Hours** 15

**Total Hours** 129

* University general education requirement.
** Engineering general education requirement.
$^S, G, E, C$ ECIV Sequences: S = Structural, G = Geotechnical, E = Environmental, C = Construction Management, P = Pre-architecture.
1 ENGR 398 and ENGL 398 must be taken concurrently. Must be an approved course in a basic science other than chemistry or physics such as biology, astronomy, or geology. See list of pre-approved Basic Science/Math Electives for Environmental (E) sequence.
2 ECIV 374, a Fall course, may be taken in lieu of ECIV 373. See list of pre-approved Technical Electives for each sequence. Two of these courses must be a designated "design" course (indicated in list of pre-approved Technical Electives with an asterisk *). Three of these courses must be from ECIV department.
Other courses may be approved by the student’s academic advisor.

ECIV 398 may be taken in Fall or Spring.