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, Geotechnical, Construction Management, Pre-architecture, or Environmental.

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 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.

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 undertake 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, environmental, and economic 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. Alternatively or additionally, students may obtain employment as summer interns.

Undergraduate Policies

For undergraduate policies and procedures, please review the Undergraduate Academics 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 Undergraduate Academics 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 Unified General Education Requirements. Students completing this program as a secondary major while completing another undergraduate degree program do not need to satisfy the school-specific requirements associated with this major.

After completing a set of core courses in general engineering and civil engineering, undergraduate students choose a concentration in one of the areas of civil engineering of particular interest: Structural, Geotechnical, Construction Management, Pre-architecture, or Environmental.

### Code | Title | Hours
--- | --- | ---
### Required Mathematics, Science and Engineering Courses:
MATH 121 | Calculus for Science and Engineering I | 4
MATH 122 | Calculus for Science and Engineering II | 4
or MATH 124 | Calculus II | 3
MATH 223 | Calculus for Science and Engineering III | 3
or MATH 227 | Calculus III | 3
MATH 224 | Elementary Differential Equations | 3
or MATH 228 | Differential Equations | 3
PHYS 121 | General Physics I - Mechanics | 4
or PHYS 123 | Physics and Frontiers I - Mechanics | 4
PHYS 122 | General Physics II - Electricity and Magnetism | 4
or PHYS 124 | Physics and Frontiers II - Electricity and Magnetism | 4
CHEM 111 | Principles of Chemistry for Engineers | 4
ENGR 130 | Foundations of Engineering and Programming | 3
ENGR 145 | Chemistry of Materials | 4
ENGR 200 | Statics and Strength of Materials | 3
ENGR 399 | Impact of Engineering on Society | 3

### Code | Title | Hours
--- | --- | ---
### Required Courses:
ECIV 260 | Surveying and Computer Graphics | 3
ECIV 310 | Strength of Materials | 3
ECIV 315 | Introduction to Structural Engineering and Analysis | 3
ECIV 330 | Soil Mechanics | 3
ECIV 340 | Construction Management | 3
ECIV 360 | Civil Engineering Systems | 3
ECIV 368 | Environmental Engineering | 3
ECIV 398 | Civil Engineering Senior Project | 3

### Concentration Requirements

#### Structural

### Code | Title | Hours
--- | --- | ---
### Required Courses:
ECIV 311 | Civil Engineering Materials | 3
ECIV 373 | Reinforced Concrete Design | 3
or ECIV 374 | Structural Steel Design | 3

### Technical Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ENGR 210</td>
<td>Introduction to Circuits and Instrumentation</td>
<td>3</td>
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<td>EMAE 181</td>
<td>Dynamics</td>
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### Geotechnical

**Technical Electives**

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<tr>
<td>ARTS 302</td>
<td>Architecture and City Design I</td>
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<tr>
<td>ECIV 300</td>
<td>Undergraduate Research</td>
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<tr>
<td>ECIV 316/416</td>
<td>Matrix Analysis of Structures</td>
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<td>ECIV 342</td>
<td>BIM and Computer Graphics</td>
<td>3</td>
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<td>ECIV 372/472</td>
<td>Timber and Masonry Design</td>
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<td>ECIV 373</td>
<td>Reinforced Concrete Design</td>
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<td>ECIV 374</td>
<td>Structural Steel Design</td>
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<td>ECIV 413</td>
<td>Theory of Elasticity and Plasticity</td>
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<td>ECIV 415</td>
<td>Fracture Mechanics and Size Effect</td>
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<td>Bridge Engineering</td>
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<td>ECIV 419</td>
<td>Damage and Deterioration of Structures</td>
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<tr>
<td>ECIV 420</td>
<td>Finite Element Analysis</td>
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<tr>
<td>ECIV 426</td>
<td>Probabilistic Analysis</td>
<td>3</td>
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<tr>
<td>ECIV 430</td>
<td>Foundation Engineering</td>
<td>3</td>
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<tr>
<td>ECIV 455</td>
<td>Data Analysis for Civil and Environmental Engineering</td>
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<td>ECIV 456</td>
<td>Intelligent Infrastructure Systems</td>
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<tr>
<td>ECIV 473</td>
<td>Advanced Topics in Reinforced Concrete Design</td>
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<tr>
<td>ECIV 474</td>
<td>Advanced Structural Steel Design</td>
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<td>ECIV 476</td>
<td>Structural Fire Engineering</td>
<td>3</td>
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<td>ECSE 342</td>
<td>Introduction to Global Issues</td>
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<td>ECSE 350</td>
<td>Operations and Systems Design</td>
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<td>ECSE 352</td>
<td>Engineering Economics and Decision Analysis</td>
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<tr>
<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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<td>EMSE 276</td>
<td>Materials Properties: Composition and Structure</td>
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<td>EMSE 372</td>
<td>Structural Materials by Design</td>
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<tr>
<td>ENGR 225</td>
<td>Thermodynamics, Fluid Dynamics, Heat and Mass Transfer</td>
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</tbody>
</table>

*a* Three of the technical electives must be from the Civil and Environmental Engineering Department. Two of the technical electives must be designated as design courses.

*b* Design course.
**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
**or ECIV 472**  Timber and Masonry Design
**ECIV 373**  Reinforced Concrete Design
**ECIV 374**  Structural Steel Design
**ECIV 413**  Theory of Elasticity and Plasticity
**ECIV 415**  Fracture Mechanics and Size Effect
**ECIV 420**  Finite Element Analysis
**ECIV 430**  Foundation Engineering
**ECIV 437**  Pavement Analysis and Design
**ECIV 456**  Intelligent Infrastructure Systems

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<thead>
<tr>
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<tr>
<td>ECIV 311</td>
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<td>Reinforced Concrete Design</td>
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<tr>
<td>or ECIV 374</td>
<td>Structural Steel Design</td>
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<tr>
<td>ENGR 210</td>
<td>Introduction to Circuits and Instrumentation</td>
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**ECIV 473**  Advanced Topics in Reinforced Concrete Design
**ECIV 474**  Advanced Structural Steel Design
**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
**EMAE 181**  Dynamics
**EMAE 250**  Computers in Mechanical Engineering
**ENGR 225**  Thermodynamics, Fluid Dynamics, Heat and Mass Transfer
**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

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**Construction Management**

**Required Courses:**
- ECIV 311  Civil Engineering Materials
- ECIV 373  Reinforced Concrete Design
- or ECIV 374  Structural Steel Design
- ENGR 210  Introduction to Circuits and Instrumentation

**Technical Electives:**
- ACCT 100  Foundations of Accounting I
- BAFI 355  Corporate Finance
- ECIV 300  Undergraduate Research
- ECIV 341  Construction Scheduling and Estimating
- ECIV 342  BIM and Computer Graphics
- ECIV 343  BIM Data Management & Remote Sensing
- ECIV 372/472  Timber and Masonry Design
- ECIV 373  Reinforced Concrete Design
- ECIV 374  Structural Steel Design
- ECIV 413  Theory of Elasticity and Plasticity
- ECIV 418  Bridge Engineering
- ECIV 419  Damage and Deterioration of Structures
- ECIV 430  Foundation Engineering
- ECIV 437  Pavement Analysis and Design
- ECIV 456  Intelligent Infrastructure Systems

**Pre-Architecture**

**Required Courses:**
- ECIV 311  Civil Engineering Materials
- ECIV 373  Reinforced Concrete Design
- or ECIV 374  Structural Steel Design
- ENGR 225  Thermodynamics, Fluid Dynamics, Heat and Mass Transfer

**Technical Electives:**
- ARTS 106  Creative Drawing I
- ARTS 206  Creative Drawing II
- ARTS 302  Architecture and City Design I
- ARTS 303  Architecture and City Design II
- ARTS 304  Architecture and City Design III
- 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 372/472  Timber and Masonry Design
- ECIV 373  Reinforced Concrete Design
- ECIV 374  Structural Steel Design
- ECIV 419  Damage and Deterioration of Structures
- ECIV 420  Finite Element Analysis
- ECIV 426  Probabilistic Analysis
- ECIV 430  Foundation Engineering
- & ECIV 437  and Pavement Analysis and Design

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Design course.
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**Sample Plans of Study**

The following are suggested plans of study. Current students should always consult their advisors and their individual graduation requirement plans.

### Sample Plan of Study: Structural or Geotechnical Concentrations

#### First Year

**Fall**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CHEM 111</td>
<td>Principles of Chemistry for Engineers</td>
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<td>Foundations of Engineering and Programming</td>
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**Hours** 17

**Spring**

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<td>ENGR 145</td>
<td>Chemistry of Materials</td>
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<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
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**Hours** 15
### Second Year

#### Fall

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<tbody>
<tr>
<td>ECIV 260</td>
<td>Surveying and Computer Graphics</td>
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<td>ENGR 200</td>
<td>Statics and Strength of Materials</td>
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<td>MATH 223</td>
<td>Calculus for Science and Engineering III</td>
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<td>General Physics II - Electricity and Magnetism</td>
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#### Spring

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<th>Course</th>
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<th>Hours</th>
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<tbody>
<tr>
<td>ECIV 310</td>
<td>Strength of Materials</td>
<td>3</td>
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<tr>
<td>ENGR 399</td>
<td>Impact of Engineering on Society</td>
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<tr>
<td>MATH 224</td>
<td>Elementary Differential Equations</td>
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<td>Breadth, or Elective course a</td>
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<td>Natural Science Elective b</td>
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#### Hours

16

### Third Year

#### Fall

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<tbody>
<tr>
<td>ECIV 315</td>
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<tr>
<td>ECIV 340</td>
<td>Construction Management</td>
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<tr>
<td>ENGR 210</td>
<td>Introduction to Circuits and Instrumentation</td>
<td>4</td>
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<tr>
<td>ECIV 311</td>
<td>Civil Engineering Materials</td>
<td>3</td>
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<tr>
<td>EMAE 181</td>
<td>Dynamics</td>
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#### Spring

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<tr>
<td>ECIV 330</td>
<td>Soil Mechanics</td>
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<td>ECIV 368</td>
<td>Environmental Engineering</td>
<td>3</td>
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<td>ECIV 373</td>
<td>Reinforced Concrete Design c</td>
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<td>Breadth, or Elective course a</td>
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#### Hours

16

### Fourth Year

#### Fall

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<td>ECIV 398</td>
<td>Civil Engineering Senior Project</td>
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#### Spring

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<tbody>
<tr>
<td>ECIV 360</td>
<td>Civil Engineering Systems</td>
<td>3</td>
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#### Hours

15

### Total Hours

128

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a Unified General Education Requirement.

b A basic science elective other than Chemistry or Physics (such as Biology, Astronomy or Geology). Must be approved by academic advisor.

c ECIV 374, a fall course, may be taken in lieu of ECIV 373.

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### Sample Plan of Study: Construction Management or Pre-Architecture Concentrations

#### First Year

**Fall**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CHEM 111</td>
<td>Principles of Chemistry for Engineers</td>
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<td>ENGR 130</td>
<td>Foundations of Engineering and Programming</td>
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<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
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**Hours**

17

**Spring**

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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>ENGR 145</td>
<td>Chemistry of Materials</td>
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<td>MATH 122</td>
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<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
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<td>Academic Inquiry Seminar, Breadth, or Elective course a</td>
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**Hours**

15

#### Second Year

**Fall**

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<td>MATH 223</td>
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<td>PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
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<td>Breadth, or Elective course a</td>
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**Hours**

16

**Spring**

<table>
<thead>
<tr>
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<td>MATH 224</td>
<td>Elementary Differential Equations</td>
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**Hours**

18

#### Third Year

**Fall**

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**Hours**

15

**Spring**

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<td>ENGR 399</td>
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**Hours**

16

#### Fourth Year

**Fall**

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**Hours**

15

**Total Hours**

128

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a Unified General Education Requirement.

b A basic science elective other than Chemistry or Physics (such as Biology, Astronomy or Geology). Must be approved by academic advisor.

c ECIV 374, a fall course, may be taken in lieu of ECIV 373.
Breadth, or Elective course<sup>a</sup> 3
Open Elective 3

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### Sample Plan of Study: Environmental Concentration

#### First Year

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<th>Course</th>
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<tbody>
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<td>CHEM 111</td>
<td>Principles of Chemistry for Engineers</td>
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<td>ENGR 130</td>
<td>Foundations of Engineering and Programming</td>
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<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
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<td>Chemistry of Materials</td>
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<td>MATH 122</td>
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<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
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<td>Surveying and Computer Graphics</td>
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<td>ENGR 200</td>
<td>Statics and Strength of Materials</td>
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<td>General Physics II - Electricity and Magnetism</td>
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<td>Environmental Engineering</td>
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