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	
MATH 223	Calculus for Science and Engineering III	3
or MATH 227	Calculus III	
MATH 224	Elementary Differential Equations	3
or MATH 228	Differential Equations	
PHYS 121	General Physics I - Mechanics	4
or PHYS 123	Physics and Frontiers I - Mechanics	
PHYS 122	General Physics II - Electricity and Magnetism	4
or PHYS 124	Physics and Frontiers II - Electricity and Magnetism	
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:		**25**
ECIV 260	Surveying and Computer Graphics	
ECIV 310	Strength of Materials	
ECIV 315	Introduction to Structural Engineering and Analysis	
ECIV 330	Soil Mechanics	
ECIV 340	Construction Management	
ECIV 360	Civil Engineering Systems	
ECIV 368	Environmental Engineering	
ECIV 398	Civil Engineering Senior Project	

Concentration Requirements

Structural

Code	Title	Hours
Required Courses:		**13**
ECIV 311	Civil Engineering Materials	
ECIV 373	Reinforced Concrete Design	
or ECIV 374	Structural Steel Design	
ENGR 210	Introduction to Circuits and Instrumentation	
EMAE 181	Dynamics	
Technical Electives [a]		**18**
ARTS 302	Architecture and City Design I	
ECIV 300	Undergraduate Research	
ECIV 316/416	Matrix Analysis of Structures	
ECIV 342	BIM and Computer Graphics	
ECIV 372/472	Timber and Masonry Design [b]	
ECIV 373	Reinforced Concrete Design [b]	
ECIV 374	Structural Steel Design [b]	
ECIV 413	Theory of Elasticity and Plasticity	
ECIV 415	Fracture Mechanics and Size Effect	
ECIV 417	Structural Dynamics	
ECIV 418	Bridge Engineering [b]	
ECIV 419	Damage and Deterioration of Structures	
ECIV 420	Finite Element Analysis	
ECIV 426	Probabilistic Analysis	
ECIV 430	Foundation Engineering [b]	
ECIV 455	Data Analysis for Civil and Environmental Engineering	
ECIV 456	Intelligent Infrastructure Systems	
ECIV 473	Advanced Topics in Reinforced Concrete Design	
ECIV 474	Advanced Structural Steel Design	
ECIV 476	Structural Fire Engineering [b]	
ECSE 342	Introduction to Global Issues	
ECSE 350	Operations and Systems Design	
ECSE 352	Engineering Economics and Decision Analysis	
EMAE 250	Computers in Mechanical Engineering	
EMAE 401	Mechanics of Continuous Media	
EMSE 276	Materials Properties: Composition and Structure	
EMSE 372	Structural Materials by Design	
ENGR 225	Thermodynamics, Fluid Dynamics, Heat and Mass Transfer	

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.

Geotechnical

Code	Title	Hours
Required Courses:		**13**
ECIV 311	Civil Engineering Materials	
ECIV 373	Reinforced Concrete Design	
or ECIV 374	Structural Steel Design	
ENGR 210	Introduction to Circuits and Instrumentation	
EMAE 181	Dynamics	
Technical Electives: [a]		**18**
DSCI 432	Spatial Statistics for Near Surface, Surface, and Subsurface Modeling	
ECIV 300	Undergraduate Research	
ECIV 316	Matrix Analysis of Structures	
or ECIV 416	Matrix Analysis of Structures	

ECIV 342	BIM and Computer Graphics
ECIV 343	BIM Data Management & Remote Sensing
ECIV 351	Engineering Hydraulics and Hydrology [b]
ECIV 372	Timber and Masonry Design [b]
or ECIV 472	Timber and Masonry Design
ECIV 373	Reinforced Concrete Design [b]
ECIV 374	Structural Steel Design [b]
ECIV 413	Theory of Elasticity and Plasticity
ECIV 415	Fracture Mechanics and Size Effect
ECIV 420	Finite Element Analysis
ECIV 430	Foundation Engineering [b]
ECIV 437	Pavement Analysis and Design [b]
ECIV 455	Data Analysis for Civil and Environmental Engineering
ECIV 456	Intelligent Infrastructure Systems
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
EMAE 250	Computers in Mechanical Engineering
ENGR 225	Thermodynamics, Fluid Dynamics, Heat and Mass Transfer

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.

Construction Management

Code	Title	Hours
Required Courses:		**10**
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: [a]		**18**
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 [b]	
ECIV 373	Reinforced Concrete Design [b]	
ECIV 374	Structural Steel Design [b]	
ECIV 413	Theory of Elasticity and Plasticity	
ECIV 418	Bridge Engineering [b]	
ECIV 419	Damage and Deterioration of Structures	
ECIV 430	Foundation Engineering [b]	
ECIV 437	Pavement Analysis and Design [b]	
ECIV 456	Intelligent Infrastructure Systems	
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	

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.

Pre-Architecture

Code	Title	Hours
Required Courses:		**10**
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: [a]		**18**
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 [b]	
ECIV 373	Reinforced Concrete Design [b]	
ECIV 374	Structural Steel Design [b]	
ECIV 419	Damage and Deterioration of Structures	
ECIV 420	Finite Element Analysis	
ECIV 426	Probabilistic Analysis	
ECIV 430 & ECIV 437	Foundation Engineering and Pavement Analysis and Design [b]	

ECIV 476	Structural Fire Engineering
EMAE 181	Dynamics
EMAE 250	Computers in Mechanical Engineering
ENGR 225	Thermodynamics, Fluid Dynamics, Heat and Mass Transfer

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.

Environmental

Code	Title	Hours
Required Courses:		**7**
ECIV 351	Engineering Hydraulics and Hydrology	
ENGR 225	Thermodynamics, Fluid Dynamics, Heat and Mass Transfer	
Basic Science/Math Electives		**9**
BIOL 114	Principles of Biology	
BIOL 214	Genes, Evolution and Ecology	
BIOL 215	Cells and Proteins	
BIOL 300	Dynamics of Biological Systems: A Quantitative Introduction to Biology	
BIOL 343	Microbiology	
CHEM 223	Introductory Organic Chemistry I	
CHEM 224	Introductory Organic Chemistry II	
CHEM 301	Introductory Physical Chemistry I	
CHEM 302	Introductory Physical Chemistry II	
CHEM 323	Organic Chemistry I	
CHEM 324	Organic Chemistry II	
CHEM 335	Physical Chemistry I	
CHEM 336	Physical Chemistry II	
CSDS 132	Programming in Java	
CSDS 133	Introduction to Data Science and Engineering for Majors	
CSDS 233	Introduction to Data Structures	
CSDS 313	Introduction to Data Analysis	
CSDS 391	Introduction to Artificial Intelligence	
CSDS 440	Machine Learning	
DSCI 351	Exploratory Data Science	
DSCI 353	Data Science: Statistical Learning, Modeling and Prediction	
DSCI 354	Data Visualization and Analytics	
EEPS 110	Physical Geology	
EEPS 117	Weather and Climate	
EEPS 202	Global Environmental Problems	
EEPS 220	Environmental Geology	
EEPS 260	Introduction to Climate Change: Physics, Forecasts, and Strategies	
EEPS 352	Biogeochemistry	
MATH 380	Introduction to Probability	
PQHS 426	An Introduction to GIS for Health and Social Sciences	
PQHS 431	Statistical Methods I	
STAT 312	Basic Statistics for Engineering and Science	
Technical Electives:		**18**
ECHE 260	Introduction to Chemical Systems [b]	
ECHE 360	Transport Phenomena for Chemical Systems [b]	
ECHE 361	Separation Processes [b]	
ECHE 362	Chemical Engineering Laboratory [b]	
ECHE 364	Chemical Reaction Processes [b]	
ECHE 367	Process Control [b]	
ECHE 398	Process Analysis, Design and Safety [b]	
ECIV 300	Undergraduate Research	
ECIV 311	Civil Engineering Materials	
ECIV 361	Water Resources Engineering [b]	
ECIV 362/462	Solid and Hazardous Waste Management	
ECIV 363	Environmental Engineering Green Stormwater Infrastructure	
ECIV 426	Probabilistic Analysis	
ECIV 427	Environmental Organic Chemistry	
ECIV 450	Environmental Engineering Chemistry	
ECIV 455	Data Analysis for Civil and Environmental Engineering	
ECIV 461	Environmental Engineering Biotechnology [b]	
ECIV 463	Environmental Engineering Green Stormwater Infrastructure	
ECIV 464	Environmental Hazard Mitigation of Nonpoint and Point Source Pollution	
ENGR 210	Introduction to Circuits and Instrumentation	

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.

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		**Hours**
CHEM 111	Principles of Chemistry for Engineers	4
ENGR 130	Foundations of Engineering and Programming	3
MATH 121	Calculus for Science and Engineering I	4
Academic Inquiry Seminar, Breadth, or Elective course [a]		3
Open Elective		3
	Hours	**17**
Spring		
ENGR 145	Chemistry of Materials	4
MATH 122	Calculus for Science and Engineering II	4
PHYS 121	General Physics I - Mechanics	4
Academic Inquiry Seminar, Breadth, or Elective course [a]		3
	Hours	**15**

Second Year		
Fall		
ECIV 260	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
Breadth, or Elective course [a]		3
	Hours	**16**
Spring		
ECIV 310	Strength of Materials	3
ENGR 399	Impact of Engineering on Society	3
MATH 224	Elementary Differential Equations	3
Breadth, or Elective course [a]		3
Natural Science Elective [b]		3
Open Elective		3
	Hours	**18**
Third Year		
Fall		
ECIV 315	Introduction to Structural Engineering and Analysis	3
ECIV 340	Construction Management	3
ENGR 210	Introduction to Circuits and Instrumentation	4
ECIV 311	Civil Engineering Materials	3
EMAE 181	Dynamics	3
	Hours	**16**
Spring		
ECIV 330	Soil Mechanics	4
ECIV 368	Environmental Engineering	3
ECIV 373	Reinforced Concrete Design [c]	3
Breadth, or Elective course [a]		3
Open Elective		3
	Hours	**16**
Fourth Year		
Fall		
ECIV 398	Civil Engineering Senior Project	3
Breadth, or Elective course [a]		3
Breadth, or Elective course [a]		3
Technical Elective		3
Technical Elective		3
	Hours	**15**
Spring		
ECIV 360	Civil Engineering Systems	3
Breadth, or Elective course [a]		3
Technical Elective		3
Technical Elective		3
Technical Elective		3
	Hours	**15**
	Total Hours	**128**

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.

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

First Year		
Fall		**Hours**
CHEM 111	Principles of Chemistry for Engineers	4
ENGR 130	Foundations of Engineering and Programming	3
MATH 121	Calculus for Science and Engineering I	4
Academic Inquiry Seminar, Breadth, or Elective course [a]		3
Open Elective		3
	Hours	**17**
Spring		
ENGR 145	Chemistry of Materials	4
MATH 122	Calculus for Science and Engineering II	4
PHYS 121	General Physics I - Mechanics	4
Academic Inquiry Seminar, Breadth, or Elective course [a]		3
	Hours	**15**
Second Year		
Fall		
ECIV 260	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
Breadth, or Elective course [a]		3
	Hours	**16**
Spring		
ECIV 310	Strength of Materials	3
ENGR 399	Impact of Engineering on Society	3
MATH 224	Elementary Differential Equations	3
Breadth, or Elective course [a]		3
Natural Science Elective [b]		3
Open Elective		3
	Hours	**18**
Third Year		
Fall		
ECIV 315	Introduction to Structural Engineering and Analysis	3
ECIV 340	Construction Management	3
ENGR 210	Introduction to Circuits and Instrumentation	4
ECIV 311	Civil Engineering Materials	3
Open Elective		3
	Hours	**16**
Spring		
ECIV 330	Soil Mechanics	4
ECIV 360	Civil Engineering Systems	3
ECIV 373	Reinforced Concrete Design [c]	3

Breadth, or Elective course [a]		3
Open Elective		3
	Hours	**16**
Fourth Year		
Fall		
ECIV 398	Civil Engineering Senior Project	3
Breadth, or Elective course [a]		3
Technical Elective		3
Technical Elective		3
Technical Elective		3
	Hours	**15**
Spring		
ECIV 360	Civil Engineering Systems	3
Breadth, or Elective course [a]		3
Technical Elective		3
Technical Elective		3
Technical Elective		3
	Hours	**15**
	Total Hours	**128**

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.

Sample Plan of Study: Environmental Concentration

First Year		
Fall		**Hours**
CHEM 111	Principles of Chemistry for Engineers	4
ENGR 130	Foundations of Engineering and Programming	3
MATH 121	Calculus for Science and Engineering I	4
Academic Inquiry Seminar, Breadth, or Elective course [a]		3
Open Elective		3
	Hours	**17**
Spring		
ENGR 145	Chemistry of Materials	4
MATH 122	Calculus for Science and Engineering II	4
PHYS 121	General Physics I - Mechanics	4
Academic Inquiry Seminar, Breadth, or Elective course [a]		3
	Hours	**15**
Second Year		
Fall		
ECIV 260	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
Breadth, or Elective course [a]		3
	Hours	**16**
Spring		
ECIV 310	Strength of Materials	3
ENGR 399	Impact of Engineering on Society	3
MATH 224	Elementary Differential Equations	3
Breadth, or Elective course [a]		3
Natural Science Elective [b]		3
Open Elective		3
	Hours	**18**
Third Year		
Fall		
ECIV 315	Introduction to Structural Engineering and Analysis	3
ECIV 340	Construction Management	3
ENGR 225	Thermodynamics, Fluid Dynamics, Heat and Mass Transfer	4
Basic Science/Math Elective		3
Basic Science/Math Elective		3
	Hours	**16**
Spring		
ECIV 330	Soil Mechanics	4
ECIV 368	Environmental Engineering	3
ECIV 351	Engineering Hydraulics and Hydrology	3
Technical Elective		3
Basic Science/Math Elective		3
	Hours	**16**
Fourth Year		
Fall		
ECIV 398	Civil Engineering Senior Project	3
Breadth, or Elective course [a]		3
Technical Elective		3
Technical Elective		3
Technical Elective		3
	Hours	**15**
Spring		
ECIV 360	Civil Engineering Systems	3
Breadth, or Elective course [a]		3
Breadth, or Elective course [a]		3
Technical Elective		3
Technical Elective		3
	Hours	**15**
	Total Hours	**128**

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.