CIVIL ENGINEERING, B.S. (ENGINEERING)

Begin Campus: Any Penn State Campus
End Campus: University Park

Program Description
The program in Civil and Environmental Engineering is designed to provide the basic undergraduate education required for private practice and public service in civil engineering and/or continue formal education. Emphasis is placed on the fundamentals of civil engineering principles and design techniques. Students utilize basic engineering science concepts in several of the different specialty areas (e.g., construction/management, environmental, materials/pavement design/geotechnical, structures, transportation, and water resources). Finally the students are able to choose an area of specialization for professional practice or graduate studies.

The program is broadened by courses in communication, arts, humanities, social and behavioral sciences, as well as other engineering disciplines. Students gain experience in working as members of a team and using interdisciplinary approaches to solve problems. These experiences, as well as those related to engineering principles and design, are provided through exercises in the classroom, laboratory, and field. The program culminates in a capstone design course wherein the students’ knowledge and skills are applied to actual engineering problems.

What is Civil Engineering?
Civil Engineering is the application of mathematics and physical science principles to solve the design, construction, and maintenance concerns of the natural and physically built environment. Civil engineering deals with public works including highways, railroads, bridges, buildings, and water and energy systems. Civil engineers work in the public sector for government agencies or in the private sector at consulting or construction firms. Some civil engineers hold supervisory or administrative positions, while others pursue careers in design, construction, or education. Civil engineers may also aim to develop solutions to environmental problems. They are involved in efforts to improve recycling, waste disposal, public health, and water and air pollution control.

You Might Like This Program If...
• You enjoy math and creative problem-solving.
• You like to build and create projects or models.
• You prefer to use analysis and the scientific method to understand things.
• You enjoy working on multidisciplinary teams on complex problems.

Entrance to Major
This program currently has administrative enrollment controls. Administrative Enrollment Controls are initiated when limitations of space, faculty, or other resources in a major prevent accommodating all students who request them. Students must follow the administrative enrollment controls that are in effect for the semester that they enter the university.

First-Year Students Entering Summer 2020, Fall 2020, Spring 2021
In order to be eligible for entrance to this major, students must satisfy the following requirements:
• 29-55 graded Penn State credits (excludes transfer and AP credits)
• completed with a grade of C or better: CHEM 110, EDSGN 100, MATH 140, MATH 141, PHYS 211
• earned a minimum cumulative grade-point average (GPA) of 2.80

Students Who Entered Prior to Summer 2020
Students who entered the University from Summer 2018 through Spring 2020 should view the administrative enrollment controls in the appropriate Undergraduate Bulletin archive. Students who entered the University prior to the summer 2018 semester should view the administrative enrollment controls for the semester that they entered the university on the Academic Advising Portal.

Degree Requirements
For the Bachelor of Science degree in Civil Engineering, a minimum of 127 credits is required:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>109</td>
</tr>
</tbody>
</table>

27 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 9 credits of GWS courses.

General Education
Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required.)
• Quantification (GQ): 6 credits
• Writing and Speaking (GWS): 9 credits

Knowledge Domains
• Arts (GA): 6 credits
• Health and Wellness (GHW): 3 credits
• Humanities (GH): 6 credits
• Social and Behavioral Sciences (GS): 6 credits
• Natural Sciences (GN): 9 credits
Integrative Studies (may also complete a Knowledge Domain requirement)
- Inter-Domain or Approved Linked Courses: 6 credits

University Degree Requirements

First Year Engagement
All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement
6 credits are required and may satisfy other requirements
- United States Cultures: 3 credits
- International Cultures: 3 credits

Writing Across the Curriculum
3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits
A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work
Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition
The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80)). For more information, check the Suggested Academic Plan for your intended program.

Requirements for the Major
To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 111</td>
<td>Experimental Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>GEO 1</td>
<td>Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>MATH 220</td>
<td>Matrices</td>
<td>2</td>
</tr>
<tr>
<td>STAT 401</td>
<td>Experimental Methods</td>
<td>3</td>
</tr>
<tr>
<td>Prescribed Courses: Require a grade of C or better</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CE 310   Surveying                              3
CE 321   Highway Engineering                    3
CE 332   Professionalism, Economics & Construction Project Delivery 3
CE 335   Engineering Mechanics of Soils         3
CE 336   Materials Science for Civil Engineers  3
CE 340   Structural Analysis                    3
CE 360   Fluid Mechanics                        3
CE 370   Introduction to Environmental Engineering 3
CHEM 110 Chemical Principles I                   3
EDSGN 100 Cornerstone Engineering Design         3
EMCH 211 Statics                                 3
EMCH 212 Dynamics                                3
EMCH 213 Strength of Materials                   3
ENGL 202C Effective Writing: Technical Writing   3
MATH 140 Calculus With Analytic Geometry I       4
MATH 141 Calculus with Analytic Geometry II      4
MATH 251 Ordinary and Partial Differential Equations 4
PHYS 211 General Physics: Mechanics              4
PHYS 212 General Physics: Electricity and Magnetism 4

Additional Courses
CE 337   Civil Engineering Materials Laboratory 1 Water Quality Chemistry 1
or CE 475  
CHE 220   Introduction to Chemical Engineering 3 Thermodynamics 2
or ME 201 Introduction to Thermal Science 3
CMPS 200 Programming for Engineers with MATLAB 3
or CMPS 201 Programming for Engineers with C++ 3

Select one of the following:

Select 6 credits of the following: 3
CE 341   Design of Concrete Structures            3
CE 342   Design of Steel Structures               3
CE 371   Water and Wastewater Treatment           3
CE 441   Structural Design of Foundations         3
CE 447   Structural Analysis by Matrix Methods    3
CE 461   Water-resource Engineering               3
CE 462   Open Channel Hydraulics                  3
CE 475   Water Quality Chemistry                  3
CE 476   Solid and Hazardous Wastes               3
CE 479   Environmental Microbiology for Engineers 3

Select 3 credits of CE 400 level "W" courses     3

Additional Courses: Require a grade of C or better
CAS 100A Effective Speech                        3
or CAS 100B Effective Speech                      3
ENGL 15   Rhetoric and Composition               3
or ENGL 30
Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (http:// senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy/)

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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2020-21 academic year. To access previous years' suggested academic plans, please visit the archive (http://bulletins.psu.edu/undergraduate/archive/) to view the appropriate Undergraduate Bulletin edition (Note: the archive only contain suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin).

All Civil Engineering Disciplines, University Park Campus

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

If you are starting at a campus other than the one this plan is ending at, please refer to: http://advising.engr.psu.edu/degree-requirements/academic-plans-by-major.aspx

First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 100S (or other First Year Seminar)†</td>
<td>1</td>
<td>CHEM 111</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 110 (GN)‡†</td>
<td>3</td>
<td>ECON 102 or 104 (GS)†</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 15, 30, or ESL 15 (GWS)‡†</td>
<td>3</td>
<td>MATH 141 or 141E (GQ)‡†</td>
<td>4</td>
</tr>
<tr>
<td>EDSGN 100§</td>
<td>3</td>
<td>PHYS 211 (PHYS 211L and PHYS 211R (GN))§†</td>
<td>4</td>
</tr>
<tr>
<td>MATH 140 or 140E (GQ)‡†</td>
<td>4</td>
<td>General Education Course†</td>
<td>3</td>
</tr>
</tbody>
</table>

Supporting Courses and Related Areas

Select 12 credits of technical elective from CE 300-level courses, CE 400-level courses, or department list

1. If CE 475 is taken, one credit goes toward lab requirement and remaining three go towards CE or general technical electives.
2. Students may substitute 6 credits of ROTC for 3 credits of GHW courses and 3 credits of ME.
3. Two of those courses must be selected from at least 2 of the 3 remaining technical areas in the Civil Engineering program—structures (x40), hydrosystems (x60), and environmental (x70).

Program Educational Objectives

The educational objectives of our undergraduate program will prepare our graduates to:

• begin and sustain a career in consulting, industry, or state and federal government agencies, such as the departments of transportation and departments of environmental protection;
• lead and work in interdisciplinary teams needed to design sustainable and resilient infrastructure through knowledge and application of environmental, geotechnical, materials, structural, transportation, and water resources engineering;
• engage in life-long learning opportunities, including graduate school; and
• obtain and maintain professional licensure

Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Civil Engineering program is designed to enable students to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. 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
3. Communicate effectively with a range of audiences
4. 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
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

Civil Engineering, B.S. (Engineering)
General Education Course† 3 General Education Course (GHW)† 1.5

Second Year
Fall Credits Spring Credits
CAS 100A or 100B (GWS)†† 3 CMPSC 200 or 201 3
EMCH 211 †† 3 EMCH 212* 3
GEOG 1 3 EMCH 213 or 213D† 3
MATH 251†† 4 IE 424 or STAT 401 3
PHYS 212 (PHYS 212L and PHYS 212R (GNI))†† 4 MATH 220 2
General Education Course† 3

Third Year
Fall Credits Spring Credits
CE 310† 3 CE 321† 3
CE 332† 3 CE 335† 3
CE 336† 3 CE 337† 1
CE 340† 3 CE 370† 3
CE 360† 3 ME 201 3
General Education Course (GHW)† 1.5

Fourth Year
Fall Credits Spring Credits
ENGL 202C (GWS)†† 3 Civil Engineering Capstone Design 3
Civil Engineering Elective 3 Civil Engineering Elective 3
Civil Engineering Elective 3 Technical Elective 3
Technical Elective 3 Technical Elective 3
General Education Course† 3 General Education Course† 3

Total Credits 127

* Course requires a grade of C or better for the major
† Course requires a grade of C or better for General Education
‡ Course is an Entrance to Major requirement
†† Course satisfies General Education and degree requirement

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of ‘C’ or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

All incoming Schreyer Honors College first-year students at University Park will take ENGL/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

College Notes:

• CE Elective: CE Electives must be selected from two of these specific technical areas in the program: Structures (X40); Water Resources Engineering (X60); Environmental Engineering (X70).

• Health and Physical Activity Elective: Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement and 3 ROTC credits for M E 201.

• Technical Elective: Select from department list. Students who complete the Cooperative Education Program may substitute the 3-credit sequence of ENGR 295, ENGR 395, and ENGR 495 for a Technical Elective.

• ** If a student is pursuing the Structural sub-discipline in Civil Engineering, if CE 340 is not taken in the 5th semester it may delay graduation.

Career Paths

Our graduates work in a variety of fields to develop solutions for challenges in design, construction, research, and education. Civil engineering graduates work in the public sector for government agencies or in the private sector at consulting or construction firms. Some civil engineers hold supervisory or administrative positions, while others pursue careers in design, construction, or education.

Opportunities for Graduate Studies

Our graduate degree programs give students a stronger foundation in civil or environmental engineering that helps prepare them to apply their skills across a broad range of disciplines in both academia and industry. If you wish to develop and expand your expertise, you will have ample opportunity to do so here. Our first-rate faculty collectively possess a deep and broad range of knowledge that provides an ideal environment for interdisciplinary work. Whether your passion calls you to start your own business, pursue the next ground-breaking innovation, or help solve a humanitarian crisis, our graduate degree programs can take you closer to your goals.

Professional Resources

• American Concrete Institute (https://www.concrete.org/)

• American Society of Civil Engineers (https://www.asce.org)

Accreditation

The baccalaureate program in Civil Engineering is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org/

MORE INFORMATION ABOUT ABET ACCREDITATION (https://www.abet.org/)

Contact

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