CIVIL ENGINEERING

http://www.pacific.edu/Academics/Schools-and-Colleges/School-of-Engineering-and-Computer-Science/Academics-/Majors/Civil-Engineering-.html
Phone: (209) 932-2805
Location: John T. Chambers Technology Center

Degrees Offered

Bachelor of Science in Civil Engineering

Program Educational Objectives

Within a few years of graduation, graduates of the Civil Engineering program are expected to:

- Plan, design, evaluate, construct, operate, maintain, analyze, advance, and manage civil engineering systems
- Pursue professional licensure and certifications
- Engage in life-long learning and pursue advanced level studies
- Demonstrate leadership skills through career advancement and active participation in the civil engineering profession and in the community

Students who complete the BS degree in Civil Engineering will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. 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.

3. An ability to communicate effectively with a range of audiences.

4. 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.

5. 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.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Bachelor of Science in Civil Engineering

Student must complete a minimum of 120 units of academic work and a minimum of 32 units of Cooperative Education in order to earn the bachelor of science degree in civil engineering.

I. General Education Requirements

For more details, see General Education (http://catalog.pacific.edu/stocktongeneral/generaleducationprogram/)

Minimum 28 units and 9 courses that include:

A. CORE Seminars (2 courses)

CORE 001	Problem Solving & Oral Comm	3
CORE 002	Writing and Critical Thinking	4

Note: 1) CORE Seminars cannot be taken for Pass/No Credit. ***2)*** Transfer students with 28 or more transfer credits taken after high school are exempt from both CORE seminars.

B. Breadth Requirement (7 courses, at least 3 units each)

At least one course from each of the following areas:

- Artistic Process & Creation
- Civic & Global Responsibility
- Language & Narratives
- Quantitative Reasoning
- Scientific Inquiry
- Social Inquiry
- World Perspectives & Ethics

Note: 1) No more than 2 courses from a single discipline can be used to meet the Breadth Requirement.

C. Diversity and Inclusion Requirement

All students must complete Diversity and Inclusion coursework (at least 3 units)

Note: 1) Diversity and Inclusion courses can also be used to meet the breadth category requirements, or major or minor requirements.

D. Fundamental Skills

Students must demonstrate competence in:

- Writing
- Quantitative Analysis (Math)

Note: 1) Failure to satisfy the fundamental skills requirements by the end of four semesters of full-time study at the University is grounds for academic disqualification.

II. Major Requirements

Mathematics and Science (minimum 30 units)

MATH 051	Calculus I	4
MATH 053	Calculus II	4
MATH 055	Calculus III	4
MATH 057	Applied Differential Equations I: ODEs	4
PHYS 053	Principles of Physics I	5
Select one of the following: *		4-5
CHEM 024	Fundamentals of Chem	
CHEM 025	General Chemistry	
CHEM 027	General Chemistry	
Math or Science Elective		3-4
Geological or Biological Science Elective		3-4

Engineering Science:

ENGR 010	Dean's Seminar	1
ENGR 019	Computer Applications in Engineering	3
ENGR 020	Engineering Mechanics I (Statics)	3
ENGR 025	Professional Practice Seminar	1
ENGR 030	Engineering and Computing Ethics in Society	3
ENGR 045	Materials Engineering	3
ENGR 045L	Materials Engineering Lab	1
ENGR 120	Engineering Mechanics II (Dynamics)	3
ENGR 121	Mechanics of Materials	3
Select one of the following:		3-4
ECPE 041 & 041L	Circuits and Circuits Laboratory	
One 3 or 4 unit 100-Level BENG, CIVL, ECPE, EMGT, ENGR, or MECH		
Professional Practice (minimum 32 units)		
ENGR 181	Professional Practice	1-16
ENGR 182	Professional Practice	1-16
ENGR 183	Professional Practice	1-16
Civil Engineering Core:		
CIVL 015	Civil Engineering Graphics	3
CIVL 060	Water Quality	4
CIVL 100	Structural Engineering	4
CIVL 130	Fluid Mechanics I	3
CIVL 130L	Fluid Mechanics I Lab	1
CIVL 132	Environmental Engineering	4
CIVL 133	Water Resources Engineering	4
CIVL 140	Geotechnical Engineering	4
CIVL 180	Engineering Synthesis	4
EMGT 170	Project Decision Making	4
Select four of the following from a, b and c:		12
a. Civil Engineering Analysis Electives		
CIVL 022	Geomatics	
CIVL 134	Groundwater	
CIVL 145	Engineering Geology	
CIVL 160	Structural Analysis	
CIVL 163	Introduction to Earthquake Engineering	
CIVL 171	Water and Environmental Policy	
CIVL 173	Sustainable Engineering	
CIVL 191	Independent Study	
CIVL 193	Special Topics	
CIVL 197	Undergraduate Research	
EMGT 115	Building Information Modeling	
EMGT 174	Engineering Project Management	
b. Civil Engineering Design Electives:		
CIVL 136	Design of Water Quality Control Facilities	
CIVL 138	Solid Waste Systems Design and Management	
CIVL 141	Earth Structure Design	
CIVL 150	Transportation Engineering	
CIVL 151	Construction Engineering	
CIVL 164	Structural Timber Design	
CIVL 165	Structural Steel Design	
CIVL 166	Reinforced Concrete Design	
CIVL 193	Special Topics (c. Infrastructure Systems Electives:)	
c. Infrastructure Systems Electives:		
CIVL 022	Geomatics	
CIVL 150	Transportation Engineering	
CIVL 151	Construction Engineering	
CIVL 171	Water and Environmental Policy	
EMGT 115	Building Information Modeling	
EMGT 176	Systems Engineering Management	

* AP CHEM scores of 4 or 5, or IB CHEM Higher Level scores of 5, 6, or 7, will satisfy the elective

> ***Note:*** *A minimum of one structural design elective (3 units minimum) and one infrastructure systems elective (3 units minimum) must be taken.*

Civil Engineering Courses

CIVL 015. Civil Engineering Graphics. 3 Units.
Coverage of the principles and applications of graphics in engineering design. Pictorial and isometric sketching and orthographic projection and use of auxiliary views and sections are used. Drafting standards and conventions, dimensioning and tolerances. Layout and assembly drawings, detail drawings and production drawings using AutoCAD software. Laboratory work is included. Prerequisite may be taken concurrently: ENGR 010 with a "C-" or better.

CIVL 022. Geomatics. 3 Units.
This course is an introduction to geomatics engineering which includes in depth coverage of plane surveying and an introduction to Global Navigation Satellite Systems (GNSS), geodetics and geospatial sciences. Fundamental surveying methods and equipment will be presented in both a lecture and a hands-on laboratory section. Topics include: error theory, leveling, traverse computations, topography, coordinate systems, construction surveying, geometric design, Global Navigation Satellite Systems (GNSS), photogrammetry and the presentation of other emerging and relevant technologies. Prerequisite: MATH 041 with a "C-" or better or a passing score on the University's trigonometry placement test.

CIVL 060. Water Quality. 4 Units.
Students examine chemical reactions and processes in aquatic systems with engineering applications. Topics include chemical equilibrium and kinetics associated with acid-base, dissolution-precipitation, complexation, and reduction-oxidation reactions in natural and engineered environments. Laboratory work is included. Prerequisites: AP Chem with score of 4 or 5, CHEM IB Higher Level (score of 5, 6, or 7), CHEM 024 or CHEM 025 or CHEM 027; and MATH 051 with a "C-" or better. **(ENST)**

CIVL 100. Structural Engineering. 4 Units.
Students examine the theory and applications of structural analysis and design. Topics include determination of loads, analysis of beams, trusses and frames, influence lines and indeterminate structures. Laboratory is included. Prerequisites: Completion of all Fundamental Skills; CIVL 15 or MECH 15; ENGR 19; Prerequisite can be taken concurrently: ENGR 121 with a "C-" or better (Spring).

CIVL 130. Fluid Mechanics I. 3 Units.
Students study the physical properties of fluids, statics and dynamics of incompressible fluids that include hydrostatics, conservation of mass, energy and momentum principles, laminar and turbulent flow with emphasis on pipe flow. Prerequisite: Completion of all Fundamental Skills and ENGR 120 with a "C-" or better. Corequisite: CIVL 130L.

CIVL 130L. Fluid Mechanics I Lab. 1 Unit.
Experimental analysis of concepts are discussed in CIVL 130. Prerequisite: Completion of all Fundamental Skills and ENGR 120 with a "C-" or better. Corequisite: CIVL 130.

CIVL 132. Environmental Engineering. 4 Units.
Students are introduced to the physical, chemical, and biological processes associated with water quality in natural environments and engineering systems. Topics include operation and design of water and wastewater treatment facilities as well as the occurrence, behavior and control of indoor and regional air pollution. Laboratory is included. Prerequisites: Completion of all Fundamental Skills; CIVL 015 or MECH 015; CIVL 060 with a "C-" or better.

CIVL 133. Water Resources Engineering. 4 Units.
Hydraulic and hydrologic analysis and design including pipe flow, open channel flow, elements of the hydrologic cycle, analysis of rainfall-runoff data, design applications, and the application of computers in hydrologic and hydraulic design. Laboratory is included. Prerequisites: Completion of all Fundamental Skills; CIVL 015 or MECH 015; CIVL 130 with a "C-" or better.

CIVL 134. Groundwater. 4 Units.
Aquifer properties, groundwater hydraulics in confined and unconfined aquifers under steady and unsteady flow conditions. Well hydraulics under ideal and non-ideal conditions. Constituent transport and fate in groundwater. Prerequisites: Completion of all Fundamental Skills; CIVL 130; MATH 057 with a "C-" or better.

CIVL 136. Design of Water Quality Control Facilities. 4 Units.
This advanced course covers the physical, chemical, and biological processes that are involved in the design of water and wastewater treatment plant facilities as well as applicable design standards and regulations. Prerequisites: Completion of all Fundamental Skills, CIVL 130, CIVL 132 with a "C-" or better.

CIVL 138. Solid Waste Systems Design and Management. 3 Units.
This is an introductory course to solid waste systems, that analyzes of problems associated with storage, collection, transport, processing, and disposal of solid wastes. Students review of current and expected regulatory requirements and the planning and design of solid waste management components that include systems and processes for solid waste prevention, recycling/composting, incineration, and landfilling. Prerequisite: Completion of all Fundamental Skills and CIVL 132 with a "C-" or better.

CIVL 140. Geotechnical Engineering. 4 Units.
This course covers the fundamentals of geotechnical engineering including the characterization of soils and their behavior as an engineering material. Topics include classification of soils, compaction, permeability, and consolidation. Design applications include settlement predictions, strength characterization, soil exploration programs, and an overview of shallow and deep foundations. The course includes laboratory work. Prerequisites: Completion of all Fundamental Skills; CIVL 015 or MECH 015; ENGR 121 with a "C-" or better.

CIVL 141. Earth Structure Design. 4 Units.
Evaluation of drained and undrained field conditions and the relationship between temporary and permanent design conditions over time. In-situ tests, including SPT and CPT. Analysis of lateral stresses in soil masses. Design of slopes, cantilever retaining walls, sheet piles, anchored bulkheads, and mechanically-stabilized earth walls. Design includes analysis of effects of water and seismic conditions, including liquefaction. Prerequisite: CIVL 140.

CIVL 145. Engineering Geology. 4 Units.
This introductory course to is the study of geology in which geologic principles, data and techniques are applied to civil engineering problems. Also listed as GEOS 145. Prerequisites: Completion of all Fundamental Skills; GEOS 051 or GEOS 061 or CIVL 140 with a "C-" or better.

CIVL 150. Transportation Engineering. 4 Units.
Students study the considerations and procedures in the planning, design, and operation of various transportation systems with primary emphasis on highways. Prerequisites: Completion of all Fundamental Skills. Junior or Senior standing.

CIVL 151. Construction Engineering. 3 Units.
An introduction to construction engineering and construction management. Construction engineering topics include construction processes and construction econometrics. Construction management topics include estimating, planning, bidding, and scheduling. Prerequisites: Completion of all Fundamental Skills. Junior or Senior standing.

CIVL 160. Structural Analysis. 3 Units.
Students analyze the behavior of trusses and framed structures under gravity and lateral loads. Other topics include analysis of shear walls, the use of structural analysis software, and the buckling of frames. Prerequisites: Completion of all Fundamental Skills; CIVL 100 and MATH 057 with a "C-" or better.

CIVL 163. Introduction to Earthquake Engineering. 3 Units.
Determination of loads on structures due to earthquakes. Overview of seismology. Methods of estimating equivalent static lateral forces; response spectrum and time history analysis. Concepts of mass, damping and stiffness for typical structures. Design for inelastic behavior. Numerical solutions and code requirements. Prerequisites: Completion of all Fundamental Skills, ENGR 019, ENGR 121 with a "C-" or better.

CIVL 164. Structural Timber Design. 4 Units.
Students will study the design of timber structural members, specifically tension, compression, flexural, and beam-column elements and connections to satisfy design code requirements. Prerequisite, may be taken concurrently: CIVL 100.

CIVL 165. Structural Steel Design. 4 Units.
Students study the design of steel structural members, specifically tension, compression, flexural, and beam-column elements and connections to satisfy design code requirements. Prerequisite: Completion of all Fundamental Skills. Prerequisite may be taken concurrently: CIVL 100 with a "C-" or better.

CIVL 166. Reinforced Concrete Design. 4 Units.
Students study the design and proportioning of structural members, specifically beams, columns, one-way slabs, footings, and walls to satisfy design criteria for reinforced concrete systems. Prerequisite: Completion of all Fundamental Skills. Prerequisite may be taken concurrently: CIVL 100 with a "C-" or better.

CIVL 171. Water and Environmental Policy. 3 Units.
This course introduces students to Federal and State of California environmental regulations pertaining to air, water, hazardous wastes, and toxic substances. Topics include an overview of water rights and environmental impact assessment, relevant case studies, and examples of monitoring and enforcement issues. Prerequisite: Completion of all Fundamental Skills. Junior or Senior standing. **(ENST)**

CIVL 173. Sustainable Engineering. 3 Units.
This interdisciplinary course provides an introduction to principles and practice of sustainable engineering. Topics include the analysis of economic, social, and environmental factors, life cycle assessment, resource use and waste generation in engineering products and processes. The course also examines case studies, readings, and class discussion emphasizes analysis and development of sustainable solutions. Prerequisite: Completion of all Fundamental Skills. Junior or Senior standing.

CIVL 180. Engineering Synthesis. 4 Units.
This course is a culminating experience wherein a group of students synthesize their previous class work into one project. Both technical and non-technical concerns are addressed. One or more faculty members and/or professional engineers are involved depending upon the fields covered in the project. Prerequisites: Completion of all Fundamental Skills; EMGT 170 and 2 of the following: CIVL 100, CIVL 132, CIVL 133, CIVL 140 with a "C-" or better. Senior standing.

CIVL 191. Independent Study. 1-4 Units.
Students undertake special individual projects under the direction of one or more faculty members. Permission of department chairperson and faculty member involved.

CIVL 193. Special Topics. 4 Units.
Upper division elective subject area based on expertise of faculty members.

CIVL 197. Undergraduate Research. 1-4 Units.
This course is applied or basic research in civil engineering under faculty supervision. Permission of faculty supervisor and department chair. Student must be in good academic standing.