Environmental Engineering

Minor

The Department of Civil and Environmental Engineering offers a minor program in Environmental Engineering. Environmental problem formulation, identification of solutions, and then implementation require an interdisciplinary approach. Additional breadth can be obtained by combining an undergraduate major in physical, mathematical, social, or biological sciences with a minor in Environmental Engineering. This minor will develop quantitative approaches to environmental analysis and is good preparation for graduate study in Environmental Engineering within the Department of Civil and Environmental Engineering at Berkeley or elsewhere.

There is no major in Environmental Engineering.

Declaring the Minor

To be considered for admission to the minor, students should have the following:

- An overall grade-point average (GPA) of 3.0
- Completed the lower division prerequisite courses with a GPA of 3.0; for further information regarding the prerequisites, please see the Minor Requirements tab on this page
- Upon admission to the minor, completed a minimum of six courses, of which no more than one can be counted toward of the requirements of the major(s)
- A minimum of a grade-point average of 2.0 in the minor
- Completion of the minor cannot delay graduation

After completion of the prerequisite courses, students need to complete and submit to the Civil and Environmental Academic Affairs office (750 Davis Hall) a Minor Program Application form.

Upon completion of the minor requirements, the student must complete and submit the Confirmation of Completion form to the Civil and Environmental Engineering Department's Office of Academic Affairs no later than two weeks after the end of the term in which the minor was completed.

Other Majors and Minors Offered by the Department of Civil and Environmental Engineering

Civil Engineering (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/civil-engineering) (Major only)
GeoSystems (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/geosystems) (Minor only)
Structural Engineering (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/structural-engineering) (Minor only)

Minor programs are areas of concentration requiring fewer courses than an undergraduate major. These programs are optional but can provide depth and breadth to a UC Berkeley education. The College of Engineering does not offer additional time to complete a minor, but it is usually possible to finish within the allotted time with careful course planning. Students are encouraged to meet with their ESS Adviser to discuss the feasibility of completing a minor program.

All the engineering departments offer minors. Students may also consider pursuing a minor in another school or college.

General Guidelines

1. All courses taken to fulfill the minor requirements must be taken for graded credit.
2. A minimum overall grade point average (GPA) of 3.0 and a minimum GPA of 3.0 in the prerequisite courses is required for acceptance into the minor program.
3. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.
4. No more than one upper-division course may be used to simultaneously fulfill requirements for a student's major and minor programs.
5. Completion of the minor program cannot delay a student's graduation.

Lower-division Prerequisites

MATH 1A & MATH 1B	Calculus and Calculus	8
MATH 53 & MATH 54	Multivariable Calculus and Linear Algebra and Differential Equations	8
Select one of the following:		8
CHEM 1A & CHEM 1B	General Chemistry and General Chemistry	
CHEM 4A & CHEM 4B	General Chemistry and Quantitative Analysis and General Chemistry and Quantitative Analysis	
PHYSICS 7A & PHYSICS 7B	Physics for Scientists and Engineers and Physics for Scientists and Engineers	8
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers (or equivalent)	4
CIV ENG 93	Engineering Data Analysis (or equivalent)	3
CIV ENG C30/ MEC ENG C85	Introduction to Solid Mechanics	3

Upper-division Minor Requirements

CIV ENG 100	Elementary Fluid Mechanics (Prerequisites: CE C30/ME C85& CE 93- may be taken concurrently)	4
or MEC ENG 106	Fluid Mechanics	
CIV ENG 111	Environmental Engineering (Prerequisites: CE 100, CE 11 recommended)	3
Select three of the following:		
CIV ENG 101	Fluid Mechanics of Rivers, Streams, and Wetlands (Prerequisites: CE 100 or ME 106 or consent of instructor)	
CIV ENG 103	Introduction to Hydrology (Prerequisites: CE 93 & CE 100)	
CIV ENG C106	Air Pollution (Prerequisites: CHEM 1A & CHEM 1B, PHYSICS 7A)	

CIV ENG 107	Climate Change Mitigation (Prerequisites: Consent of instructor)
CIV ENG 108	Course Not Available (Prerequisites: CE 111)
CIV ENG 112	Environmental Engineering Design (Prerequisites: CE 100, CE 111, CE 167 -recommended)
CIV ENG 113N	Ecological Engineering for Water Quality Improvement (Prerequisites: CE 111)
CIV ENG 114	Environmental Microbiology (Prerequisites: CHEM 1A & CHEM 1B)
CIV ENG 115	Water Chemistry (Prerequisites: Upper Div Standing)
CIV ENG C116	Chemistry of Soils (Prerequisites: CE 111 or equivalent)
CIV ENG 173	Groundwater and Seepage (Prerequisites: Senior Standing, CE 100 is recommended)

Environmental Engineering

CIV ENG 11 Engineered Systems and Sustainability 3 Units
An introduction to key engineered systems (e.g., energy, water supply, buildings, transportation) and their environmental impacts. Basic principles of environmental science needed to understand natural processes as they are influenced by human activities. Overview of concepts and methods of sustainability analysis. Critical evaluation of engineering approaches to address sustainability.
Rules & Requirements

Prerequisites: Chemistry 1A, Mathematics 1A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Harley, Horvath, Nelson

CIV ENG 24 Freshman Seminars 1 Unit
The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley seminars are offered in all campus departments, and topics vary from department to department and semester to semester.
Rules & Requirements

Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

CIV ENG C30 Introduction to Solid Mechanics 3 Units
A review of equilibrium for particles and rigid bodies. Application to truss structures. The concepts of deformation, strain, and stress. Equilibrium equations for a continuum. Elements of the theory of linear elasticity. The states of plane stress and plane strain. Solution of elementary elasticity problems (beam bending, torsion of circular bars). Euler buckling in elastic beams.
Rules & Requirements

Prerequisites: Mathematics 53 and 54 (may be taken concurrently); PHYSICS 7A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer:
6 weeks - 7.5 hours of lecture and 2.5 hours of discussion per week
10 weeks - 4.5 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Armero, Papadopoulos, Zohdi

Also listed as: MEC ENG C85

CIV ENG W30 Introduction to Solid Mechanics 3 Units
A review of equilibrium for particles and rigid bodies. Application to truss structures. The concepts of deformation, strain, and stress. Equilibrium equations for a continuum. Elements of the theory of linear elasticity. The states of plane stress and plane strain. Solution of elementary elasticity problems (beam bending, torsion of circular bars). Euler buckling in elastic beams.
Objectives & Outcomes

Course Objectives: To learn statics and mechanics of materials

Student Learning Outcomes: - Correctly draw free-body
- Apply the equations of equilibrium to two and three-dimensional solids
- Understand the concepts of stress and strain
- Ability to calculate deflections in engineered systems
- Solve simple boundary value problems in linear elastostatics (tension, torsion, beam bending)

Rules & Requirements

Prerequisites: Mathematics 53 and 54 (may be taken concurrently); PHYSICS 7A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of web-based lecture and 1 hour of web-based discussion per week

Summer:
6 weeks - 7.5 hours of web-based lecture and 2.5 hours of web-based discussion per week
8 weeks - 6 hours of web-based lecture and 2 hours of web-based discussion per week
10 weeks - 4.5 hours of web-based lecture and 1.5 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Govindjee, Sanjay

Also listed as: MEC ENG W85

CIV ENG 60 Structure and Properties of Civil Engineering Materials 3 Units
Introduction to structure and properties of civil engineering materials such as asphalt, cements, concrete, geological materials (e.g. soil and rocks), steel, polymers, and wood. The properties range from elastic, plastic and fracture properties to porosity and thermal and environmental responses. Laboratory tests include evaluation of behavior of these materials under a wide range of conditions.
Rules & Requirements

Repeat rules: Students may receive two units of credit for 60 after taking Engineering 45. One unit of a deficient grade may be removed in Engineering 45 with 60. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Monteiro, Ostertag

CIV ENG 70 Engineering Geology 3 Units
Principles of physical and structural geology; the influence of geological factors on engineering works and the environment. Field trip.
Rules & Requirements

Prerequisites: Chemistry 1A (may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Glaser, Sitar

CIV ENG 92 Introduction to Civil and Environmental Engineering 1 Unit
A course designed to familiarize the entering student with the nature and scope of civil and environmental engineering and its component specialty areas.
Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

CIV ENG 93 Engineering Data Analysis 3 Units
Application of the concepts and methods of probability theory and statistical inference to CEE problems and data; graphical data analysis and sampling; elements of set theory; elements of probability theory; random variables and expectation; simulation; statistical inference. Applications to various CEE problems and real data will be developed by use of MATLAB and existing codes. The course also introduces the student to various domains of uncertainty analysis in CEE.
Rules & Requirements

Prerequisites: Engineering 7

Credit Restrictions: Students will receive no credit after taking Statistics 25.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Summer: 6 weeks - 5 hours of lecture and 7.5 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Der Kiureghian, Hansen, Madanat, Rubin

CIV ENG 98 Supervised Group Study and Research 1 - 3 Units
Supervised group study and research by lower division students.
Rules & Requirements

Prerequisites: Consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of directed group study per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

CIV ENG 99 Supervised Independent Study and Research 1 - 4 Units
Supervised independent study by lower division students.
Rules & Requirements

Prerequisites: Freshman or sophomore standing and consent of instructor. Minimum grade point average of 3.3 required

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer: 8 weeks - 2-7.5 hours of independent study per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

CIV ENG 100 Elementary Fluid Mechanics 4 Units
Fluid statics and dynamics, including laboratory experiments with technical reports. Fundamentals: integral and differential formulations of the conservation laws are solved in special cases such as boundary layers and pipe flow. Flow visualization and computation techniques are introduced using Matlab. Empirical equations are used for turbulent flows, drag, pumps, and open channels. Principles of empirical equations are also discussed: dimensional analysis, regression, and uncertainty.
Rules & Requirements

Prerequisites: PHYSICS 7A and Mathematics 53 required; concurrent enrollment in Engineering 7, Civil and Environmental Engineering C30/ Mechanical Engineering C85 recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of recitation per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Chow, Stacey, Variano

CIV ENG 101 Fluid Mechanics of Rivers, Streams, and Wetlands 3 Units
Analysis of steady and unsteady open-channel flow and application to rivers and streams. Examination of mixing and transport in rivers and streams. Effects of channel complexity. Floodplain dynamics and flow routing. Interaction of vegetation and fluid flows. Freshwater and tidal marshes. Sediment transport in rivers, streams, and wetlands. Implications for freshwater ecosystem function.
Rules & Requirements

Prerequisites: 100 or Mechanical Engineering 106 or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Variano

CIV ENG 103 Introduction to Hydrology 3 Units
Course addresses principles and practical aspects of hydrology. Topics in introduction to hydrology include hydrologic cycle, precipitation, evaporation, infiltration, snow and snowmelt, and streamflow; introduction to geomorphology, GIS (Geographic Information Systems) applications, theory of unit hydrograph, frequency analysis, flood routing through reservoirs and rivers; introduction to rainfall-runoff analyses, watershed modeling, urban hydrology, and introduction to groundwater hydrology.
Rules & Requirements

Prerequisites: 93 and 100

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Thompson

CIV ENG 105 Environmental Fluid Mechanics Design 3 Units
Hands-on design course in applied fluid mechanics. Course goes beyond basic examples of fluid flow to include detailed discussion of real-world environmental engineering. Class team projects are used to explore real fluid mechanics, e.g., engineering for air quality or design for sea level rise mitigation. Specific project topics vary by offering and include interdisciplinary design issues from structural, geotechnical, environmental and/or transporation engineering.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 100 or equivalent; two core courses, upper-division standing in science and engineering

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructors: Chow, Stacey, Variano

CIV ENG C106 Air Pollution 3 Units
This course is an introduction to air pollution and the chemistry of earth's atmosphere. We will focus on the fundamental natural processes controlling trace gas and aerosol concentrations in the atmosphere, and how anthropogenic activity has affected those processes at the local, regional, and global scales. Specific topics include stratospheric ozone depletion, increasing concentrations of green house gasses, smog, and changes in the oxidation capacity of the troposphere.
Rules & Requirements

Prerequisites: Chemistry 1A-1B, PHYSICS 8A or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Goldstein

Also listed as: EPS C180/ESPM C180

CIV ENG 107 Climate Change Mitigation 3 Units
Assessment of technological options for responding to climate change. Overview of climate-change science; sources, sinks, and atmospheric dynamics of greenhouse gases. Current systems for energy supply and use. Renewable energy resources, transport, storage, and transformation technologies. Technological opportunities for improving end-use energy efficiency. Recovery, sequestration, and disposal of greenhouse gases. Societal context for implementing engineered responses.
Rules & Requirements

Prerequisites: Upper division or graduate standing in engineering or physical science, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Nazaroff

CIV ENG 111 Environmental Engineering 3 Units
Quantitative overview of air and water contaminants and their engineering control. Elementary environmental chemistry and transport. Reactor models. Applications of fundamentals to selected current issues in water quality engineering, air quality engineering, air quality engineering, and hazardous waste management.
Rules & Requirements

Prerequisites: Upper division standing in engineering or physical sciences, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Alvarez-Cohen, Nazaroff, Nelson, Sedlak

CIV ENG 111L Water and Air Quality Laboratory 1 Unit
This laboratory course is designed to accompany the lecture topics in Civil Engineering 111. Each laboratory activity will provide an opportunity to understand key concepts in water and air quality through hands-on experimentation. Laboratory topics include phase partitioning, acid/base reactions, redox reactions, biochemical oxygen demand, absorption, gas transfer, reactor hydraulics, particle destablization, disinfection, and combustion emissions.
Rules & Requirements

Prerequisites: Civil Engineering 111 (may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Alvarez-Cohen, Nazaroff, Nelson, Sedlak

CIV ENG 112 Environmental Engineering Design 3 Units
Engineering design and project management of environmental systems. Students will complete a design project focusing on pollution control in a selected environmental system. Lectures and project activities will address process design, economic optimization, legal and institutional constraints on design, and project management. Additional components of design (e.g., hydraulics, engineering sustainability, plant structures) will be included.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 100, 111

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Hermanowicz

CIV ENG 113N Ecological Engineering for Water Quality Improvement 3 Units
Ecological engineering approaches for treating contaminated water using natural processes to improve water quality. Emphasis on combining basic science and engineering approaches to understand the fundamental processes that govern the effectiveness of complex natural treatment systems. Applications include constructed wetlands, waste stabilization ponds, stormwater bioretention, decentralized wastewater management, ecological sanitation. Laboratory sessions will consist of design and monitoring of laboratory and full-scale natural treatment systems, including a range of water quality measurements.
Rules & Requirements

Prerequisites: 111 or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Nelson

CIV ENG 114 Environmental Microbiology 3 Units
The scope of modern environmental engineering requires a fundamental knowledge of microbial processes with specific application to water, wastewater and the environmental fate of pollutants. This course will cover basic microbial physiology, biochemistry, metabolism, growth energetics and kinetics, ecology, pathogenicity, and genetics for application to both engineered and natural environmental systems.
Rules & Requirements

Prerequisites: Chemistry 1A-1B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Alvarez-Cohen

CIV ENG 115 Water Chemistry 3 Units
The application of principles of inorganic, physical, and dilute solution equilibrium chemistry to aquatic systems, both in the aquatic environment and in water and wastewater treatment processes.
Rules & Requirements

Prerequisites: Upper division or graduate standing in engineering or physical science, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Sedlak

CIV ENG C116 Chemistry of Soils 3 Units
Chemical mechanisms of reactions controlling the fate and mobility of nutrients and pollutants in soils. Role of soil minerals and humus in geochemical pathways of nutrient biovailability and pollutant detoxification. Chemical modeling of nutrient and pollutant soil chemistry. Applications to soil acidity and salinity.
Rules & Requirements

Prerequisites: Civil Engineering 111 or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Sposito

Also listed as: ESPM C128

CIV ENG 120 Structural Engineering 3 Units
Introduction to design and analysis of structural systems. Loads and load placement. Proportioning of structural members in steel, reinforced concrete, and timber. Structural analysis theory. Hand and computer analysis methods, validation of results from computer analysis. Applications, including bridges, building frames, and long-span cable structures.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering C30/Mechanical Engineering C85 required; Civil and Environmental Engineering 60 (maybe taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 6 weeks - 5 hours of lecture and 7.5 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Moehle

CIV ENG 121 Advanced Structural Analysis 3 Units
Theory and application of structural analysis. Stiffness and flexibility methods, with emphasis on the direct stiffness method. Equilibrium and compatibility. Virtual work. Response of linear and simple nonlinear structures to static loads. Use of computer programs for structural analysis. Modeling of two- and three-dimensional structures. Verification and interpretation of structural response.
Rules & Requirements

Prerequisites: 120

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Filippou

CIV ENG 122L Structural Steel Design Project 1 Unit
Introduction to one or more comprehensive structural design problems. Design teams will conceive structural system; determine design loads; conduct preliminary and final design of structure and its foundation; prepare construction cost estimate; prepare final report containing project description, design criteria, cost estimate, structural drawings, and supporting calculations; and make "client" presentations as required.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 122N

Credit Restrictions: Students will receive no credit for Civil and Environmental Engineering 122L after taking Civil and Environmental Engineering 122 or 123L.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructors: Astaneh, Stojadinovic

CIV ENG 122N Design of Steel Structures 3 Units
Introduction to materials and methods of steel construction; behavior and design of tension members, compression members, flexural members and beam-columns; design of welds, bolts, shear connections and moment connections; design of spread footings or other foundation elements, inroduction to design of earthquake-resistant steel structures including concentrically braced frames and moment frames.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 120 or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Astaneh, Stojadinovic

Formerly known as: Civil and Environmental Engineering 122

CIV ENG 123L Structural Concrete Design Project 1 Unit
Introduction to one or more comprehensive structural design problems. Design teams will conceive structural system; determine design loads; conduct preliminary and final design of structure and its foundation; prepare construction cost estimate; prepare final report containing project description, design criteria, cost estimate, structural drawings, and supporting calculations; make "client" presentations as required.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 123N

Credit Restrictions: Students will receive no credit for Civil and Environmental Engineering 123L after taking Civil and Environmental Engineering 122L or 123.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructors: Mahin, Moehle, Mosalam, Panagiotou

CIV ENG 123N Design of Reinforced Concrete Structures 3 Units
Introduction to materials and methods of reinforced concrete construction; behavior and design of reinforced concrete beams and one-way slabs considering deflections, flexure, shear, and anchorage; behavior and design of columns; design of spread footings or other foundation elements; design of earthquake-resistant structures; introduction to prestressed concrete.
Rules & Requirements

Prerequisites: 120 or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Mahin, Moehle, Mosalam, Panagiotou

Formerly known as: Civil and Environmental Engineering 123

CIV ENG 124 Structural Design in Timber 3 Units
Characteristics and properties of wood as a structural material; design and detailing of structural elements and entire structures of wood. Topics include allowable stresses, design and detailing of solid sawn and glulam beams and columns, nailed and bolted connections, plywood diaphragms and shear walls. Case studies.
Rules & Requirements

Prerequisites: 120

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Mahin, Filippou

CIV ENG 130N Mechanics of Structures 3 Units
Elastic and plastic stress and deformation analysis of bars, shafts, beams, and columns; energy and variational methods; plastic analysis of structures; stability analysis of structures; computer-aided mathematical techniques for solution of engineering problems and modular computer programming methods.
Rules & Requirements

Prerequisites: C30/Mechanical Engineering C85, and either 60 or Engineering 45

Credit Restrictions: Students will receive no credit for 130N after taking 130.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Summer: 8 weeks - 4 hours of lecture and 6 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Filippou, Govindjee, Li

CIV ENG C133 Engineering Analysis Using the Finite Element Method 3 Units
This is an introductory course on the finite element method and is intended for seniors in engineering and applied science disciplines. The course covers the basic topics of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems. Finite element formulations for several important field equations are introduced using both direct and integral approaches. Particular emphasis is placed on computer simulation and analysis of realistic engineering problems from solid and fluid mechanics, heat transfer, and electromagnetism. The course uses FEMLAB, a multiphysics MATLAB-based finite element program that possesses a wide array of modeling capabilities and is ideally suited for instruction. Assignments will involve both paper- and computer-based exercises. Computer-based assignments will emphasize the practical aspects of finite element model construction and analysis.
Rules & Requirements

Prerequisites: Engineering 7 or 77 or Computer Science 61A; Mathematics 53 and 54; senior status in engineering or applied science

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: MEC ENG C180

CIV ENG 140 Failure Mechanisms in Civil Engineering Materials 3 Units
The failure mechanisms in civil engineering materials (cement-based materials, metallic- and polymer-based materials) are associated with processing, microstructure, stress states, and environmental changes. Fracture mechanics of brittle, quasi-brittle, and ductile materials; cracking processes in monolithic, particulate, and fiber reinforced materials; examples of ductile/brittle failure transitions in civil engineering structures; retrofitting of existing structures; non-destructive techniques for damage detection.
Rules & Requirements

Prerequisites: 60

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Ostertag

CIV ENG 153 Transportation Facility Design 3 Units
A capstone class with the objective to design transportation facilities based on operational capacity, site constraints, and environmental design considerations. Emphasis on airports, including landside and airside elements, and environmental assessment and mitigation techniques.
Rules & Requirements

Prerequisites: 155

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Hansen

CIV ENG 155 Transportation Systems Engineering 3 Units
Operation, management, control, design, and evaluation of passenger and freight transportation systems. Their economic role. Demand analysis. Overall logistical structure. Performance models and modeling techniques: time-space diagrams, queuing theory, network analysis, and simulation. Design of control strategies for simple systems. Feedback effects. Paradoxes. Transportation impact modeling; noise; air pollution. Multi-criteria evaluation and decision making. Financing and politics.
Rules & Requirements

Prerequisites: Sophomore standing in engineering or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Cassidy, Daganzo, Hansen, Kanafani, Madanat

CIV ENG 156 Infrastructure Planning and Management 3 Units
This course focuses on physical infrastructure systems that support society, including transportation, communications, power, water, and waste. These are complex, large-scale systems that must be planned and managed over a long-term horizon. Economics-based, analytical tools are covered, including topics of supply, demand, and evaluation. Problem sets, case studies, and a class project provide for hands-on experience with a range of infrastructure systems, issues, and methods of analysis.
Rules & Requirements

Prerequisites: Mathematics 1A-1B and Civil Engineering 93 (or equivalent)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Walker

CIV ENG 165 Concrete Materials, Construction, and Sustainability 3 Units
Concrete materials: cements, supplementary cementitious materials, water, and admixtures. Sustainability analysis of concrete materials and mixtures. Development of special concretes: self-leveling concrete, high-performance concrete, and mass concrete. Consideration of sustainability of concrete construction methods used for buildings, highways, airfields, bridges, dams and other hydraulic structures. Non-destructive methods. Discussion of long-term durability. Comprehensive group projects.
Rules & Requirements

Prerequisites: 60

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Monteiro

CIV ENG 166 Construction Engineering 3 Units
Introduction to construction engineering and field operations. The construction industry, construction methods and practice, productivity improvement, equipment selection, site layout formwork, erection of steel and concrete structures. Labs demonstrate the concepts covered. Field trips to local construction projects.
Rules & Requirements

Prerequisites: Upper division standing, 167 recommended

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Horvath

CIV ENG 167 Engineering Project Management 3 Units
Principles of economics, decision making, and law applied to company and project management. Business ownership, liability and insurance, cash flow analysis, and financial management. Project life-cycle, design-construction interface, contracts, estimating, scheduling, cost control.
Rules & Requirements

Prerequisites: 93 (can be taken concurrently) or equivalent

Credit Restrictions: Students will receive 2 units of credit for 167 after taking Engineering 120.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Ibbs, Tommelein

CIV ENG 171 Introduction to Geological Engineering 3 Units
Geological and geophysical exploration for structures in rock; properties and behavior of rock masses; rock slope stability; geological engineering of underground openings; evaluation of rock foundations, including dams. No final examination.
Rules & Requirements

Prerequisites: 70 or an introductory course in physical geology and upper division standing in Engineering

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Glaser

CIV ENG 173 Groundwater and Seepage 3 Units
Introduction to principles of groundwater flow, including steady and transient flow through porous media, numerical analysis, pumping tests, groundwater geology, contaminant transport, and design of waste containment systems.
Rules & Requirements

Prerequisites: Senior standing in engineering or science, 100 recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Rubin, Sitar

CIV ENG 174 Engineering Geomatics 3 Units
Engineering Geomatics is a field that integrates collections, processing, and analysis of digital geospatial data. This new field is anchored in the established field of geodetics that describes the complex shape of the Earth, elements and usage of topographic data and maps. Basic and advanced GPS satellite mapping. Digital globe technology. Advanced laser-LIDAR mapping. Quantitative terrain modeling, change detection, and analysis. Hydrogeomatics-seafloor mapping.
Hours & Format

Summer: 6 weeks - 6 hours of lecture and 5 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

CIV ENG 175 Geotechnical and Geoenvironmental Engineering 3 Units
Soil formation and identification. Engineering properties of soils. Fundamental aspects of soil characterization and response, including soil mineralogy, soil-water movement, effective stress, consolidation, soil strength, and soil compaction. Use of soils and geosynsynthetics in geotechnical and geoenvironmental applications. Introduction to site investigation techniques. Laboratory testing and evaluation of soil composition and properties.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering C30/Mechanical Engineering C85 (may be taken concurrently). Civil and Environmental Engineering 100 recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Bray, Pestana, Seed, Sitar

CIV ENG 176 Environmental Geotechnics 3 Units
Principles of environmental geotechnics applied to waste encapsulation and remediation of contaminated sites. Characterization of soils and wastes, engineering properties of soils and geosynthetics and their use in typical applications. Fate and transport of contaminants. Fundamental principles and practices in groundwater remediation. Application of environmental geotechnics in the design and construction of waste containment systems. Discussion of soil remediation and emerging technologies.
Rules & Requirements

Prerequisites: 175 required (or consent of instructor). 111 and 173 recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Pestana, Sitar

CIV ENG 177 Foundation Engineering Design 3 Units
Principles of foundation engineering. Shear strength of soil and theories related to the analysis and design of shallow and deep foundations, and retaining structures. Structural design of foundation elements; piles, pile caps, and retaining structures. The course has a group project that incorporates both geotechnical and structural components of different foundation elements.
Rules & Requirements

Prerequisites: CE 175 required, CE 120 recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructors: Bray, Seed

CIV ENG C178 Applied Geophysics 3 Units
The theory and practice of geophysical methods for determining the subsurface distribution of physical rock and soil properties. Measurements of gravity and magnetic fields, electrical and electromagnetic fields, and seismic velocity are interpreted to map the subsurface distribution of density, magnetic susceptibility, electrical conductivity, and mechanical properties.
Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Rector

Also listed as: EPS C178

CIV ENG 180 Life-Cycle Design and Construction 4 Units
Course encompasses two design aspects of a civil and environmental engineering system: 1) Design of whole system, component, or life-cycle phase, subject to engineering standards and constraints, and 2) production system design (e.g., cost estimation and control, scheduling, commercial and legal terms, site layout design). Students form teams to address real-life projects and prepare project documentation and a final presentation.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 167

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Horvath

CIV ENG 186 Design of Cyber-Physical Systems 3 Units
Design and prototype of large-scale technology intensive systems. Design project incorporating infrastruture systems and areas such as transportation and hydrology; for example, watershed sensor networks, robot networks for environmental management, mobile Internet monitoring, open societal scale systems, crowd-sources applications, traffic management. Design of sensing and control systems, prototyping systems, and measures of system performance. Modeling, software and hardware implementation.
Rules & Requirements

Prerequisites: 191

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructors: Bayen, Glaser, Sengupta

CIV ENG 191 Civil and Environmental Engineering Systems Analysis 3 Units
This course is organized around five real-world large-scale CEE systems problems. The problems provide the motivation for the study of quantitative tools that are used for planning or managing these systems. The problems include design of a public transportation system for an urban area, resource allocation for the maintenance of a water supply system, development of repair and replacement policies for reinforced concrete bridge decks, traffic signal control for an arterial street, scheduling in a large-scale construction project.
Rules & Requirements

Prerequisites: 93, Engineering 7 or 77

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Bayen, Madanat, Sengupta

Formerly known as: 152

CIV ENG 192 The Art and Science of Civil and Environmental Engineering Practice 1 Unit
A series of lectures by distinguished professionals designed to provide an appreciation of the role of science, technology, and the needs of society in conceiving projects, balancing the interplay of conflicting demands, and utilizing a variety of disciplines to produce unified and efficient systems.
Rules & Requirements

Prerequisites: Senior standing in civil and environmental engineering

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

CIV ENG 193 Engineering Risk Analysis 3 Units
Applications of probability theory and statistics in planning, analysis, and design of civil engineering systems. Development of probabilistic models for risk and reliability evaluation. Occurrence models; extreme value distributions. Analysis of uncertainties. Introduction to Bayesian statistical decision theory and its application in engineering decision-making.
Rules & Requirements

Prerequisites: Upper division standing

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Der Kiureghian

CIV ENG H194 Honors Undergraduate Research 3 - 4 Units
Supervised research. Students who have completed 3 or more upper division courses may pursue original research under the direction of one of the members of the staff. A final report or presentation is required. A maximum of 4 units of H194 may be used to fulfill the technical elective requirement.
Rules & Requirements

Prerequisites: Upper division technical GPA 3.3, consent of instructor and faculty advsior

Repeat rules: Course may be repeated once for credit only.Course may be repeated for a maximum of 8 units.

Hours & Format

Fall and/or spring: 15 weeks - 3-4 hours of independent study per week

Summer:
6 weeks - 7.5-10 hours of independent study per week
8 weeks - 6-7.5 hours of independent study per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

CIV ENG 197 Field Studies in Civil Engineering 1 - 4 Units
Supervised experience in off-campus companies relevant to specific aspects and applications of civil engineering. Written report required at the end of the semester.
Rules & Requirements

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of fieldwork per week

Summer:
6 weeks - 2.5-10 hours of fieldwork per week
8 weeks - 1.5-7.5 hours of fieldwork per week
10 weeks - 1.5-6 hours of fieldwork per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

CIV ENG 198 Directed Group Study for Advanced Undergraduates 1 - 4 Units
Group study of a selected topic or topics in civil engineering.
Rules & Requirements

Prerequisites: Senior standing in engineering

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

CIV ENG 199 Supervised Independent Study 1 - 4 Units
Supervised independent study.
Rules & Requirements

Prerequisites: Consent of instructor and major adviser. Enrollment is restricted; see the Course Number Guide for details

Credit Restrictions: Course may be repeated for a maximum of four units per semester.

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week
10 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.