Structural Engineering

Minor

The Minor in Structural Engineering is designed primarily for students in the College of Environmental Design to experience the engineering approach to the solution of design problems, but it is available to students from any department who meet the following prerequisites to apply:

1. Understanding of material behavior for structural response and ability to describe such behavior with simple models
2. Understanding of structures and methods of analysis
3. Design of structures made of steel, concrete or timber

These basic foundations are complemented by additional courses in materials and construction and analysis.

The minor offers to students of the College of Environmental Design access to the joint graduate Masters in Science and Masters in Architecture (MS-MArch) degree from the two departments, one of very few such degrees in the entire United States. With it comes the ability to practice either as an architect or as a structural engineer with a very thorough knowledge of each field. Whereas engineering focuses on analytical methods for the solution to problems, the visual, socio-economical approach of architecture courses is an indispensable complement. The same is true the other way.

Employment opportunities exist in major architectural-engineering companies that appreciate the holistic approach to design including Ove Arup, Skidmore, Owings and Merill, Buro Happold, Calatrava, and Schlaich-Bergerman. However, graduates of the joint degree are also employed with smaller companies emphasizing either architectural design or engineering.

Declaring the Minor

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

- Have an overall grade point average (GPA) of 3.0.
- Have completed the lower division prerequisite courses with a GPA of 3.0 (for further information regarding the prerequisites, see the Minor Requirements tab on this page).
- Be able to complete the minor without delaying graduation.

Upon admission to the minor, students should:

- Complete a minimum of five courses, of which no more than one can be counted toward of the requirements of the major(s).
- Earn a minimum GPA of 2.0 in the minor.

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 to the Civil and Environmental Engineering Department’s Office of Academic Affairs the Confirmation of Completion form 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/undergraduate/degree-programs/civil-engineering) (Major only)
Environmental Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/environmental-engineering) (Minor only)
GeoSystems (http://guide.berkeley.edu/undergraduate/degree-programs/geo-systems) (Minor only)

Minor programs are areas of concentration requiring fewer courses than an undergraduate major. These programs are optional, but they 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.

Lower Division Prerequisites

Select one of the following math sequences:

<table>
<thead>
<tr>
<th>Math Sequence</th>
<th>Requirement</th>
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</thead>
<tbody>
<tr>
<td>MATH 1A &amp; MATH 1B</td>
<td>Calculus and Calculus</td>
</tr>
<tr>
<td>MATH 16A &amp; MATH 16B</td>
<td>Analytic Geometry and Calculus and Analytic Geometry and Calculus</td>
</tr>
<tr>
<td>PHYSICS 7A or PHYSICS 8A</td>
<td>Physics for Scientists and Engineers or Introductory Physics</td>
</tr>
<tr>
<td>CIV ENG C30/MEC ENG C85</td>
<td>Introduction to Solid Mechanics</td>
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Requirements

<table>
<thead>
<tr>
<th>Courses</th>
<th>Course Name</th>
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<tr>
<td>CIV ENG 60</td>
<td>Structure and Properties of Civil Engineering Materials</td>
</tr>
<tr>
<td>CIV ENG 120</td>
<td>Structural Engineering</td>
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<tr>
<td>CIV ENG 122N</td>
<td>Design of Steel Structures</td>
</tr>
<tr>
<td>CIV ENG 123N</td>
<td>Design of Reinforced Concrete Structures</td>
</tr>
<tr>
<td>CIV ENG 121</td>
<td>Structural Analysis</td>
</tr>
<tr>
<td>CIV ENG 122N</td>
<td>Design of Steel Structures or CIV ENG 12: Design of Reinforced Concrete Structures</td>
</tr>
<tr>
<td>CIV ENG 124</td>
<td>Structural Design in Timber</td>
</tr>
<tr>
<td>CIV ENG 130N</td>
<td>Mechanics of Structures</td>
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<td>CIV ENG 140</td>
<td>Failure Mechanisms in Civil Engineering Materials</td>
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<td>CIV ENG 165</td>
<td>Concrete Materials, Construction, and Sustainability</td>
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<td>CIV ENG 166</td>
<td>Construction Engineering</td>
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<td>CIV ENG 175</td>
<td>Geotechnical and Geoenvironmental Engineering</td>
</tr>
<tr>
<td>CIV ENG 193</td>
<td>Engineering Risk Analysis</td>
</tr>
</tbody>
</table>

1 CIV ENG 121 is required for admission into the graduate program in Structural Engineering, Mechanics and Materials Program.
University of California Requirements

Entry Level Writing (http://guide.berkeley.edu/undergraduate/colleges-schools/natural-resources/entry-level-writing-requirement)

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the Entry Level Writing Requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

American History and American Institutions (http://guide.berkeley.edu/undergraduate/colleges-schools/natural-resources/american-history-institutions-requirement)

The American History and Institutions requirements are based on the principle that a U.S. resident graduated from an American university should have an understanding of the history and governmental institutions of the United States.

Campus Requirement

American Cultures (http://guide.berkeley.edu/undergraduate/colleges-schools/natural-resources/american-cultures-requirement)

American Cultures (AC) is the one requirement that all undergraduate students at UC Berkeley need to take and pass in order to graduate. The requirement offers an exciting intellectual environment centered on the study of race, ethnicity and culture in the United States. AC courses offer students opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

Structural Engineering

CIV ENG 11 Engineered Systems and Sustainability 3 Units
Terms offered: Spring 2017, Summer 2016 10 Week Session, Summer 2016 8 Week Session

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

Summer: 8 weeks - 6 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

Engineered Systems and Sustainability: Read Less [-]

CIV ENG 24 Freshman Seminars 1 Unit
Terms offered: Fall 2017, Spring 2017, Fall 2016

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.

Freshman Seminars: Read Less [-]
CIV ENG C30 Introduction to Solid Mechanics
3 Units
Terms offered: Fall 2017, Summer 2017 10 Week Session, Spring 2017
Introduction to Solid Mechanics: Read More [+]

Rules & Requirements

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

Credit Restrictions: Students will receive no credit for Mechanical Engineering C85/Civil and Environmental Engineering C30 after completing Mechanical Engineering W85. A deficient grade in Mechanical Engineering W85 may be removed by taking Mechanical Engineering C85/Civil and Environmental Engineering C30.

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

Introduction to Solid Mechanics: Read Less [-]

CIV ENG W30 Introduction to Solid Mechanics
3 Units
Terms offered: Summer 2016, Summer 2016 10 Week Session, Summer 2015 10 Week Session, Summer 2015 8 Week Session
Introduction to Solid Mechanics: Read More [+]

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

Credit Restrictions: Students will receive no credit for Mechanical Engineering W85/Civil and Environmental Engineering W30 after completing Mechanical Engineering C85/Civil and Environmental Engineering C30. A deficient grade in Mechanical Engineering C85/Civil and Environmental Engineering C30 may be removed by taking Mechanical Engineering W85/Civil and Environmental Engineering W30.

Hours & Format

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

Instructor: Govindjee

Also listed as: MEC ENG W85

Introduction to Solid Mechanics: Read Less [-]
CIV ENG 60 Structure and Properties of Civil Engineering Materials 3 Units
Terms offered: Fall 2017, Spring 2017, Fall 2016
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.
Structure and Properties of Civil Engineering Materials: Read More [+]
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.
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
Structure and Properties of Civil Engineering Materials: Read Less [-]

CIV ENG 70 Engineering Geology 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
Principles of physical and structural geology; the influence of geological factors on engineering works and the environment. Field trip.
Engineering Geology: Read More [+]
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
Engineering Geology: Read Less [-]

CIV ENG 88 Data Science for Smart Cities 2 Units
Terms offered: Fall 2017, Fall 2016, Spring 2016
Cities become more dependent on the data flows that connect infrastructures between themselves, and users to infrastructures. Design and operation of smart, efficient, and resilient cities nowadays require data science skills. This course provides an introduction to working with data generated within transportation systems, power grids, communication networks, as well as collected via crowd-sensing and remote sensing technologies, to build demand- and supply-side urban services based on data analytics.
Data Science for Smart Cities: Read More [+]
Rules & Requirements
Prerequisites: Corequisite or Prerequisite: Foundations of Data Science (COMPSCI C8/INFO C8/STAT C8). This course is a Data Science connector course and is meant to be taken concurrent with or after COMPSCI C8/INFO C8/STAT C8. Students may take more than one Data Science connector course if they wish, concurrent with or after having taken the C8 course
Hours & Format
Fall and/or spring: 15 weeks - 0.5 hours of lecture, 0.5 hours of discussion, and 1 hour of laboratory per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/ Undergraduate
Grading/Final exam status: Letter grade. Alternative to final exam.
Instructor: Pozdnukhov
Data Science for Smart Cities: Read Less [-]
CIV ENG 88B Time Series Analysis: Sea Level Rise and Coastal Flooding 2 Units
Terms offered: Spring 2017
In this course, we will pursue analysis of long-term records of coastal water levels in the context of sea level rise. We will cover the collection, evaluation, visualization and analysis of time series data using long-term records of sea levels from coastal sites around the world. Specific topics will include extreme events and distributions, frequency-based descriptions, averaging, filtering, harmonic analysis, trend identification, extrapolations, and decision-making under uncertainty.

Time Series Analysis: Sea Level Rise and Coastal Flooding: Read More [+]
Rules & Requirements
Prerequisites: Concurrent or prior enrollment in Foundations of Data Science (COMPSCI C8 / DATASCI C8 / INFO C8 / STAT C8) and Math 1A

Hours & Format
Fall and/or spring: 15 weeks - 1 hour of lecture and 1 hour of laboratory per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Alternative to final exam.
Instructor: Stacey
Time Series Analysis: Sea Level Rise and Coastal Flooding: Read Less [-]

CIV ENG 92 Introduction to Civil and Environmental Engineering 1 Unit
Terms offered: Fall 2017, Fall 2016, Fall 2015
A course designed to familiarize the entering student with the nature and scope of civil and environmental engineering and its component specialty areas.

Introduction to Civil and Environmental Engineering: Read More [+]
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.

Introduction to Civil and Environmental Engineering: Read Less [-]

CIV ENG 93 Engineering Data Analysis 3 Units
Terms offered: Fall 2017, Spring 2017, Fall 2016
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.

Engineering Data Analysis: Read More [+]
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
Engineering Data Analysis: Read Less [-]

CIV ENG 98 Supervised Group Study and Research 1 - 3 Units
Terms offered: Fall 2017, Spring 2017, Fall 2016
Supervised group study and research by lower division students.

Supervised Group Study and Research: Read More [+]
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.

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.

Supervised Group Study and Research: Read Less [-]
CIV ENG 99 Supervised Independent Study and Research 1 - 4 Units
Terms offered: Fall 2017, Spring 2017, Fall 2016
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.
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.
Supervised Independent Study and Research: Read Less [-]

CIV ENG 100 Elementary Fluid Mechanics 4 Units
Terms offered: Fall 2017, Summer 2017 8 Week Session, Fall 2016
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
Summer: 8 weeks - 6 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: Variano
Elementary Fluid Mechanics: Read Less [-]

CIV ENG 101 Fluid Mechanics of Rivers, Streams, and Wetlands 3 Units
Terms offered: Fall 2014, Spring 2013, Fall 2010
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
Fluid Mechanics of Rivers, Streams, and Wetlands: Read Less [-]

CIV ENG 103 Introduction to Hydrology 3 Units
Terms offered: Fall 2017, Spring 2017, Spring 2016
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 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: Thompson
Introduction to Hydrology: Read Less [-]
CIV ENG 105 Environmental Fluid Mechanics and Hydrology 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2013
Hands-on design course in applied fluid mechanics, hydrology and water resources. Course goes beyond basic examples of fluid flow to develop environmental engineering solutions to real-world problems. A class team project is used to (i) explore the design process and project management, mirroring a workplace setting; and (ii) to integrate concepts from hydrology and fluid mechanics with structural, geotechnical and transportation engineering for a holistic design approach. Specific project topics vary with offering. Example topics include: engineering for air quality, design for sea-level rise mitigation, and development of alternative water supplies to address scarcity and post-disaster management.

Environmental Fluid Mechanics and Hydrology: Read More [+]

Objectives Outcomes
Course Objectives:
To develop and defend design criteria
To gain familiarity with the process of design and project management, from proposal writing to preliminary design delivery
To integrate fundamental engineering principles, subject to the needs and constraints of a specific design.

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 - 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. Alternative to final exam.
Instructors: Chow, Stacey, Variano, Thompson

Environmental Fluid Mechanics and Hydrology: Read Less [-]

CIV ENG C106 Air Pollution 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2015
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 greenhouse gasses, smog, and changes in the oxidation capacity of the troposphere.

Air Pollution: Read More [+]

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

Air Pollution: Read Less [-]

CIV ENG 107 Climate Change Mitigation 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2015

Climate Change Mitigation: Read More [+]

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

Climate Change Mitigation: Read Less [-]
CIV ENG 110 Water Systems of the Future 3 Units
Terms offered: Spring 2017, Fall 1999, Fall 1998
This course will familiarize students with the complex infrastructure used to meet human water demands; competing uses and demands; water and wastewater infrastructure; technologies to enable recovery of water, energy, and other resources from wastewater; supply planning; trends and forecasting; costs, pricing and financing; environmental justice; methods to assess sustainability; regulatory, policy and institutional challenges; and water’s contribution to other sectors (e.g., energy, food, buildings). Innovation, both barriers and opportunities, will be highlighted. California and the U.S. will be emphasized but global challenges will be discussed. Students will study, critique, and recommend improvements for a real-world system.
Water Systems of the Future: Read More [+]

Objectives Outcomes

Course Objectives:
- Consider costs and tradeoffs in water supply planning under uncertainty for real-world water systems
- Critically evaluate water planning and innovation potential for real-world utilities given future uncertainties and competing priorities.
- Explore the innovation ecosystem in the water sector, its opportunities and challenges, and analyze case studies
- Introduce the technologies that are currently in use for treating and managing water and wastewater, as well as innovations that have the potential to dramatically change water infrastructure.
- Provide overview and examples of concepts and methods for analyzing the sustainability of water systems
- Provide overview of the complex infrastructure systems that supply and manage water and wastewater.

Student Learning Outcomes:
- Ability to apply knowledge of mathematics, science, and engineering. MODERATE
- Ability to communicate effectively. EXTENSIVE
- Ability to design a system, component, or process to meet desired needs. MODERATE
- Ability to function on multi-disciplinary teams. EXTENSIVE
- Ability to identify, formulate and solve engineering problems. MODERATE
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. MODERATE
- Knowledge of contemporary issues. EXTENSIVE
- Recognition of the need for, and an ability to engage in life-long learning. EXTENSIVE
- Understand the impact of engineering solutions in a global and societal context. EXTENSIVE
- Understanding of professional and ethical responsibility. EXTENSIVE

Rules & Requirements

Prerequisites: Upper division status or consent of the 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: Nelson

Water Systems of the Future: Read Less [-]

CIV ENG 111 Environmental Engineering 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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.
Environmental Engineering: Read More [+]

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

Environmental Engineering: Read Less [-]

CIV ENG 111L Water and Air Quality Laboratory 1 Unit
Terms offered: Fall 2017, Fall 2016, Spring 2016
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 destabilization, disinfection, and combustion emissions.
Water and Air Quality Laboratory: Read More [+]

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

Water and Air Quality Laboratory: Read Less [-]
CIV ENG 112 Environmental Engineering Design 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2015
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.
Environmental Engineering Design: Read More [+]  
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  
Environmental Engineering Design: Read Less [-]  

CIV ENG 113 Ecological Engineering for Water Quality Improvement 3 Units
Terms offered: Spring 2017, Fall 2003, Fall 2002
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.
Ecological Engineering for Water Quality Improvement: Read More [+]  
Objectives Outcomes  
Course Objectives: Become familiar with common applications of natural treatment systems through lectures, reading materials, laboratory activities, and field trips  
Develop a solid understanding of the fundamental processes in ecological engineering approaches to natural treatment systems that govern the removal or transformation of contaminants in water  
Learn common design approaches for waste stabilization ponds and wetlands, as well as their necessary operation and maintenance activities  
Measure key water quality parameters and evaluate the performance of mesocosm ponds and wetlands based on the data collected throughout the semester  
Understand and appreciate the complexity of these systems compared to mechanical treatment systems  
Student Learning Outcomes: Ability to apply knowledge of mathematics, science, and engineering. EXTENSIVE  
Ability to communicate effectively. MODERATE  
Ability to design a system, component, or process to meet desired needs. EXTENSIVE  
Ability to design and conduct experiments, as well as to analyze and interpret data. EXTENSIVE  
Ability to function on multi-disciplinary teams. MODERATE  
Ability to identify, formulate and solve engineering problems. EXTENSIVE  
Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. EXTENSIVE  
Knowledge of contemporary issues. MODERATE  
Recognition of the need for, and an ability to engage in life-long learning. MODERATE  
Understand the impact of engineering solutions in a global and societal context. MODERATE  
Understanding of professional and ethical responsibility. MODERATE  
Rules & Requirements  
Prerequisites: 111 or consent of instructor  
Credit Restrictions: Civ Eng 113N  
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. Alternative to final exam.  
Instructor: Nelson  
Formerly known as: Civil and Environmental Engineering 113N
CIV ENG 114 Environmental Microbiology 3 Units
Terms offered: Spring 2016, Spring 2015, Fall 2014
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.
Environmental Microbiology: Read More [+]
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

Environmental Microbiology: Read Less [-]

CIV ENG 115 Water Chemistry 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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.
Water Chemistry: Read More [+]
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

Water Chemistry: Read Less [-]

CIV ENG C116 Chemistry of Soils 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2015
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 bioavailability and pollutant detoxification. Chemical modeling of nutrient and pollutant soil chemistry. Applications to soil acidity and salinity.
Chemistry of Soils: Read More [+]
Rules & Requirements
Prerequisites: Civil Engineering 111 or equivalent

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: Sposito
Also listed as: ESPM C128
Chemistry of Soils: Read Less [-]

CIV ENG 120 Structural Engineering 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2015
Structural Engineering: Read More [+]
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
Structural Engineering: Read Less [-]
CIV ENG 121 Structural Analysis 3 Units
Terms offered: Fall 2017, Fall 2016, Spring 2016

Structural Analysis: Read More [+]

Objectives Outcomes

Course Objectives: Collapse load factor determination of simple structures by lower bound theorem of plastic analysis.
Consistent process of writing equilibrium and compatibility relations for small and large structures permitting solution by hand and by matrix algebra software. Identification of degree of static indeterminacy. Force-deformation relations for truss and frame elements
Modeling of structures. Nodes, elements, loading, organization of information for describing structural model, element properties and loading
Solution of simple statically indeterminate structures by the force method of analysis. Understanding of structure flexibility and flexibility coefficients. Treatment of nodal loads and non-mechanical element deformations
Solution of statically indeterminate structures of any size by the displacement method of analysis. Stiffness coefficients. Treatment of element and thermal loads. Computer implementation in the form of the direct stiffness approach
Structural systems and their use in buildings and bridges. Parametric studies
Work and energy principles. Principles of virtual work and complementary virtual work. Relation between virtual work principles and equilibrium/compatibility relations

Student Learning Outcomes: Analyze any type of truss and frame structure with the displacement method of analysis by hand and by computer. Determine internal forces, deformations, global displacements, support reactions. Error checking of computer analysis results (ABET Learning Goals: 1, 3, 5).
Determine the collapse load of simple perfectly-plastic truss and frame structures under equilibrium considerations (ABET Learning Goals: 1, 3, 5).
Identify the structural response contribution of individual elements and identify the effect of changes in element properties on the results (ABET Learning Goals: 1, 3, 11).
Perform analysis of statically determinate truss and frame structures under equilibrium and compatibility considerations. Perform equilibrium checks for given results under given loading. Perform compatibility checks for given deformations (ABET Learning Goals: 1, 3, 5).
Recognize force flow in beam, arch and cable structures and their derivatives, like suspension bridges, cable-stayed bridges, roofs and high-rise buildings (ABET Learning Goals: 3, 8, 10, 11).
Understand basic structural systems and their use throughout history and in modern times. (ABET Learning Goals: 3, 8, 10, 11)
Understand structural modeling. Be able to assess the complexity of a structural model and identify number of unknowns in the solution of the structural response to given loading. Be able to select the most appropriate solution method for hand calculations (ABET Learning Goals: 1, 3, 5).

Rules & Requirements

Prerequisites: Civil and Environmental Engineering 122N

CIV ENG 122L Structural Steel Design Project 1 Unit
Terms offered: Spring 2017, Spring 2016, Spring 2015
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.

Design of Steel Structures: Read More [+]

Rules & Requirements

Prerequisites: Civil and Environmental Engineering 122N

CIV ENG 122N Design of Steel Structures 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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, introduction to design of earthquake-resistant steel structures including concentrically braced frames and moment frames.

Design of Steel Structures: Read More [+]

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

Design of Steel Structures: Read Less [-]
CIV ENG 123L Structural Concrete Design Project 1 Unit
Terms offered: Spring 2017, Spring 2016, Spring 2015
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.
Structural Concrete Design Project: Read More [+]
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
Structural Concrete Design Project: Read Less [-]

CIV ENG 123N Design of Reinforced Concrete Structures 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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.
Design of Reinforced Concrete Structures: Read More [+]
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, Filippou
Structural Design in Timber: Read Less [-]

CIV ENG 124 Structural Design in Timber 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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.
Structural Design in Timber: Read More [+]
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
Structural Design in Timber: Read Less [-]

CIV ENG 130N Mechanics of Structures 3 Units
Terms offered: Summer 2017 8 Week Session, Spring 2017, Summer 2016 8 Week Session
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.
Mechanics of Structures: Read More [+]
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
Mechanics of Structures: Read Less [-]
CIV ENG C133 Engineering Analysis Using the Finite Element Method 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2015
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.

Engineering Analysis Using the Finite Element Method: Read More [+]

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.
Instructor: Ostertag

Engineering Analysis Using the Finite Element Method: Read Less [-]

CIV ENG 140 Failure Mechanisms in Civil Engineering Materials 3 Units
Terms offered: Spring 2013, Spring 2010, Spring 2009
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.

Failure Mechanisms in Civil Engineering Materials: Read More [+]

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
Failure Mechanisms in Civil Engineering Materials: Read Less [-]

CIV ENG 153 Transportation Facility Design 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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.

Transportation Facility Design: Read More [+]

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
Transportation Facility Design: Read Less [-]
CIV ENG 155 Transportation Systems Engineering 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2015
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. Transportation Systems Engineering: Read More [+]
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
Transportation Systems Engineering: Read Less [-]

CIV ENG 156 Infrastructure Planning and Management 3 Units
Terms offered: Fall 2014, Spring 2014, Fall 2011
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. Infrastructure Planning and Management: Read More [+]
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
Infrastructure Planning and Management: Read Less [-]

CIV ENG 165 Concrete Materials, Construction, and Sustainability 3 Units
Terms offered: Fall 2016, Spring 2016, Spring 2015
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
Concrete Materials, Construction, and Sustainability: Read Less [-]

CIV ENG 166 Construction Engineering 3 Units
Terms offered: Spring 2016, Fall 2014, Fall 2012
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. Construction Engineering: Read More [+]
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
Construction Engineering: Read Less [-]
CIV ENG 167 Engineering Project Management 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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
Engineering Project Management: Read Less [-]

CIV ENG 171 Rock Mechanics 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2015
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.
Rules & Requirements
Prerequisites: Civil and Environmental Engineering 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 required.
Instructor: Glaser
Rock Mechanics: Read Less [-]

CIV ENG 173 Groundwater and Seepage 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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
Groundwater and Seepage: Read Less [-]

CIV ENG 174 Engineering Geomatics 3 Units
Terms offered: Summer 2015 First 6 Week Session, Summer 2014 10 Week Session, Summer 2014 First 6 Week Session
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.
Rules & Requirements
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.
Engineering Geomatics: Read Less [-]
CIV ENG 175 Geotechnical and Geoenvironmental Engineering 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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 geosynthetics in geotechnical and geoenvironmental applications. Introduction to site investigation techniques. Laboratory testing and evaluation of soil composition and properties.

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

CIV ENG 176 Environmental Geotechnics 3 Units
Terms offered: Spring 2016, Spring 2015, Spring 2014
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.

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

CIV ENG 177 Foundation Engineering Design 3 Units
Terms offered: Spring 2017, Spring 2016, Fall 2014
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.

Prerequisites: Civil and Environmental Engineering 175 required, Civil and Environmental Engineering 120 recommended

CIV ENG C178 Applied Geophysics 3 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
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.

Also listed as: EPS C178

Instructor: Rector
CIV ENG 180 Life-Cycle Design and Construction 4 Units  
Terms offered: Spring 2017, Spring 2015, Spring 2013  
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.  
Life-Cycle Design and Construction: Read More [+]

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

Life-Cycle Design and Construction: Read Less [-]

CIV ENG 186 Design of Cyber-Physical Systems 3 Units  
Terms offered: Fall 2017, Fall 2016, Fall 2015  
Design and prototype of large-scale technology intensive systems. Design project incorporating infrastructure 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.  
Design of Cyber-Physical Systems: Read More [+]

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

Design of Cyber-Physical Systems: Read Less [-]

CIV ENG 190 Special Topics in Civil and Environmental Engineering 1 - 4 Units  
Terms offered: Spring 2016  
This course covers current topics of interest in civil and environmental engineering. The course content may vary from semester to semester depending upon the instructor  
Special Topics in Civil and Environmental Engineering: Read More [+]

Hours & Format  
Fall and/or spring: 15 weeks - 1-4 hours of lecture per week

Additional Details  
Subject/Course Level: Civil and Environmental Engineering/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructor: Variano

Special Topics in Civil and Environmental Engineering: Read Less [-]

CIV ENG 191 Civil and Environmental Engineering Systems Analysis 3 Units  
Terms offered: Fall 2016, Fall 2015, Fall 2014  
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.  
Civil and Environmental Engineering Systems Analysis: Read More [+]

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

Civil and Environmental Engineering Systems Analysis: Read Less [-]
CIV ENG 192 The Art and Science of Civil and Environmental Engineering Practice 1 Unit
Terms offered: Fall 2017, Fall 2016, Fall 2015
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. The Art and Science of Civil and Environmental Engineering Practice: Read More [+]
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.
The Art and Science of Civil and Environmental Engineering Practice: Read Less [-]

CIV ENG 193 Engineering Risk Analysis 3 Units
Terms offered: Fall 2017, Fall 2015, Fall 2014
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.
Engineering Risk Analysis: Read More [+]
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.
The Engineering Risk Analysis: Read Less [-]

CIV ENG H194 Honors Undergraduate Research 3 - 4 Units
Terms offered: Fall 2017, Spring 2017, Fall 2016
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.
Honors Undergraduate Research: Read More [+]
Rules & Requirements
Prerequisites: Upper division technical GPA 3.3, consent of instructor and faculty advisor
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.
The Honors Undergraduate Research: Read Less [-]

CIV ENG 197 Field Studies in Civil Engineering 1 - 4 Units
Terms offered: Fall 2017, Summer 2017 8 Week Session, Summer 2017 First 6 Week Session
Supervised experience in off-campus companies relevant to specific aspects and applications of civil engineering. Written report required at the end of the semester.
Field Studies in Civil Engineering: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit.
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.
The Field Studies in Civil Engineering: Read Less [-]
CIV ENG 198 Directed Group Study for Advanced Undergraduates 1 - 4 Units
Terms offered: Fall 2017, Spring 2017, Fall 2016
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.

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
Terms offered: Fall 2017, Summer 2017 10 Week Session, Spring 2017
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.

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.