Civil and Environmental Engineering

Overview

The mission of the Department of Civil and Environmental Engineering at UC Berkeley is to serve as the world’s academic leader in civil and environmental engineering, defining the evolving domains of the field through teaching and scholarly research. The department educates undergraduate and graduate students to be knowledgeable, forward-thinking, and ethical professionals so that they may pursue careers characterized by leadership and innovation. The faculty values professional and public service through research, and seeks scientific and technological advances that address critical societal needs.

Libraries

The Kresge Engineering Library (http://www.lib.berkeley.edu/ENGI), located in the nearby Stephen D. Bechtel Engineering Center, contains over more than 175,000 volumes, more than 2,000 journals and periodicals, and 680,000 technical reports.

The Water Resources Center Archives (http://library.ucr.edu/wrca), located at UC Riverside, specializes in material related to hydraulics, hydrology, and coastal engineering, with 100,000 titles in water resources and over 15,000 reports and papers on ocean engineering and oceanography.

The Institute of Transportation Studies Harmer E. Davis Library (http://library.its.berkeley.edu) contains one of the largest multimodal, interdisciplinary transportation reference and research collections in the world. The library holds over 125,000 volumes and receives more than 2,500 serials. The library is also a depository for government transportation publications.

The Earthquake Engineering Research Center (EERC) Library (http://nisee.berkeley.edu/elibrary) is an affiliated library of UC Berkeley, specializing in structural engineering, geotechnical engineering, engineering dynamics, engineering seismology, and earthquake public policy. It is located at the Richmond Field Station, five miles from the main Berkeley campus and is accessible by a Berkeley-RFS shuttle.

Research Laboratories

Located on the second floor of Davis Hall within the UC Berkeley campus, the Structural and Materials Laboratory (http://www.ce.berkeley.edu/testing-facilities/structures) houses equipment for studying the behavior of structural elements and systems on both scale models and prototypes. The laboratory is based upon the base-isolated strong floor, to which the reaction frames, actuators, and specimens are securely fastened during the tests. Testing facilities range from miniaturized precision equipment to a four-million-pound capacity testing machine.

The Environmental Fluid Mechanics Laboratory, located in O’Brien Hall, is equipped for experimental work in general fluid mechanics, granular flow, water-sediment interactions, hydraulic structures, wave hydrodynamics, and sediment transport and supports field-based studies of environmental hydrodynamics. Hydrology laboratories in Davis Hall provide equipment and instrumentation supporting terrestrial, ecological and in-channel hydrology, and field deployment staging areas. Several large-scale experimental facilities are available at the Richmond Field Station, including a wave flume, a tow tank and a large wave basin. Computational facilities are available through the Berkeley Research Computing program.

Environmental Quality laboratories are located in Davis and O’Brien Halls. The campus laboratories for research and teaching are configured for organic and inorganic chemical analysis in air, water, and soils; process analysis for aerosol dynamics, biological transformations, photochemical reactions, and mass transfer rates in porous media; and computational facilities to support environmental transport modeling. Additional facilities, including mesocosms and experimental wetlands, are utilized at the Richmond Field Station and at Lawrence Berkeley Laboratory.

The Geotechnical Engineering Laboratories (on campus) and the Soil Mechanics and Bituminous Materials Laboratory (situated at the Richmond Field Station) provide extensive facilities for research on soil and rock properties, soil and rock mechanics, foundation engineering, and the behavior and properties of asphalts and asphaltic mixtures. State-of-the-art computer facilities are available for test control, data acquisition, data processing, and numerical analysis. Graduate students working toward master’s or doctoral degrees in the Department of Civil and Environmental Engineering conduct individual research in these laboratories, usually as a part of a continuing program of research conducted by faculty members.

Research Groups

The Consortium on Green Design and Manufacturing (http://cgdm.berkeley.edu) (CGDM) was formed to encourage multidisciplinary research and education on environmental management, design for environment, and pollution prevention issues in critical industries.

The Institute for Environmental Science and Engineering (IESE) is an interdisciplinary Organized Research Unit of UC Berkeley that has a mandate to support research that helps protect public health and the environment. The institute plays a major role in supporting the efforts of the Berkeley Water Center, an organization that coordinates campus-wide research on topic such as urban water infrastructure, water and sanitation in developing countries and water-related climate change adaptation.

The Institute of Transportation Studies (ITS) (http://www.its.berkeley.edu) is a multidisciplinary program that has supported transportation research at the University of California since 1948. The ITS administers several Organized Research Units, including Partners for Advanced Transit and Highways (PATH) (http://www.path.berkeley.edu) and the Pavement Research Center (http://www.ucprc.ucdavis.edu). The ITS is a member of the National Center of Excellence for Aviation Operations Research (http://www.nextor.org) consortium and is the home of the University of California Transportation Center (http://www.uctc.net).

The Pacific Earthquake Engineering Research Center (http://peer.berkeley.edu) (PEER) is a multi-institutional research and education center with headquarters at UC Berkeley. Investigators from over 20 universities, several consulting companies, and researchers at various state and federal government agencies contribute to research programs focused on performance-based earthquake engineering. These programs aim to identify and reduce the risks from major earthquakes to life safety and to the economy by including research in a wide variety of disciplines, including structural and geotechnical engineering, geology/seismology, lifelines, transportation, architecture, economics, risk management, and public policy. The center also provides software through the Open
System for Earthquake Engineering Simulation (OPENSEES) project (http://opensees.berkeley.edu), operates the NISEE Library (http://nisee.berkeley.edu), and houses a Strong Motions Database (http://peer.berkeley.edu/products/strong_ground_motion_db.html) of earthquake records.

**Undergraduate Programs**

Civil Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/civil-engineering): BS

Environmental Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/environmental-engineering): Minor

GeoSystems (http://guide.berkeley.edu/undergraduate/degree-programs/geosystems): Minor

Structural Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/structural-engineering): Minor

**Graduate Programs**

Civil and Environmental Engineering (http://guide.berkeley.edu/graduate/degree-programs/civil-environmental-engineering): MEng, MS, PhD

**Civil and Environmental Engineering**

Expand all course descriptions [+]Collapse all course descriptions [-]

**CIV ENG 11 Engineered Systems and Sustainability 3 Units**

Terms offered: Spring 2020, Spring 2019, Spring 2018

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.

Engineered Systems and Sustainability: Read More [+]Rules & Requirements

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

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 To be decided by the instructor when the class is offered.

Freshman Seminars: Read Less [-]

**CIV ENG 24 Freshman Seminars 1 Unit**

Terms offered: Spring 2020, Fall 2019, Spring 2019

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.

Freshman Seminars: Read More [+]Rules & Requirements

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

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 To be decided by the instructor when the class is offered.

Freshman Seminars: Read Less [-]
CIV ENG C30 Introduction to Solid Mechanics
3 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019

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, Johnson

Also listed as: MEC ENG C85

Introduction to Solid Mechanics: Read Less [-]

CIV ENG W30 Introduction to Solid Mechanics
3 Units
Terms offered: Summer 2019 8 Week Session, Summer 2018 8 Week Session, Summer 2016 10 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: MATH 53 and MATH 54 (may be taken concurrently); PHYSICS 7A

Credit Restrictions: Students will receive no credit for MEC ENG W85 after completing MEC ENG C85. A deficient grade in MEC ENG W85 may be removed by taking MEC ENG C85.

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.

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: Spring 2020, Fall 2019, Spring 2019
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: Course may be repeated for credit without restriction.

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
Terms offered: Fall 2019, Fall 2018, Fall 2017
Principles of physical and structural geology; the influence of geological factors on engineering works and the environment. Field trip.

Rules & Requirements
Prerequisites: CHEM 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 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.

Rules & Requirements
Prerequisites: Concurrent or prior enrollment in Foundations of Data Science (COMPSCI 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 C88 Data Science for Smart Cities 2

Units
Terms offered: Spring 2020
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. Terms offered: Not yet offered
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.

Objectives & Outcomes
Course Objectives: Become familiar with urban big data and sensor data collection techniques.

Develop intuition in various machine learning classification algorithms, as well as regression modelling. Develop intuition in various machine learning classification algorithms, as well as regression modelling.

Foster critical thinking about real-world actionability from analytics. Learn how to use data science techniques in urban decision-making and scenario generation.

Student Learning Outcomes: Develop capabilities in a range of data science techniques.

Gain the ability to solve problems in smart city research and practice. Think critically about how to assess analytics for cities. Use data analytics in the smart city domain.

Rules & Requirements
Prerequisites: This course is a Data Science connector course and is meant to be taken concurrent with or after Foundations of Data Science COMPSCI C8/INFO C8/STAT C8. Students may take more than one Data Science connector course if they wish, concurrently or after taking the C8 course

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. Alternative to final exam.

Instructor: Gonzalez

Formerly known as: Civil and Environmental Engineering 88

Also listed as: CY PLAN C88

Data Science for Smart Cities: Read More [+]

CIV ENG C88 Data Science for Smart Cities 2

Units
Terms offered: Spring 2020
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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. Alternative to final exam.

Instructor: Gonzalez

Formerly known as: Civil and Environmental Engineering 88

Also listed as: CY PLAN C88

Data Science for Smart Cities: Read More [+]

Data Science for Smart Cities:

Also listed as:

Formerly known as:

Instructor:

Grading/Final exam status:

Undergraduate

Subject/Course Level:

Additional Details

Fall and/or spring:

Hours & Format

Units

Prerequisites:

Objectives & Outcomes

Course Objectives:

Student Learning Outcomes:

Rules & Requirements

Hours & Format

Additional Details

Subject/Course Level:

Instructor:

Formerly known as:

Also listed as:
CIV ENG 92 Introduction to Civil and Environmental Engineering 1 Unit
Terms offered: Fall 2019, Fall 2018, Fall 2017
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: Spring 2020, Fall 2019, Spring 2019
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. Use of computer programming languages for analysis of CEE-related data and problems. The course also introduces the student to various domains of uncertainty analysis in CEE.
Engineering Data Analysis: Read More [+]

Rules & Requirements
Prerequisites: ENGIN 7 or COMPSCI C8 / INFO C8 / STAT C8. Student should consult instructor prior to enrolling

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: Hansen, Rubin, Walker

Engineering Data Analysis: Read Less [-]

CIV ENG 98 Supervised Group Study and Research 1 - 3 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
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 without restriction.

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: Spring 2020, Fall 2019, Spring 2019
Supervised independent study by lower division students.
Supervised Independent Study and Research: Read More [+]

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 without restriction.

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 2019, Fall 2018, Summer 2018 8 Week Session
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.
Elementary Fluid Mechanics: Read More [+]

Rules & Requirements
Prerequisites: PHYSICS 7A, MATH 53, and ENGIN 7 (may be taken concurrently); and CIV ENG C30 / MEC ENG C85 recommended

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of laboratory per week
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.
Instructors: Chow, Stacey, Variano

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.
Fluid Mechanics of Rivers, Streams, and Wetlands: Read Less [-]

Rules & Requirements
Prerequisites: CIV ENG 100, MEC ENG 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
Terms offered: Fall 2018, Fall 2017, Spring 2017
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.
Introduction to Hydrology: Read More [+]

Rules & Requirements
Prerequisites: CIV ENG 93 and CIV ENG 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

CIV ENG C103N Terrestrial Hydrology 4 Units
Terms offered: Spring 2020, Spring 2019, Spring 2017, Spring 2014
A quantitative introduction to the hydrology of the terrestrial environment including lower atmosphere, watersheds, lakes, and streams. All aspects of the hydrologic cycle, including precipitation, infiltration, evapotranspiration, overland flow, streamflow, and groundwater flow. Chemistry and dating of groundwater and surface water. Development of quantitative insights through problem solving and use of simple models. This course requires one field experiment and several group computer lab assignments.
Terrestrial Hydrology: Read More [+]

Rules & Requirements
Prerequisites: CHEM 1A, MATH 1A, MATH 1B, and PHYSICS 7A; 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. Alternative to final exam.
Instructor: Larsen

Also listed as: ESPM C130/GEOG C136
Terrestrial Hydrology: Read Less [-]
CIV ENG 105 Water and Wind - Design for a Variable Environment 3 Units
Terms offered: Spring 2020, Fall 2017, Fall 2016
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 (1) explore the design process and project management; and (2) to integrate concepts from hydology and fluid mechanics with structural, geotechnical and/or 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.

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: CIV ENG 100 and CIV ENG 103; or instructor's permission

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

Water and Wind - Design for a Variable Environment: Read More [+]

CIV ENG C106 Air Pollution 3 Units
Terms offered: Spring 2020, Spring 2018, Spring 2017
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 gases, smog, and changes in the oxidation capacity of the troposphere.

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: 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 2020, Spring 2019, Spring 2018

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: 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.

Climate Change Mitigation: Read Less [-]
CIV ENG 110 Water Systems of the Future 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2017
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:
1. Consider costs and tradeoffs in water supply planning under uncertainty for real-world water systems.
2. Critically evaluate water planning and innovation potential for real-world utilities given future uncertainties and competing priorities.
3. Explore the innovation ecosystem in the water sector, its opportunities and challenges, and analyze case studies.
4. 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.
5. Provide overview and examples of concepts and methods for analyzing the sustainability of water systems.
6. Provide overview of the complex infrastructure systems that supply and manage water and wastewater.

Student Learning Outcomes:
1. Ability to apply knowledge of mathematics, science, and engineering. MODERATE
2. Ability to communicate effectively. EXTENSIVE
3. Ability to design a system, component, or process to meet desired needs. MODERATE
4. Ability to function on multi-disciplinary teams. EXTENSIVE
5. Ability to identify, formulate and solve engineering problems. MODERATE
6. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. MODERATE
7. Knowledge of contemporary issues. EXTENSIVE
8. Recognition of the need for, and an ability to engage in life-long learning. EXTENSIVE
9. Understand the impact of engineering solutions in a global and societal context. EXTENSIVE
10. 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

CIV ENG 111 Environmental Engineering 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
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, Nelson, Sedlak

CIV ENG 111L Water and Air Quality Laboratory 1 Unit
Terms offered: Fall 2019, Fall 2018, Fall 2017
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: CIV ENG 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, 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: CIV ENG 100 and CIV ENG 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.

Environmental Engineering Design: Read Less [-]

CIV ENG 113 Ecological Engineering for Water Quality Improvement 3 Units
Terms offered: Spring 2019, Spring 2017, Fall 2003
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: CIV ENG 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: CHEM 1A and CHEM 1B

CIV ENG 115 Water Chemistry 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
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

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 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: CIV ENG 111

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 120 Structural Engineering 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Structural Engineering: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG C30 / MEC ENG C85 and CIV ENG 60 (may be taken concurrently)

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: Moehle
CIV ENG 121 Structural Analysis 3 Units
Terms offered: Fall 2018, Fall 2017, Fall 2016
Structural Analysis: Read More [+]

Objectives & Outcomes

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 of 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: CIV ENG 120 and CIV ENG 130

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

CIV ENG 122L Structural Steel Design Project 1 Unit
Terms offered: Spring 2020, Spring 2019, Spring 2018
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.
Structural Steel Design Project: Read More [+]

Rules & Requirements
Prerequisites: CIV ENG 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.

Instructor: Becker

Structural Steel Design Project: Read Less [-]

CIV ENG 122N Design of Steel Structures 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
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: CIV ENG 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.

Instructor: Becker

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 2020, Spring 2019, Spring 2018
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: CIV ENG 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: Moehle, Mosalam

CIV ENG 123N Design of Reinforced Concrete Structures 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
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: CIV ENG 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: Moehle, Mosalam
Formerly known as: Civil and Environmental Engineering 123

CIV ENG 124 Structural Design in Timber 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
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: CIV ENG 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.
Instructor: Filippou

CIV ENG 126 Engineering Dynamics and Vibrations 3 Units
Terms offered: Fall 2019
Engineering Dynamics and Vibrations: Read More [+]

Rules & Requirements
Prerequisites: CIV ENG C30 / MEC ENG C85 and ENGIN 7; or consent of instructor
Credit Restrictions: Students will receive no credit for CIV ENG 126 after completing MEC ENG 104. A deficient grade in CIV ENG 126 may be removed by taking MEC ENG 104, or MEC ENG 104.

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: Konstantinidis, DeJong
Engineering Dynamics and Vibrations: Read Less [-]
CIV ENG 130N Mechanics of Structures 3 Units
Terms offered: Spring 2019, Summer 2018 8 Week Session, Spring 2018
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: CIV ENG C30 / MEC ENG C85; and CIV ENG 60 or MAT SCI 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 132 Applied Structural Mechanics 3 Units
Terms offered: Spring 2020
Concepts of theory of solid mechanics: three dimensional stress, strain, and material response; elastic and inelastic boundary value problems; fracture, fatigue, and geometric instability. Problems in advanced strength of materials; thin plate and axis-symmetric shell theory.
Applied Structural Mechanics: Read More [+]

Rules & Requirements
Prerequisites: CIV ENG C30 / MEC ENG C85, MATH 53 and MATH 54
Credit Restrictions: Students will receive no credit for CivEng 132 after CivEng 130N.

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week
Summer: 8 weeks - 6 hours of lecture and 2 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: Govindjee, Li, Konstantinidis

Applied Structural Mechanics: Read Less [-]
CIV ENG C133 Engineering Analysis Using the Finite Element Method 3 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
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 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

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: CIV ENG 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 2019, Fall 2018, Fall 2017
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: CIV ENG 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: Fall 2019, Spring 2019, Spring 2018

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 Less [-]

CIV ENG 156 Concrete Materials, Construction, and Sustainability 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018

Rules & Requirements
Prerequisites: CIV ENG 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: Fall 2018, Spring 2016, Fall 2014
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; CIV ENG 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 2019, Fall 2018, Fall 2017
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.

Engineering Project Management: Read More [+]

Rules & Requirements
Prerequisites: CIV ENG 93 (can be taken concurrently)

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 2020, Spring 2019, Spring 2017
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.

Rock Mechanics: Read More [+]

Rules & Requirements
Prerequisites: CIV ENG 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 2019, Fall 2018, Fall 2017
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.

Groundwater and Seepage: Read More [+]

Rules & Requirements
Prerequisites: Senior standing in engineering or science; CIV ENG 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.

Engineering Geomatics: Read More [+]

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.
Instructor: Glaser

Engineering Geomatics: Read Less [-]
CIV ENG 175 Geotechnical and Geoenvironmental Engineering 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
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 geosynthetic materials in geotechnical and geoenvironmental applications. Introduction to site investigation techniques. Laboratory testing and evaluation of soil composition and properties.

Rules & Requirements
Prerequisites: CIV ENG C30 / MEC ENG C85 (may be taken concurrently); CIV ENG 100 recommended

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Bray, Sitar, Soga

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.

Rules & Requirements
Prerequisites: CIV ENG 175 or consent of instructor; CIV ENG 111 and CIV ENG 173 recommended

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Sitar

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.

Rules & Requirements
Prerequisites: CIV ENG 175; CIV ENG 120 recommended

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Bray

CIV ENG C178 Applied Geophysics 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
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.

Rules & Requirements
Prerequisites: CIV ENG 175 or consent of instructor; CIV ENG 111 and CIV ENG 173 recommended

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Sitar

Also listed as: EPS C178

Applied Geophysics: Read Less [-]
CIV ENG 179 Geosystems Engineering Design 3 Units
Terms offered: Fall 2019, Fall 2018, Spring 2018
Geosystem engineering design principles and concepts. Fundamental aspects of the geomechanical and geoenvironmental responses of soil are applied to analyze and design civil systems, such as earth dams and levees, earth retention systems, building and bridge foundations, solid-waste fills, and tailings dams. Students form teams to design geotechnical aspects of a civil project and prepare/present a design document. Field trip to a project site.
Geosystems Engineering Design: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 175

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: Bray, Sitar, Soga

Geosystems Engineering Design: Read Less [-]

CIV ENG 180 Life-Cycle Design and Construction 4 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
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: CIV ENG 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 2019, Fall 2018, Fall 2017
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: CIV ENG 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: Spring 2020, Spring 2019, Spring 2018
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: CIV ENG 93 and ENGIN 7

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 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 2019, Fall 2018, Fall 2017
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.

Instructor: Li

Engineering Risk Analysis: Read Less [-]

CIV ENG H194 Honors Undergraduate Research 3 - 4 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
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 for credit up to a total 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. Alternative to final exam.

Honors Undergraduate Research: Read Less [-]
CIV ENG 197 Field Studies in Civil Engineering 1 - 4 Units
Terms offered: Spring 2020, Fall 2019, Summer 2019 10 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 without restriction.

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.

Field Studies in Civil Engineering: Read Less [-]

CIV ENG 198 Directed Group Study for Advanced Undergraduates 1 - 4 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
Group study of a selected topic or topics in civil engineering.
Directed Group Study for Advanced Undergraduates: Read More [+]

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 without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 1-4 hours of directed group 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.

Directed Group Study for Advanced Undergraduates: Read Less [-]

CIV ENG 199 Supervised Independent Study 1 - 4 Units
Terms offered: Spring 2020, Fall 2019, Summer 2019 3 Week Session
Supervised independent study.
Supervised Independent Study: Read More [+]

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 without restriction.

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.

Supervised Independent Study: Read Less [-]
CIV ENG 200A Environmental Fluid Mechanics 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Fluid mechanics of the natural water and air environment. Flux equation analyses; unsteady free surface flow; stratified flow; Navier-Stokes equations; boundary layers, jets and plumes; turbulence, Reynolds equations, turbulence modeling; mixing, diffusion, dispersion, and contaminant transport; geophysical flows in atmosphere and ocean; steady and unsteady flow in porous media. Application to environmentally sensitive flows in surface and groundwater and in lower atmosphere.
Environmental Fluid Mechanics: Read More [+]
Rules & Requirements
Prerequisites: 100; Mathematics 53, 54 or equivalents
Credit Restrictions: Students will receive no credit for 200A after taking 105 before fall 1999.
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/Graduate
Grading: Letter grade.
Instructors: Chow, Stacey
Environmental Fluid Mechanics: Read Less [-]

CIV ENG 200B Numerical Methods for Environmental Flow Modeling 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Introduction to numerical methods with application to environmental flows (atmospheric, surface water, and subsurface flows). Scalar advection/diffusion equations used to study finite difference schemes, numerical errors and stability. Methods introduced for solving Navier-Stokes equations and for turbulence modeling with Reynolds-averaging and large-eddy simulation. Basic programming skills required for hands-on exercises.
Numerical Methods for Environmental Flow Modeling: Read More [+]
Rules & Requirements
Prerequisites: 200A or consent of instructor
Repeat rules: Course may be repeated for credit when topic changes.
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Chow
Numerical Methods for Environmental Flow Modeling: Read Less [-]

CIV ENG 200C Transport and Mixing in the Environment 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2014
Application of fluid mechanics to transport and mixing in the environment. Fundamentals of turbulence, turbulent diffusion, and shear dispersion in steady and oscillatory flows and the effects of stratification. Application to rivers, wetlands, lakes, estuaries, the coastal ocean, and the lower atmosphere.
Transport and Mixing in the Environment: Read More [+]
Rules & Requirements
Prerequisites: 100, Math 53 and 54, 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/Graduate
Grading: Letter grade.
Instructor: Stacey
Transport and Mixing in the Environment: Read Less [-]

CIV ENG 202A Vadose Zone Hydrology 3 Units
Terms offered: Spring 2019, Spring 2018, Spring 2016
Course addresses fundamental and practical issues in flow and transport phenomena in the vadose zone, which is the geologic media between the land surface and the regional water table. A theoretical framework for modeling these phenomena will be presented, followed by applications in the areas of ecology, drainage and irrigation, and contaminant transport. Hands-on applications using numerical modeling and analysis of real-life problems and field experiments will be emphasized.
Vadose Zone Hydrology: Read More [+]
Rules & Requirements
Prerequisites: 173 or equivalent
Credit Restrictions: Students will receive no credit for 202A after taking 202 before fall 1998.
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Rubin
Formerly known as: 202
Vadose Zone Hydrology: Read Less [-]
CIV ENG 203A Graduate Hydrology 3 Units
Terms offered: Fall 2018, Fall 2014
Hydrology is presented and analyzed in the context of a continuum extending from the atmosphere to the land surface to the subsurface to free water bodies. In this class, we develop the theoretical frameworks required to address problems that both lie within individual components and span these traditionally separate environments. Starting from a development of the fundamental dynamics of fluid motion, we examine applications within the subsurface, the atmosphere and surface water systems.
Graduate Hydrology: Read More [+]

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/Graduate
Grading: Letter grade.
Instructor: Rubin
Graduate Hydrology: Read Less [-]

CIV ENG 203N Surface Water Hydrology 3 Units
Terms offered: Spring 2018, Fall 2016, Fall 2015
Course addresses topics of surface water hydrology, such as processes of water in the atmosphere, over land surface, and within soil; advanced representation and models for infiltration and evapotranspiration processes; partition of water and energy budgets at the land surface; snow and snowmelt processes; applications of remote sensing; flood and drought, and issues related to advanced hydrological modeling. Students will address practical problems and will learn how to use the current operational hydrologic forecasting model, and build hydrological models.
Surface Water Hydrology: Read More [+]

Rules & Requirements
Prerequisites: 103 or equivalent, 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/Graduate
Grading: Letter grade.
Formerly known as: 203
Surface Water Hydrology: Read Less [-]

CIV ENG 205B Margins of Quality for Engineered Systems 3 Units
Terms offered: Fall 2009, Fall 2007, Fall 2000
Processes and procedures to define and determine the demands and capacities of the structures and hardware elements of engineered systems during their life-cycles: margins of quality. The objective of this course is to provide students with the knowledge and skills to define and evaluate system demands, capacities, and reliability targets to be used in design, requalification, construction, operation, maintenance, and decommissioning of engineered systems.
Margins of Quality for Engineered Systems: Read More [+]

Rules & Requirements
Prerequisites: 125, 193 or equivalents and senior design experience

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Bea
Margins of Quality for Engineered Systems: Read Less [-]

CIV ENG 206 Water Resources Management 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
The course provides a framework to address contemporary water-resources problems, and to achieve water security for local areas and broader regions. Students will become aware of critical water-resources issues at local, national and global scales, and learn to formulate solutions for water-resources problems using engineering, natural-science and social-science tools. The main focus is on California and the Western United States, with comparative analysis for other regions.
Water Resources Management: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing or senior undergrad with 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/Graduate
Grading: Letter grade.
Instructor: Bales
Water Resources Management: Read Less [-]
CIV ENG 209 Design for Sustainable Communities 3 Units
Terms offered: Spring 2016, Spring 2015, Spring 2014
This course provides conceptual and hands-on experience in design and implementation of innovative products or processes for improving the sustainability of resource-constrained communities (mostly poor ones in the developing countries). Teams of students will take on practical projects, with guidance from subject experts.
Design for Sustainable Communities: Read More [+]
Rules & Requirements
Prerequisites: Graduate standing 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/Graduate
Grading: Letter grade.
Instructor: Gadgil

CIV ENG 210 Control of Water-Related Pathogens 3 Units
Terms offered: Fall 2018, Spring 2018, Spring 1996
Comprehensive strategies for the assessment and control of water-related human pathogens (disease-causing microorganisms). Transmission routes and life cycles of common and emerging organisms, conventional and new detection methods (based on molecular techniques), human and animal sources, fate and transport in the environment, treatment and disinfection, appropriate technology, regulatory approaches, water reuse.
Control of Water-Related Pathogens: Read More [+]
Rules & Requirements
Prerequisites: Basic course in microbiology recommended; graduate standing 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/Graduate
Grading: Letter grade.
Instructor: Nelson
Formerly known as: Civil and Environmental Engineering 210A

CIV ENG 211A Environmental Physical-Chemical Processes 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Fundamental concepts of physical-chemical processes that affect water quality in natural and engineered environmental systems. Focus is on developing a qualitative understanding of mechanisms as well as quantitative tools to describe, predict, and control the behavior of physical-chemical processes. Topics include reactor hydraulics and reaction kinetics, gas transfer, adsorption, particle characteristics, flocculation, gravitational separations, filtration, membranes, and disinfection.
Environmental Physical-Chemical Processes: Read More [+]
Rules & Requirements
Prerequisites: Civil and Environmental Engineering 111 or equivalent and course work in aquatic chemistry, 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/Graduate
Grading: Letter grade.
Instructor: Nelson

CIV ENG 211B Environmental Biological Processes 3 Units
Terms offered: Fall 2019, Spring 2019, Fall 2017
Fundamental concepts of biological processes that are important in natural and engineered environmental systems, especially those affecting water quality. Incorporates basic fundamentals of microbiology into a quantifiable engineering context to describe, predict, and control behavior of environmental biological systems. Topics include the stoichiometry, energetics and kinetics of microbial reactions, suspended and biofilm processes, carbon and nutrient cycling, and bioremediation applications.
Environmental Biological Processes: Read More [+]
Rules & Requirements
Prerequisites: Civil and Environmental Engineering 111 or equivalent and course work in microbiology, 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/Graduate
Grading: Letter grade.
Instructor: Alvarez-Cohen
CIV ENG 213 Watersheds and Water Quality 3 Units
Terms offered: Fall 1996
Overview of approaches used by engineers to preserve or improve water quality at the watershed scale. Characterization and modeling of nutrients, metals, and organic contaminants in watersheds. Application of ecosystem modification and pollutant trading to enhance water quality. The course emphasizes recent case studies and interdisciplinary approaches for solving water quality problems. Watersheds and Water Quality: Read More [+]
Rules & Requirements
Prerequisites: Graduate standing or consent of instructor
Credit Restrictions: Students will receive no credit for 213 after taking 290C.
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Sedlak
Watersheds and Water Quality: Read Less [-]

CIV ENG 217 Environmental Chemical Kinetics 3 Units
Terms offered: Spring 2020, Spring 2017, Spring 2015
Rules & Requirements
Prerequisites: Graduate standing or consent of instructor; 115 or 214 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/Graduate
Grading: Letter grade.
Instructor: Sedlak
Environmental Chemical Kinetics: Read Less [-]

CIV ENG 218A Air Quality Engineering 3 Units
Terms offered: Spring 2020, Fall 2018, Fall 2017
Quantitative overview of the characterization and control of air pollution problems. Summary of fundamental chemical and physical processes governing pollutant behavior. Analysis of key elements of the air pollution system: sources and control techniques, atmospheric transformation, atmospheric transport, modeling, and air quality management. Air Quality Engineering: Read More [+]
Rules & Requirements
Prerequisites: Graduate standing in engineering 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/Graduate
Grading: Letter grade.
Instructor: Harley
Air Quality Engineering: Read Less [-]

CIV ENG 218B Atmospheric Aerosols 3 Units
Terms offered: Spring 2013, Fall 2008, Spring 2006
Rules & Requirements
Prerequisites: Graduate standing or consent of instructor, Civil and Environmental Engineering 218A recommended
Hours & Format
Fall and/or spring: 15 weeks - 1 hour of lecture and 3 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Harley
Atmospheric Aerosols: Read Less [-]
CIV ENG 218C Air Pollution Modeling 3 Units
Terms offered: Spring 2010, Spring 2008, Spring 2005
Air Pollution Modeling: Read More [+]
Rules & Requirements
Prerequisites: 218A
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Harley
Air Pollution Modeling: Read Less [-]

CIV ENG 219 Fluid Flow in Environmental Processes 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Transport and mixing of solutes in water. Focus on rivers, lakes, estuaries, and wetlands, with some discussion of groundwater and the atmosphere. Basic equations of fluid motion will be used to contextualize and/or derive applied empirical equations for use in specific cases of applied environmental engineering practice. Example applications include outfalls, total maximum daily loads, residence time, and longitudinal dispersion.
Fluid Flow in Environmental Processes: Read More [+]
Rules & Requirements
Prerequisites: Graduate standing or senior undergrad with 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/Graduate
Grading: Letter grade.
Instructors: Variano, Stacey
Fluid Flow in Environmental Processes: Read Less [-]

CIV ENG 220 Structural Analysis Theory and Applications 3 Units
Terms offered: Fall 2019, Fall 2015, Fall 2014
Structural Analysis Theory and Applications: Read More [+]
Rules & Requirements
Prerequisites: 121 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/Graduate
Grading: Letter grade.
Instructor: Filippou
Structural Analysis Theory and Applications: Read Less [-]

CIV ENG 220N Nonlinear Structural Analysis 3 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
Nonlinear Structural Analysis: Read More [+]
Rules & Requirements
Prerequisites: Civ Eng 121 or equivalent
Credit Restrictions: Students who have previously taken Civ Eng 221 will not receive credit for this course
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/Graduate
Grading: Letter grade.
Instructor: Filippou
Nonlinear Structural Analysis: Read Less [-]
CIV ENG 221 Nonlinear Structural Analysis 3 Units
Terms offered: Spring 2020, Spring 2016, Spring 2015
Prerequisites: 220
Rules & Requirements

CIV ENG 222 Finite Element Methods 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Prerequisites: 220 or equivalent, 131 or 231
Rules & Requirements

CIV ENG 223 Earthquake Protective Systems 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Conceptual basis for earthquake protective systems including seismic isolation and energy absorbing techniques. Design rules for seismic isolation, energy absorbing and self-centering systems. Characteristics of isolation bearings, frictional, metallic and energy absorbing devices, code provision for earthquake protective systems. Applications to new and existing structures.
CIV ENG W224A Introduction to Earthquake Engineering 3 Units
Terms offered: Prior to 2007
Introduction to key concepts in earthquake engineering, including engineering seismology, dynamics of single-degree-of-freedom systems, earthquake ground motions, seismic hazard assessment, performance-based earthquake engineering, geotechnical design for earthquakes, and structural design for earthquakes.
Introduction to Earthquake Engineering: Read More 

Objectives & Outcomes
Course Objectives: The goal of this course is to provide students with introductory knowledge of earthquake engineering to serve as the basis for more advanced and specialized courses to follow. This knowledge aims towards general exposure to elements of earthquake hazard, ground motion, structural dynamics, and design and evaluation of structural systems. An important objective of this introductory course is to emphasize the importance of risk analysis and performance-based earthquake engineering.

Rules & Requirements
Prerequisites: Civil and Environmental Engineering 120, 175, 122N, 123N or equivalent
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of web-based lecture per week
Online: This is an online course.
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructors: Mosalam, Bray
Introduction to Earthquake Engineering: Read Less [-]

CIV ENG W224B Linear Analysis of Structural and Geotechnical Systems 3 Units
Terms offered: Prior to 2007
Methods of linear static and dynamic analysis of structural and geotechnical systems; displacement method of analysis and direct stiffness implementation; modeling of structural and geotechnical systems; 1d and 2d finite elements; equations of motions; modal analysis and direct integration; linear response evaluation methods.
Linear Analysis of Structural and Geotechnical Systems: Read More [+]

Objectives & Outcomes
Course Objectives: The goal of this course is to provide students with background knowledge of the linear elastic response of structural and geotechnical systems. The modules introduce the students to the modeling of structures and foundations, the concepts of the displacement method of analysis for skeletal structures and to basic concepts of finite element analysis. The modules also cover the modal analysis of multi-degree of freedom elastic systems. The assigned homework enables students to analyze and evaluate the linear elastic static and dynamic response of structural systems.

Rules & Requirements
Prerequisites: Civil and Environmental Engineering C30/Mechanical Engineering C85; Civil and Environmental Engineering 120, 121 and 175 or equivalent
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of web-based lecture per week
Online: This is an online course.
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructors: Filippou, Chopra, Pestana
Linear Analysis of Structural and Geotechnical Systems: Read Less [-]
CIV ENG W224C Earthquake Geotechnical Engineering 3 Units
Terms offered: Prior to 2007
Earthquake surface fault rupture, earthquake ground motions; influence of soil conditions on seismic site response; seismic site response analysis; evaluation and modeling of dynamic soil properties; seismic performance of foundations and soil structure interaction; evaluation and mitigation of soil liquefaction and its consequences; seismic slope stability and displacement analysis; seismic safety of dams, levees, embankments; seismic design of earth retaining structures.
Earthquake Geotechnical Engineering: Read More [+]

Objectives & Outcomes
Course Objectives: The goal of this course is to familiarize students with the field of earthquake geotechnical engineering. Lectures focus on describing earthquake hazards and developing methods used for seismic analysis and design in geotechnical engineering. Assigned problems and projects reinforce essential concepts and provide realistic applications of prevalent analytical procedures. Readings provide necessary background information and are an essential component of the course.

Rules & Requirements
Prerequisites: Civil and Environmental Engineering W224A or equivalent
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of web-based lecture per week
Online: This is an online course.

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructors: Bray, Seed

Earthquake Geotechnical Engineering: Read Less [-]

CIV ENG W224D Nonlinear Analysis of Structural and Geotechnical Systems 3 Units
Terms offered: Prior to 2007
Response of structural systems with nonlinear materials under large displacements; event-to-event analysis for simple material response; nonlinear solution strategies; linear stability analysis; second order analysis; section analysis for nonlinear material response (moment-curvature, interaction diagrams); truss and beam-column elements with nonlinear materials; nonlinear time history analysis of structures; case studies of nonlinear response.
Nonlinear Analysis of Structural and Geotechnical Systems: Read More [+]

Objectives & Outcomes
Course Objectives: The goal of this course is to provide students with background knowledge of the nonlinear response of structural systems. The modules cover the nonlinear response of materials and structural components as well as the nonlinear response of structures under large displacements. The modules also cover the numerical methods for the static and transient response of structures. The assigned homework enables students to analyze and evaluate the response of structural systems under extreme load and environmental conditions inducing large inelastic strains of structural materials and large displacements of structural systems.

Rules & Requirements
Prerequisites: Civil and Environmental Engineering W224B
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of web-based lecture per week
Online: This is an online course.

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructors: Filippou, McKenna

Nonlinear Analysis of Structural and Geotechnical Systems: Read Less [-]
CIV ENG W224E Earthquake Resistant Design 2 Units
Terms offered: Prior to 2007

Objectives & Outcomes

Course Objectives: The goal of this course is to provide students with skills in the evaluation and design of earthquake-resistant structures. The course brings together knowledge of engineering seismology, geotechnical engineering, and structural engineering learned in previous courses and develops concepts and analytical methods for earthquake engineering. An overall objective is for students to understand the characteristics of earthquake-resistant construction and to recognize the basic structural framing systems that are commonly in use.

Rules & Requirements

Prerequisites: Civil and Environmental Engineering W224A, W224C, W224D or equivalents

Hours & Format

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

Online: This is an online course.

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructors: Mahin, Panagiotou

Earthquake Resistant Design: Read Less [-]
CIV ENG W224G Earthquake Resistant Concrete Structures 2 Units
Terms offered: Prior to 2007
Design methods for earthquake-resistant concrete construction; materials including confined concrete; design of beams, columns, and walls; structural diaphragms; foundations; conventional construction and hybrid construction; applications for buildings and bridges.

Earthquake Resistant Concrete Structures: Read More [+]

Objectives & Outcomes
Course Objectives: The goal of this course is to provide students with a working knowledge of how reinforced concrete structures respond to earthquakes and how to design such structures to be earthquake-resistant. The modules introduce students to common forms of concrete construction and analytical methods for establishing requirements for such structures. The assigned homework enables students to develop experience in analyzing and designing earthquake-resistant concrete structures

Rules & Requirements
Prerequisites: Civil and Environmental Engineering 123N or equivalent; Civil and Environmental Engineering W224A, W224D, W224E may be taken concurrently

Hours & Format
Fall and/or spring: 15 weeks - 2 hours of web-based lecture per week
Online: This is an online course.

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructors: Moehle, Panagiotou

CIV ENG W224H Earthquake-Resistant Steel Structures 2 Units
Terms offered: Prior to 2007
Design methods for earthquake-resistant steel structures; material properties of steel, welds, and bolts; design of tension members, beams, columns, and beam-columns; connections including shear and moment connections, gusset plates, and base plates; floor diaphragms; lateral force resisting systems; concentrically braced frames; moment frames; eccentrically braced frames; steel shear walls; applications to buildings and bridges

Earthquake-Resistant Steel Structures: Read More [+]

Objectives & Outcomes
Course Objectives: The goal of this course is to provide students with a working knowledge of how steel structures respond to earthquakes and how to design such structures to be earthquake-resistant. The modules introduce students to common steel structural framing systems to resist gravity and lateral forces and concepts and methods for seismic design of such structures. The assigned homework enables students to develop experience in analyzing and designing earthquake-resistant steel structures.

Rules & Requirements
Prerequisites: CE W224A, CE W224D, CE W224E

Hours & Format
Fall and/or spring: 15 weeks - 2 hours of web-based lecture per week
Online: This is an online course.

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Astaneh
CIV ENG W224I Dynamic Response of Foundations/Soil-Structure Interaction 2 Units
Terms offered: Prior to 2007
Dynamic response of foundations, design of foundations to resist seismic loading, influence of liquefaction on deep foundations, soil-structure interaction.
Dynamic Response of Foundations/Soil-Structure Interaction: Read More [+]
Objectives & Outcomes
Course Objectives: The objective of the course is to provide in depth coverage of seismic soil-structure interaction as it pertains to seismic design of major foundation elements: footings, piles and piers; and seismic design of various types of retaining structures. To this end case histories will be used to illustrate past experience and then current analysis and design methods will be covered in detail. Assignments will be structured to provide students with the necessary tools for application of the methods in design of new structures. Building code provisions will be reviewed to the extent that they apply in this context.
Rules & Requirements
Prerequisites: CE W224C and CE W 224E
Hours & Format
Fall and/or spring: 15 weeks - 2 hours of web-based lecture per week
Online: This is an online course.
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructors: Sitar, Mosalam
Dynamic Response of Foundations/Soil-Structure Interaction: Read Less [-]

CIV ENG W224J Performance-Based Earthquake Engineering 2 Units
Terms offered: Prior to 2007
Fundamentals and evolution of Performance-Based Earthquake Engineering (PBEE). Probabilistic framework of PBEE. PBEE components: ground motion intensity measures, engineering demand parameters, damage measure, and decision variable. Multidisciplinary aspects of PBEE. Case studies of applications of PBEE.
Performance-Based Earthquake Engineering: Read More [+]
Objectives & Outcomes
Course Objectives: The objective of this course is to bring together all of the concepts learned in previous and concurrent courses and develop an understanding of the methods of performance-based earthquake engineering. This is done through a series of modules that introduce the framework for performance-based earthquake engineering and also cover of the framework from seismology through decision-making. The assigned homework enables students to develop experience in using and combining these basic elements, finally bringing them together in a term project that serves as a demonstration of mastery in performance-based earthquake engineering.
Rules & Requirements
Prerequisites: CE W225E and CE W224F
Hours & Format
Fall and/or spring: 15 weeks - 2 hours of web-based lecture per week
Online: This is an online course.
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructors: Bozorgnia, Mahin
Performance-Based Earthquake Engineering: Read Less [-]
CIV ENG 225 Dynamics of Structures 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Evaluation of deformations and forces in structures, idealized as single-degree of freedom or discrete-parameter multi-degree of freedom systems, due to dynamic forces. Evaluation of earthquake-induced deformations and forces in structures by linear response history analysis; estimation of maximum response by response spectrum analysis; effects of inelastic behavior. Laboratory demonstrations.
Dynamics of Structures: Read More [+]
Rules & Requirements
Prerequisites: 220 (may be taken concurrently) 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/Graduate
Grading: Letter grade.
Instructor: DeJong
Dynamics of Structures: Read Less [-]

CIV ENG 226 Stochastic Structural Dynamics 3 Units
Terms offered: Spring 2016, Spring 2014, Spring 2012
Stochastic Structural Dynamics: Read More [+]
Rules & Requirements
Prerequisites: 225
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Stochastic Structural Dynamics: Read Less [-]

CIV ENG 227 Earthquake-Resistant Design 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Earthquake-Resistant Design: Read More [+]
Rules & Requirements
Prerequisites: 220 and 225
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/Graduate
Grading: Letter grade.
Instructors: Moehle, Becker
Earthquake-Resistant Design: Read Less [-]

CIV ENG 228 Advanced Earthquake Analysis 3 Units
Terms offered: Spring 2015, Spring 2013, Spring 2012
Advanced Earthquake Analysis: Read More [+]
Rules & Requirements
Prerequisites: 225
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Advanced Earthquake Analysis: Read Less [-]
CIV ENG 229 Structural System Reliability 3 Units
Terms offered: Spring 2020, Spring 2015, Spring 2013

Structural System Reliability: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.

Structural System Reliability: Read Less [-]

CIV ENG C231 Mechanics of Solids 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Mechanics of Solids: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing 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/Graduate
Grading: Letter grade.
Instructor: Govindjee
Also listed as: MAT SCI C211
Mechanics of Solids: Read Less [-]

CIV ENG 232 Structural Mechanics 3 Units
Terms offered: Spring 2020, Spring 2018, Spring 2016
The goal of this course is to study the theories of structural mechanics within the framework of nonlinear continuum mechanics of solids. Finite elasticity; invariance. Energy principles: principles of virtual and complementary virtual work; primary and mixed variational principles. Theory of stability: Euler method; stability under follower loads. Classical theories of beams: planar, torsional, and lateral buckling. Plate theories. Invariant theories of structural mechanics: directed continua; Cosserat theories of rods.
Structural Mechanics: Read More [+]

Rules & Requirements
Prerequisites: 231 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/Graduate
Grading: Letter grade.
Instructor: Armero

Structural Mechanics: Read Less [-]

CIV ENG 233 Computational Mechanics 3 Units
Terms offered: Fall 2018, Fall 2016, Fall 2014
Computational Mechanics: Read More [+]

Rules & Requirements
Prerequisites: 222, 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/Graduate
Grading: Letter grade.
Instructor: Armero

Computational Mechanics: Read Less [-]
CIV ENG 234 Computational Inelasticity 3 Units
Terms offered: Spring 2011, Fall 2007, Fall 2005
Computational methods applied to inelastic deformations of solids; 1, 2, and 3-D large and small-deformation continuum plasticity and viscoelasticity models and their algorithmic approximations; viscoplastic regularizations and softening; thermodynamics and its relationship to algorithmic stability; return mappings, closest-point projections and operator splits; application to metals, soils, concrete, and polymers and incorporation into finite element codes.

Rules & Requirements
Prerequisites: 231 or Materials Science and Engineering 211 or Mechanical Engineering 185

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructors: Armero, Govindjee

Computational Inelasticity: Read More [+]

CIV ENG C235 Introduction to Statistical Mechanics for Engineers 3 Units
Terms offered: Spring 2020, Spring 2017, Fall 2013

Objectives & Outcomes
Course Objectives: To provide a modern introduction to the application of statistical mechanics for engineering with a particular emphasis on mechanical response.

Rules & Requirements
Prerequisites: CE C231 or MSE C211 or ME 185 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/Graduate
Grading: Letter grade.
Instructors: Govindjee, Papadopoulos

Also listed as: MEC ENG C279

Introduction to Statistical Mechanics for Engineers: Read Less [-]
CIV ENG C236 Micromechanics 3 Units
Terms offered: Spring 2018, Spring 2016, Spring 2014
Basic theories, analytical techniques, and mathematical foundations of micromechanics. It includes 1. physical micromechanics, such as mathematical theory of dislocation, and cohesive fracture models; 2. micro-elasticity that includes Eshelby's eigenstrain theory, comparison variational principles, and micro-crack/micro-cavity based damage theory; 3. theoretical composite material that includes the main methodologies in evaluating overall material properties; 4. meso-plasticity that includes meso-damage theory, and the crystal plasticity; 5. homogenization theory for materials with periodic structures.
Micromechanics: Read More [+]

Rules & Requirements
Prerequisites: 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/Graduate
Grading: Letter grade.
Instructors: Govindjee, Li
Also listed as: MAT SCI C214
Micromechanics: Read Less [-]

CIV ENG C237 Computational Nano-mechanics 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018, Spring 2017, Fall 2014
Basic mathematics foundations, physical models, computational formulations and algorithms that are used in nanoscale simulations and modelings. They include (1) cohesive finite element methods and discontinuous Galerkin methods; (2) meshfree methods, partition of unity methods, and the eXtended finite element methods (X-FEM); (3) quasicontinuum method; (4) molecular dynamics; (5) multiscale simulations; (6) Boltzmann method.
Computational Nano-mechanics: Read More [+]

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Li
Also listed as: NSE C237
Computational Nano-mechanics: Read Less [-]

CIV ENG 240 Civil Engineering Materials 3 Units
Terms offered: Fall 2018, Fall 2016, Fall 2015
Microstructures of concrete, wood, and steel. Differences and similarities in response to loading and environmental effects on these materials, with emphasis on strength, elastic properties, creep, shrinkage, thermal stresses, and failure mechanisms.
Civil Engineering Materials: Read More [+]

Rules & Requirements
Prerequisites: An undergraduate course in civil engineering materials

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/Graduate
Grading: Letter grade.
Instructors: Monteiro, Ostertag
Civil Engineering Materials: Read Less [-]

CIV ENG 241 Concrete Technology 3 Units
Terms offered: Spring 2019, Spring 2015, Spring 2013
Concrete Technology: Read More [+]

Rules & Requirements
Prerequisites: 165 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/Graduate
Grading: Letter grade.
Instructor: Monteiro
Concrete Technology: Read Less [-]
**CIV ENG 244 Reinforced Concrete Structures**

3 Units  
Terms offered: Fall 2019, Fall 2018, Fall 2017  
Analysis and design of reinforced concrete elements and systems that are common in building and bridge structures, with an emphasis on seismic response and design; structural design methods; reinforced concrete materials; confined concrete; line elements under axial, flexural, and shear loadings; bond, anchorage, and development; seismic design principles; earthquake-resistant building frames, walls, diaphragms, and foundations; earthquake-resistant bridges.  
Reinforced Concrete Structures: Read More [+]  
Rules & Requirements  
Prerequisites: Civil and Environmental Engineering 123

**CIV ENG 246 Prestressed Concrete Structures**

3 Units  
Terms offered: Spring 2020, Spring 2019, Spring 2018  
Behavior and design of statically determinate prestressed concrete structures under bending moment, shear, torsion and axial load effects. Design of continuous prestressed concrete beams, frames, slabs, and shells. Time-dependent effects and deflections of prestressed concrete structures. Applications to the design and construction of bridges and buildings.  
Prestressed Concrete Structures: Read More [+]  
Rules & Requirements  
Prerequisites: 244 or consent of instructor

**CIV ENG 245 Behavior of Reinforced Concrete**

3 Units  
Terms offered: Spring 2015, Spring 2013, Spring 2011  
Advanced topics in reinforced concrete construction, including inelastic flexural behavior; applications of plastic analysis to reinforced concrete frames; behavior in shear and torsion; yield-line analysis of slabs; behavior under cyclic and reversed loading; seismic rehabilitation.  
Behavior of Reinforced Concrete: Read More [+]  
Rules & Requirements  
Prerequisites: 123 and 220

**CIV ENG 247 Design of Steel and Composite Structures**

3 Units  
Terms offered: Spring 2020, Spring 2019, Spring 2018  
Design of Steel and Composite Structures: Read More [+]  
Rules & Requirements  
Prerequisites: 122 or equivalent

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**CIV ENG 244 Reinforced Concrete Structures**

3 Units  
Terms offered: Fall 2019, Fall 2018, Fall 2017  
Analysis and design of reinforced concrete elements and systems that are common in building and bridge structures, with an emphasis on seismic response and design; structural design methods; reinforced concrete materials; confined concrete; line elements under axial, flexural, and shear loadings; bond, anchorage, and development; seismic design principles; earthquake-resistant building frames, walls, diaphragms, and foundations; earthquake-resistant bridges.  
Reinforced Concrete Structures: Read More [+]  
Rules & Requirements  
Prerequisites: Civil and Environmental Engineering 123

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**CIV ENG 246 Prestressed Concrete Structures**

3 Units  
Terms offered: Spring 2020, Spring 2019, Spring 2018  
Behavior and design of statically determinate prestressed concrete structures under bending moment, shear, torsion and axial load effects. Design of continuous prestressed concrete beams, frames, slabs, and shells. Time-dependent effects and deflections of prestressed concrete structures. Applications to the design and construction of bridges and buildings.  
Prestressed Concrete Structures: Read More [+]  
Rules & Requirements  
Prerequisites: 244 or consent of instructor

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**CIV ENG 245 Behavior of Reinforced Concrete**

3 Units  
Terms offered: Spring 2015, Spring 2013, Spring 2011  
Advanced topics in reinforced concrete construction, including inelastic flexural behavior; applications of plastic analysis to reinforced concrete frames; behavior in shear and torsion; yield-line analysis of slabs; behavior under cyclic and reversed loading; seismic rehabilitation.  
Behavior of Reinforced Concrete: Read More [+]  
Rules & Requirements  
Prerequisites: 123 and 220

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**CIV ENG 247 Design of Steel and Composite Structures**

3 Units  
Terms offered: Spring 2020, Spring 2019, Spring 2018  
Design of Steel and Composite Structures: Read More [+]  
Rules & Requirements  
Prerequisites: 122 or equivalent
CIV ENG 248 Behavior and Plastic Design of Steel Structures 3 Units
Terms offered: Fall 2015, Fall 2012, Fall 2010
Topics related to inelastic behavior and plastic design of steel members and structures. Behavior of plastic hinge in members subjected to bending moment, axial force, shear, and their combinations. Collapse mechanisms of steel members and structures such as moment frames and braced systems. Inelastic cyclic behavior of steel components. Introduction to fracture and fatigue of steel components.

Behavior and Plastic Design of Steel Structures: Read More [+]

Rules & Requirements
Prerequisites: 122 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/Graduate
Grading: Letter grade.

Behavior and Plastic Design of Steel Structures: Read Less [-]

CIV ENG 249 Experimental Methods in Structural Engineering 3 Units
Terms offered: Fall 2019, Fall 2017, Fall 2015
This course covers the following topics: similitude laws, design of structural models, instrumentation and measurement techniques; use of computers to acquire data and control tests; pseudo-dynamic testing method; standard proof-testing for capacity assessment; non-destructive testing for condition assessment, and virtual experimentation. Upon completing this course, the students will be able to use experimental methods to investigate the behavior of a structure and to evaluate its condition.

Experimental Methods in Structural Engineering: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing 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/Graduate
Grading: Letter grade.
Instructor: Mosalam

Experimental Methods in Structural Engineering: Read Less [-]

CIV ENG C250N Transportation Policy and Planning 3 Units
Terms offered: Spring 2020, Fall 2018, Spring 2018
Policy issues in urban transportation planning; measuring the performance of transportation systems; the transportation policy formulation process; transportation finance, pricing, and subsidy issues; energy and air quality in transportation; specialized transportation for elderly and disabled people; innovations in transportation policy.

Transportation Policy and Planning: Read More [+]

Rules & Requirements
Prerequisites: 213 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/Graduate
Grading: Letter grade.

Also listed as: CY PLAN C217

Transportation Policy and Planning: Read Less [-]

CIV ENG 251 Operation of Transportation Facilities 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017

Operation of Transportation Facilities: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing 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/Graduate
Grading: Letter grade.
Instructors: Cassidy, Daganzo

Operation of Transportation Facilities: Read Less [-]
CIV ENG 252 Systems Analysis in Transportation 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Systems Analysis in Transportation: Read More [+]

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Hansen

CIV ENG 253 Intelligent Transportation Systems 3 Units
Terms offered: Spring 2019, Spring 2017, Fall 2015
The use of advanced surveillance, navigation, communication, and computer technology to monitor, analyze, and improve the performance of transportation systems. Enabling technologies. Application to monitoring, analysis, evaluation, and prediction of transportation system performance and behavior. Intervention strategies. Feasibility studies. Human factors and institutional issues. Case studies. In the laboratory, students carry out a term project under the supervision of an ITS researcher.
Intelligent Transportation Systems: Read More [+]

Rules & Requirements
Prerequisites: 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/Graduate
Grading: Letter grade.
Instructors: Sengupta, Skabardonis

CIV ENG 254 Transportation Economics 3 Units
Terms offered: Spring 2019, Spring 2010, Spring 2009
Transportation Economics: Read More [+]

Rules & Requirements
Prerequisites: 252 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/Graduate
Grading: Letter grade.
Instructors: Hansen, Kanafani

CIV ENG 255 Highway Traffic Operations 3 Units
Terms offered: Spring 2020, Spring 2018, Spring 2016
Operational planning and management of the highway transportation system. The highway system is presented as a set of operating environments with each having its unique analytical framework. Major topics to be covered include policy and institutional issues, selection of strategies and tactics, evaluation of objectives and measures of effectiveness.
Highway Traffic Operations: Read More [+]

Rules & Requirements
Prerequisites: 251 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/Graduate
Grading: Letter grade.
Instructor: Cassidy
CIV ENG 256 Transportation Sustainability 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
This multi-disciplinary course is intended to introduce students to the fundamentals of sustainable transportation, with an emphasis on: 1) current trends, climate and energy science, and the policy context; 2) methodological and analysis techniques; 3) vehicle technology, fuels, and intelligent transportation systems (ITS) solutions (supply side); and 4) land use, public transportation, and demand management.
Transportation Sustainability: Read More [+]

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Horvath

CIV ENG 258 Logistics 3 Units
Terms offered: Fall 2013, Fall 2011, Fall 2010
Vehicle routing. Transportation-inventory-production interrelationships, physical distribution networks, many-to-many networks (airlines, postal, etc.), the role of transshipments and terminals in logistic systems for the transportation of goods and passengers, public and private transportation system design. Relevant methodologies.
Logistics: Read More [+]

Rules & Requirements
Prerequisites: 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/Graduate
Grading: Letter grade.
Instructor: Shen

CIV ENG C258 Supply Chain and Logistics Management 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Supply chain analysis is the study of quantitative models that characterize various economic trade-offs in the supply chain. The field has made significant strides on both theoretical and practical fronts. On the theoretical front, supply chain analysis inspires new research ventures that blend operations research, game theory, and microeconomics. These ventures result in an unprecedented amalgamation of prescriptive, descriptive, and predictive models characteristic of each subfield. On the practical front, supply chain analysis offers solid foundations for strategic positioning, policy setting, and decision making.
Supply Chain and Logistics Management: Read More [+]

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.

CIV ENG 259 Public Transportation Systems 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Analysis of mass transit systems, their operation, and management. Technology of transit vehicles and structures. Public policy and financing.
Public Transportation Systems: Read More [+]

Rules & Requirements
Prerequisites: 251, 252, and 262 (or equivalent course)

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/Graduate
Grading: Letter grade.
Instructors: Cassidy, Daganzo

Public Transportation Systems: Read Less [-]
CIV ENG 260 Air Transportation 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Nature of civil aviation; structure of the airline industry; aircraft characteristics and performance; aircraft noise; navigation and air traffic control; airport planning and design; airline operations; aviation system planning.
Air Transportation: Read More [+]
Prerequisites: Graduate standing or consent of instructor

CIV ENG 261 Infrastructure Systems Management 3 Units
Terms offered: Spring 2014, Spring 2013, Spring 2011
Integrated treatment of quantitative and analytical methods for the management of infrastructure facilities over their life. The focus of the course is on statistical modeling and numerical optimization methods and their application to managing systems of civil infrastructure, with an emphasis on transportation facilities.
Infrastructure Systems Management: Read More [+]
Prerequisites: 252 or equivalent, 262 or equivalent

CIV ENG 262 Analysis of Transportation Data 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Probabilistic models in transportation. The use of field data. Data gathering techniques, sources of errors, considerations of sample size. Experiment design for demand forecasting and transportation operations analysis. Analysis techniques.
Analysis of Transportation Data: Read More [+]
Prerequisites: College calculus or consent of instructor

CIV ENG 263 Operations of Transportation Terminals 3 Units
Terms offered: Fall 2008, Spring 2007, Spring 2006
Characteristics of terminals on a mode by mode basis (sea ports, railyards, airports, parking lots, etc.). Methodologies used to study terminal operations and the management of congestion. (Chronographs, input-output diagrams, pricing, simulation). Studies illustrating the use of the methodologies for different modes.
Operations of Transportation Terminals: Read More [+]
Prerequisites: Graduate standing or consent of instructor
CIV ENG 263N Scalable Spatial Analytics 3 Units
Terms offered: Spring 2019, Fall 2016, Fall 2015
Introduction to modern methods of data analysis, spatial data handling and visualization technologies for engineers and data scientists. Theoretical coverage includes a selection of methods from spatial statistics, exploratory data analysis, spatial data mining, discriminative and generative approaches of machine learning. Projects and assignment tasks are targeted at real-world scalable implementation of systems and services based on data analytics in environmental remote sensing, transportation, energy, location-based services and the domain of “smart cities” in general.

Scalable Spatial Analytics: Read More [+]

Rules & Requirements
Prerequisites: Civil and Environmental Engineering 290I 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/Graduate
Grading: Letter grade.

Scalable Spatial Analytics: Read Less [-]

CIV ENG 264 Behavioral Modeling for Engineering, Planning, and Policy Analysis 3 Units
Terms offered: Spring 2020, Spring 2018, Spring 2017
Many aspects of engineering, planning, and policy involve a human element, be it consumers, businesses, governments, or other organizations. Effective design and management requires understanding this human response. This course focuses on behavioral theories and the use of quantitative methods to analyze human response. A mix of theory and practical tools are covered, with applications drawn from infrastructure investment and use, urban growth and design, health, and sustainability.

Behavioral Modeling for Engineering, Planning, and Policy Analysis: Read More [+]

Rules & Requirements
Prerequisites: 262 or City and Regional Planning 204 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/Graduate
Grading: Letter grade.
Instructor: Walker

Behavioral Modeling for Engineering, Planning, and Policy Analysis: Read Less [-]

CIV ENG C265 Traffic Safety and Injury Control 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
This course applies principles of engineering, behavioral science, and vision science to preventing traffic collisions and subsequent injury. A systematic approach to traffic safety will be presented in the course, and will include (1) human behavior, vehicle design, and roadway design as interacting approaches to preventing traffic crashes and (2) vehicle and roadway designs as approaches to preventing injury once a collision has occurred. Implications of intelligent transportation system concepts for traffic safety will be discussed throughout the course.

Traffic Safety and Injury Control: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing 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/Graduate
Grading: Letter grade.
Instructor: Ragland

Also listed as: PB HLTH C285
Traffic Safety and Injury Control: Read Less [-]

CIV ENG 268A Lean Construction Concepts and Methods 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Inspired by the “lean” resolution in manufacturing, production management concepts and methods are woven into a lean project delivery system. Key concepts include flow, value, variability, and waste. Key methods include prosecution system design, target costing, value stream mapping, and work flow control. Student teams apply concepts and methods in field studies of real project management processes and construction operations. The course includes a tour of the NUMMI Auto Plant in Fremont.

Lean Construction Concepts and Methods: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing in Civil and Environmental Engineering

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Tommelein
Formerly known as: 290M
Lean Construction Concepts and Methods: Read Less [-]
CIV ENG 268B Lean Construction and Supply Chain Management 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Principles and practices of "lean" production are applied to project delivery in the AEC industry. Case studies illustrate the concepts. Project delivery is viewed holistically with a focus on work structuring and supply chain management. Topics include systems dynamics, uncertainty, and variation; materials management; logistics; e-commerce; building information modeling (BIM); and integrated product and process design. Students use process simulation to assess performance of different system configurations and develop a case study applying concepts on a real project.
Lean Construction and Supply Chain Management: Read More [+]

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Tommelein
Formerly known as: 290N

Lean Construction and Supply Chain Management: Read Less [-]

CIV ENG 268D Law for Engineers 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Engineering involves many parties with diverse interests. Legal principles form the framework for their interaction. Contracts for engineering services establish both risk allocation and reciprocal liabilities. Issues of contract formation, performance, breach, and remedy are covered in detail. Standard of care and professional negligence are emphasized during the discussion of tort law. Other topics include regulation, legal relationships, litigation, and alternative dispute resolution.
Law for Engineers: Read More [+]

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Tommelein
Formerly known as: 290N

Law for Engineers: Read Less [-]

CIV ENG 268E Civil Systems and the Environment 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Methods and tools for economic and environmental analysis of civil engineering systems. Focus on construction, transportation, and operation, and maintenance of the built infrastructure. Life-cycle planning, design, costing, financing, and environmental assessment. Industrial ecology, design for environment, pollution prevention, external costs. Models and software tools for life-cycle economic and environmental inventory, impact, and improvement analysis of civil engineering systems.
Civil Systems and the Environment: Read More [+]

Rules & Requirements
Prerequisites: 166 or 167 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/Graduate
Grading: Letter grade.
Instructor: Horvath

Civil Systems and the Environment: Read Less [-]

CIV ENG 268H Advanced Project Planning and Control 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Cost and time estimating and controlling techniques for projects. Evaluation of labor, material, equipment, and subcontract resources, scheduling techniques, earned value concepts. Measuring project percent complete. Contractual risk allocation. Project investment analysis techniques.
Advanced Project Planning and Control: Read More [+]

Rules & Requirements
Prerequisites: 167

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Ibbbs

Advanced Project Planning and Control: Read Less [-]
CIV ENG 268I Business Fundamentals for Engineers 3 Units
Terms offered: Spring 2019, Spring 2017, Spring 2016
This course will provide a broad survey of management practices critical to starting and managing a business in the engineering and construction industries. Topics that are covered include the entrepreneurial process; organizing and staffing; establishing and applying production control systems; means of protecting products and services from competitive threat; and financial management.

Rules & Requirements
Prerequisites: 167 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/Graduate
Grading: Letter grade.
Instructor: Ibbs

Business Fundamentals for Engineers: Read More [+]

CIV ENG 268K Human and Organizational Factors: Quality and Reliability of Engineered Systems 3 Units
Terms offered: Spring 2011, Spring 2010, Fall 2009
This course addresses human and organizational factors in development of desirable quality and reliability in engineered systems during their life cycles (concept development through decommissioning). Applications tested and verified proactive, reactive, and interactive approaches are developed and illustrated.

Rules & Requirements
Prerequisites: Graduate standing

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Formerly known as: 290A

Human and Organizational Factors: Quality and Reliability of Engineered Systems: Read Less [-]

CIV ENG 268S Buildings and Sustainability 3 Units
Terms offered: Spring 2018
Overview of what makes buildings and their systems “green” and “sustainable,” and analysis throughout their life cycle (design, materials, construction, operation, maintenance, renovation, end of life) and in interaction with infrastructure systems (energy, transportation, water, waste management), the economy, natural environment, society, innovative approaches, expectations for future developments. Cost-benefit analysis. Life-cycle management. Net-zero buildings. Case studies.

Rules & Requirements
Prerequisites: Graduate or senior undergraduate standing with 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/Graduate
Grading: Letter grade.
Instructor: Horvath

Buildings and Sustainability: Read Less [-]
CIV ENG 270 Advanced Geomechanics 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Advanced treatment of topics in soil mechanics, including state of stress, consolidation and settlement analysis, shear strength of cohesionless and cohesive soils, and slope stability analysis.
Advanced Geomechanics: Read More [+]
Rules & Requirements
Prerequisites: 175 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/Graduate
Grading: Letter grade.
Instructors: Bray, Soga
Formerly known as: 270A
Advanced Geomechanics: Read Less [-]

CIV ENG 271 Sensors and Signal Interpretation 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
An introduction to the fundamentals of sensor usage and signal processing, and their application to civil systems. In particular, the course focuses on how basic classes of sensors work, and how to go about choosing the best of the new MEMS-based devices for an application. The interpretation of the data focuses on analysis of transient signals, an area typically ignored in traditional signal processing courses. Goals include development of a critical understanding of the assumptions used in common sensing and analysis methods and their implications, strengths, and limitations.
Sensors and Signal Interpretation: Read More [+]
Rules & Requirements
Prerequisites: Graduate standing 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/Graduate
Grading: Letter grade.
Instructor: Glaser

Sensors and Signal Interpretation: Read Less [-]

CIV ENG 272 Numerical Modelling in Geomechanics 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Constitutive laws for geotechnical materials including inelastic hyperbolic and elasto-plastic Cam-clay; soil behavior and critical-state soil mechanics; application of the finite element method to static analysis of earth structures; the Discontinuous Deformation Analysis method.
Numerical Modelling in Geomechanics: Read More [+]
Rules & Requirements
Prerequisites: Graduate standing 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/Graduate
Grading: Letter grade.
Instructors: Bray, Soga

Numerical Modelling in Geomechanics: Read Less [-]

CIV ENG 273 Advanced GeoEngineering Testing and Design 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Field and laboratory testing of soils to support analysis and design of earth structures. In situ field testing, including SPT, CPT, and vane shear, undisturbed sampling of soil, and laboratory testing of soil, including advanced equipment, instrumentation, data acquisition, and measurement techniques. Consolidation and static and cyclic triaxial and simple shear testing under stress- and strain-control with pore pressure measurements. Preparation of an engineering report.
Advanced GeoEngineering Testing and Design: Read More [+]
Rules & Requirements
Prerequisites: 270 or consent of instructor

Hours & Format
Fall and/or spring: 15 weeks - 1.5 hours of lecture and 3 hours of laboratory per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Bray

Formerly known as: 270L
Advanced GeoEngineering Testing and Design: Read Less [-]
CIV ENG 275 Geotechnical Earthquake Engineering 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Seismicity, influence of soil conditions on site response, seismic site response analysis, evaluation and modelling of dynamic soil properties, analysis of seismic soil-structure interaction, evaluation and mitigation of soil liquefaction and its consequences, seismic code provisions and practice, seismic earth pressures, seismic slope stability and deformation analysis, seismic safety of dams and embankments, seismic performance of pile foundations, and additional current topics.
Geotechnical Earthquake Engineering: Read More [+]

Rules & Requirements
Prerequisites: 175 or equivalent, 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/Graduate
Grading: Letter grade.
Instructor: Bray

Geotechnical Earthquake Engineering: Read Less [-]

CIV ENG C276 Seismic Hazard Analysis and Design Ground Motions 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018, Spring 2017
Deterministic and probabilistic approaches for seismic hazard analysis. Separation of uncertainty into aleatory variability and epistemic uncertainty. Discussion of seismic source and ground motion characterization and hazard computation. Development of time histories for dynamic analyses of structures and seismic risk computation, including selection of ground motion parameters for estimating structural response, development of fragility curves, and methods for risk calculations.
Seismic Hazard Analysis and Design Ground Motions: Read More [+]

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/Graduate
Grading: Letter grade.
Instructor: Abrahamson
Also listed as: EPS C276

Seismic Hazard Analysis and Design Ground Motions: Read Less [-]

CIV ENG 277 Advanced Foundation Engineering 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Advanced treatment of topics in foundation engineering, including earth pressure theories, design of earth retaining structures, bearing capacity, ground improvement for foundation support, analysis and design of shallow and deep foundations.
Advanced Foundation Engineering: Read More [+]

Rules & Requirements
Prerequisites: 270 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/Graduate
Grading: Letter grade.
Instructor: Bray
Formerly known as: 270B

Advanced Foundation Engineering: Read Less [-]

CIV ENG 281 Engineering Geology 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Influence of geologic origin and history on the engineering characteristics of soils and rocks. Application of geology in exploration, design, and construction of engineering works.
Engineering Geology: Read More [+]

Rules & Requirements
Prerequisites: A course in physical geology

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/Graduate
Grading: Letter grade.
Instructor: Sitar

Engineering Geology: Read Less [-]
CIV ENG 285C Seismic Methods in Applied Geophysics 3 Units
Terms offered: Spring 2011, Spring 2006, Spring 2002
This course gives an overview of seismic methods used to image the subsurface. Acquisition, processing, and interpretation of seismic data are discussed, with application to petroleum production, environmental site characterization, earthquake engineering, and groundwater.

Rules & Requirements
Prerequisites: C178 or equivalent (introductory course in applied geophysics); Engineering 7 or 77 or equivalent (introductory course in computer programming)
Credit Restrictions: Students will receive no credit for 285C after taking Mineral Engineering 236 before Fall 2001.

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Rector
Formerly known as: Mineral Engineering 236
Seismic Methods in Applied Geophysics: Read Less [-]

CIV ENG 286 Digital Data Processing 3 Units
Terms offered: Spring 2019, Spring 2017, Spring 2013

Rules & Requirements
Prerequisites: Consent of instructor
Credit Restrictions: Students will receive no credit for 286 after taking Mineral Engineering 240 taken before Fall 2001.

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Rector
Formerly known as: Mineral Engineering 240
Digital Data Processing: Read Less [-]

CIV ENG C289 Embedded System Design: Modeling, Analysis, and Synthesis 4 Units
Terms offered: Spring 2020, Spring 2019, Spring 2016
Principles of embedded system design. Focus on design methodologies and foundations. Platform-based design and communication-based design and their relationship with design time, re-use, and performance. Models of computation and their use in design capture, manipulation, verification, and synthesis. Mapping into architecture and systems platforms. Performance estimation. Scheduling and real-time requirements. Synchronous languages and time-triggered protocols to simplify the design process.

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 2 hours of laboratory per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Sangiovanni-Vincentelli
Formerly known as: Electrical Engineering C249/Civil and Environmental Engineering C289
Also listed as: EL ENG C249B
Embedded System Design: Modeling, Analysis, and Synthesis: Read Less [-]

CIV ENG 290 Advanced Special Topics in Civil and Environmental Engineering 1 - 3 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
This course covers current topics of interest in civil and environmental engineering. The course content may vary from semester to semester depending upon instructor.

Rules & Requirements
Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 1-3 hours of lecture per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Advanced Special Topics in Civil and Environmental Engineering: Read Less [-]
CIV ENG 290F Advanced Topics in Seismology 3 Units
Terms offered: Spring 2018, Spring 2016, Spring 2014
Active areas of research in applied seismology. Subjects include: anisotropic and viscoelastic wave propagation, borehole seismology, crosswell seismology, including crosswell seismic tomography, vertical seismic profiling, reservoir monitoring including passive seismic methods.
Advanced Topics in Seismology: Read More [+]
Rules & Requirements
Prerequisites: Introductory course in seismology; 286 or Mineral Engineering 240
Repeat rules: Course may be repeated for credit with instructor consent.
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Rector
Formerly known as: Mineral Engineering 290C
Advanced Topics in Seismology: Read Less [-]

CIV ENG 290I Civil Systems: Control and Information Management 3 Units
Terms offered: Fall 2019, Fall 2018, Spring 2018
Mathematical methods and information technologies for controlling CEE systems. Emphasizes designing component organizations that interact with the world in real-time to control a large system. Methods applied to transportation operations, supply chains, and structures. Management of design complexity by hierarchical specification, systematic use of simulation and verification tools, semantics, polymorphism, information management services, and compilation from high-level design languages. Civil Systems: Control and Information Management: Read More [+]
Rules & Requirements
Prerequisites: Graduate standing 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/Graduate
Grading: Letter grade.
Instructor: Sengupta
Civil Systems: Control and Information Management: Read Less [-]

CIV ENG 290J Advanced Topics in Geotechnical Engineering 3 Units
Advanced treatment of developing areas of geomechanics and geotechnical earthquake engineering, including the development of generalized nonlinear soil constitutive models, new developments in soil dynamics and geotechnical earthquake engineering, soil improvement, geosynthetics and earth structures, and case studies of geotechnical problems.
Advanced Topics in Geotechnical Engineering: Read More [+]
Rules & Requirements
Prerequisites: Advanced graduate standing in Geoengineering
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of seminar per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Bray
Advanced Topics in Geotechnical Engineering: Read Less [-]

CIV ENG 290T Advanced Topics in Transportation Theory 1 Unit
Terms offered: Fall 2008, Spring 2008, Fall 2007
Selected topics in the mathematical analysis of transportation systems. Topics will vary from year to year.
Advanced Topics in Transportation Theory: Read More [+]
Rules & Requirements
Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 1 hour of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Offered for satisfactory/unsatisfactory grade only.
Instructors: Cassidy, Daganzo
Advanced Topics in Transportation Theory: Read Less [-]
CIV ENG C290U Transportation and Land Use Planning 3 Units
Terms offered: Fall 2019, Spring 2019, Fall 2017
Examination of the interactions between transportation and land use systems; historical perspectives on transportation; characteristics of travel and demand estimation; evaluation of system performance; location theory; models of transportation and urban structure; empirical evidence of transportation-land use impacts; case study examinations.
Transportation and Land Use Planning: Read More [+]

Rules & Requirements
Prerequisites: 113A 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/Graduate
Grading: Letter grade.
Instructors: Chatman, Cervero
Also listed as: CY PLAN C213

CIV ENG 291F Control and Optimization of Distributed Parameters Systems 3 Units
Terms offered: Fall 2017, Spring 2016, Spring 2015, Spring 2014
Control and Optimization of Distributed Parameters Systems: Read More [+]

Rules & Requirements
Prerequisites: Engineering 77, Mathematics 54 (or equivalent), 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/Graduate
Grading: Letter grade.
Also listed as: EL ENG C291/MEC ENG C236

CIV ENG C291G Advanced Estimation, Control, and Optimization of Partial Differential Equations 3 Units
Terms offered: Prior to 2007
This course will cover advanced methods in estimation, control, and optimization of distributed parameter systems (partial differential equations in particular). The course builds on 291 and covers discrete methods relying on finite differencing such as quadratic programming for optimal control and variational data assimilation, (ensemble, extended) Kalman filtering. The course covers distributed transfer function analysis and frequency responses of PDEs, and characteristics-based stability analysis.
Advanced Estimation, Control, and Optimization of Partial Differential Equations: Read More [+]

Rules & Requirements
Prerequisites: Civil and Environmental Engineering C291F/Electrical Engineering C291/Mechanical Engineering C236 or equivalent, 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/Graduate
Grading: Letter grade.
Instructor: Bayen

CIV ENG 292A Technologies for Sustainable Societies 1 Unit
Terms offered: Fall 2018, Fall 2017, Fall 2016
Exploration of selected important technologies that serve major societal needs, such as shelter, water, food, energy, and transportation, and waste management. How specific technologies or technological systems do or do not contribute to a move toward sustainability. Specific topics vary from year to year according to student and faculty interests.
Technologies for Sustainable Societies: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing or consent of instructor
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 1.5 hours of seminar per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Offered for satisfactory/unsatisfactory grade only.
Instructors: Horvath, Nazaroff

Technologies for Sustainable Societies: Read Less [-]
CIV ENG 295 Energy Systems and Control 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Introduction to energy system management and the underlying control system tools. Applications of interest include batteries, electric vehicles, renewable energy, power systems, and smart buildings/homes. Technical tools include system modeling, state-space representations, stability, parameter identification, state observers, feedback control, and optimization.

Objectives & Outcomes
Course Objectives: This course provides an introduction to emerging smart energy systems and the associated fundamental concepts in control systems theory.

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Moura
Energy Systems and Control: Read More [+]

CIV ENG 297 Field Studies in Civil and Environmental Engineering 1 - 12 Units
Terms offered: Spring 2020, Fall 2019, Summer 2019 First 6 Week Session
Supervised experience in off-campus companies relevant to specific aspects and applications of civil and environmental engineering. Written report required at the end of the semester. Course does not satisfy unit or residence requirements for a master's or doctoral degree.

Objectives & Outcomes
Course Objectives: This course provides an introduction to emerging smart energy systems and the associated fundamental concepts in control systems theory.

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Letter grade.
Instructor: Moura
Energy Systems and Control: Read Less [-]

CIV ENG 298 Group Studies, Seminars, or Group Research 1 - 6 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
Advanced studies in various subjects through special seminars on annually selected topics, informal group studies of special problems, group participation in comprehensive design problems, or group research on complete problems for analysis and experimentation.

Objectives & Outcomes
Course Objectives: This course provides an introduction to emerging smart energy systems and the associated fundamental concepts in control systems theory.

Hours & Format
Fall and/or spring: 15 weeks - 1-2 hours of seminar per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Offered for satisfactory/unsatisfactory grade only.
Instructor: Moura
Group Studies, Seminars, or Group Research: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing
Repeat rules: Course may be repeated for credit without restriction.

CIV ENG 299 Individual Research 1 - 12 Units
Terms offered: Spring 2020, Fall 2019, Summer 2019 3 Week Session
Research or investigation in selected advanced subjects.

Objectives & Outcomes
Course Objectives: This course provides an introduction to emerging smart energy systems and the associated fundamental concepts in control systems theory.

Hours & Format
Fall and/or spring: 15 weeks - 3-36 hours of independent study per week
Summer: 8 weeks - 6-68 hours of independent study per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Offered for satisfactory/unsatisfactory grade only.
Instructor: Moura
Individual Research: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 3-36 hours of independent study per week
Summer: 8 weeks - 6-68 hours of independent study per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate
Grading: Offered for satisfactory/unsatisfactory grade only.
Instructor: Moura
Individual Research: Read More [+]

Rules & Requirements
Prerequisites: Graduate standing
Repeat rules: Course may be repeated for credit without restriction.

Field Studies in Civil and Environmental Engineering: Read Less [-]
CIV ENG 301 Workshop for Future Civil and Environmental Engineering Teachers 1 - 3 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
The course will include supervised teaching of laboratory sections of civil engineering courses, group analysis of videotapes, reciprocal classroom visitations, and an individual project.
Workshop for Future Civil and Environmental Engineering Teachers: Read More [+]
Rules & Requirements
Prerequisites: Teaching assistant or graduate student status
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 2 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Professional course for teachers or prospective teachers
Grading: Offered for satisfactory/unsatisfactory grade only.
Workshop for Future Civil and Environmental Engineering Teachers: Read Less [-]

CIV ENG 601 Individual Study for Master's Students 1 - 6 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
Individual study for the comprehensive or language requirements in consultation with the major field adviser. Units may not be used to meet either unit or residence requirements.
Individual Study for Master's Students: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 0 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
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate examination preparation
Grading: Offered for satisfactory/unsatisfactory grade only.
Individual Study for Master's Students: Read Less [-]

CIV ENG 602 Individual Study for Doctoral Students 1 - 6 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare for the various examinations required of candidates for doctoral degrees. May not be used for unit or residence requirements.
Individual Study for Doctoral Students: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 0 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
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Graduate examination preparation
Grading: Offered for satisfactory/unsatisfactory grade only.
Individual Study for Doctoral Students: Read Less [-]