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, and through research, seeks scientific and technological advances that address critical societal needs.

Libraries

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

The Water Resources Center Archives (http://wrca.library.ucr.edu) , 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://www.lib.berkeley.edu/ITSL) 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.

Research Laboratories

Located on Campus at the 2nd Floor of Davis Hall, the Structural and Materials Laboratory (http://www.ce.berkeley.edu/research/structures) houses equipment for studying the behavior of structural elements and systems both on scale models and prototypes. Our laboratory is based upon our base-isolated strong floor, to which the reaction frames, actuators, and specimens are securely fastened during the tests. Our testing facilities range from miniaturized precision equipment to a 4,000,000 (four-million) pound capacity testing machine.

The Construction Systems Laboratory is a state-of-the-art computer facility that serves both research and teaching functions. A mix of Windows and Macintosh personal computers are available for the exclusive use of students in the construction program. Access to campus and non-campus computing facilities is available through these units. For those students interested in construction materials, the department has excellent testing facilities in the Richmond Field Station, the Structural Engineering Materials Laboratory and the Geotechnical Engineering Laboratory.

Environmental Water Resources laboratories are predominately located in O'Brien Hall and are equipped for experimental work in general fluid mechanics, granular flow, water-sediment interactions, surface and groundwater hydrology, hydraulic structures, wave hydrodynamics, and sediment transport. Additional experimental facilities are available at the Richmond Field Station including flumes for estuary studies, a large model basin for studies of harbors, river restoration and related problems, wind-wave channels, and flumes for stratified flow and debris flow studies

Environmental Quality laboratories are located in Davis Hall and off campus. 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, 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 multi- disciplinary 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 inter-disciplinary Organized Research Unit of the University of California at Berkeley. The unit was created in 1950, in response to a state legislature mandate for research on water pollution and solid waste management. IESE serves as a bridge between basic research, often associated with an academic environment, and the more applied studies necessary for sound environmental management. IESE is thus very different from the typical university research unit, and equally distinct from industry, which is actually involved in design and construction. In this unique position, IESE is able to focus the expertise available throughout the University of California on environmental problems of current and future concern.

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 the University of California, 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 it 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/archive/2014-15/undergraduate/degree-programs/civil-engineering) : BS
Environmental Engineering (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/environmental-engineering) : Minor
GeoSystems (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/geosystems) : Minor
Structural Engineering (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/structural-engineering) : Minor

Graduate Programs

Civil and Environmental Engineering (http://guide.berkeley.edu/archive/2014-15/graduate/degree-programs/civil-environmental-engineering) : MEng, MS, PhD

Civil and Environmental Engineering

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

Prerequisites: Chemistry 1A, Mathematics 1A

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Harley, Horvath, Nelson

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Armero, Papadopoulos, Zohdi

Also listed as: MEC ENG C85

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

Course Objectives: To learn statics and mechanics of materials

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

Rules & Requirements

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

Hours & Format

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

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

Online: This is an online course.

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Govindjee, Sanjay

Also listed as: MEC ENG W85

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Monteiro, Ostertag

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

Prerequisites: Chemistry 1A (may be taken concurrently)

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Glaser, Sitar

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

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

Prerequisites: Engineering 7

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Der Kiureghian, Hansen, Madanat, Rubin

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

Prerequisites: Consent of instructor

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

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

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Chow, Stacey, Variano

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

Prerequisites: 100 or Mechanical Engineering 106 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Variano

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

Prerequisites: 93 and 100

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Thompson

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Chow, Stacey, Variano

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Goldstein

Also listed as: EPS C180/ESPM C180

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Nazaroff

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Alvarez-Cohen, Nazaroff, Nelson, Sedlak

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

Prerequisites: Civil Engineering 111 (may be taken concurrently)

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Alvarez-Cohen, Nazaroff, Nelson, Sedlak

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

Prerequisites: Civil and Environmental Engineering 100, 111

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Hermanowicz

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

Prerequisites: 111 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Nelson

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

Prerequisites: Chemistry 1A-1B

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Alvarez-Cohen

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Sedlak

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

Prerequisites: Civil Engineering 111 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Sposito

Also listed as: ESPM C128

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Moehle

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

Prerequisites: 120

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Filippou

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

Prerequisites: Civil and Environmental Engineering 122N

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Astaneh, Stojadinovic

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

Prerequisites: Civil and Environmental Engineering 120 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Astaneh, Stojadinovic

Formerly known as: Civil and Environmental Engineering 122

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

Prerequisites: Civil and Environmental Engineering 123N

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Mahin, Moehle, Mosalam, Panagiotou

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

Prerequisites: 120 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Mahin, Moehle, Mosalam, Panagiotou

Formerly known as: Civil and Environmental Engineering 123

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

Prerequisites: 120

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Mahin, Filippou

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

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Filippou, Govindjee, Li

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Also listed as: MEC ENG C180

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

Prerequisites: 60

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Ostertag

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

Prerequisites: 155

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Hansen

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

Prerequisites: Sophomore standing in engineering or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Cassidy, Daganzo, Hansen, Kanafani, Madanat

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Walker

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

Prerequisites: 60

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Monteiro

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

Prerequisites: Upper division standing, 167 recommended

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Horvath

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

Prerequisites: 93 (can be taken concurrently) or equivalent

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Ibbs, Tommelein

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Glaser

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

Prerequisites: Senior standing in engineering or science, 100 recommended

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Rubin, Sitar

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Bray, Pestana, Seed, Sitar

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Pestana, Sitar

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

Prerequisites: CE 175 required, CE 120 recommended

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Bray, Seed

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Rector

Also listed as: EPS C178

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

Prerequisites: Civil and Environmental Engineering 167

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Horvath

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

Prerequisites: 191

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Bayen, Glaser, Sengupta

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

Prerequisites: 93, Engineering 7 or 77

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Bayen, Madanat, Sengupta

Formerly known as: 152

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

Prerequisites: Senior standing in civil and environmental engineering

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

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

Prerequisites: Upper division standing

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Der Kiureghian

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

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

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

Prerequisites: Senior standing in engineering

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

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

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

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

CIV ENG 200A Environmental Fluid Mechanics 3 Units
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.
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 per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Graduate

Grading: Letter grade.

Instructors: Chow, Stacey

Formerly known as: 105

CIV ENG 200B Numerical Methods for Environmental Flow Modeling 3 Units
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.
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

Formerly known as: 204

CIV ENG 200C Transport and Mixing in the Environment 3 Units
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.
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

Formerly known as: 209A

CIV ENG 202A Vadose Zone Hydrology 3 Units
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.
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

CIV ENG 203A Graduate Hydrology 3 Units
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.
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: Thompson, Rubin

CIV ENG 203N Surface Water Hydrology 3 Units
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.
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

CIV ENG 205B Margins of Quality for Engineered Systems 3 Units
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 reliabiltity targets to be used in design, requalification, construction, operation, maintenance, and decommissioning of engineered systems.
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

CIV ENG 209 Design for Sustainable Communities 3 Units
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.
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: Gadgill

CIV ENG 210A Control of Water-Related Pathogens 3 Units
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.
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

CIV ENG 211A Environmental Physical-Chemical Processes 3 Units
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.
Rules & Requirements

Prerequisites: 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 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
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.
Rules & Requirements

Prerequisites: 111 or equivalent and course work in microbiology, 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: Alvarez-Cohen

CIV ENG 213 Watersheds and Water Quality 3 Units
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.
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

CIV ENG 217 Environmental Chemical Kinetics 3 Units
Kinetic aspects of chemical fate and transport in aquatic systems. Quantitative descriptions of the kinetics of intermedia transport and pollutant transformation by abiotic, photochemical, and biological reactions. Techniques for the estimation of environmental reaction rates. Development of models of pollutant behavior in complex natural systems.
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

CIV ENG 218A Air Quality Engineering 3 Units
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.
Rules & Requirements

Prerequisites: Graduate standing in engineering 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: Nazaroff, Harley

CIV ENG 218B Atmospheric Aerosols 3 Units
Nature, behavior and signifance of airborne particulate matter. Size distributions. Transport phenomena and deposition processes. Light scattering, visibility impairment, and climate consequences. Aerosol thermodynamics and kinetics of phase-change processes, including nucleation. Phase partitioning of semivolatile species. Coagulation. Atmospheric sources including primary and secondary particle formation. Loss mechanisms including wet and dry deposition. Technological controls.
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: Nazaroff

CIV ENG 218C Air Pollution Modeling 3 Units
Theory and practice of mathematical air quality modeling. Modeling atmospheric chemical transformation processes. Effects of uncertainty in model parameters on predictions. Review of atmospheric diffusion theory and boundary layer meteorology. Dispersion modeling. Combining chemistry and transport.
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

CIV ENG 220 Structural Analysis Theory and Applications 3 Units
Theory and applications of modern structural analysis. Direct stiffness method. Matrix formulations. Virtual work principles. Numerical solution methods. Modeling and practical analysis of large frame structures. Elastoplastic analysis of frames. P-delta effects.
Rules & Requirements

Prerequisites: 121 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: Filippou

CIV ENG 221 Nonlinear Structural Analysis 3 Units
Theory, modeling, and computation for analysis of structures with material and geometric nonlinearities. Sources of nonlinearity. Solution strategies for static and dynamic loads. Modeling of inelastic materials and members. P-delta and large deformation theory. Analysis of stability. Practical applications.
Rules & Requirements

Prerequisites: 220

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

CIV ENG 222 Finite Element Methods 3 Units
Approximation theory for analysis of deformation and stress in solids. Finite element formulations for frame, plane stress/strain, axisymmetric, torsion, and three-dimensional elastic problems. The isoparametric formulation and implementation. Plate and shell elements. Finite element modeling of structural systems.
Rules & Requirements

Prerequisites: 220 or equivalent, 131 or 231

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: Filippou, Govindjee

CIV ENG 223 Earthquake Protective Systems 3 Units
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.
Rules & Requirements

Prerequisites: 220, 225, or consent of instructor

Credit Restrictions: Students will receive no credit for 223 after taking 290D.

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: Mahin, Panagiotou

Formerly known as: 290D

CIV ENG W224A Introduction to Earthquake Engineering 3 Units
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.
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

CIV ENG W224B Linear Analysis of Structural and Geotechnical Systems 3 Units
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.
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

CIV ENG W224C Earthquake Geotechnical Engineering 3 Units
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.
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

CIV ENG W224D Nonlinear Analysis of Structural and Geotechnical Systems 3 Units
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.

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

CIV ENG W224E Earthquake Resistant Design 2 Units
Design of structures to resist earthquakes excitations. Characterization of earthquakes for design. Development of design criteria for elastic and inelastic structural response. Seismic performance of various structural systems. Prediction of nonlinear seismic behavior. Basis for code design procedures. Preliminary design of steel and reinforced concrete structures. Evaluation of earthquake vulnerability of existing structures and rehabilitation of seismic deficiencies.

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

CIV ENG W224F Risk Analysis and Decision Making 2 Units
Risk analysis and seismic policy issues for pre-event planning and post-event recovery: Topics will include national and local policies governing seismic safety, risk modeling, resilience metrics and lessons from policy and planning before and after recent major events in Japan, New Zealand, Italy, China, Haiti, Chile, and others.
Objectives & Outcomes

Course Objectives: The goal of this course is to expose students to risk and decision-making aspects that influence planning for earthquakes and post-earthquake recovery. The modules consist of a series of real-world case studies that reveal policies that govern seismic safety, models for risk assessment, and community resilience. A unique objective of this course is to expose students to aspects of earthquake engineering that are outside the usual realm of engineering and reside instead in areas of public policy, economics, and decision-making.

Rules & Requirements

Prerequisites: Civil and Environmental Engineering W224A

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: Comerio, Moehle

CIV ENG W224G Earthquake Resistant Concrete Structures 2 Units
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.
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
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
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
Dynamic response of foundations, design of foundations to resist seismic loading, influence of liquefaction on deep foundations, soil-structure interaction.
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

CIV ENG W224J Performance-Based Earthquake Engineering 2 Units
Fundamentals and evolution of Performance-Based Earthquake Engineering (PBEE). Probalilistic 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.
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

CIV ENG 225 Dynamics of Structures 3 Units
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.
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: Chopra

CIV ENG 226 Stochastic Structural Dynamics 3 Units
Introduction to the theory of probability and random processes. Correlation and power spectral density functions. Stochastic dynamic analysis of single- and multi-degree-of-freedom structures subjected to stationary and non-stationary random excitations. Time- and frequency-domain analyses; modal cross-correlations. Response to multi-support excitations. Level crossings, envelope process, first-excursion probability, and distributions of peaks and extremes. Introduction to nonlinear stochastic dynamic analysis. Applications in earthquake, wind, and ocean engineering.
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.

Instructor: Der Kiureghian

CIV ENG 227 Earthquake-Resistant Design 3 Units
Design of structures to resist earthquakes and other dynamic excitations. Characterization of earthquakes for design. Development of design criteria for elastic and inelastic structural response. Seismic performance of various structural systems. Prediction of nonlinear seismic behavior. Basis for code design procedures. Preliminary design of steel and reinforced concrete structures. Evaluation of earthquake vulnerability of existing structures and rehabilitation of seismic deficiencies.
Rules & Requirements

Prerequisites: 220 and 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.

Instructors: Mahin, Moehle

CIV ENG 228 Advanced Earthquake Analysis 3 Units
Advanced topics in time-domain dynamic analysis of structures. Frequency-domain analysis of dynamic response; discrete Fourier transform methods. Earthquake analysis of structures including structural-foundation-soil interaction, and of structures interacting with fluids.
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.

Instructor: Chopra

CIV ENG 229 Structural System Reliability 3 Units
Review of probability theory. Multivariate distribution models. Review of classical methods for characterization of systems and assessment of system reliability. Formulation of structural reliability for components and systems. Exact solutions for special cases. Computational reliability methods, including first- and second-order reliability methods (FORM and SORM), response surface, Monte Carlo simulation, and importance sampling. Bounds on system reliability. Reliability sensitivity and importance measures. Bayesian updating and reliability analysis under statistical and model uncertainties. Introductions to reliability-based optimal design, time- and space-variant reliability analysis, and finite-element reliability methods.
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.

Instructor: Der Kiureghian

CIV ENG C231 Mechanics of Solids 3 Units
Mechanical response of materials: Simple tension in elastic, plastic and viscoelastic members. Continuum mechanics: The stress and strain tensors, equilibrium, compatibility. Three-dimensional elastic, plastic and viscoelastic problems. Thermal, transformation, and dealloying stresses. Applications: Plane problems, stress concentrations at defects, metal forming problems.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Credit Restrictions: Students will receive no credit for 231 after taking 231A or 231B prior to Fall 1992.

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

CIV ENG 232 Structural Mechanics 3 Units
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.
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

CIV ENG 233 Computational Mechanics 3 Units
Computational methods for solution of problems in structural mechanics. Finite-element methods for displacement and mixed variational solutions of problems in elasticity and inelasticity. Treatment of constraints arising from near incompressibility in solids, transverse shear effects in beams, plates, and shells, and/or contact between structures. Programming methods for finite-element implementations.
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

CIV ENG 234 Computational Inelasticity 3 Units
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

CIV ENG C235 Statistical Mechanics of Elasticity 3 Units
Introduction to statistical mechanics for engineers interested in the constitutive behavior of matter with a particular interest in continua. Systems of interest will be polymers and crystalline solids. Coverage includes introduction to statistical mechanics, ensembles, phase spaces, partitions functions, free energy, polymer chain statistics, polymer networks, harmonic and quasi-harmonic crystalline solids, limitations of classical methods and quantum mechanical influences.
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

CIV ENG C236 Micromechanics 3 Units
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.
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

CIV ENG C237 Computational Nano-mechanics 3 Units
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.
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

CIV ENG 240 Civil Engineering Materials 3 Units
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.
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

CIV ENG 241 Concrete Technology 3 Units
Properties of fresh and hardened concrete; strength, elastic behavior, creep, shrinkage, and durability to chemical and physical attacks. New concrete-making materials. Recent advancements in concrete technology: high-strength, high-workability, and high-performance concrete; fiber-reinforced concrete, and roller-compacted concrete.
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

CIV ENG 244 Reinforced Concrete Structures 3 Units
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.
Rules & Requirements

Prerequisites: 123

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: Moehle

CIV ENG 245 Behavior of Reinforced Concrete 3 Units
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.
Rules & Requirements

Prerequisites: 123 and 220

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: Moehle

CIV ENG 246 Prestressed Concrete Structures 3 Units
Behavior and design of statically determinate prestressed concrete structures under bending moment, shear, torsion and axial load effects. Design of continous 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.
Rules & Requirements

Prerequisites: 244 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: Filippou, Moehle

CIV ENG 247 Design of Steel and Composite Structures 3 Units
Behavior and design of steel plate girders and shear walls. Design of bracings for stability. Design of members subjected to torsion. Design of composite beams, columns, and beam-columns. Behavior and design of shear, semi-rigid and moment connections. Concepts used in design of gusset plates and base plates. Selection and design of steel and composite systems.
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.

Instructors: Astaneh, Mahin

CIV ENG 248 Behavior and Plastic Design of Steel Structures 3 Units
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.
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.

Instructors: Astaneh, Mahin, Stojadinovic

CIV ENG 249 Experimental Methods in Structural Engineering 3 Units
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.
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.

Instructors: Stojadinovic, Mahin

CIV ENG C250N Transportation Policy and Planning 3 Units
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.
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

CIV ENG 251 Operation of Transportation Facilities 3 Units
The management of vehicle flows and fleets. Traffic stream properties and their measurement. Theories of traffic flow. Capacity analysis and queueing. Flow control and fleet scheduling.
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

CIV ENG 252 Systems Analysis in Transportation 3 Units
The systems approach and its application to transportation planning and engineering. Prediction of flows and level of service. Production functions and cost minimization. Utility theory and demand modeling. Transportation network analysis and equilibrium assignment. Decision analysis and evaluation of transportation projects.
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: Madanat

CIV ENG 253 Intelligent Transportation Systems 3 Units
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.
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
Application of micro- and macro-economic concepts to transportation systems. Urban and interregional travel demand analysis. Freight demand. Project and program evaluation. Social welfare theory. Analysis of social cost. Investment analysis and pricing theory. Economic impact analysis. Role of economic analysis in decision making.
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
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.
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
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.
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
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.
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: Daganzo

CIV ENG C258 Supply Chain and Logistics Management 3 Units
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.
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

Also listed as: IND ENG C253

CIV ENG 259 Public Transportation Systems 3 Units
Analysis of mass transit systems, their operation, and management. Technology of transit vehicles and structures. Public policy and financing.
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, Madanat

CIV ENG 260 Air Transportation 3 Units
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.
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: Hansen, Kanafani

CIV ENG 261 Infrastructure Systems Management 3 Units
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.
Rules & Requirements

Prerequisites: 252 or equivalent, 262 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: Madanat

CIV ENG 262 Analysis of Transportation Data 3 Units
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.
Rules & Requirements

Prerequisites: College calculus or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Graduate

Grading: Letter grade.

Instructors: Daganzo, Hansen, Madanat

CIV ENG 263 Operations of Transportation Terminals 3 Units
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.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Graduate

Grading: Letter grade.

Instructor: Daganzo

CIV ENG 263N Scalable Spatial Analytics 3 Units
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
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 290I 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: Pozdnukhov

CIV ENG 264 Behavioral Modeling for Engineering, Planning, and Policy Analysis 3 Units
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.
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

CIV ENG C265 Traffic Safety and Injury Control 3 Units
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 occured. Implications of intelligent transportation system concepts for traffic safety will be discussed throughout the course.
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

CIV ENG 268A Lean Construction Concepts and Methods 3 Units
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 proecution 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.
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: Ballard

Formerly known as: 290M

CIV ENG 268B Lean Construction and Supply Chain Management 3 Units
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.
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

CIV ENG 268D Law for Engineers 3 Units
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.
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: 290L

CIV ENG 268E Civil Systems and the Environment 3 Units
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.
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

CIV ENG 268H Advanced Project Planning and Control 3 Units
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.
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: Ibbs

CIV ENG 268I Business Fundamentals for Engineers 3 Units
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

CIV ENG 268K Human and Organizational Factors: Quality and Reliability of Engineered Systems 3 Units
This course addresses human and organizational factors in development of desirable quality and reliabiltiy in engineered systems during their life-cyles (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.

Instructor: Bea

Formerly known as: 290A

CIV ENG 270 Advanced Geomechanics 3 Units
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.
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, Pestana, Seed

Formerly known as: 270A

CIV ENG 271 Sensors and Signal Interpretation 3 Units
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.
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

CIV ENG 272 Numerical Modelling in Geomechanics 3 Units
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.
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: Bray, Pestana

CIV ENG 273 Advanced GeoEngineering Testing and Design 3 Units
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.
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.

Instructors: Bray, Pestana, Seed

Formerly known as: 270L

CIV ENG 275 Geotechnical Earthquake Engineering 3 Units
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.
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.

Instructors: Bray, Seed

CIV ENG C276 Seismic Hazard Analysis and Design Ground Motions 3 Units
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.
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: Abrahamson

Also listed as: EPS C276

CIV ENG 277 Advanced Foundation Engineering 3 Units
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.
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.

Instructors: Bray, Pestana, Seed

Formerly known as: 270B

CIV ENG 281 Engineering Geology 3 Units
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.
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

CIV ENG 285C Seismic Methods in Applied Geophysics 3 Units
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

CIV ENG 286 Digital Data Processing 3 Units
Considerations for digital signal processing and data analysis. Fourier Transforms, convolution and correlation. Discrete linear systems, Z tranforms. Digital processing of seismic reflection data, deconvolution and migration. Introduction to 3-D seismic data.
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

CIV ENG C289 Embedded System Design: Modeling, Analysis, and Synthesis 4 Units
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

CIV ENG 290 Advanced Special Topics in Civil and Environmental Engineering 1 - 3 Units
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. Course may be repeated for credit when topic changes.

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.

CIV ENG 290F Advanced Topics in Seismology 3 Units
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.
Rules & Requirements

Prerequisites: Introductory course in seismology; 286 or Mineral Engineering 240

Repeat rules: Course may be repeated for credit with consent of instructor. 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: Rector

Formerly known as: Mineral Engineering 290C

CIV ENG 290I Civil Systems: Control and Information Management 3 Units
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.
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

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.
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.

Instructors: Bray, Pestana, Seed

CIV ENG 290T Advanced Topics in Transportation Theory 1 Unit
Selected topics in the mathematical analysis of transportation systems. Topics will vary from year to year.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

Fall and/or spring: 15 weeks - 1 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

CIV ENG C290U Transportation and Land Use Planning 3 Units
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.
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 291G Advanced Estimation, Control, and Optimization of Partial Differential Equations 3 Units
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.
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 C291F Control and Optimization of Distributed Parameters Systems 3 Units
Distributed systems and PDE models of physical phenomena (propagation of waves, network traffic, water distribution, fluid mechanics, electromagnetism, blood vessels, beams, road pavement, structures, etc.). Fundamental solution methods for PDEs: separation of variables, self-similar solutions, characteristics, numerical methods, spectral methods. Stability analysis. Adjoint-based optimization. Lyapunov stabilization. Differential flatness. Viability control. Hamilton-Jacobi-based control.
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 292A Technologies for Sustainable Societies 1 Unit
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.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

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

Hours & Format

Fall and/or spring: 15 weeks - 1.5 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

CIV ENG 295 Energy Systems and Control 3 Units
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

CIV ENG 297 Field Studies in Civil and Environmental Engineering 1 - 12 Units
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.
Rules & Requirements

Prerequisites: Graduate standing

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

Hours & Format

Fall and/or spring: 15 weeks - 1-12 hours of fieldwork per week

Summer:
6 weeks - 2.5-30 hours of fieldwork per week
8 weeks - 1.5-22.5 hours of fieldwork per week
10 weeks - 1.5-18 hours of fieldwork per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

CIV ENG 298 Group Studies, Seminars, or Group Research 1 - 6 Units
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.
Rules & Requirements

Prerequisites: Graduate standing

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

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

CIV ENG 299 Individual Research 1 - 12 Units
Research or investigation in selected advanced subjects.
Rules & Requirements

Prerequisites: Graduate standing

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

Hours & Format

Fall and/or spring: 15 weeks - 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.

CIV ENG 301 Workshop for Future Civil and Environmental Engineering Teachers 1 - 3 Units
The course will include supervised teaching of laboratory sections of civil engineering courses, group analysis of videotapes, reciprocal classroom visitations, and an individual project.
Rules & Requirements

Prerequisites: Teaching assistant or graduate student status

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

Hours & Format

Fall and/or spring: 15 weeks - 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.

CIV ENG 601 Individual Study for Master's Students 1 - 6 Units
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.
Rules & Requirements

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

Hours & Format

Fall and/or spring: 15 weeks - 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.

CIV ENG 602 Individual Study for Doctoral Students 1 - 6 Units
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.

Rules & Requirements

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

Hours & Format

Fall and/or spring: 15 weeks - 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.