

# Civil and Environmental Engineering (CIV ENG)

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## Courses

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

Terms offered: Fall 2024, Spring 2024, Fall 2023

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

Engineered Systems and Sustainability: Read More [+]

#### Rules & Requirements

**Prerequisites:** CHEM 1A and MATH 1A

#### Hours & Format

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

**Summer:** 8 weeks - 6 hours of lecture per week

#### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/  
Undergraduate

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

**Instructors:** Harley, Horvath, Nelson

Engineered Systems and Sustainability: Read Less [-]

### CIV ENG 24 Freshman Seminars 1 Unit

Terms offered: Spring 2020, Fall 2019, Spring 2019

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

Freshman Seminars: Read More [+]

#### Rules & Requirements

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

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

Freshman Seminars: Read Less [-]

## CIV ENG C30 Introduction to Solid Mechanics 3 Units

Terms offered: Fall 2024, Spring 2024, Fall 2023

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.

Introduction to Solid Mechanics: Read More [+]

### Rules & Requirements

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

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

### Hours & Format

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

### Summer:

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Armero, Papadopoulos, Zohdi, Johnson

**Also listed as:** MEC ENG C85

Introduction to Solid Mechanics: Read Less [-]

## CIV ENG W30 Introduction to Solid Mechanics 3 Units

Terms offered: Summer 2021 8 Week Session, Summer 2020 8 Week Session, Summer 2019 8 Week Session

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.

Introduction to Solid Mechanics: Read More [+]

### Objectives & Outcomes

**Course Objectives:** To learn statics and mechanics of materials

### Student Learning Outcomes: -

Correctly draw free-body

-

Apply the equations of equilibrium to two and three-dimensional solids

-

Understand the concepts of stress and strain

-

Ability to calculate deflections in engineered systems

-

Solve simple boundary value problems in linear elastostatics (tension, torsion, beam bending)

### Rules & Requirements

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

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

### Hours & Format

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

### Summer:

6 weeks - 7.5 hours of web-based lecture and 2.5 hours of web-based discussion per week

8 weeks - 6 hours of web-based lecture and 2 hours of web-based discussion per week

10 weeks - 4.5 hours of web-based lecture and 1.5 hours of web-based discussion per week

**Online:** This is an online course.

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Govindjee

**Also listed as:** MEC ENG W85

Introduction to Solid Mechanics: Read Less [-]

## CIV ENG 60 Structure and Properties of Civil Engineering Materials 3 Units

Terms offered: Fall 2024, Spring 2024, Fall 2023

Introduction to structure and properties of civil engineering materials such as asphalt, cements, concrete, geological materials (e.g. soil and rocks), steel, polymers, and wood. The properties range from elastic, plastic and fracture properties to porosity and thermal and environmental responses. Laboratory tests include evaluation of behavior of these materials under a wide range of conditions.

Structure and Properties of Civil Engineering Materials: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/  
Undergraduate

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

**Instructors:** Monteiro, Ostertag

Structure and Properties of Civil Engineering Materials: Read Less [-]

## CIV ENG 70 Engineering Geology 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Principles of physical and structural geology; the influence of geological factors on engineering works and the environment. Field trip.

Engineering Geology: Read More [+]

### Rules & Requirements

**Prerequisites:** CHEM 1A (may be taken concurrently)

### Hours & Format

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

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/  
Undergraduate

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

**Instructors:** Glaser, Sitar

Engineering Geology: Read Less [-]

## CIV ENG 88B Time Series Analysis: Sea Level Rise and Coastal Flooding 2 Units

Terms offered: Spring 2017

In this course, we will pursue analysis of long-term records of coastal water levels in the context of sea level rise. We will cover the collection, evaluation, visualization and analysis of time series data using long-term records of sea levels from coastal sites around the world. Specific topics will include extreme events and distributions, frequency-based descriptions, averaging, filtering, harmonic analysis, trend identification, extrapolations, and decision-making under uncertainty.

Time Series Analysis: Sea Level Rise and Coastal Flooding: Read More [+]

### Rules & Requirements

**Prerequisites:** Concurrent or prior enrollment in Foundations of Data Science (COMPSCI C8 / INFO C8 / STAT C8) and MATH 1A

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/  
Undergraduate

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

**Instructor:** Stacey

Time Series Analysis: Sea Level Rise and Coastal Flooding: Read Less [-]

## CIV ENG C88 Data Science for Smart Cities 2 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Cities become more dependent on the data flows that connect infrastructures between themselves, and users to infrastructures.

Design and operation of smart, efficient, and resilient cities nowadays require data science skills. This course provides an introduction to working with data generated within transportation systems, power grids, communication networks, as well as collected via crowd-sensing and remote sensing technologies, to build demand- and supply-side urban services based on data analytics.

Data Science for Smart Cities: Read More [+]

### Objectives & Outcomes

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

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

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

Foster critical thinking about real-world actionability from analytics.

Learn how to use data science techniques in urban decision-making and scenario generation.

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

Gain the ability to solve problems in smart city research and practice.

Think critically about how to assess analytics for cities.

Use data analytics in the smart city domain.

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Gonzalez

**Formerly known as:** Civil and Environmental Engineering 88

**Also listed as:** CY PLAN C88

Data Science for Smart Cities: Read Less [-]

## CIV ENG 92 Introduction to Civil and Environmental Engineering 1 Unit

Terms offered: Fall 2019, Fall 2018, Fall 2017

A course designed to familiarize the entering student with the nature and scope of civil and environmental engineering and its component specialty areas.

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

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

## CIV ENG 92A Design for Future Infrastructure Systems 2 Units

Terms offered: Spring 2022, Fall 2020

Hands-on engineering design experience for creating future infrastructure systems. Intelligent infrastructure systems leverage data and computational to enhance sustainability and resilience for smart cities of the future. Student teams identify a challenge with current transportation, energy, water, waste, and/or the built infrastructure. Student teams design and prototype an innovation that solves this problem using maker resources, e.g. 3D printing, laser cutters, and open-source electronics. The project will be executing via the "Design Sprint" process, which is popular in agile development and Silicon Valley. Students present projects to guest judges from industry. Course is an introductory design experience for first-year students.

Design for Future Infrastructure Systems: Read More [+]

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Alternative to final exam.

**Instructor:** Moura

Design for Future Infrastructure Systems: Read Less [-]

## CIV ENG 92B Cornerstone Structural Design 2 Units

Terms offered: Fall 2024, Fall 2023, Spring 2023

This course introduces students to conceptual structural design, fabrication, and testing. The course aims to provide a hands-on structural engineering design experience and to inspire creativity. Students will learn the design process as well as fundamental principles of structural analysis. Student teams will be given a design challenge with performance objectives and practical constraints that emphasize sustainable design practices. Student teams will use maker space resources (e.g. 3D printing, laser cutting, CNC router, woodshop) to fabricate their structures, which will be tested to failure in the Structural Engineering Lab in Davis Hall.

Cornerstone Structural Design: Read More [+]

### Objectives & Outcomes

#### Student Learning Outcomes: -

Explain basic concepts of statics and equilibrium.

### 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. Alternative to final exam.

**Instructor:** DeJong

Cornerstone Structural Design: Read Less [-]

## CIV ENG 93 Engineering Data Analysis 3 Units

Terms offered: Fall 2024, Spring 2024, Fall 2023

Application of the concepts and methods of probability theory and statistical inference to CEE problems and data; graphical data analysis and sampling; elements of set theory; elements of probability theory; random variables and expectation; simulation; statistical inference. Use of computer programming languages for analysis of CEE-related data and problems. The course also introduces the student to various domains of uncertainty analysis in CEE.

Engineering Data Analysis: Read More [+]

### Rules & Requirements

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

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

### Hours & Format

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

**Summer:** 6 weeks - 7.5 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.

**Instructors:** Hansen, Rubin, Walker

Engineering Data Analysis: Read Less [-]

## CIV ENG 98 Supervised Group Study and Research 1 - 3 Units

Terms offered: Spring 2024, Fall 2023, Spring 2023

Supervised group study and research by lower division students.

Supervised Group Study and Research: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

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

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/  
Undergraduate

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

Supervised Group Study and Research: Read Less [-]

## CIV ENG 99 Supervised Independent Study and Research 1 - 4 Units

Terms offered: Spring 2024, Spring 2023, Fall 2022

Supervised independent study by lower division students.

Supervised Independent Study and Research: Read More [+]

### Rules & Requirements

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

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/  
Undergraduate

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

Supervised Independent Study and Research: Read Less [-]

## CIV ENG 100 Elementary Fluid Mechanics 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

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

Elementary Fluid Mechanics: Read More [+]

### Rules & Requirements

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

### Hours & Format

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

**Summer:** 8 weeks - 6 hours of lecture and 3 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/  
Undergraduate

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

**Instructors:** Chow, Stacey, Variano

Elementary Fluid Mechanics: Read Less [-]

## CIV ENG C103N Terrestrial Hydrology 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

A quantitative introduction to the hydrology of the terrestrial environment including lower atmosphere, watersheds, lakes, and streams. All aspects of the hydrologic cycle, including precipitation, infiltration, evapotranspiration, overland flow, streamflow, and groundwater flow. Chemistry and dating of groundwater and surface water. Development of quantitative insights through problem solving and use of simple models. This course requires one field experiment and several group computer lab assignments.

Terrestrial Hydrology: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** CHEM 1A, MATH 1A, MATH 1B, and PHYSICS 7A; or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Larsen

**Also listed as:** ESPM C130/GEOG C136

Terrestrial Hydrology: [Read Less](#) [-]

## CIV ENG 104 Planetary Boundaries and the Anthropocene 1 Unit

Terms offered: Fall 2022, Fall 2021, Spring 1998

This course aims to introduce students to the debates and discussions about the impact of increasing human resource consumption, increasing population, and increasing human prosperity on the planet's environmental systems that support human societies.

Planetary Boundaries and the Anthropocene: [Read More](#) [+]

### Objectives & Outcomes

**Course Objectives:** Explain the major arguments on the sides of "planetary boundaries" and "cornucopia"  
Understand the basic system dynamics view of planetary systems  
Understand the main features of several of planetary boundaries that have scientific consensus

### Rules & Requirements

**Prerequisites:** Upper division undergraduate standing

**Credit Restrictions:** Students will receive no credit for CIV ENG 104 after completing CIV ENG 104. A deficient grade in CIV ENG 104 may be removed by taking CIV ENG 104.

### 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:** Letter grade. Alternative to final exam.

**Instructors:** Chow , Gadgil

Planetary Boundaries and the Anthropocene: [Read Less](#) [-]



## CIV ENG 105 Design for Global Transformation 3 Units

Terms offered: Spring 2024, Spring 2022, Spring 2021

Student teams will design strategies to address critical global challenges, such as climate change, biodiversity loss, pollution, and related issues, with the potential for transformational change. Project topics will vary. Students will explore global to local scales using principles and practices from design science, systems thinking, regenerative design, circular economy, environmental justice, science communication, data visualization, and numerical modeling, among other disciplines.

Design for Global Transformation: Read More [+]

### Objectives & Outcomes

**Course Objectives:** Create a multi-media exhibit to clearly communicate your findings and strategy

Iteratively design a comprehensive strategy to address your team's global challenge

To gain familiarity with relevant design and engineering tools, including data visualization and simulation and modeling

Work strategically and collaboratively with fellow students in a design team

### Rules & Requirements

**Prerequisites:** At least one of the following courses: CIV ENG C103N / ESPM C130 / GEOG C136, CIV ENG 111, CIV ENG 120, CIV ENG 155, CIV ENG 175, or CIV ENG 191; or instructor's permission

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Chow

Design for Global Transformation: Read Less [-]

## CIV ENG C106 Air Pollution 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

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.

Air Pollution: Read More [+]

### Rules & Requirements

**Prerequisites:** CHEM 1A, CHEM 1B, and PHYSICS 8A or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Goldstein

**Also listed as:** EPS C180/ESPM C180

Air Pollution: Read Less [-]

## CIV ENG 107 Climate Change Mitigation 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2021

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.

Climate Change Mitigation: Read More [+]

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

Climate Change Mitigation: Read Less [-]



## CIV ENG 108 Climate Change Adaptation 3 Units

Terms offered: Fall 2024, Fall 2023, Spring 2022

In this course, we will examine the local manifestation of global climate change and consider interventions and responses that anticipate long-term change in communities. The course will integrate environmental sciences, civil and environmental engineering, and the social sciences to both understand the impacts of global change and to quantitatively evaluate possible adaptation interventions. Upon completing the course, you will have a holistic perspective on the challenges associated with climate change adaptation, an understanding of the wide range of potential solutions and interventions that may be possible, and an awareness of the strengths and weaknesses of those solutions.

Climate Change Adaptation: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 11 or introductory climate science course, 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. Alternative to final exam.

**Instructor:** Stacey

Climate Change Adaptation: Read Less [-]

## CIV ENG 110 Water Systems of the Future 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

This course will familiarize students with the complex infrastructure used to meet human water demands; competing uses and demands; water and wastewater infrastructure; technologies to enable recovery of water, energy, and other resources from wastewater; supply planning; trends and forecasting; costs, pricing and financing; environmental justice; methods to assess sustainability; regulatory, policy and institutional challenges; and water's contribution to other sectors (e.g., energy, food, buildings). Innovation, both barriers and opportunities, will be highlighted. California and the U.S. will be emphasized but global challenges will be discussed. Students will study, critique, and recommend improvements for a real-world system.

Water Systems of the Future: Read More [+]

### Objectives & Outcomes

**Course Objectives:** Consider costs and tradeoffs in water supply planning under uncertainty for real-world water systems  
Critically evaluate water planning and innovation potential for real-world utilities given future uncertainties and competing priorities.

Explore the innovation ecosystem in the water sector, its opportunities and challenges, and analyze case studies

Introduce the technologies that are currently in use for treating and managing water and wastewater, as well as innovations that have the potential to dramatically change water infrastructure.

Provide overview and examples of concepts and methods for analyzing the sustainability of water systems

Provide overview of the complex infrastructure systems that supply and manage water and wastewater.

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

### Rules & Requirements

**Prerequisites:** Upper division status or consent of the instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Nelson

Water Systems of the Future: Read Less [-]

## CIV ENG 111 Environmental Engineering 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Quantitative overview of air and water contaminants and their engineering control. Elementary environmental chemistry and transport. Reactor models. Applications of fundamentals to selected current issues in water quality engineering, air quality engineering, air quality engineering, and hazardous waste management.

Environmental Engineering: [Read More](#) [+]

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Alvarez-Cohen, Nelson, Sedlak

Environmental Engineering: [Read Less](#) [-]

## CIV ENG 111L Water and Air Quality Laboratory 1 Unit

Terms offered: Fall 2024, Fall 2023, Fall 2022

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

Water and Air Quality Laboratory: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 111 (may be taken concurrently)

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Alvarez-Cohen, Nelson, Sedlak

Water and Air Quality Laboratory: [Read Less](#) [-]

## CIV ENG 112 Water & Wastewater Systems Design and Operation 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Water and wastewater systems serving communities are complex, large, and were built and expanded over many decades. The infrastructure includes a network of reservoirs, pipelines, pump stations, treatment plants, and other facilities that are connected to natural systems such as watersheds, rivers, groundwater basins, and bay and ocean environments. The planning, design, operation, and maintenance of urban water and wastewater systems require balancing many factors including aging infrastructure, changing regulations, climate change, costs, and community impacts.

One of the greatest challenges facing civil engineers in the 21st century is the stewardship of the infrastructure to protect public health and the environment. Existing systems r

Water & Wastewater Systems Design and Operation: [Read More](#) [+]

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Soga

Water & Wastewater Systems Design and Operation: [Read Less](#) [-]

## CIV ENG 113 Ecological Engineering for Water Quality Improvement 3 Units

Terms offered: Spring 2021, Spring 2019, Spring 2017

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

Ecological Engineering for Water Quality Improvement: Read More [+]

### Objectives & Outcomes

**Course Objectives:** Become familiar with common applications of natural treatment systems through lectures, reading materials, laboratory activities, and field trips

Develop a solid understanding of the fundamental processes in ecological engineering approaches to natural treatment systems that govern the removal or transformation of contaminants in water

Learn common design approaches for waste stabilization ponds and wetlands, as well as their necessary operation and maintenance activities. Measure key water quality parameters and evaluate the performance of mesocosm ponds and wetlands based on the data collected throughout the semester

Understand and appreciate the complexity of these systems compared to mechanical treatment systems

**Student Learning Outcomes:** Ability to apply knowledge of mathematics, science, and engineering. EXTENSIVE  
Ability to communicate effectively. MODERATE  
Ability to design a system, component, or process to meet desired needs. EXTENSIVE

Ability to design and conduct experiments, as well as to analyze and interpret data. EXTENSIVE

Ability to function on multi-disciplinary teams. MODERATE

Ability to identify, formulate and solve engineering problems. EXTENSIVE  
Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. EXTENSIVE

Knowledge of contemporary issues. MODERATE

Recognition of the need for, and an ability to engage in life-long learning. MODERATE

Understand the impact of engineering solutions in a global and societal context. MODERATE

Understanding of professional and ethical responsibility. MODERATE

### Rules & Requirements

**Prerequisites:** CIV ENG 111 or consent of instructor

**Credit Restrictions:** Civ Eng 113N

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Nelson

**Formerly known as:** Civil and Environmental Engineering 113N

## CIV ENG 114 Environmental Microbiology 3 Units

Terms offered: Spring 2016, Spring 2015, Fall 2014

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

Environmental Microbiology: Read More [+]

### Rules & Requirements

**Prerequisites:** CHEM 1A and CHEM 1B

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Alvarez-Cohen

Environmental Microbiology: Read Less [-]

## CIV ENG 115 Water Chemistry 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

The application of principles of inorganic, physical, and dilute solution equilibrium chemistry to aquatic systems, both in the aquatic environment and in water and wastewater treatment processes.

Water Chemistry: Read More [+]

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Sedlak

Water Chemistry: Read Less [-]

## CIV ENG C116 Chemistry of Soils 3 Units

Terms offered: Fall 2021, Fall 2020, Spring 2018

Chemical mechanisms of reactions controlling the fate and mobility of nutrients and pollutants in soils. Role of soil minerals and humus in geochemical pathways of nutrient bioavailability and pollutant detoxification. Chemical modeling of nutrient and pollutant soil chemistry. Applications to soil acidity and salinity.

Chemistry of Soils: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 111

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture 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.

**Also listed as:** ESPM C128

Chemistry of Soils: Read Less [-]

## CIV ENG 120 Structural Engineering 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

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.

Structural Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG C30 / MEC ENG C85 and CIV ENG 60 (may be taken concurrently)

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/  
Undergraduate

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

**Instructor:** Moehle

Structural Engineering: Read Less [-]

## CIV ENG 122 Design of Steel Structures 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

A first course in steel design focusing on basic principles. 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. Includes laboratory sessions to illustrate member behavior. By the end of the course students should be able to design simple steel structures subjected to static gravity and lateral loads. Design teams will conceive, determine design loads, and conduct a preliminary and final design of a structural system and its foundation. Teams will prepare a report containing project description, design criteria, structural drawings, and supporting calculations.

Design of Steel Structures: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 120

**Credit Restrictions:** Students will receive no credit for CIV ENG 122 after completing CIV ENG 122N, or CIV ENG 122. A deficient grade in CIV ENG 122 may be removed by taking CIV ENG 122N, or CIV ENG 122.

### 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:** Becker

Design of Steel Structures: Read Less [-]

## CIV ENG 123 Design of Reinforced Concrete Structures 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Introduction to materials and methods of reinforced concrete design and construction; behavior and design of reinforced concrete beams and one-way slabs considering deflections, moment, shear, and reinforcement development requirements; behavior and design of columns; design of spread footings; design of earthquake-resistant structures; laboratory sessions to illustrate member behavior, to solve problem sets, and to develop and present the preliminary designs for a design project.

Design of Reinforced Concrete Structures: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 120

**Credit Restrictions:** Students will receive no credit for CIV ENG 123 after completing CIV ENG 123N, or CIV ENG 123. A deficient grade in CIV ENG 123 may be removed by taking CIV ENG 123N, or CIV ENG 123.

### 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:** Moehle

Design of Reinforced Concrete Structures: Read Less [-]

## CIV ENG 124 Structural Design in Timber 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Characteristics and properties of wood as a structural material; design and detailing of structural elements and entire structures of wood. Topics include allowable stresses, design and detailing of solid sawn and glulam beams and columns, nailed and bolted connections, plywood diaphragms and shear walls. Case studies.

Structural Design in Timber: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 120

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

Structural Design in Timber: Read Less [-]

## CIV ENG 126 Engineering Dynamics and Vibrations 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Introduction to the dynamics of particles, rigid bodies, and deformable solids in civil engineering. Newtonian and Lagrangian formulations. Vibration of particles and rigid body systems: natural frequencies and mode shapes, free and forced vibration. Vibration of continuous systems: bars, strings, beams. Modeling and numerical simulation methods..

Engineering Dynamics and Vibrations: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG C30 / MEC ENG C85 and ENGIN 7; or consent of instructor

**Credit Restrictions:** Students will receive no credit for CIV ENG 126 after completing MEC ENG 104. A deficient grade in CIV ENG 126 may be removed by taking MEC ENG 104, or MEC ENG 104.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Konstantinidis, DeJong

Engineering Dynamics and Vibrations: Read Less [-]

## CIV ENG 132 Applied Structural Mechanics 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Concepts of theory of solid mechanics: three dimensional stress, strain, and material response; elastic and inelastic boundary value problems; fracture, fatigue, and geometric instability. Problems in advanced strength of materials; thin plate and axis-symmetric shell theory.

Applied Structural Mechanics: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG C30 / MEC ENG C85, MATH 53 and MATH 54

**Credit Restrictions:** Students will receive no credit for CivEng 132 after CivEng 130N.

### Hours & Format

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

**Summer:** 8 weeks - 6 hours of lecture and 2 hours of discussion per week

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Govindjee, Li, Konstantinidis

Applied Structural Mechanics: Read Less [-]

## CIV ENG C133 Engineering Analysis Using the Finite Element Method 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

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

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

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Also listed as:** MEC ENG C180

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



## CIV ENG C138 Flight Vehicle Structures and Aeroelasticity 3 Units

Terms offered: Prior to 2007

This course introduces engineering students to the analysis and design of load-bearing components of flight structures, ranging from subsonic aircraft to rockets. Emphasis is placed on the quasi-static and dynamic analysis of structural components which are prevalent in aerospace engineering. Attention is also devoted to a comprehensive design roadmap of flight vehicle structures from the full system- to the individual component-level

Flight Vehicle Structures and Aeroelasticity: Read More [+]

### Objectives & Outcomes

**Course Objectives:** 1. Familiarize students with the different load-bearing components and loads encountered in flight vehicles.

2. Sharpen the students' skills in the statics and dynamics of thin-walled structures.

3. Enhance the students' aerospace engineering design skills by leveraging the use of the finite element method as a tool for both global and local analysis.

**Student Learning Outcomes:** Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

(g) A knowledge of contemporary issues.

Ability to apply knowledge of mathematics, science, and engineering.

Ability to design and conduct experiments, as well as to analyze and interpret data

Ability to identify, formulate, and solve engineering problems.

Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Understanding of professional and ethical responsibility.

### Rules & Requirements

**Prerequisites:** CIV ENG C30 / MEC ENG C85, and MEC ENG 104 or CIV ENG 126

### 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/ Undergraduate

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

**Instructor:** Papadopoulos

**Formerly known as:** Mechanical Engineering 184

**Also listed as:** AERO ENG C184/MEC ENG C184

Flight Vehicle Structures and Aeroelasticity: Read Less [-]

## CIV ENG 140 Failure Mechanisms in Civil Engineering Materials 3 Units

Terms offered: Spring 2013, Spring 2010, Spring 2009

The failure mechanisms in civil engineering materials (cement-based materials, metallic- and polymer-based materials) are associated with processing, microstructure, stress states, and environmental changes. Fracture mechanics of brittle, quasi-brittle, and ductile materials; cracking processes in monolithic, particulate, and fiber reinforced materials; examples of ductile/brittle failure transitions in civil engineering structures; retrofitting of existing structures; non-destructive techniques for damage detection.

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

### Rules & Requirements

**Prerequisites:** CIV ENG 60

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Ostertag

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

## CIV ENG 153 Transportation Facility Design 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

A capstone class with the objective to design transportation facilities based on operational capacity, site constraints, and environmental design considerations. Emphasis on airports, including landside and airside elements, and environmental assessment and mitigation techniques. Transportation Facility Design: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 155

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Hansen

Transportation Facility Design: Read Less [-]



## CIV ENG 155 Transportation Systems Engineering 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

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

### Rules & Requirements

**Prerequisites:** Sophomore standing in engineering or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Cassidy, Daganzo, Hansen, Kanafani, Madanat

Transportation Systems Engineering: Read Less [-]

## CIV ENG 160D Data Science in Aviation 3 Units

Terms offered: Spring 2023

The course will be centered around analyses of a set of aviation data sets and will enable the students to become familiar with data science applications to aviation. Aviation topics to be covered include fundamentals of air traffic control, models of aviation operations, aircraft trajectory prediction and optimization, data sources in aviation, overview of data science methods, role of data science in solving problems in aviation operations such as conflict detection and resolution, traffic flow management, arrivals management and surface operations, airline operations, fuel efficiency, global aviation.

Data Science in Aviation: Read More [+]

### Rules & Requirements

**Prerequisites:** DATA C8 and CIV ENG 93

### 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.

Data Science in Aviation: Read Less [-]

## CIV ENG 165 Concrete Materials, Construction, and Sustainability 3 Units

Terms offered: Spring 2023, Spring 2021, Spring 2020

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.

Concrete Materials, Construction, and Sustainability: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 60

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Monteiro

Concrete Materials, Construction, and Sustainability: Read Less [-]

## CIV ENG 166 Construction Engineering 3 Units

Terms offered: Spring 2024, Spring 2023, Fall 2021

Introduction to construction engineering and field operations. The construction industry, construction methods and practice, productivity improvement, equipment selection, site layout formwork, erection of steel and concrete structures. Labs demonstrate the concepts covered. Field trips to local construction projects.

Construction Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** Upper division standing; CIV ENG 167 recommended

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Horvath

Construction Engineering: Read Less [-]

## CIV ENG 167 Engineering Project Management 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Principles of economics, decision making, and law applied to company and project management. Business ownership, liability and insurance, cash flow analysis, and financial management. Project life-cycle, design-construction interface, contracts, estimating, scheduling, cost control.

Engineering Project Management: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 93 (can be taken concurrently)

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Ibbs, Tommelein

Engineering Project Management: Read Less [-]

## CIV ENG 170A Infrastructure Sensing and Modeling 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Introduction to sensing and modeling of infrastructure system; Imagery analysis (point clouds, lidar, structure for motion, satellite); Geophysics (Synthetic-aperture radar analysis, time histories analyses); Sensor systems (distributed fiber optics, wireless sensor network, MEMS, conventional); Structural health monitoring and analysis; Infrastructure network analysis (graph theory, GIS, simulations); entrepreneurship in infrastructure and smart cities industry.

Infrastructure Sensing and Modeling: Read More [+]

### Rules & Requirements

**Prerequisites:** ENGIN 7, CIV ENG C30, and CIV ENG 93 or equivalents

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Soga, Zekkos, Kayen

Infrastructure Sensing and Modeling: Read Less [-]

## CIV ENG 171 Rock Mechanics 3 Units

Terms offered: Spring 2024, Spring 2022, Spring 2020

Geological and geophysical exploration for structures in rock; properties and behavior of rock masses; rock slope stability; geological engineering of underground openings; evaluation of rock foundations, including dams.

Rock Mechanics: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 70 or an introductory course in physical geology; and upper division standing in engineering

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Glaser

Rock Mechanics: Read Less [-]

## CIV ENG C172 Remote Sensing of the Environment 4 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

The course will introduce junior/senior undergraduate students to the basic physical concepts of remote sensing as they relate to different earth surface processes. It will introduce students to a variety of recently developed ground, airborne, and satellite instruments and their applications to monitor and analyze environmental processes. These include active (e.g., Lidar), and passive (radiometers) sensors, optical (e.g., Landsat, MODIS), microwave (e.g., SMAP), and gravitational (e.g., GRACE) satellites.

Remote Sensing of the Environment: Read More [+]

### Rules & Requirements

**Credit Restrictions:** Students will receive no credit for ESPM C172 after completing CIV ENG 172, or ESPM 172. A deficient grade in ESPM C172 may be removed by taking CIV ENG 172, or ESPM 172.

### 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:** Girotto

**Also listed as:** ESPM C172

Remote Sensing of the Environment: Read Less [-]

## CIV ENG 173 Groundwater and Seepage 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Introduction to principles of groundwater flow, including steady and transient flow through porous media, numerical analysis, pumping tests, groundwater geology, contaminant transport, and design of waste containment systems.

Groundwater and Seepage: Read More [+]

### Rules & Requirements

**Prerequisites:** Senior standing in engineering or science; CIV ENG 100 recommended

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Rubin, Sitar

Groundwater and Seepage: Read Less [-]

## CIV ENG 174 Engineering Geomatics 3 Units

Terms offered: Summer 2015 First 6 Week Session, Summer 2014 10 Week Session, Summer 2014 First 6 Week Session

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

Engineering Geomatics: Read More [+]

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

Engineering Geomatics: Read Less [-]

## CIV ENG 175 Geotechnical and Geoenvironmental Engineering 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Soil formation and identification. Engineering properties of soils. Fundamental aspects of soil characterization and response, including soil mineralogy, soil-water movement, effective stress, consolidation, soil strength, and soil compaction. Use of soils and geosynthetic materials in geotechnical and geoenvironmental applications. Introduction to site investigation techniques. Laboratory testing and evaluation of soil composition and properties.

Geotechnical and Geoenvironmental Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG C30 / MEC ENG C85 (may be taken concurrently); CIV ENG 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, Sitar, Soga

Geotechnical and Geoenvironmental Engineering: Read Less [-]

## CIV ENG 176 Environmental Geotechnics 3 Units

Terms offered: Spring 2021, Spring 2016, Spring 2015

Principles of environmental geotechnics applied to waste encapsulation and remediation of contaminated sites. Characterization of soils and wastes, engineering properties of soils and geosynthetic materials 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.

Environmental Geotechnics: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 175 or consent of instructor; CIV ENG 111 and CIV ENG 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.

**Instructor:** Sitar

Environmental Geotechnics: Read Less [-]

## CIV ENG C178 Applied Geophysics 3 Units

Terms offered: Fall 2024, Fall 2022, Fall 2021, Fall 2019

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.

Applied Geophysics: Read More [+]

### 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

Applied Geophysics: Read Less [-]

## CIV ENG 179 Geosystems Engineering Design 3 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

Geosystem engineering design principles and concepts. Fundamental aspects of the geomechanical and geoenvironmental responses of soil are applied to analyze and design civil systems, such as earth dams and levees, earth retention systems, building and bridge foundations, solid-waste fills, and tailings dams. Students form teams to design geotechnical aspects of a civil project and prepare/present a design document. Field trip to a project site.

Geosystems Engineering Design: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 175

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Bray, Sitar, Soga

Geosystems Engineering Design: Read Less [-]

## CIV ENG 180 Life-Cycle Design and Construction 4 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

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

Life-Cycle Design and Construction: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 167

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

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

## CIV ENG 186 Design of Internet-of-Things for Smart Cities 3 Units

Terms offered: Spring 2023, Spring 2022, Fall 2019

Hands-on engineering design experience for creating cyber-physical systems, or more colloquially, "internet-of-things (IoT) systems" for smart cities. Projects overlay a software layer onto physical infrastructure to produce one integrated system. Student teams will identify a challenge with current urban systems, e.g. mobility, energy & environment, water, waste, health, security, and the built environment. Student teams design and prototype an innovation that addresses this challenge using maker resources, e.g. 3D printing, laser cutters, and open-source electronics. The project will be executing via the "Design Sprint" process, which is popular in agile development and Silicon Valley. Students present projects to industry judges.

Design of Internet-of-Things for Smart Cities: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 191

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

**Instructors:** Moura, Sengupta

Design of Internet-of-Things for Smart Cities: Read Less [-]

## CIV ENG 188 Carbon Capture and Storage 3 Units

Terms offered: Spring 2024

Carbon capture and storage and its role in reducing carbon emissions, Fossil fuels and concentrated emissions sources. Chemistry, physics, and engineering principles of pre and post combustion carbon capture technologies. Principles of underground sequestration. Geology of storage zones, physical and chemical properties of pore fluids. Principles of subsurface CO<sub>2</sub> flow. Drilling, wellbore construction, and characterization of deep injection boreholes. Injection and monitoring. Political and socio-economic drivers and constraints for carbon capture and storage.

Carbon Capture and Storage: Read More [+]

### Rules & Requirements

**Prerequisites:** Upper division standing or consent of instructor

**Credit Restrictions:** Students will receive no credit for CIV ENG 188 after completing CIV ENG 188. A deficient grade in CIV ENG 188 may be removed by taking CIV ENG 188.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Rector

Carbon Capture and Storage: Read Less [-]

## CIV ENG 190 Special Topics in Civil and Environmental Engineering 1 - 4 Units

Terms offered: Fall 2024, Spring 2024, Fall 2023

This course covers current topics of interest in civil and environmental engineering. The course content may vary from semester to semester depending upon the instructor

Special Topics in Civil and Environmental Engineering: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction. Students may enroll in multiple sections of this course within the same semester.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Variano

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

## CIV ENG 190S Special Topics in Civil and Environmental Engineering 3 Units

Terms offered: Fall 2024, Spring 2024, Fall 2023

This course covers current topics of interest in civil and environmental engineering. The course content may vary from semester to semester depending upon the instructor.

Special Topics in Civil and Environmental Engineering: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 93 (or equivalent) and DATA 8 (or equivalent)

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

### 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 required.

**Instructor:** Sengupta

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

## CIV ENG 191 Civil and Environmental Engineering Systems Analysis 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

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

Civil and Environmental Engineering Systems Analysis: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 93 and ENGIN 7

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructors:** Bayen, Madanat, Sengupta

**Formerly known as:** 152

Civil and Environmental Engineering Systems Analysis: [Read Less](#) [-]

## CIV ENG 192 The Art and Science of Civil and Environmental Engineering Practice 1 Unit

Terms offered: Fall 2017, Fall 2016, Fall 2015

A series of lectures by distinguished professionals designed to provide an appreciation of the role of science, technology, and the needs of society in conceiving projects, balancing the interplay of conflicting demands, and utilizing a variety of disciplines to produce unified and efficient systems.

The Art and Science of Civil and Environmental Engineering Practice:

[Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Senior standing in Civil Engineering

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

The Art and Science of Civil and Environmental Engineering Practice:

[Read Less](#) [-]

## CIV ENG 193 Engineering Risk Analysis 3 Units

Terms offered: Fall 2024, Fall 2023, Spring 2023

Applications of probability theory and statistics in planning, analysis, and design of civil engineering systems. Development of probabilistic models for risk and reliability evaluation. Occurrence models; extreme value distributions. Analysis of uncertainties. Introduction to Bayesian statistical decision theory and its application in engineering decision-making.

Engineering Risk Analysis: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Upper division standing

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

**Instructor:** Li

Engineering Risk Analysis: [Read Less](#) [-]



## CIV ENG H194 Honors Undergraduate Research 3 - 4 Units

Terms offered: Spring 2024, Fall 2023, Spring 2023

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

Honors Undergraduate Research: Read More [+]

### Rules & Requirements

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

**Repeat rules:** Course may be repeated for credit up to a total of 8 units.

### Hours & Format

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

### Summer:

6 weeks - 7.5-10 hours of independent study per week

8 weeks - 6-7.5 hours of independent study per week

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

Honors Undergraduate Research: Read Less [-]

## CIV ENG 197 Field Studies in Civil Engineering 1 - 4 Units

Terms offered: Spring 2024, Fall 2023, Summer 2023

Supervised experience in off-campus companies or tutoring/mentoring relevant to specific aspects and applications of civil engineering on or off campus. Written report required at the end of the semester.

Field Studies in Civil Engineering: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Summer:

6 weeks - 2.5-10 hours of fieldwork per week

8 weeks - 1.5-7.5 hours of fieldwork per week

10 weeks - 1.5-6 hours of fieldwork per week

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

Field Studies in Civil Engineering: Read Less [-]

## CIV ENG 198 Directed Group Study for Advanced Undergraduates 1 - 4 Units

Terms offered: Spring 2024, Fall 2023, Spring 2023

Group study of a selected topic or topics in civil engineering.

Directed Group Study for Advanced Undergraduates: Read More [+]

### Rules & Requirements

**Prerequisites:** Senior standing in engineering

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

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

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

## CIV ENG 199 Supervised Independent Study 1 - 4 Units

Terms offered: Spring 2024, Fall 2023, Summer 2023 10 Week Session  
Supervised independent study.

Supervised Independent Study: Read More [+]

### Rules & Requirements

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

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

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

10 weeks - 1-4 hours of independent study per week

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/ Undergraduate

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

Supervised Independent Study: Read Less [-]



## CIV ENG 200A Environmental Fluid Mechanics I 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Fundamental fluid mechanics with application to the environment. Analytical solutions and numerical modeling of advection-diffusion and Navier-Stokes equations, with a focus on understanding both the numerical techniques needed to predict environmental flow and transport and the underlying physical processes described by the mathematical equations. Fluid kinematics, scalar transport, numerical error and stability analysis, scaling analysis, channel flows, Stokes flows, and introduction to turbulence.

Environmental Fluid Mechanics I: Read More [+]

### Rules & Requirements

**Prerequisites:** Undergraduate fluid mechanics, basic computer programming or permission of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Chow, Stacey

Environmental Fluid Mechanics I: Read Less [-]

## CIV ENG 200B Environmental Fluid Mechanics II 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Fundamental fluid mechanics with application to the environment, including turbulent channel flows and boundary layers, surface waves, and sediment transport. Turbulence modeling and development of analytical and numerical solutions for the equations governing flow and transport in the environment. Scaling analysis and numerical techniques applied to examples from surface water and atmospheric flows.

Environmental Fluid Mechanics II: Read More [+]

### Rules & Requirements

**Prerequisites:** Civ Eng 200A or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Chow, Stacey

Environmental Fluid Mechanics II: Read Less [-]

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

Terms offered: Spring 2017, Spring 2016, Spring 2014

Application of fluid mechanics to transport and mixing in the environment. Fundamentals of turbulence, turbulent diffusion, and shear dispersion in steady and oscillatory flows and the effects of stratification. Application to rivers, wetlands, lakes, estuaries, the coastal ocean, and the lower atmosphere.

Transport and Mixing in the Environment: Read More [+]

### Rules & Requirements

**Prerequisites:** 100, Math 53 and 54, or equivalent

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Stacey

**Formerly known as:** 209A

Transport and Mixing in the Environment: Read Less [-]

## CIV ENG 202A Vadose Zone Hydrology 3 Units

Terms offered: Spring 2021, Spring 2019, Spring 2018

Course addresses fundamental and practical issues in flow and transport phenomena in the vadose zone, which is the geologic media between the land surface and the regional water table. A theoretical framework for modeling these phenomena will be presented, followed by applications in the areas of ecology, drainage and irrigation, and contaminant transport. Hands-on applications using numerical modeling and analysis of real-life problems and field experiments will be emphasized.

Vadose Zone Hydrology: Read More [+]

### Rules & Requirements

**Prerequisites:** 173 or equivalent

**Credit Restrictions:** Students will receive no credit for 202A after taking 202 before fall 1998.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Rubin

**Formerly known as:** 202

Vadose Zone Hydrology: Read Less [-]

## CIV ENG 203N Surface Water Hydrology 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

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

### Rules & Requirements

**Prerequisites:** 103 or equivalent, or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Formerly known as:** 203

Surface Water Hydrology: Read Less [-]

## CIV ENG 204 Planetary Boundaries and the Anthropocene 1 Unit

Terms offered: Fall 2022, Fall 2021, Spring 1999

This course aims to introduce students to the debates and discussions about the impact of increasing human resource consumption, increasing population, and increasing human prosperity on the planet's environmental systems that support human societies.

Planetary Boundaries and the Anthropocene: Read More [+]

### Objectives & Outcomes

**Course Objectives:** Explain the major arguments on the sides of "planetary boundaries" and "cornucopia"  
Understand the basic system dynamics view of planetary systems  
Understand the main features of several of planetary boundaries that have scientific consensus

### Rules & Requirements

**Prerequisites:** Graduate Standing

**Credit Restrictions:** Students will receive no credit for CIV ENG 204 after completing CIV ENG 204. A deficient grade in CIV ENG 204 may be removed by taking CIV ENG 204.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Chow, Gadgil

Planetary Boundaries and the Anthropocene: Read Less [-]

## CIV ENG 205B Margins of Quality for Engineered Systems 3 Units

Terms offered: Fall 2009, Fall 2007, Fall 2000

Processes and procedures to define and determine the demands and capacities of the structures and hardware elements of engineered systems during their life-cycles: margins of quality. The objective of this course is to provide students with the knowledge and skills to define and evaluate system demands, capacities, and reliability targets to be used in design, requalification, construction, operation, maintenance, and decommissioning of engineered systems.

Margins of Quality for Engineered Systems: Read More [+]

### Rules & Requirements

**Prerequisites:** 125, 193 or equivalents and senior design experience

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Bea

Margins of Quality for Engineered Systems: Read Less [-]

## CIV ENG 206 Water Resources Management 3 Units

Terms offered: Spring 2022, Spring 2021, Spring 2020

The course provides a framework to address contemporary water-resources problems, and to achieve water security for local areas and broader regions. Students will become aware of critical water-resources issues at local, national and global scales, and learn to formulate solutions for water-resources problems using engineering, natural-science and social-science tools. The main focus is on California and the Western United States, with comparative analysis for other regions.

Water Resources Management: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or senior undergrad with consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Bales

Water Resources Management: Read Less [-]

## CIV ENG 209 Design for Sustainable Communities 3 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021

This course provides conceptual and hands-on experience in design and implementation of innovative products or processes for improving the sustainability of resource-constrained communities (mostly poor ones in the developing countries). Teams of students will take on practical projects, with guidance from subject experts.

Design for Sustainable Communities: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Gadgill

Design for Sustainable Communities: Read Less [-]

## CIV ENG 210 Control of Water-Related Pathogens 3 Units

Terms offered: Spring 2023, Spring 2022, Fall 2018

Comprehensive strategies for the assessment and control of water-related human pathogens (disease-causing microorganisms). Transmission routes and life cycles of common and emerging organisms, conventional and new detection methods (based on molecular techniques), human and animal sources, fate and transport in the environment, treatment and disinfection, appropriate technology, regulatory approaches, water reuse.

Control of Water-Related Pathogens: Read More [+]

### Rules & Requirements

**Prerequisites:** Basic course in microbiology recommended; graduate standing or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Nelson

**Formerly known as:** Civil and Environmental Engineering 210A

Control of Water-Related Pathogens: Read Less [-]

## CIV ENG 211A Water Quality Engineering 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

The fundamental concepts of physical, chemical, and microbiological 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 processes that effect water quality. The class consists of three main parts: (1) Physical Processes: mass balance, chemical kinetics, reactor hydraulics, reactor models; (2) Biological processes: microbiological principles, pathogens, and microbial transformations; (3) Chemical contaminants: properties, partitioning and reactivity.

Water Quality Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** CE 111 (Introduction to Environmental Engineering), CE 115 (Water Chemistry)

### 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:** Offered for satisfactory/unsatisfactory grade only.

**Instructors:** Nelson, Sedlak, Mi

Water Quality Engineering: Read Less [-]

## CIV ENG 211B Environmental Biological Processes 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Fundamental concepts of biological processes that are important in natural and engineered environmental systems, especially those affecting water quality. Incorporates basic fundamentals of microbiology into a quantifiable engineering context to describe, predict, and control behavior of environmental biological systems. Topics include the stoichiometry, energetics and kinetics of microbial reactions, suspended and biofilm processes, carbon and nutrient cycling, and bioremediation applications.

Environmental Biological Processes: Read More [+]

### Rules & Requirements

**Prerequisites:** Civil and Environmental Engineering 111 or equivalent and course work in microbiology, or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Alvarez-Cohen

Environmental Biological Processes: Read Less [-]

## CIV ENG 213 Watersheds and Water Quality 3 Units

Terms offered: Fall 1996

Overview of approaches used by engineers to preserve or improve water quality at the watershed scale. Characterization and modeling of nutrients, metals, and organic contaminants in watersheds. Application of ecosystem modification and pollutant trading to enhance water quality. The course emphasizes recent case studies and interdisciplinary approaches for solving water quality problems.

Watersheds and Water Quality: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

**Credit Restrictions:** Students will receive no credit for 213 after taking 290C.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Sedlak

Watersheds and Water Quality: Read Less [-]

## CIV ENG 215 Emerging Technologies for Water Sustainability 3 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021

Overview of technological development to address global challenges on water-energy nexus and water scarcity. Introduction to emerging technologies, such as membrane filtration, thermal processes, and nanotechnology. Their applications in water purification, wastewater reuse, desalination, and renewable energy production. Quantitative understanding of energy efficiency, transport mechanisms, and interfacial phenomena involved in the above engineered systems. Group projects on selected topic.

Emerging Technologies for Water Sustainability: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 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/Graduate

**Grading:** Letter grade.

**Instructor:** Mi

Emerging Technologies for Water Sustainability: Read Less [-]

## CIV ENG 217 Environmental Chemical Kinetics 3 Units

Terms offered: Spring 2024, Spring 2022, Spring 2020

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. Environmental Chemical Kinetics: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor; 115 or 214 or equivalent

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Sedlak

Environmental Chemical Kinetics: Read Less [-]

## CIV ENG 218A Air Quality Engineering 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Quantitative overview of the characterization and control of air pollution problems. Summary of fundamental chemical and physical processes governing pollutant behavior. Analysis of key elements of the air pollution system: sources and control techniques, atmospheric transformation, atmospheric transport, modeling, and air quality management. Air Quality Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing in engineering or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Harley

Air Quality Engineering: Read Less [-]

## CIV ENG 218B Atmospheric Aerosols 3 Units

Terms offered: Spring 2013, Fall 2008, Spring 2006

Nature, behavior and significance 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.

Atmospheric Aerosols: Read More [+]

### 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.

Atmospheric Aerosols: Read Less [-]

## CIV ENG 218C Air Pollution Modeling 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

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.

Air Pollution Modeling: Read More [+]

### Rules & Requirements

**Prerequisites:** 218A

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Harley

Air Pollution Modeling: Read Less [-]

## CIV ENG 219 Fluid Flow in Environmental Processes 3 Units

Terms offered: Spring 2021, Spring 2020, Spring 2019

Transport and mixing of solutes in water. Focus on rivers, lakes, estuaries, and wetlands, with some discussion of groundwater and the atmosphere. Basic equations of fluid motion will be used to contextualize and/or derive applied empirical equations for use in specific cases of applied environmental engineering practice. Example applications include outfalls, total maximum daily loads, residence time, and longitudinal dispersion.

Fluid Flow in Environmental Processes: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or senior undergrad with consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Variano, Stacey

Fluid Flow in Environmental Processes: Read Less [-]

## CIV ENG 220 Structural Analysis Theory and Applications 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

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.

Structural Analysis Theory and Applications: Read More [+]

### Rules & Requirements

**Prerequisites:** 121 or equivalent

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Filippou

Structural Analysis Theory and Applications: Read Less [-]

## CIV ENG 220N Nonlinear Structural Analysis 3 Units

Terms offered: Spring 2019, Spring 2018, Spring 2017

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-# analysis and large deformation theory. Elastic stability. Nonlinear dynamic analysis. Time integration methods. Practical applications.

Nonlinear Structural Analysis: Read More [+]

### Rules & Requirements

**Prerequisites:** Civ Eng 121 or equivalent

**Credit Restrictions:** Students who have previously taken Civ Eng 221 will not receive credit for this course

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Filippou

Nonlinear Structural Analysis: Read Less [-]

## CIV ENG 221 Nonlinear Structural Analysis 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

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.

Nonlinear Structural Analysis: Read More [+]

### 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

Nonlinear Structural Analysis: Read Less [-]



## CIV ENG 222 Finite Element Methods 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

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.

Finite Element Methods: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 220; and CIV ENG 132 or CIV ENG C231

### 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

Finite Element Methods: Read Less [-]

## CIV ENG 223 Earthquake Protective Systems 3 Units

Terms offered: Spring 2024, Spring 2022, Spring 2021

Earthquake protective systems including seismic isolation and energy dissipating devices. Behavior and modeling of rubber and sliding seismic isolation bearings, hysteretic dampers, fluid viscous dampers, buckling restrained braces, and self-centering systems. Linear and nonlinear response analysis and design of structures with earthquake protective systems.

Earthquake Protective Systems: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 220 and CIV ENG 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.

**Instructor:** Konstantinidis

**Formerly known as:** 290D

Earthquake Protective Systems: Read Less [-]

## CIV ENG 225 Dynamics of Structures 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Evaluation of deformations and forces in structures, idealized as single-degree of freedom or discrete-parameter multi-degree of freedom systems, due to dynamic forces. Evaluation of earthquake-induced deformations and forces in structures by linear response history analysis; estimation of maximum response by response spectrum analysis; effects of inelastic behavior. Laboratory demonstrations.

Dynamics of Structures: Read More [+]

### Rules & Requirements

**Prerequisites:** 220 (may be taken concurrently) or equivalent

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** DeJong

Dynamics of Structures: Read Less [-]

## CIV ENG 226 Stochastic Structural Dynamics 3 Units

Terms offered: Spring 2016, Spring 2014, Spring 2012

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-exursion probability, and distributions of peaks and extremes. Introduction to nonlinear stochastic dynamic analysis. Applications in earthquake, wind, and ocean engineering.

Stochastic Structural Dynamics: Read More [+]

### Rules & Requirements

**Prerequisites:** 225

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

Stochastic Structural Dynamics: Read Less [-]



### **CIV ENG 227 Earthquake-Resistant Design 3 Units**

Terms offered: Spring 2024, Spring 2023, Spring 2022  
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.  
Earthquake-Resistant Design: Read More [+]

#### **Rules & Requirements**

**Prerequisites:** 220 and 225

#### **Hours & Format**

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

#### **Additional Details**

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Moehle, Becker

Earthquake-Resistant Design: Read Less [-]

### **CIV ENG 228 Advanced Earthquake Analysis 3 Units**

Terms offered: Fall 2021, Spring 2015, Spring 2013  
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.  
Advanced Earthquake Analysis: Read More [+]

#### **Rules & Requirements**

**Prerequisites:** 225

#### **Hours & Format**

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

#### **Additional Details**

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

Advanced Earthquake Analysis: Read Less [-]

### **CIV ENG 229 Structural System Reliability 3 Units**

Terms offered: Spring 2024, Spring 2022, Spring 2020  
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.  
Structural System Reliability: Read More [+]

#### **Rules & Requirements**

**Prerequisites:** Graduate standing

#### **Hours & Format**

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

#### **Additional Details**

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

Structural System Reliability: Read Less [-]

### **CIV ENG C231 Mechanics of Solids 3 Units**

Terms offered: Fall 2024, Fall 2023, Fall 2022  
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.  
Mechanics of Solids: Read More [+]

#### **Rules & Requirements**

**Prerequisites:** Graduate standing or consent of instructor

#### **Hours & Format**

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

#### **Additional Details**

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Govindjee

**Also listed as:** MAT SCI C211

Mechanics of Solids: Read Less [-]

## CIV ENG 232 Structural Mechanics 3 Units

Terms offered: Spring 2024, Spring 2022, Spring 2020

The goal of this course is to study the theories of structural mechanics within the framework of nonlinear continuum mechanics of solids.

Finite elasticity; invariance. Energy principles: principles of virtual and complementary virtual work; primary and mixed variational principles.

Theory of stability: Euler method; stability under follower loads. Classical theories of beams: planar, torsional, and lateral buckling. Plate theories. Invariant theories of structural mechanics: directed continua; Cosserat theories of rods.

Structural Mechanics: Read More [+]

### Rules & Requirements

**Prerequisites:** 231 or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Armero

Structural Mechanics: Read Less [-]

## CIV ENG 233 Computational Mechanics 3 Units

Terms offered: Fall 2024, Fall 2022, Spring 2021

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.

Computational Mechanics: Read More [+]

### Rules & Requirements

**Prerequisites:** 222, or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Armero

Computational Mechanics: Read Less [-]

## CIV ENG 234 Computational Inelasticity 3 Units

Terms offered: Spring 2011, Fall 2007, Fall 2005

Computational methods applied to inelastic deformations of solids; 1, 2, and 3-D large and small-deformation continuum plasticity and viscoelasticity models and their algorithmic approximations; viscoplastic regularizations and softening; thermodynamics and its relationship to algorithmic stability; return mappings, closest-point projections and operator splits; application to metals, soils, concrete, and polymers and incorporation into finite element codes.

Computational Inelasticity: Read More [+]

### Rules & Requirements

**Prerequisites:** 231 or Materials Science and Engineering 211 or Mechanical Engineering 185

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Armero, Govindjee

Computational Inelasticity: Read Less [-]

## **CIV ENG C235 Introduction to Statistical Mechanics for Engineers 3 Units**

Terms offered: Spring 2020, Spring 2017, Fall 2013

Introduction to statistical mechanics for engineers. Basics of ensembles, phase spaces, partitions functions, and free energies. Analysis of expectation values and fluctuations in system properties. Applications to the study of elementary gases, phonons in solids, polymer chains and networks, harmonic and quasi-harmonic crystalline solids; limitations of classical methods and quantum mechanical influences; molecular dynamics simulations for solids.

Introduction to Statistical Mechanics for Engineers: Read More [+]

### **Objectives & Outcomes**

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

### **Rules & Requirements**

**Prerequisites:** CE C231 or MSE C211 or ME 185 or consent of instructor

### **Hours & Format**

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

### **Additional Details**

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Govindjee, Papadopoulos

**Also listed as:** MEC ENG C279

Introduction to Statistical Mechanics for Engineers: Read Less [-]

## **CIV ENG C236 Micromechanics 3 Units**

Terms offered: Fall 2023, Spring 2022, Spring 2018

Basic theories, analytical techniques, and mathematical foundations of micromechanics. It includes 1. physical micromechanics, such as mathematical theory of dislocation, and cohesive fracture models; 2. micro-elasticity that includes Eshelby's eigenstrain theory, comparison variational principles, and micro-crack/micro-cavity based damage theory; 3. theoretical composite material that includes the main methodologies in evaluating overall material properties; 4. meso-plasticity that includes meso-damage theory, and the crystal plasticity; 5. homogenization theory for materials with periodic structures.

Micromechanics: Read More [+]

### **Rules & Requirements**

**Prerequisites:** Consent of instructor

### **Hours & Format**

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

### **Additional Details**

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Govindjee, Li

**Also listed as:** MAT SCI C214

Micromechanics: Read Less [-]

## CIV ENG 237 Computational Nano-mechanics 3 Units

Terms offered: Prior to 2007

Basic statistical thermodynamics foundations, physical models, computational formulations, algorithms, and software that are used in nanoscale simulations and modellings. They include (1) Molecular dynamics; (2) Monte Carlo methods; (3) Coarse-grained molecular dynamics, and (4) Multiscale methods including coupling between molecular dynamics and finite element methods.

Computational Nano-mechanics: Read More [+]

### Rules & Requirements

**Prerequisites:** Undergraduate level thermodynamics and calculus-based physics, e.g., MECENG 40 and PHYSICS 7A/B or equivalents

**Credit Restrictions:** Students will receive no credit for CIV ENG C237 after completing CIV ENG 237. A deficient grade in CIV ENG C237 may be removed by taking CIV ENG 237.

### 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:** Li

**Formerly known as:** Civil and Environmental Engineering C237/  
Nanoscale Science and Engineering C237

Computational Nano-mechanics: Read Less [-]

## CIV ENG 240 Civil Engineering Materials 3 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021

Microstructures of concrete, wood, and steel. Differences and similarities in response to loading and environmental effects on these materials, with emphasis on strength, elastic properties, creep, shrinkage, thermal stresses, and failure mechanisms.

Civil Engineering Materials: Read More [+]

### Rules & Requirements

**Prerequisites:** An undergraduate course in civil engineering materials

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Monteiro, Ostertag

Civil Engineering Materials: Read Less [-]

## CIV ENG 241 Concrete Technology 3 Units

Terms offered: Spring 2019, Spring 2015, Spring 2013

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.

Concrete Technology: Read More [+]

### Rules & Requirements

**Prerequisites:** 165 or equivalent

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Monteiro

Concrete Technology: Read Less [-]

## CIV ENG 244 Reinforced Concrete Structures 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Analysis and design of reinforced concrete elements and systems that are common in building and bridge structures, with an emphasis on seismic response and design; structural design methods; reinforced concrete materials; confined concrete; line elements under axial, flexural, and shear loadings; bond, anchorage, and development; seismic design principles; earthquake-resistant building frames, walls, diaphragms, and foundations; earthquake-resistant bridges.

Reinforced Concrete Structures: Read More [+]

### Rules & Requirements

**Prerequisites:** Civil and Environmental Engineering 123

### 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:** Moehle

Reinforced Concrete Structures: Read Less [-]

## CIV ENG 245 Behavior of Reinforced Concrete 3 Units

Terms offered: Spring 2015, Spring 2013, Spring 2011

Advanced topics in reinforced concrete construction, including inelastic flexural behavior; applications of plastic analysis to reinforced concrete frames; behavior in shear and torsion; yield-line analysis of slabs; behavior under cyclic and reversed loading; seismic rehabilitation.

Behavior of Reinforced Concrete: Read More [+]

### Rules & Requirements

**Prerequisites:** 123 and 220

### 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

Behavior of Reinforced Concrete: Read Less [-]

## CIV ENG 246 Prestressed Concrete Structures 3 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021

Behavior and design of statically determinate prestressed concrete structures under bending moment, shear, torsion and axial load effects. Design of continuous prestressed concrete beams, frames, slabs, and shells. Time-dependent effects and deflections of prestressed concrete structures. Applications to the design and construction of bridges and buildings.

Prestressed Concrete Structures: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 123N 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

Prestressed Concrete Structures: Read Less [-]

## CIV ENG 247 Design of Steel and Composite Structures 3 Units

Terms offered: Fall 2024, Spring 2024, Spring 2023

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.

Design of Steel and Composite Structures: Read More [+]

### Rules & Requirements

**Prerequisites:** 122 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.

**Instructors:** Astaneh, Mahin

Design of Steel and Composite Structures: Read Less [-]

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

Terms offered: Fall 2015, Fall 2012, Fall 2010

Topics related to inelastic behavior and plastic design of steel members and structures. Behavior of plastic hinge in members subjected to bending moment, axial force, shear, and their combinations. Collapse mechanisms of steel members and structures such as moment frames and braced systems. Inelastic cyclic behavior of steel components. Introduction to fracture and fatigue of steel components.

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

### Rules & Requirements

**Prerequisites:** CIV ENG 122

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

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

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

Terms offered: Fall 2024, Fall 2023, Fall 2022

This course covers the following topics: similitude laws, design of structural models, instrumentation and measurement techniques; use of computers to acquire data and control tests; pseudo-dynamic testing method; standard proof-testing for capacity assessment; non-destructive testing for condition assessment, and virtual experimentation. Upon completing this course, the students will be able to use experimental methods to investigate the behavior of a structure and to evaluate its condition.

Experimental Methods in Structural Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Mosalam

Experimental Methods in Structural Engineering: Read Less [-]

## CIV ENG C250N Transportation Policy and Planning 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Policy issues in urban transportation planning; measuring the performance of transportation systems; the transportation policy formulation process; transportation finance, pricing, and subsidy issues; energy and air quality in transportation; specialized transportation for elderly and disabled people; innovations in transportation policy. Transportation Policy and Planning: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 213

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Also listed as:** CY PLAN C217

Transportation Policy and Planning: Read Less [-]

## CIV ENG 251 Operation of Transportation Facilities 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

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.

Operation of Transportation Facilities: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Cassidy, Daganzo

Operation of Transportation Facilities: Read Less [-]

## CIV ENG 252 Systems Analysis in Transportation 3 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021

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.

Systems Analysis in Transportation: Read More [+]

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Hansen

Systems Analysis in Transportation: Read Less [-]

## **CIV ENG 253 Intelligent Transportation Systems 3 Units**

Terms offered: Spring 2021, Spring 2019, Spring 2017

The use of advanced surveillance, navigation, communication, and computer technology to monitor, analyze, and improve the performance of transportation systems. Enabling technologies. Application to monitoring, analysis, evaluation, and prediction of transportation system performance and behavior. Intervention strategies. Feasibility studies. Human factors and institutional issues. Case studies. In the laboratory, students carry out a term project under the supervision of an ITS researcher.

Intelligent Transportation Systems: Read More [+]

### **Rules & Requirements**

**Prerequisites:** Consent of instructor

### **Hours & Format**

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

### **Additional Details**

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Sengupta, Skabardonis

Intelligent Transportation Systems: Read Less [-]

## **CIV ENG 254 Transportation Economics 3 Units**

Terms offered: Spring 2019, Spring 2010, Spring 2009

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.

Transportation Economics: Read More [+]

### **Rules & Requirements**

**Prerequisites:** CIV ENG 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

Transportation Economics: Read Less [-]

## **CIV ENG 254G Global Metropolitan Studies: Introduction to Theories, Histories & Methods 3 Units**

Terms offered: Spring 2024, Spring 2023, Fall 2021

Implications of increasing urbanization are widespread: from environmental challenges, to segregation, to new political and social movements. This course provides an overview of different disciplinary approaches to understanding urban systems, drawing on engineering, the social sciences, urban planning, and the natural sciences. Students will learn from other disciplines to enrich the study of cities within their own field and be better prepared for interdisciplinary collaborations.

Global Metropolitan Studies: Introduction to Theories, Histories & Methods: Read More [+]

### **Rules & Requirements**

**Prerequisites:** PhD standing (any discipline)

### **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:** Walker, Soga

Global Metropolitan Studies: Introduction to Theories, Histories & Methods: Read Less [-]

## **CIV ENG 255 Highway Traffic Operations 3 Units**

Terms offered: Fall 2023, Fall 2022, Fall 2021

Operational planning and management of the highway transportation system. The highway system is presented as a set of operating environments with each having its unique analytical framework. Major topics to be covered include policy and institutional issues, selection of strategies and tactics, evaluation of objectives and measures of effectiveness.

Highway Traffic Operations: Read More [+]

### **Rules & Requirements**

**Prerequisites:** CIV ENG 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

Highway Traffic Operations: Read Less [-]



## CIV ENG 256 Transportation Sustainability 3 Units

Terms offered: Fall 2024, Spring 2024, Spring 2023

This multi-disciplinary course is intended to introduce students to the fundamentals of sustainable transportation, with an emphasis on: 1) current trends, climate and energy science, and the policy context; 2) methodological and analysis techniques; 3) vehicle technology, fuels, and intelligent transportation systems (ITS) solutions (supply side); and 4) land use, public transportation, and demand management.

Transportation Sustainability: Read More [+]

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Horvath

Transportation Sustainability: Read Less [-]

## CIV ENG 257 Sustainable Aviation and Infrastructure 3 Units

Terms offered: Spring 2024, Spring 2022, Spring 2021

Principles of “green” and “sustainable” aviation, and analysis methods for evaluating aviation sustainability metrics and measurements.

Aircraft operations and airport systems in the context of global warming, aviation noise, local and global emissions, third-party risk, environmental economics and resilience. Models of carbon reduction, and technology and operations alternatives are studied. Future concepts, such as urban and regional air mobility using electric aircraft and vertiports.

Sustainable Aviation and Infrastructure: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

**Credit Restrictions:** Students will receive no credit for CIV ENG 257 after completing CIV ENG 257, or CIV ENG 257. A deficient grade in CIV ENG 257 may be removed by taking CIV ENG 257, or CIV ENG 257.

### 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:** Rakas

Sustainable Aviation and Infrastructure: Read Less [-]

## CIV ENG 258 Logistics 3 Units

Terms offered: Fall 2013, Fall 2011, Fall 2010

Vehicle routing. Transportation-inventory-production interrelationships, physical distribution networks, many-to-many networks (airlines, postal, etc.), the role of transshipments and terminals in logistic systems for the transportation of goods and passengers, public and private transportation system design. Relevant methodologies.

Logistics: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Daganzo

Logistics: Read Less [-]

## CIV ENG C258 Supply Chain and Logistics Management 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022, Spring 2021

Supply chain analysis is the study of quantitative models that characterize various economic trade-offs in the supply chain. The field has made significant strides on both theoretical and practical fronts. On the theoretical front, supply chain analysis inspires new research ventures that blend operations research, game theory, and microeconomics. These ventures result in an unprecedented amalgamation of prescriptive, descriptive, and predictive models characteristic of each subfield. On the practical front, supply chain analysis offers solid foundations for strategic positioning, policy setting, and decision making.

Supply Chain and Logistics Management: Read More [+]

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Shen

**Also listed as:** IND ENG C253

Supply Chain and Logistics Management: Read Less [-]

## **CIV ENG 259 Public Transportation Systems 3 Units**

Terms offered: Spring 2024, Spring 2023, Spring 2022  
Analysis of mass transit systems, their operation, and management.  
Technology of transit vehicles and structures. Public policy and financing.  
Public Transportation Systems: [Read More](#) [+]

### **Rules & Requirements**

**Prerequisites:** CIV ENG 251, CIV ENG 252, and CIV ENG 262

### **Hours & Format**

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

### **Additional Details**

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Cassidy, Daganzo

Public Transportation Systems: [Read Less](#) [-]

## **CIV ENG 260 Air Transportation 3 Units**

Terms offered: Fall 2024, Spring 2024, Spring 2023  
Nature of civil aviation; structure of the airline industry; aircraft characteristics and performance; aircraft noise; navigation and air traffic control; airport planning and design; airline operations; aviation system planning.  
Air Transportation: [Read More](#) [+]

### **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

Air Transportation: [Read Less](#) [-]

## **CIV ENG 260D Data Science in Aviation 3 Units**

Terms offered: Spring 2023

The course will be centered around analyses of a set of aviation data sets and will enable the students to become familiar with data science applications to aviation. Aviation topics to be covered include fundamentals of air traffic control, models of aviation operations, aircraft trajectory prediction and optimization, data sources in aviation, overview of data science methods, role of data science in solving problems in aviation operations such as conflict detection and resolution, traffic flow management, arrivals management and surface operations, airline operations, fuel efficiency, global aviation.  
Data Science in Aviation: [Read More](#) [+]

### **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/Graduate

**Grading:** Letter grade.

Data Science in Aviation: [Read Less](#) [-]

## **CIV ENG 261 Infrastructure Systems Management 3 Units**

Terms offered: Spring 2014, Spring 2013, Spring 2011  
Integrated treatment of quantitative and analytical methods for the management of infrastructure facilities over their life. The focus of the course is on statistical modeling and numerical optimization methods and their application to managing systems of civil infrastructure, with an emphasis on transportation facilities.  
Infrastructure Systems Management: [Read More](#) [+]

### **Rules & Requirements**

**Prerequisites:** CIV ENG 252 and CIV ENG 262

### **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.

Infrastructure Systems Management: [Read Less](#) [-]

## CIV ENG 262 Analysis of Transportation Data 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Probabilistic models in transportation. The use of field data. Data gathering techniques, sources of errors, considerations of sample size. Experiment design for demand forecasting and transportation operations analysis. Analysis techniques.

Analysis of Transportation Data: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** College calculus or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Daganzo, Hansen

Analysis of Transportation Data: [Read Less](#) [-]

## CIV ENG C263H Human Mobility and Network Science 3 Units

Terms offered: Fall 2024, Fall 2023

Techniques for analyzing individual daily activities and travels both at urban and at global scale. The course is designed for graduate students interested in methods to analyze human dynamics, and their interactions with the built and the natural environment. Course covers five units each of which is centered in a seminal research paper. Students learn to reproduce the results of the selected paper in the classroom via computer labs, and through a related data analysis and modeling assignments.

Human Mobility and Network Science: [Read More](#) [+]

### Objectives & Outcomes

**Course Objectives:** The course reviews basic concepts of data analysis, modeling, and visualization. Methods include principal component analysis to identify the structure inherent in daily behavior, spatial clustering, introduction to trip distribution models and parsing of spatial trajectories. Ending with models and methods to represent various socio-technical systems as networks, such as: daily commuting, air travels, and roads.

### Rules & Requirements

**Prerequisites:** An undergraduate-level understanding of probability, statistics, algorithms, and linear algebra is required

**Credit Restrictions:** Students will receive no credit for CY PLAN C257H after completing CY PLAN 257.

### 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:** Gonzalez

**Also listed as:** CY PLAN C257H

Human Mobility and Network Science: [Read Less](#) [-]

## CIV ENG 263N Scalable Spatial Analytics 3 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

Introduction to modern methods of data analysis, spatial data handling and visualization technologies for engineers and data scientists.

Theoretical coverage includes a selection of methods from spatial statistics, exploratory data analysis, spatial data mining, discriminative and generative approaches of machine learning. Projects and assignment tasks are targeted at real-world scalable implementation of systems and services based on data analytics in environmental remote sensing, transportation, energy, location-based services and the domain of "smart cities" in general

Scalable Spatial Analytics: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 290I or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

Scalable Spatial Analytics: Read Less [-]

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

Terms offered: Spring 2023, Spring 2022, Spring 2021

Many aspects of engineering, planning, and policy involve a human element, be it consumers, businesses, governments, or other organizations. Effective design and management requires understanding this human response. This course focuses on behavioral theories and the use of quantitative methods to analyze human response. A mix of theory and practical tools are covered, with applications drawn from infrastructure investment and use, urban growth and design, health, and sustainability.

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

### Rules & Requirements

**Prerequisites:** CIV ENG 262 or CY PLAN 204

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Walker

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

## CIV ENG C265 Traffic Safety and Injury Control 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

This course applies principles of engineering, behavioral science, and vision science to preventing traffic collisions and subsequent injury. A systematic approach to traffic safety will be presented in the course, and will include (1) human behavior, vehicle design, and roadway design as interacting approaches to preventing traffic crashes and (2) vehicle and roadway designs as approaches to preventing injury once a collision has occurred. Implications of intelligent transportation system concepts for traffic safety will be discussed throughout the course.

Traffic Safety and Injury Control: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Ragland

**Also listed as:** PB HLTH C285

Traffic Safety and Injury Control: Read Less [-]

## CIV ENG 268A Lean Construction Concepts and Methods 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2021

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 procurement system design, target costing, value stream mapping, and work flow control. Student teams apply concepts and methods in field studies of real project management processes and construction operations. The course includes a tour of the NUMMI Auto Plant in Fremont.

Lean Construction Concepts and Methods: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing in Civil and Environmental Engineering

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Tommelein

**Formerly known as:** 290M

Lean Construction Concepts and Methods: Read Less [-]

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

Terms offered: Spring 2024, Spring 2023, Spring 2022

Principles and practices of "lean" production are applied to project delivery in the AEC industry. Case studies illustrate the concepts. Project delivery is viewed holistically with a focus on work structuring and supply chain management. Topics include systems dynamics, uncertainty, and variation; materials management; logistics; e-commerce; building information modeling (BIM); and integrated product and process design. Students use process simulation to assess performance of different system configurations and develop a case study applying concepts on a real project.

Lean Construction and Supply Chain Management: Read More [+]

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Tommelein

**Formerly known as:** 290N

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

## CIV ENG 268D Law for Engineers 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Engineering involves many parties with diverse interests. Legal principles form the framework for their interaction. Contracts for engineering services establish both risk allocation and reciprocal liabilities. Issues of contract formation, performance, breach, and remedy are covered in detail. Standard of care and professional negligence are emphasized during the discussion of tort law. Other topics include regulation, legal relationships, litigation, and alternative dispute resolution.

Law for Engineers: Read More [+]

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Formerly known as:** 290L

Law for Engineers: Read Less [-]

## CIV ENG 268E Environmental Life-Cycle Assessment 3 Units

Terms offered: Fall 2024, Fall 2022, Fall 2021

Methods and tools of environmental life-cycle assessment (LCA, an international standard), especially as applied to infrastructure, but also applicable to other products, processes, services, and systems. Focus on design, management, and supply chains of the entire life cycle: manufacturing, construction, transportation, operation and maintenance, and end of life. Economic life-cycle cost analysis. Models and tools for life-cycle environmental inventory, impact, and improvement analysis.

Environmental Life-Cycle Assessment: Read More [+]

### Objectives & Outcomes

**Student Learning Outcomes:** After taking this course, students will be able to analyze the life-cycle environmental and economic implications of products, processes, and services using state-of-the-art methods, make decisions with confidence, document their analysis in a structured and transparent way, and be cognizant of the policy dimensions of decisions needing LCA.

### 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

Environmental Life-Cycle Assessment: Read Less [-]

## CIV ENG 268H Advanced Project Planning and Control 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Cost and time estimating and controlling techniques for projects. Evaluation of labor, material, equipment, and subcontract resources, scheduling techniques, earned value concepts. Measuring project percent complete. Contractual risk allocation. Project investment analysis techniques.

Advanced Project Planning and Control: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 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

Advanced Project Planning and Control: Read Less [-]

## CIV ENG 268I Business Fundamentals for Engineers 3 Units

Terms offered: Spring 2019, Spring 2017, Spring 2016

This course will provide a broad survey of management practices critical to starting and managing a business in the engineering and construction industries. Topics that are covered include the entrepreneurial process; organizing and staffing; establishing and applying production control systems; means of protecting products and services from competitive threat; and financial management.

Business Fundamentals for Engineers: Read More [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 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

Business Fundamentals for Engineers: Read Less [-]

## CIV ENG 268K Human and Organizational Factors: Quality and Reliability of Engineered Systems 3 Units

Terms offered: Spring 2011, Spring 2010, Fall 2009

This course addresses human and organizational factors in development of desirable quality and reliability in engineered systems during their life-cycles (concept development through decommissioning). Applications tested and verified proactive, reactive, and interactive approaches are developed and illustrated.

Human and Organizational Factors: Quality and Reliability of Engineered Systems: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Formerly known as:** 290A

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

## CIV ENG 268S Buildings and Sustainability 3 Units

Terms offered: Spring 2018

Overview of what makes buildings and their systems "green" and "sustainable," and analysis throughout their life cycle (design, materials, construction, operation, maintenance, renovation, end of life) and in interaction with infrastructure systems (energy, transportation, water, waste management), the economy, natural environment, society. Innovative approaches, expectations for future developments. Cost-benefit analysis. Life-cycle management. Net-zero buildings. Case studies.

Buildings and Sustainability: Read More [+]

### Objectives & Outcomes

#### Course Objectives: 1.

Provide overview of the importance of buildings to resource management, particularly focused on energy, transportation systems, water, waste, and land use

2.

Introduce the major design considerations, practices, and outcomes associated with green buildings

3.

Develop students' ability to think critically about the role of buildings in society.

4.

Critically evaluate tradeoffs in building systems design subject to time, cost, material, social, and environmental constraints, and ethical considerations.

5.

Consider the future of the green building industry in the context of real-world developments and practice, equity, and justice.

6.

Evaluate the interplay between buildings and policy, including use of local case studies.

### Rules & Requirements

**Prerequisites:** Graduate or senior undergraduate standing with consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Horvath

Buildings and Sustainability: Read Less [-]



## CIV ENG 270 Advanced Geomechanics 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Advanced treatment of topics in soil mechanics, including state of stress, consolidation and settlement analysis, shear strength of cohesionless and cohesive soils, and slope stability analysis.

Advanced Geomechanics: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 175

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Bray, Soga

**Formerly known as:** 270A

Advanced Geomechanics: [Read Less](#) [-]

## CIV ENG 271 Sensors and Signal Interpretation 3 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017

An introduction to the fundamentals of sensor usage and signal processing, and their application to civil systems. In particular, the course focuses on how basic classes of sensors work, and how to go about choosing the best of the new MEMS-based devices for an application. The interpretation of the data focuses on analysis of transient signals, an area typically ignored in traditional signal processing courses. Goals include development of a critical understanding of the assumptions used in common sensing and analysis methods and their implications, strengths, and limitations.

Sensors and Signal Interpretation: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Glaser

Sensors and Signal Interpretation: [Read Less](#) [-]

## CIV ENG 272 Numerical Modelling in Geomechanics 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Constitutive laws for geotechnical materials including inelastic hyperbolic and elasto-plastic Cam-clay; soil behavior and critical-state soil mechanics; application of the finite element method to static analysis of earth structures; the Discontinuous Deformation Analysis method.

Numerical Modelling in Geomechanics: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Bray, Soga

Numerical Modelling in Geomechanics: [Read Less](#) [-]

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

Terms offered: Spring 2024, Spring 2023, Spring 2022

Field and laboratory testing of soils to support analysis and design of earth structures. In situ field testing, including SPT, CPT, and vane shear, undisturbed sampling of soil, and laboratory testing of soil, including advanced equipment, instrumentation, data acquisition, and measurement techniques. Consolidation and static and cyclic triaxial and simple shear testing under stress- and strain-control with pore pressure measurements. Preparation of an engineering report.

Advanced GeoEngineering Testing and Design: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** CIV ENG 270 or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Bray

**Formerly known as:** 270L

Advanced GeoEngineering Testing and Design: [Read Less](#) [-]

## CIV ENG 275 Geotechnical Earthquake Engineering 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Seismicity, influence of soil conditions on site response, seismic site response analysis, evaluation and modelling of dynamic soil properties, analysis of seismic soil-structure interaction, evaluation and mitigation of soil liquefaction and its consequences, seismic code provisions and practice, seismic earth pressures, seismic slope stability and deformation analysis, seismic safety of dams and embankments, seismic performance of pile foundations, and additional current topics.

Geotechnical Earthquake Engineering: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** CIV ENG 175 or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Bray

Geotechnical Earthquake Engineering: Read Less [\[-\]](#)

## CIV ENG C276 Seismic Hazard Analysis and Design Ground Motions 3 Units

Terms offered: Spring 2023, Spring 2021, Spring 2019

Deterministic and probabilistic approaches for seismic hazard analysis. Separation of uncertainty into aleatory variability and epistemic uncertainty. Discussion of seismic source and ground motion characterization and hazard computation. Development of time histories for dynamic analyses of structures and seismic risk computation, including selection of ground motion parameters for estimating structural response, development of fragility curves, and methods for risk calculations.

Seismic Hazard Analysis and Design Ground Motions: Read More [\[+\]](#)

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Abrahamson

**Also listed as:** EPS C276

Seismic Hazard Analysis and Design Ground Motions: Read Less [\[-\]](#)

## CIV ENG 277 Advanced Foundation Engineering 3 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022

Advanced treatment of topics in foundation engineering design, including earth pressure theories, design of earth retaining structures, settlement, bearing capacity, analysis and design of shallow and deep foundations.

Advanced Foundation Engineering: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** CIV ENG 175 or equivalent

### Hours & Format

#### Fall and/or spring:

15 weeks - 3 hours of lecture and 0 hours of discussion per week

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:** Bray

**Formerly known as:** 270B

Advanced Foundation Engineering: Read Less [\[-\]](#)

## CIV ENG 278 Infrastructure Sensing and Modeling 3 Units

Terms offered: Fall 2024

The future of infrastructure relies on smarter information; the rich information obtained from embedded sensors within infrastructure and large-scale computer simulations will act as catalysts for new design, construction, operation and maintenance processes for integrated infrastructure systems linked directly with user behavior patterns. This course will teach the fundamentals of various sensing and modeling tools used for infrastructure engineering and present case studies. The trend in entrepreneurship for emerging technologies in infrastructure and smart cities industry will be discussed.

Infrastructure Sensing and Modeling: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** ENGIN 7, CIVENG C30, and CIVENG 93

### 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:** Soga, Zekkos, Kayen

Infrastructure Sensing and Modeling: Read Less [\[-\]](#)

## CIV ENG 281 Engineering Geology 3 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022

Influence of geologic origin and history on the engineering characteristics of soils and rocks. Application of geology in exploration, design, and construction of engineering works.

Engineering Geology: Read More [ + ]

### Rules & Requirements

**Prerequisites:** A course in physical geology

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Sitar

Engineering Geology: Read Less [ - ]

## CIV ENG 285C Seismic Methods in Applied Geophysics 3 Units

Terms offered: Spring 2011, Spring 2006, Spring 2002

This course gives an overview of seismic methods used to image the subsurface. Acquisition, processing, and interpretation of seismic data are discussed, with application to petroleum production, environmental site characterization, earthquake engineering, and groundwater.

Seismic Methods in Applied Geophysics: Read More [ + ]

### Rules & Requirements

**Prerequisites:** CIV ENG C178 (introductory course in applied geophysics); and ENGIN 7 (introductory course in computer programming)

**Credit Restrictions:** Students will receive no credit for 285C after taking Mineral Engineering 236 before Fall 2001.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Rector

**Formerly known as:** Mineral Engineering 236

Seismic Methods in Applied Geophysics: Read Less [ - ]

## CIV ENG 286 Digital Data Processing 3 Units

Terms offered: Spring 2023, Spring 2021, Spring 2019

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.

Digital Data Processing: Read More [ + ]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Credit Restrictions:** Students will receive no credit for 286 after taking Mineral Engineering 240 taken before Fall 2001.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Rector

**Formerly known as:** Mineral Engineering 240

Digital Data Processing: Read Less [ - ]

## **CIV ENG C289 Cyber Physical System Design Principles and Applications 4 Units**

Terms offered: Spring 2020, Spring 2019, Spring 2016

Principles of embedded system design. Focus on design methodologies and foundations. Platform-based design and communication-based design and their relationship with design time, re-use, and performance. Models of computation and their use in design capture, manipulation, verification, and synthesis. Mapping into architecture and systems platforms. Performance estimation. Scheduling and real-time requirements. Synchronous languages and time-triggered protocols to simplify the design process.

Cyber Physical System Design Principles and Applications: Read More [+]

### **Rules & Requirements**

**Prerequisites:** Suggested but not required: CS170, EECS149/249A

**Credit Restrictions:** Students will receive no credit for EECS C249B after completing EL ENG 249, or EECS 249B. A deficient grade in EECS C249B may be removed by taking EECS 249B.

### **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 C249B/Civil and Environmental Engineering C289

**Also listed as:** EECS C249B

Cyber Physical System Design Principles and Applications: Read Less [-]

## **CIV ENG 290 Advanced Special Topics in Civil and Environmental Engineering 1 - 3 Units**

Terms offered: Fall 2024, Spring 2024, Fall 2023

This course covers current topics of interest in civil and environmental engineering. The course content may vary from semester to semester depending upon instructor.

Advanced Special Topics in Civil and Environmental Engineering: Read More [+]

### **Rules & Requirements**

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### **Hours & Format**

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

### **Additional Details**

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

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

## **CIV ENG C290U Transportation and Land Use Planning 3 Units**

Terms offered: Fall 2024, Fall 2023, Fall 2022

Examination of the interactions between transportation and land use systems; historical perspectives on transportation; characteristics of travel and demand estimation; evaluation of system performance; location theory; models of transportation and urban structure; empirical evidence of transportation-land use impacts; case study examinations.

Transportation and Land Use Planning: Read More [+]

### **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:** Chatman

**Also listed as:** CY PLAN C213

Transportation and Land Use Planning: Read Less [-]

## CIV ENG 290F Advanced Topics in Seismology 3 Units

Terms offered: Spring 2022, Spring 2018, Spring 2016

Active areas of research in applied seismology. Subjects include: anisotropic and viscoelastic wave propagation, borehole seismology, crosswell seismology, including crosswell seismic tomography, vertical seismic profiling, reservoir monitoring including passive seismic methods. Advanced Topics in Seismology: Read More [+]

### Rules & Requirements

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

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Rector

**Formerly known as:** Mineral Engineering 290C

Advanced Topics in Seismology: Read Less [-]

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

Terms offered: Fall 2024, Fall 2023, Fall 2022

Mathematical methods and information technologies for controlling CEE systems. Emphasizes designing component organizations that interact with the world in real-time to control a large system. Methods applied to transportation operations, supply chains, and structures. Management of design complexity by hierarchical specification, systematic use of simulation and verification tools, semantics, polymorphism, information management services, and compilation from high-level design languages. Civil Systems: Control and Information Management: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Sengupta

Civil Systems: Control and Information Management: Read Less [-]

## CIV ENG 290J Advanced Topics in Geotechnical Engineering 3 Units

Terms offered: Spring 2014, Spring 2009, Spring 2007

Advanced treatment of developing areas of geomechanics and geotechnical earthquake engineering, including the development of generalized nonlinear soil constitutive models, new developments in soil dynamics and geotechnical earthquake engineering, soil improvement, geosynthetics and earth structures, and case studies of geotechnical problems.

Advanced Topics in Geotechnical Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** Advanced graduate standing in Geoenvironmental Engineering

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Bray

Advanced Topics in Geotechnical Engineering: Read Less [-]

## CIV ENG 290T Advanced Topics in Transportation Theory 1 Unit

Terms offered: Fall 2008, Spring 2008, Fall 2007

Selected topics in the mathematical analysis of transportation systems. Topics will vary from year to year.

Advanced Topics in Transportation Theory: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Instructors:** Cassidy, Daganzo

Advanced Topics in Transportation Theory: Read Less [-]

## CIV ENG C291F Control and Optimization of Distributed Parameters Systems 3 Units

Terms offered: Fall 2017, Spring 2016, Spring 2015, Spring 2014

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.

Control and Optimization of Distributed Parameters Systems: Read More [+]

### Rules & Requirements

**Prerequisites:** ENGIN 7 and MATH 54; 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

Control and Optimization of Distributed Parameters Systems: Read Less [-]

## CIV ENG 291D Data-driven Control Methods for Civil Engineering 3 Units

Terms offered: Spring 2024, Fall 1995

Introduction to current areas of research at the intersection of machine learning and control with application to civil systems. Investigations of machine learning and data-driven algorithms that interact with the physical world. Topics of study will include learning models of dynamical systems, using these models to represent civil systems, and machine learning techniques to manage and control civil applications spanning from energy systems to water networks, to transportation and supply chains. The course will introduce students to methods to either infer dynamics from data with the goal of using classical control algorithms or develop model-free control strategies starting from data.

Data-driven Control Methods for Civil Engineering: Read More [+]

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Delle Monache

Data-driven Control Methods for Civil Engineering: Read Less [-]

## CIV ENG 291G Advanced Estimation, Control, and Optimization of Partial Differential Equations 3 Units

Terms offered: Prior to 2007

This course will cover advanced methods in estimation, control, and optimization of distributed parameter systems (partial differential equations in particular). The course builds on 291 and covers discrete methods relying on finite differencing such as quadratic programming for optimal control and variational data assimilation, (ensemble, extended) Kalman filtering. The course covers distributed transfer function analysis and frequency responses of PDEs, and characteristics-based stability analysis.

Advanced Estimation, Control, and Optimization of Partial Differential Equations: Read More [+]

### Rules & Requirements

**Prerequisites:** Civil and Environmental Engineering C291F/Electrical Engineering C291/Mechanical Engineering C236 or equivalent, or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Bayen

Advanced Estimation, Control, and Optimization of Partial Differential Equations: Read Less [-]

## CIV ENG 292A Technologies for Sustainable Societies 1 Unit

Terms offered: Fall 2018, Fall 2017, Fall 2016

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

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Instructors:** Horvath, Nazaroff

Technologies for Sustainable Societies: Read Less [-]



## CIV ENG 292B Climate Resilient Infrastructure Design Studio 3 Units

Terms offered: Fall 2024

In this course, students develop real-world engineering and design skills to address the effects of climate change. The semester teaches design solutions based on planned and implemented projects to address sea level rise, extreme flooding and other climate risks. Students will explore applications to real-world sites in a project-based format. Topics include engineering tools, high performance landscapes, sustainable infrastructure, urban design, equity and social justice, and resilience of critically impacted built and natural infrastructure systems.

Climate Resilient Infrastructure Design Studio: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Graduate Standing or Permission of the Instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Stacey

Climate Resilient Infrastructure Design Studio: [Read Less](#) [-]

## CIV ENG 293 Uncertainty Quantification for Engineering 3 Units

Terms offered: Not yet offered

This course introduces modern models and methods of uncertainty quantification through their applications to engineering problems. The course consists of four components: (i) probabilistic models, (ii) forward uncertainty quantification, (iii) sensitivity analysis, and (iv) inverse uncertainty quantification. Students will use computer codes to apply the concepts learned to homework problems and a term project. A basic knowledge of probability theory is required, but a brief review of fundamental concepts will be offered at the beginning of the course.

Uncertainty Quantification for Engineering: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Graduate standing

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Wang, Ziqi, Govindjee, Sanjay

Uncertainty Quantification for Engineering: [Read Less](#) [-]

## CIV ENG 294 Disaster Risk Analysis of Infrastructure Systems 3 Units

Terms offered: Fall 2024

Coverage of urban risks to natural hazards such as earthquakes, hurricanes, and floods; fundamental concepts in hazards, infrastructure vulnerability, and risk; disaster risk modeling with rigorous statistical methods and large datasets; and network modeling to assess the cascading effects of infrastructure failures. Designed for graduate students interested in risk and resilience for practice and research. Course includes software development and utilization of research software for regional risk modeling of the impacts of natural hazards.

Disaster Risk Analysis of Infrastructure Systems: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Graduate standing

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Ceferino

Disaster Risk Analysis of Infrastructure Systems: [Read Less](#) [-]

## CIV ENG 295 Data Science for Energy 3 Units

Terms offered: Spring 2024, Spring 2023, Fall 2021

This course introduces students to the fundamentals of data science methods for the design and operation of energy systems. The course is oriented towards students pursuing a technical career in cleantech, or a PhD in the energy sciences and engineering. Course contents include: mathematical modeling & analysis, state estimation, optimization, machine learning, and optimal control. Homework assignments are designed around case studies, including lithium-ion batteries, oil & gas systems, renewable power systems, smart buildings, and electrified transportation. Student teams also execute a self-defined project.

Data Science for Energy: [Read More](#) [+]

### 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

Data Science for Energy: [Read Less](#) [-]

## CIV ENG 297 Field Studies in Civil and Environmental Engineering 1 - 12 Units

Terms offered: Fall 2024, Summer 2024 10 Week Session, Spring 2024  
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.

Field Studies in Civil and Environmental Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 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.

Field Studies in Civil and Environmental Engineering: Read Less [-]

## CIV ENG 298 Group Studies, Seminars, or Group Research 1 - 6 Units

Terms offered: Fall 2024, Spring 2024, Fall 2023

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.

Group Studies, Seminars, or Group Research: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

Group Studies, Seminars, or Group Research: Read Less [-]

## CIV ENG 299 Individual Research 1 - 12 Units

Terms offered: Fall 2024, Spring 2024, Fall 2023

Research or investigation in selected advanced subjects.

Individual Research: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-36 hours of independent study per week

**Summer:** 8 weeks - 6-68 hours of independent study per week

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

Individual Research: Read Less [-]

## CIV ENG 375 Workshop for Future Civil and Environmental Engineering Teachers 2 Units

Terms offered: Fall 2024, Spring 2024, Fall 2023

The course will include supervised teaching of laboratory sections of civil engineering courses, group analysis of videotapes, reciprocal classroom visitations, and an individual project.

Workshop for Future Civil and Environmental Engineering Teachers:  
Read More [+]

### Rules & Requirements

**Prerequisites:** Teaching assistant or graduate student status

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/  
Professional course for teachers or prospective teachers

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Formerly known as:** Civil and Environmental Engineering 301

Workshop for Future Civil and Environmental Engineering Teachers:  
Read Less [-]

## CIV ENG 601 Individual Study for Master's Students 1 - 6 Units

Terms offered: Fall 2024, Summer 2024 10 Week Session, Spring 2024  
Individual study for the comprehensive or language requirements in consultation with the major field adviser. Units may not be used to meet either unit or residence requirements.

Individual Study for Master's Students: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate examination preparation

**Grading:** Offered for satisfactory/unsatisfactory grade only.

Individual Study for Master's Students: [Read Less](#) [-]

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

Terms offered: Fall 2024, Spring 2024, Fall 2023

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare for the various examinations required of candidates for doctoral degrees. May not be used for unit or residence requirements.

Individual Study for Doctoral Students: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

### Additional Details

**Subject/Course Level:** Civil and Environmental Engineering/Graduate examination preparation

**Grading:** Offered for satisfactory/unsatisfactory grade only.

Individual Study for Doctoral Students: [Read Less](#) [-]