Environmental Engineering

Minor

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

There is no major in environmental engineering.

Declaring the Minor

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

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

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

Upon completion of the minor requirements, the student must complete and submit the Confirmation of Completion form to the Civil and Environmental Academic Affairs office (750 Davis Hall) a Minor Program Application form.

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

Civil Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/civil-engineering/) (Major only)
Geotechnical Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/geotechnical-engineering/) (Minor only)
Structural Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/structural-engineering/) (Minor only)

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

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

General Guidelines

1. All minors must be declared no later than one semester before a student's Expected Graduation Term (EGT). If the semester before EGT is fall or spring, the deadline is the last day of RRR week. If the semester before EGT is summer, the deadline is the final Friday of Summer Sessions. To declare a minor, contact the department advisor for information on requirements, and the declaration process.

2. All courses taken to fulfill the minor requirements must be taken for graded credit.

3. A minimum overall grade point average (GPA) of 3.0 and a minimum GPA of 3.0 in the prerequisite courses is required for acceptance into the minor program.

4. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.

5. No more than one upper division course may be used to simultaneously fulfill requirements for a student's major and minor programs.

6. Completion of the minor program cannot delay a student's graduation.

Lower Division Prerequisites

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1A</td>
<td>Calculus and Calculus</td>
<td>8</td>
</tr>
<tr>
<td>MATH 1B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 53</td>
<td>Multivariable Calculus</td>
<td>8</td>
</tr>
<tr>
<td>MATH 54</td>
<td>and Linear Algebra and Differential Equations</td>
<td></td>
</tr>
</tbody>
</table>

Select one Chemistry course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1A</td>
<td>General Chemistry</td>
<td>8</td>
</tr>
<tr>
<td>CHEM 4A</td>
<td>General Chemistry and Quantitative Analysis</td>
<td>5</td>
</tr>
</tbody>
</table>

Select one physics course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 7A</td>
<td>Physics for Scientists and Engineers</td>
<td>4</td>
</tr>
</tbody>
</table>

Select one computer programming course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGIN 7</td>
<td>Introduction to Computer Programming for Scientists and Engineers</td>
<td>4</td>
</tr>
<tr>
<td>COMPSCI 61A</td>
<td>The Structure and Interpretation of Computer Programs</td>
<td>4</td>
</tr>
</tbody>
</table>

Upper Division Minor Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV ENG 100</td>
<td>Elementary Fluid Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>or MEC ENG 108</td>
<td>Fluid Mechanics</td>
<td></td>
</tr>
<tr>
<td>CIV ENG 111</td>
<td>Environmental Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Select three of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV ENG C103N</td>
<td>Terrestrial Hydrology</td>
<td>4</td>
</tr>
<tr>
<td>CIV ENG C106</td>
<td>Air Pollution</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENG 107</td>
<td>Climate Change Mitigation</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENG 108</td>
<td>Climate Change Adaptation</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENG 110</td>
<td>Water Systems of the Future</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENG 112</td>
<td>Water &amp; Wastewater Systems Design and Operation</td>
<td>3</td>
</tr>
</tbody>
</table>
University of California Requirements

Entry Level Writing (http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext)

All students who will enter the University of California as freshmen must demonstrate their command of the English language by satisfying the Entry Level Writing Requirement (ELWR). The UC Entry Level Writing Requirement website (https://admission.universityofcalifornia.edu/elwr/) provides information on how to satisfy the requirement.

American History and American Institutions (http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext)

The American History and Institutions (AH&I) requirements are based on the principle that a US resident graduated from an American university should have an understanding of the history and governmental institutions of the United States.

Campus Requirement

American Cultures (http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext)

The American Cultures requirement is a Berkeley campus requirement, one that all undergraduate students at Berkeley need to pass in order to graduate. You satisfy the requirement by passing, with a grade not lower than C- or P, an American Cultures course. You may take an American Cultures course any time during your undergraduate career at Berkeley. The requirement was instituted in 1991 to introduce students to the diverse cultures of the United States through a comparative framework. Courses are offered in more than fifty departments in many different disciplines at both the lower and upper division level.

Environmental Engineering

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV ENG 113</td>
<td>Ecological Engineering for Water Quality Improvement</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENG 114</td>
<td>Environmental Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENG 115</td>
<td>Water Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENG C116</td>
<td>Chemistry of Soils</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENG 173</td>
<td>Groundwater and Seepage</td>
<td>3</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Prerequisites: CHEM 1A and MATH 1A</th>
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</thead>
</table>

Hours & Format

<table>
<thead>
<tr>
<th>Fall and/or spring: 15 weeks - 3 hours of lecture per week</th>
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<tbody>
<tr>
<td>Summer: 8 weeks - 6 hours of lecture per week</td>
</tr>
</tbody>
</table>

Additional Details

<table>
<thead>
<tr>
<th>Subject/Course Level: Civil and Environmental Engineering/Undergraduate</th>
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</thead>
<tbody>
<tr>
<td>Grading/Final exam status: Letter grade. Final exam required.</td>
</tr>
<tr>
<td>Instructors: Harley, Horvath, Nelson</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Repeat rules: Course may be repeated for credit when topic changes.</th>
</tr>
</thead>
</table>

Hours & Format

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

Additional Details

<table>
<thead>
<tr>
<th>Subject/Course Level: Civil and Environmental Engineering/Undergraduate</th>
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</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

Freshman Seminars: Read Less [-]
CIV ENG C30 Introduction to Solid Mechanics 3 Units
Terms offered: Fall 2024, Spring 2024, Fall 2023
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
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.

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

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.

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 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

Formerly known as: Civil and Environmental Engineering 88

Also listed as: CY PLAN C88

Data Science for Smart Cities: 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.

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 More [+]

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.

Rules & Requirements
Prerequisites: ENGIN 7 or COMPSCI C8 / INFO C8 / STAT C8. Student should consult instructor prior to enrolling
Credit Restrictions: Students will receive no credit after taking Statistics 25.

Hours & Format
Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week
Summer: 6 weeks - 5 hours of lecture and 7.5 hours of laboratory per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructors: Hansen, Rubin, Walker

Engineering Data Analysis: Read Less [-]
CIV ENG 98 Supervised Group Study and Research 1 - 3 Units
Terms offered: Spring 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 directed group 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

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.

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 More [+]

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.

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 More [+]

Climate Change Adaptation: 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.

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

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructors: Alvarez-Cohen, Nelson, Sedlak

CIV ENG 111L Water and Air Quality Laboratory 1 Unit
Terms offered: Fall 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.

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

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...

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 and Air Quality Laboratory: Read Less [-]

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
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 - 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

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.

Instructors: Konstantinidis, DeJong

Structural Design in Timber: Read Less [-]

CIV ENG 126 Engineering Dynamics and Vibrations 3 Units
Terms offered: Fall 2024, Fall 2023, Fall 2022

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.

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 More [+]

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.

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

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 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

Data Science in Aviation: Read Less [-]

CIV ENG 165 Concrete Materials, Construction, and Sustainability 3 Units
Terms offered: Spring 2023, Spring 2021, Spring 2020

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 geosynthetics and their use in typical applications. Fate and transport of contaminants. Fundamental principles and practices in groundwater remediation. Application of environmental geotechnics in the design and construction of waste containment systems. Discussion of soil remediation and emerging technologies.
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 2022, Fall 2021, Fall 2020, 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 2024, Fall 2022, Fall 2021
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 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.

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 lifecycle 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.

Instructors: Bray, Sitar, Soga

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: 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.

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

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

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.

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.
Instructor: Sengupta

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.

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.
Instructors: Bayen, Madanat, Sengupta
Formerly known as: 152

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.

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 [-]