Civil Engineering

Bachelor of Science (BS)

The Department of Civil and Environmental Engineering's (CEE) undergraduate program offers opportunities for rigorous academic learning, fellowship, hands-on experience, and leadership. Classes are relatively small, so students get to know both the faculty and fellow students.

The program in civil and environmental engineering, which is top-ranked nationally, provides students with a strong fundamental background in engineering science, design, and practice. Students learn to solve societal problems—in California, the United States, and the world—such as:

• Improving civil infrastructure
• Protecting resources
• Mitigating hazards
• Creating efficient and sustainable civil systems

CEE's four-year curriculum leads to an ABET-accredited Bachelor of Science (BS) degree in Civil Engineering. Undergraduates at Berkeley have opportunities for professional interactions and community service. CEE has active student chapters of the American Society of Civil Engineers and the national honor society of Chi Epsilon as well as seven competition teams.

Areas of Emphasis

Students with a specific interest within civil engineering may choose to emphasize one of the following areas: engineering and project management; environmental engineering; geosystems; structural engineering, mechanics and materials; or transportation engineering. See suggestions for elective courses and the capstone design project.

Selection of an area of emphasis is optional. A BS in engineering is awarded whether or not a student follows the broad and general program or chooses an area of emphasis.

Accreditation

The BS program in Civil Engineering is accredited by the Engineering Accreditation Commission of the ABET, Inc. (http://www.abet.org/accreditation)

Admission to the Major

Prospective undergraduates to the College of Engineering will apply for admission to a specific program in the college. For further information, see the College of Engineering's website (http://coe.berkeley.edu/students/prospective-students/admissions.html).

Admission to Engineering via a Change of College application for current UC Berkeley students is highly unlikely and very competitive as there are few (if any) spaces that open in the college each year to students admitted to other colleges at UC Berkeley. For further information regarding a Change of College to Engineering, see the college's website (http://coe.berkeley.edu/students/current-undergraduates/change-of-college).

Minor Program

CEE does not offer a minor in Civil Engineering. Instead, the department offers the following specialized minors:

Environmental Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/environmental-engineering)
GeoSystems (http://guide.berkeley.edu/undergraduate/degree-programs/geosystems)
Structural Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/structural-engineering)

In addition to the University, campus, and college requirements, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All technical courses taken in satisfaction of major requirements must be taken for a letter grade.
2. No more than one upper division course may be used to simultaneously fulfill requirements for a student’s major and minor programs.
3. A minimum overall grade point average (GPA) of 2.0 is required for all work undertaken at UC Berkeley.
4. A minimum GPA of 2.0 is required for all technical courses taken in satisfaction of major requirements.

For information regarding residence requirements and unit requirements, see the College Requirements tab.

For a detailed plan of study by year and semester, see the Plan of Study tab.

Lower Division Foundation Requirements

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Subject Matter Requirements

Students with a specific interest within civil engineering may choose to emphasize one of the following areas in their choice of electives: engineering and project management, environmental engineering, geosystems (geoengineering), structural engineering, or transportation engineering. See suggested courses (http://www.ce.berkeley.edu/undergrad/curriculum) for each area of interest.

Fundamentals

<table>
<thead>
<tr>
<th>Course</th>
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<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV ENG 100</td>
<td>Elementary Fluid Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>or CIV ENG 13: Applied Structural Mechanics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Fundamentals Elective - Complete one of the following:</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>COMPSCI C10 Principles &amp; Techniques of Data Science</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>EECS 127</td>
<td>Optimization Models in Engineering</td>
<td>4</td>
</tr>
<tr>
<td>ENGIN 40</td>
<td>Engineering Thermodynamics</td>
<td>4</td>
</tr>
<tr>
<td>MEC ENG 40</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>MEC ENG 104</td>
<td>Engineering Mechanics II</td>
<td>3</td>
</tr>
</tbody>
</table>

CEE Applications - Complete three of the following (9 units):

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>CIV ENG 103</td>
<td>Introduction to Hydrology</td>
</tr>
<tr>
<td>CIV ENG 111</td>
<td>Environmental Engineering</td>
</tr>
<tr>
<td>CIV ENG 120</td>
<td>Structural Engineering</td>
</tr>
<tr>
<td>CIV ENG 155</td>
<td>Transportation Systems Engineering</td>
</tr>
<tr>
<td>CIV ENG 175</td>
<td>Geotechnical and Geoenvironmental Engineering</td>
</tr>
<tr>
<td>CIV ENG 191</td>
<td>Civil and Environmental Engineering Systems Analysis</td>
</tr>
</tbody>
</table>

Professional Preparation

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<tbody>
<tr>
<td>CIV ENG 167</td>
<td>Engineering Project Management</td>
</tr>
<tr>
<td>CIV 105</td>
<td>Water and Wind - Design for a Variable Environment</td>
</tr>
<tr>
<td>CIV ENG 112</td>
<td>Environmental Engineering Design</td>
</tr>
<tr>
<td>CIV ENG 122N Design of Steel Structures &amp; CIV ENG 122R Structural Steel Design Project</td>
<td></td>
</tr>
<tr>
<td>CIV ENG 123N Design of Reinforced Concrete Structures &amp; CIV ENG 123R Structural Concrete Design Project</td>
<td></td>
</tr>
<tr>
<td>CIV ENG 153</td>
<td>Transportation Facility Design</td>
</tr>
<tr>
<td>CIV ENG 179</td>
<td>Geosystems Engineering Design</td>
</tr>
<tr>
<td>CIV ENG 180</td>
<td>Life-Cycle Design and Construction</td>
</tr>
<tr>
<td>CIV ENG 186</td>
<td>Design of Cyber-Physical Systems</td>
</tr>
</tbody>
</table>

CEE Extensions: Complete nine units of additional CIV ENG courses

1 CEE Extensions—Nine units chosen from upper-division CIV ENG courses not being counted toward other major requirements. Students may use up to three units of CIV ENG graduate courses numbered 200-295, taken Fall 2017 or later, toward their CEE Extensions units. Students must have a technical GPA of 3.0 or higher to obtain permission to enroll in CIV ENG graduate courses. Students may receive up to three units of credit toward their CEE Extensions units for work on a research project in CIV ENG H194 (Honors Undergraduate Research).

Students in the College of Engineering must complete no fewer than 120 semester units with the following provisions:

1. Completion of the requirements of one engineering major program (http://engineering.berkeley.edu/academics/undergraduate-programs) study.
2. A minimum overall grade point average of 2.00 (C average) and a minimum 2.00 grade point average in upper division technical coursework required of the major.
3. The final 30 units and two semesters must be completed in residence in the College of Engineering on the Berkeley campus.
4. All technical courses (math, science, and engineering) that can fulfill requirements for the student’s major must be taken on a letter-graded basis (unless they are only offered P/NP).
5. Entering freshmen are allowed a maximum of eight semesters to complete their degree requirements. Entering junior transfers are allowed a maximum of four semesters to complete their degree requirements. (Note: junior transfers admitted missing three or more courses from the lower-division curriculum are allowed five semesters.) Summer terms are optional and do not count toward the maximum. Students are responsible for planning and satisfactorily completing all graduation requirements within the maximum allowable semesters.
6. Adhere to all college policies and procedures (http://engineering.berkeley.edu/academics/undergraduate-guide) as they complete degree requirements.
7. Complete the lower division program before enrolling in upper division engineering courses.

Humanities and Social Sciences (H/SS) Requirement

To promote a rich and varied educational experience outside of the technical requirements for each major, the College of Engineering has a six-course Humanities and Social Sciences breadth requirement (http://engineering.berkeley.edu/student-services/degree-requirements/humanities-and-social-sciences), which must be completed to graduate. This requirement, built into all the engineering programs of study, includes two reading and composition courses (R&C), and four additional courses within which a number of specific conditions must be satisfied. Follow these guidelines to fulfill this requirement:

1. Complete a minimum of six courses from the approved Humanities/ Social Sciences (H/SS) lists (http://engineering.berkeley.edu/hssreq).
2. Courses must be a minimum of 3 semester units (or 4 quarter units).
3. Two of the six courses must fulfill the College’s Reading and Composition (R&C) requirement. These courses must be taken for a letter grade (C- or better required). The first half (R&C Part A) must be completed by the end of the freshman year; the second half (R&C Part B) must be completed by no later than the end of the sophomore year. Please see the Reading and Composition Requirement (http://guide.berkeley.edu/undergraduate/collleges-schools/engineering/reading-composition-requirement) page for a complete list of R&Cs available and a list of exams that can be applied toward the R&C Part A requirement. Students can also use the Class Schedule (https://classes.berkeley.edu) to view R&C courses offered in a given semester. Note: Only R&C Part A can be fulfilled with an AP, IB, or A-Level exam score. Test scores do not fulfill R&C Part B for College of Engineering students.
4. The four additional courses must be chosen from the five areas listed in #13 below. These four courses may be taken on a pass/no pass basis.
5. Special topics courses of 3 semester units or more will be reviewed on a case-by-case basis.
6. Two of the six courses must be upper division (courses numbered 100-196).
7. One of the six courses must satisfy the campus American Cultures requirement. Note that any American Cultures course of 3 units or more may be used to meet H/SS
8. A maximum of two exams (Advanced Placement, International Baccalaureate, or A-Level) may be used toward completion of the H/SS requirement. View the list of exams (http://engineering.berkeley.edu/academics/undergraduate-guide/) that can be applied toward H/SS requirements.
9. No courses offered by any engineering department other than BIO ENG 100, COMPSCI C79, ENGIN 125, ENGIN 157AC, ENGIN 185, and MEC ENG 191K may be used to complete H/SS requirements.
10. Language courses may be used to complete H/SS requirements. View the list of language options (http://guide.berkeley.edu/undergraduate/colleges-schools/engineering/approved-foreign-language-courses/).
11. Courses may fulfill multiple categories. For example, CY PLAN 118AC satisfies both the American Cultures requirement and one upper division H/SS requirement.
12. Courses numbered 97, 98, 99, or above 196 may not be used to complete any H/SS requirement.
13. The College of Engineering uses modified versions of five of the College of Letters and Science (L&S) breadth requirements lists to provide options to our students for completing the H/SS requirement. The five areas are:
   - Arts and Literature
   - Historical Studies
   - International Studies
   - Philosophy and Values
   - Social and Behavioral Sciences

Within the guidelines above, courses from any of the Breadth areas listed above. (Please note that you cannot use courses on the Biological Science or Physical Science Breadth list to complete the H/SS requirement.) To find course options, go to the Class Schedule (http://classes.berkeley.edu), (http://classes.berkeley.edu/search/class) select the term of interest, and use the Breadth Requirements (https://ls.berkeley.edu/sites/default/files/breadth_search_annotation_in_guide.png) filter.

Class Schedule Requirements

- Minimum units per semester: 12.0
- Maximum units per semester: 20.5
- Minimum technical courses: College of Engineering undergraduates must enroll each semester in no fewer than two technical courses (of a minimum of 3 units each, with the exception of Engineering 25, 26 and 27) required of the major program of study in which the student is officially declared. (Note: For most majors, normal progress (https://engineering.berkeley.edu/academics/undergraduate-guide/policies-procedures/scholarship-progress/#ac12283) each semester toward the bachelor's degree. The continued enrollment of students who fail to achieve minimum academic progress shall be subject to the approval of the dean. (Note: Students with official accommodations established by the Disabled Students' Program, with health or family issues, or with other reasons deemed appropriate by the dean may petition for an exception to normal progress rules.)

Normal Progress

Students in the College of Engineering must enroll in a full-time program and make normal progress (https://engineering.berkeley.edu/academics/undergraduate-guide/policies-procedures/scholarship-progress/#ac12283) each semester toward the bachelor's degree. The continued enrollment of students who fail to achieve minimum academic progress shall be subject to the approval of the dean. (Note: Students with official accommodations established by the Disabled Students' Program, with health or family issues, or with other reasons deemed appropriate by the dean may petition for an exception to normal progress rules.)

University of California Requirements

Entry Level Writing (https://www.ucop.edu/elwr)

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

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

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

**Campus Requirement**

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

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.

The American Cultures requirement and courses constitute an approach that responds directly to the problem encountered in numerous disciplines of how better to present the diversity of American experience to the diversity of American students whom we now educate.

Faculty members from many departments teach American Cultures courses, but all courses have a common framework. The courses focus on themes or issues in United States history, society, or culture; address theoretical or analytical issues relevant to understanding race, culture, and ethnicity in American society; take substantial account of groups drawn from at least three of the following: African Americans, indigenous peoples of the United States, Asian Americans, Chicano/ Latino Americans, and European Americans; and are integrative and comparative in that students study each group in the larger context of American society, history, or culture.

This is not an ethnic studies requirement, nor a Third World cultures requirement, nor an adjusted Western civilization requirement. These courses focus upon how the diversity of America’s constituent cultural traditions have shaped and continue to shape American identity and experience.

Visit the Class Schedule (http://classes.berkeley.edu) or the American Cultures website (http://americancultures.berkeley.edu) for the specific American Cultures courses offered each semester. For a complete list of approved American Cultures courses at UC Berkeley and California Community Colleges, please see the American Cultures Subcommittee’s website (https://academic-senate.berkeley.edu/committees/amcult). See your academic adviser if you have questions about your responsibility to satisfy the American Cultures breadth requirement.

For more detailed information regarding the courses listed below (e.g., elective information, GPA requirements, etc.), see the College Requirements and Major Requirements tabs.
Faculty Advisers

Students in CEE are encouraged to seek mentoring from CEE faculty advisers.

Faculty advisers (and, indeed, all faculty members) hold office hours throughout the school year to help students with course content; to advise on courses, career objectives and graduate school; to provide guidance about summer internships; to mentor students researchers; and to write letters of recommendation as appropriate. They also can be contacted (by e-mail or phone) to schedule an appointment.

College of Engineering Advising

Students are also assigned an engineering student services (ESS) adviser in the College of Engineering. ESS advisers help with a wide range of issues by assisting with course selection and academic decision-making, suggesting enrichment opportunities, explaining graduation requirements and college policies, monitoring progress towards the degree, and providing support or referrals to campus resources to help students reach their academic and personal goals. Explore the ESS website (http://engineering.berkeley.edu/student-services/advising) for detailed information on advising services.

Departmental Advising

CEE’s undergraduate adviser answers registration questions, assists with course selection and academic decision-making, describes courses, interprets departmental policy, and makes referrals to resources on campus. The department’s undergraduate adviser is located in the CEE Academic Affairs Office, 750 Davis Hall.

Further Information

See CEE Advising (http://www.ce.berkeley.edu/undergrad/advising) for more advising resources.

Student Organizations

Join one or more of the active student organizations with CEE and the College of Engineering. Learn to apply CEE knowledge outside of the classroom, get leadership and teamwork experience, meet students with similar interests, go on tours and field trips, and participate in community service projects.

CEE organizations

- ASCE Student Chapter (https://www.asce.berkeley.edu) has a membership of over 230 students.
- Chi Epsilon (http://www.ocf.berkeley.edu/7Ech) is the undergraduate honor society in CEE (invitation only).
- Competition teams: Concrete Canoe team (https://callink.berkeley.edu/organization/concretecanoe), Steel Bridge team (https://steelbridge.berkeley.edu), Environmental team (https://www.facebook.com/calenvironmental), Construction team (http://calconstructionteam.wixsite.com/construction), Transportation team
Civil Engineering

- Institute of Transportation Engineers Student Chapter (https://ite.berkeley.edu)
- COE organizations
  - Society of Women Engineers (http://swe.berkeley.edu) (SWE)
  - Engineers Without Borders (http://ewb.berkeley.edu) (EWB)
  - Engineers for a Sustainable World (http://eswberkeley.weebly.com) (ESW)

Undergraduate Participation in Research

Gain hands-on research experience while at Berkeley. Research experience adds to the quality of the undergraduate program and introduces students to the importance of graduate study.

Research opportunities

- COE’s u (http://coe.berkeley.edu/students/current-undergraduates/student-research) undergraduate research opportunities (http://coe.berkeley.edu/students/current-undergraduates/student-research)
- Undergraduate Research at Berkeley (http://research.berkeley.edu)
- Berkeley Undergraduate Research Apprentice Program (http://research.berkeley.edu/urap)
- Supervised independent study (http://www.ce.berkeley.edu/undergrad/curriculum) CIV ENG 99, CIV ENG 199, and CIV ENG H194). Receive course credit.
- Laboratory volunteer

Study Abroad

Civil and environmental engineering is a profession that depends on collaboration with colleagues nationally and internationally. Thus, the department strongly encourages its students to expand their horizons through an international educational experience. See Berkeley's extensive Education Abroad Program (http://eap.ucop.edu/Pages/index-new.html).

Civil Engineering

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

CIV ENG 11 Engineered Systems and Sustainability 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
An introduction to key engineered systems (e.g., energy, water supply, buildings, transportation) and their environmental impacts. Basic principles of environmental science needed to understand natural processes as they are influenced by human activities. Overview of concepts and methods of sustainability analysis. Critical evaluation of engineering approaches to address sustainability.

Engineered Systems and Sustainability: Read More [+]

Rules & Requirements

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: Spring 2020, Fall 2019, Spring 2019

Introduction to Solid Mechanics: Read More [+]

Rules & Requirements

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

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

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week
Summer:
6 weeks - 7.5 hours of lecture and 2.5 hours of discussion per week
10 weeks - 4.5 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructors: Armero, Papadopoulos, Zohdi, Johnson

Also listed as: MEC ENG C85

Introduction to Solid Mechanics: Read Less [-]

CIV ENG W30 Introduction to Solid Mechanics
3 Units
Terms offered: Summer 2019 8 Week Session, Summer 2018 8 Week Session, Summer 2016, Summer 2016 10 Week Session

Introduction to Solid Mechanics: Read More [+]

Objectives & Outcomes

Course Objectives:
To learn statics and mechanics of materials

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

Rules & Requirements

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

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

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of web-based lecture and 1 hour of web-based discussion per week
Summer:
6 weeks - 7.5 hours of web-based lecture and 2.5 hours of web-based discussion per week
8 weeks - 6 hours of web-based lecture and 2 hours of web-based discussion per week
10 weeks - 4.5 hours of web-based lecture and 1.5 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructor: Govindjee

Also listed as: MEC ENG W85

Introduction to Solid Mechanics: Read Less [-]
CIV ENG 60 Structure and Properties of Civil Engineering Materials 3 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
Introduction to structure and properties of civil engineering materials such as asphalt, cements, concrete, geological materials (e.g. soil and rocks), steel, polymers, and wood. The properties range from elastic, plastic and fracture properties to porosity and thermal and environmental responses. Laboratory tests include evaluation of behavior of these materials under a wide range of conditions.

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

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

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

CIV ENG 70 Engineering Geology 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Principles of physical and structural geology; the influence of geological factors on engineering works and the environment. Field trip.

Rules & Requirements
Prerequisites: CHEM 1A (may be taken concurrently)

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week
Summer: 8 weeks - 6 hours of lecture and 4 hours of laboratory per week

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

CIV ENG 88B Time Series Analysis: Sea Level Rise and Coastal Flooding 2 Units
Terms offered: Spring 2017
In this course, we will pursue analysis of long-term records of coastal water levels in the context of sea level rise. We will cover the collection, evaluation, visualization and analysis of time series data using long-term records of sea levels from coastal sites around the world. Specific topics will include extreme events and distributions, frequency-based descriptions, averaging, filtering, harmonic analysis, trend identification, extrapolations, and decision-making under uncertainty.

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

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Alternative to final exam.
Instructor: Stacey
CIV ENG C88 Data Science for Smart Cities 2

Units
Terms offered: Not yet offered
Cities become more dependent on the data flows that connect infrastructures between themselves, and users to infrastructures. Design and operation of smart, efficient, and resilient cities nowadays require data science skills. This course provides an introduction to working with data generated within transportation systems, power grids, communication networks, as well as collected via crowd-sensing and remote sensing technologies, to build demand- and supply-side urban services based on data analytics.

Objectives & Outcomes

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

- Develop intuition in various machine learning classification algorithms, as well as regression modelling.
- Develop intuition in various machine learning classification algorithms, as well as regression modelling.
- Foster critical thinking about real-world actionability from analytics.
- Learn how to use data science techniques in urban decision-making and scenario generation.

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

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructor: Gonzalez

Formerly known as: Civil and Environmental Engineering 88

Also listed as: CY PLAN C88

Data Science for Smart Cities: Read Less [-]

CIV ENG 92 Introduction to Civil and Environmental Engineering 1

Units
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.

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 98 Supervised Group Study and Research 1 - 3 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
Supervised group study and research by lower division students.
Supervised Group Study and Research: Read More [+]
Rules & Requirements
Prerequisites: Consent of instructor
Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 1-3 hours of directed group study per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.
Supervised Group Study and Research: Read Less [-]

CIV ENG 99 Supervised Independent Study and Research 1 - 4 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
Supervised independent study by lower division students.
Supervised Independent Study and Research: Read More [+]
Rules & Requirements
Prerequisites: Freshman or sophomore standing and consent of instructor. Minimum grade point average of 3.3 required
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 1-4 hours of independent study per week
Summer: 8 weeks - 2-7.5 hours of independent study per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.
Supervised Independent Study and Research: Read Less [-]

CIV ENG 100 Elementary Fluid Mechanics 4 Units
Terms offered: Fall 2019, Fall 2018, Summer 2018 8 Week Session
Fluid statics and dynamics, including laboratory experiments with technical reports. Fundamentals: integral and differential formulations of the conservation laws are solved in special cases such as boundary layers and pipe flow. Flow visualization and computation techniques are introduced using Matlab. Empirical equations are used for turbulent flows, drag, pumps, and open channels. Principles of empirical equations are also discussed: dimensional analysis, regression, and uncertainty.
Elementary Fluid Mechanics: Read More [+]
Rules & Requirements
Prerequisites: PHYSICS 7A, MATH 53, and ENGIN 7 (may be taken concurrently); and CIV ENG C30 / MEC ENG C85 recommended
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of laboratory per week
Summer: 8 weeks - 6 hours of lecture and 3 hours of laboratory per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructors: Chow, Stacey, Variano
Elementary Fluid Mechanics: Read Less [-]

CIV ENG 101 Fluid Mechanics of Rivers, Streams, and Wetlands 3 Units
Terms offered: Fall 2014, Spring 2013, Fall 2010
Analysis of steady and unsteady open-channel flow and application to rivers and streams. Examination of mixing and transport in rivers and streams. Effects of channel complexity, floodplain dynamics and flow routing. Interaction of vegetation and fluid flows. Freshwater and tidal marshes. Sediment transport in rivers, streams, and wetlands. Implications for freshwater ecosystem function.
Fluid Mechanics of Rivers, Streams, and Wetlands: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 100, MEC ENG 106, or consent of instructor
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Variano
Fluid Mechanics of Rivers, Streams, and Wetlands: Read Less [-]
CIV ENG 103 Introduction to Hydrology 3 Units
Terms offered: Fall 2018, Fall 2017, Spring 2017
Course addresses principles and practical aspects of hydrology. Topics in introduction to hydrology include hydrologic cycle, precipitation, evaporation, infiltration, snow and snowmelt, and streamflow; introduction to geomorphology, GIS (Geographic Information Systems) applications, theory of unit hydrograph, frequency analysis, flood routing through reservoirs and rivers; introduction to rainfall-runoff analyses, watershed modeling, urban hydrology, and introduction to groundwater hydrology. Introduction to Hydrology: Read More [+]

Rules & Requirements

Prerequisites: CIV ENG 93 and CIV ENG 100

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructor: Thompson

Introduction to Hydrology: Read Less [-]

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

Terrestrial Hydrology: Read More [+]

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructors: Chow, Stacey, Variano

Also listed as: ESPM C130/GEOG C136

Terrestrial Hydrology: Read Less [-]

CIV ENG 105 Water and Wind - Design for a Variable Environment 3 Units
Terms offered: Spring 2020, Fall 2017, Fall 2016
Hands-on design course in applied fluid mechanics, hydrology and water resources. Course goes beyond basic examples of fluid flow to develop environmental engineering solutions to real-world problems. A class team project is used to (1) explore the design process and project management; and (2) to integrate concepts from hydrology and fluid mechanics with structural, geotechnical and/or transportation engineering for a holistic design approach. Specific project topics vary with offering. Example topics include: engineering for air quality, design for sea-level rise mitigation, and development of alternative water supplies to address scarcity and post-disaster management.

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

Objectives & Outcomes

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructors: Chow, Stacey, Variano

Water and Wind - Design for a Variable Environment: Read Less [-]
CIV ENG C106 Air Pollution 3 Units
Terms offered: Spring 2020, Spring 2018, Spring 2017
This course is an introduction to air pollution and the chemistry of earth's atmosphere. We will focus on the fundamental natural processes controlling trace gas and aerosol concentrations in the atmosphere, and how anthropogenic activity has affected those processes at the local, regional, and global scales. Specific topics include stratospheric ozone depletion, increasing concentrations of greenhouse gases, smog, and changes in the oxidation capacity of the troposphere.
Air Pollution: Read More [+]

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructor: Goldstein

Also listed as: EPS C180/ESPM C180

Air Pollution: Read Less [-]

CIV ENG 107 Climate Change Mitigation 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
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 110 Water Systems of the Future 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2017
This course will familiarize students with the complex infrastructure used to meet human water demands; competing uses and demands; water and wastewater infrastructure; technologies to enable recovery of water, energy, and other resources from wastewater; supply planning; trends and forecasting; costs, pricing and financing; environmental justice; methods to assess sustainability; regulatory, policy and institutional challenges; and water’s contribution to other sectors (e.g., energy, food, buildings). Innovation, both barriers and opportunities, will be highlighted. California and the U.S. will be emphasized but global challenges will be discussed. Students will study, critique, and recommend improvements for a real-world system.
Water Systems of the Future: Read More [+]

Objectives & Outcomes

Course Objectives: 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 2019, Fall 2018, Fall 2017
Quantitative overview of air and water contaminants and their engineering control. Elementary environmental chemistry and transport. Reactor models. Applications of fundamentals to selected current issues in water quality engineering, air quality engineering, air quality engineering, and hazardous waste management.
Environmental Engineering: Read More [+]
Rules & Requirements
Prerequisites: Upper division standing in engineering or physical sciences, or consent of instructor

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

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

CIV ENG 111L Water and Air Quality Laboratory 1 Unit
Terms offered: Fall 2019, Fall 2018, Fall 2017
This laboratory course is designed to accompany the lecture topics in Civil Engineering 111. Each laboratory activity will provide an opportunity to understand key concepts in water and air quality through hands-on experimentation. Laboratory topics include phase partitioning, acid/base reactions, redox reactions, biochemical oxygen demand, absorption, gas transfer, reactor hydraulics, particle destabilization, disinfection, and combustion emissions.
Water and Air Quality Laboratory: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 111 (may be taken concurrently)

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

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

CIV ENG 112 Environmental Engineering Design 3 Units
Terms offered: Spring 2017, Spring 2016, Spring 2015
Engineering design and project management of environmental systems. Students will complete a design project focusing on pollution control in a selected environmental system. Lectures and project activities will address process design, economic optimization, legal and institutional constraints on design, and project management. Additional components of design (e.g., hydraulics, engineering sustainability, plant structures) will be included.
Environmental Engineering Design: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 100 and CIV ENG 111

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
CIV ENG 113 Ecological Engineering for Water Quality Improvement 3 Units
Terms offered: Spring 2019, Spring 2017, Fall 2003
Ecological engineering approaches for treating contaminated water using natural processes to improve water quality. Emphasis on combining basic science and engineering approaches to understand the fundamental processes that govern the effectiveness of complex natural treatment systems. Applications include constructed wetlands, waste stabilization ponds, stormwater bioretention, decentralized wastewater management, ecological sanitation. Laboratory sessions will consist of design and monitoring of laboratory and full-scale natural treatment systems, including a range of water quality measurements.

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

Objectives & Outcomes

Course Objectives: Become familiar with common applications of natural treatment systems through lectures, reading materials, laboratory activities, and field trips
Develop a solid understanding of the fundamental processes in ecological engineering approaches to natural treatment systems that govern the removal or transformation of contaminants in water
Learn common design approaches for waste stabilization ponds and wetlands, as well as their necessary operation and maintenance activities
Measure key water quality parameters and evaluate the performance of mesocosm ponds and wetlands based on the data collected throughout the semester
Understand and appreciate the complexity of these systems compared to mechanical treatment systems

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

Rules & Requirements

Prerequisites: CIV ENG 111 or consent of instructor
Credit Restrictions: Civ Eng 113N

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.
Instructor: Nelson
Formerly known as: Civil and Environmental Engineering 113N

CIV ENG 114 Environmental Microbiology 3 Units
Terms offered: Spring 2016, Spring 2015, Fall 2014
The scope of modern environmental engineering requires a fundamental knowledge of microbial processes with specific application to water, wastewater and the environmental fate of pollutants. This course will cover basic microbial physiology, biochemistry, metabolism, growth energetics and kinetics, ecology, pathogenicity, and genetics for application to both engineered and natural environmental systems.

Environmental Microbiology: Read More [+]

Rules & Requirements

Prerequisites: CHEM 1A and CHEM 1B

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 2019, Fall 2018, Fall 2017
The application of principles of inorganic, physical, and dilute solution equilibrium chemistry to aquatic systems, both in the aquatic environment and in water and wastewater treatment processes.

Water Chemistry: Read More [+]

Rules & Requirements

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

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
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

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

CIV ENG 121 Structural Analysis 3 Units
Terms offered: Fall 2018, Fall 2017, Fall 2016
Structural Analysis: Read More [+]
Objectives & Outcomes
Student Learning Outcomes: Analyze any type of truss and frame structure with the displacement method of analysis by hand and by computer. Determine internal forces, deformations, global displacements, support reactions. Error checking of computer analysis results (ABET Learning Goals: 1, 3, 5). Determine the collapse load of simple perfectly-plastic truss and frame structures under equilibrium considerations (ABET Learning Goals: 1, 3, 5). Identify the structural response contribution of individual elements and identify the effect of changes in element properties on the results (ABET Learning Goals: 1, 3, 11). Perform analysis of statically determinate truss and frame structures under equilibrium and compatibility considerations. Perform equilibrium checks of given results under given loading. Perform compatibility checks for given deformations (ABET Learning Goals: 1, 3, 5). Recognize force flow in beam, arch and cable structures and their derivatives, like suspension bridges, cable-stayed bridges, roofs and high-rise buildings (ABET Learning Goals: 3, 8, 10, 11). Understand basic structural systems and their use throughout history and in modern times. (ABET Learning Goals: 3, 8, 10, 11) Understand structural modeling. Be able to assess the complexity of a structural model and identify number of unknowns in the solution of the structural response to given loading. Be able to select the most appropriate solution method for hand calculations (ABET Learning Goals: 1, 3, 5).
Rules & Requirements
Prerequisites: CIV ENG 120 and CIV ENG 130

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture 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 122L Structural Steel Design Project
1 Unit
Terms offered: Spring 2020, Spring 2019, Spring 2018
Introduction to one or more comprehensive structural design problems. Design teams will conceive structural system; determine design loads; conduct preliminary and final design of structure and its foundation; prepare construction cost estimate; prepare final report containing project description, design criteria, cost estimate, structural drawings, and supporting calculations; and make "client" presentations as required.
Structural Steel Design Project: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 122N
Credit Restrictions: Students will receive no credit for Civil and Environmental Engineering 122L after taking Civil and Environmental Engineering 122 or 123L.

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
Instructor: Becker

Structural Steel Design Project: Read Less [-]

CIV ENG 122N Design of Steel Structures 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Introduction to materials and methods of steel construction; behavior and design of tension members, compression members, flexural members and beam-columns; design of welds, bolts, shear connections and moment connections; design of spread footings or other foundation elements; introduction to design of earthquake-resistant steel structures including concentrically braced frames and moment frames.
Design of Steel Structures: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 120

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Becker
Formerly known as: Civil and Environmental Engineering 122
Design of Steel Structures: Read Less [-]

CIV ENG 123L Structural Concrete Design Project 1 Unit
Terms offered: Spring 2020, Spring 2019, Spring 2018
Introduction to one or more comprehensive structural design problems. Design teams will conceive structural system; determine design loads; conduct preliminary and final design of structure and its foundation; prepare construction cost estimate; prepare final report containing project description, design criteria, cost estimate, structural drawings, and supporting calculations; and make "client" presentations as required.
Structural Concrete Design Project: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 123N
Credit Restrictions: Students will receive no credit for Civil and Environmental Engineering 123L after taking Civil and Environmental Engineering 122L or 123.

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
Instructors: Moehle, Mosalam

Structural Concrete Design Project: Read Less [-]

CIV ENG 123N Design of Reinforced Concrete Structures 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Introduction to materials and methods of reinforced concrete construction; behavior and design of reinforced concrete beams and one-way slabs considering deflections, flexure, shear, and anchorage; behavior and design of columns; design of spread footings or other foundation elements; design of earthquake-resistant structures; introduction to prestressed concrete.
Design of Reinforced Concrete Structures: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 120

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructors: Moehle, Mosalam
Formerly known as: Civil and Environmental Engineering 122
Design of Reinforced Concrete Structures: Read Less [-]
CIV ENG 124 Structural Design in Timber 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Characteristics and properties of wood as a structural material; design and detailing of structural elements and entire structures of wood. Topics include allowable stresses, design and detailing of solid sawn and glulam beams and columns, nailed and bolted connections, plywood diaphragms and shear walls. Case studies.
Structural Design in Timber: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 120

CIV ENG 126 Engineering Dynamics and Vibrations 3 Units
Terms offered: Fall 2019
Engineering Dynamics and Vibrations: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG C30 / MEC ENG C85 and ENGIN 7; or consent of instructor
Credit Restrictions: Students will receive no credit for CIV ENG 126 after completing MEC ENG 104. A deficient grade in CIV ENG 126 may be removed by taking MEC ENG 104, or MEC ENG 104.

CIV ENG 130N Mechanics of Structures 3 Units
Terms offered: Spring 2019, Summer 2018 8 Week Session, Spring 2018
Elastic and plastic stress and deformation analysis of bars, shafts, beams, and columns; energy and variational methods; plastic analysis of structures; stability analysis of structures; computer-aided mathematical techniques for solution of engineering problems and modular computer programming methods.
Mechanics of Structures: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG C30 / MEC ENG C85; and CIV ENG 60 or MAT SCI 45
Credit Restrictions: Students will receive no credit for 130N after taking 130.

Instructors:
Konstantinidis, DeJong

CIV ENG 124 Structural Design in Timber: Read Less [-]

CIV ENG 126 Engineering Dynamics and Vibrations: Read Less [-]

CIV ENG 130N Mechanics of Structures: Read Less [-]
CIV ENG 132 Applied Structural Mechanics 3 Units
Terms offered: Spring 2020
Concepts of theory of solid mechanics: three dimensional stress, strain, and material response; elastic and inelastic boundary value problems; fracture, fatigue, and geometric instability. Problems in advanced strength of materials; thin plate and axis-symmetric shell theory.

Rules & Requirements

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

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

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week
Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructors: Govindjee, Li, Konstantinidis

Applied Structural Mechanics: Read Less [-]

CIV ENG C133 Engineering Analysis Using the Finite Element Method 3 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
This is an introductory course on the finite element method and is intended for seniors in engineering and applied science disciplines. The course covers the basic topics of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems. Finite element formulations for several important field equations are introduced using both direct and integral approaches. Particular emphasis is placed on computer simulation and analysis of realistic engineering problems from solid and fluid mechanics, heat transfer, and electromagnetism. The course uses FEMLAB, a multiphysics MATLAB-based finite element program that possesses a wide array of modeling capabilities and is ideally suited for instruction. Assignments will involve both paper- and computer-based exercises. Computer-based assignments will emphasize the practical aspects of finite element model construction and analysis.

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 140 Failure Mechanisms in Civil Engineering Materials 3 Units
Terms offered: Spring 2013, Spring 2010, Spring 2009
The failure mechanisms in civil engineering materials (cement-based materials, metallic- and polymer-based materials) are associated with processing, microstructure, stress states, and environmental changes. Fracture mechanics of brittle, quasi-brittle, and ductile materials; cracking processes in monolithic, particulate, and fiber reinforced materials; examples of ductile/brittle failure transitions in civil engineering structures; retrofitting of existing structures; non-destructive techniques for damage detection.
Failure Mechanisms in Civil Engineering Materials: Read More [+]

Rules & Requirements

Prerequisites: CIV ENG 60

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructor: Ostertag

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

CIV ENG 153 Transportation Facility Design 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
A capstone class with the objective to design transportation facilities based on operational capacity, site constraints, and environmental design considerations. Emphasis on airports, including landside and airside elements, and environmental assessment and mitigation techniques.
Transportation Facility Design: Read More [+]

Rules & Requirements

Prerequisites: CIV ENG 155

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructor: Hansen

Transportation Facility Design: Read Less [-]

CIV ENG 155 Transportation Systems Engineering 3 Units
Terms offered: Fall 2019, Spring 2019, Spring 2018
Transportation Systems Engineering: Read More [+]

Rules & Requirements

Prerequisites: Sophomore standing in engineering or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Instructors: Cassidy, Daganzo, Hansen, Kanafani, Madanat

Transportation Systems Engineering: Read Less [-]

CIV ENG 156 Infrastructure Planning and Management 3 Units
Terms offered: Fall 2014, Spring 2014, Fall 2011
This course focuses on physical infrastructure systems that support society, including transportation, communications, power, water, and waste. These are complex, large-scale systems that must be planned and managed over a long-term horizon. Economics-based, analytical tools are covered, including topics of supply, demand, and evaluation. Problem sets, case studies, and a class project provide for hands-on experience with a range of infrastructure systems, issues, and methods of analysis.
Infrastructure Planning and Management: Read More [+]

Rules & Requirements

Prerequisites: MATH 1A, MATH 1B, 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.

Instructor: Walker

Infrastructure Planning and Management: Read Less [-]
CIV ENG 165 Concrete Materials, Construction, and Sustainability 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018

CIV ENG 166 Construction Engineering 3 Units
Terms offered: Fall 2018, Spring 2016, Fall 2014
Introduction to construction engineering and field operations. The construction industry, construction methods and practice, productivity improvement, equipment selection, site layout formwork, erection of steel and concrete structures. Labs demonstrate the concepts covered. Field trips to local construction projects.

CIV ENG 167 Engineering Project Management 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Principles of economics, decision making, and law applied to company and project management. Business ownership, liability and insurance, cash flow analysis, and financial management. Project life-cycle, design-construction interface, contracts, estimating, scheduling, cost control.

CIV ENG 171 Rock Mechanics 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2017
Geological and geophysical exploration for structures in rock; properties and behavior of rock masses; rock slope stability; geological engineering of underground openings; evaluation of rock foundations, including dams.
CIV ENG 173 Groundwater and Seepage 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Introduction to principles of groundwater flow, including steady and transient flow through porous media, numerical analysis, pumping tests, groundwater geology, contaminant transport, and design of waste containment systems.
Groundwater and Seepage: Read More [+]

Rules & Requirements
Prerequisites: Senior standing in engineering or science; CIV ENG 100 recommended

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

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

Groundwater and Seepage: Read Less [-]

CIV ENG 174 Engineering Geomatics 3 Units
Terms offered: Summer 2015 First 6 Week Session, Summer 2014 10 Week Session, Summer 2014 First 6 Week Session
Engineering Geomatics is a field that integrates collections, processing, and analysis of digital geospatial data. This new field is anchored in the established field of geodetics that describes the complex shape of the Earth, elements and usage of topographic data and maps. Basic and advanced GPS satellite mapping. Digital globe technology. Advanced laser-LIDAR mapping. Quantitative terrain modeling, change detection, and analysis. Hydrogeomatics-seafloor mapping.
Engineering Geomatics: Read More [+]

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

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

Engineering Geomatics: Read Less [-]

CIV ENG 175 Geotechnical and Geoenvironmental Engineering 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Soil formation and identification. Engineering properties of soils. Fundamental aspects of soil characterization and response, including soil mineralogy, soil-water movement, effective stress, consolidation, soil strength, and soil compaction. Use of soils and geosynthetic materials in geotechnical and geoenvironmental applications. Introduction to site investigation techniques. Laboratory testing and evaluation of soil composition and properties.
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 2016, Spring 2015, Spring 2014
Principles of environmental geotechnics applied to waste encapsulation and remediation of contaminated sites. Characterization of soils and wastes, engineering properties of soils and geosynthetics and their use in typical applications. Fate and transport of contaminants. Fundamental principles and practices in groundwater remediation. Application of environmental geotechnics in the design and construction of waste containment systems. Discussion of soil remediation and emerging technologies.
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 177 Foundation Engineering Design
3 Units
Terms offered: Spring 2017, Spring 2016, Fall 2014
Principles of foundation engineering. Shear strength of soil and theories related to the analysis and design of shallow and deep foundations, and retaining structures. Structural design of foundation elements; piles, pile caps, and retaining structures. The course has a group project that incorporates both geotechnical and structural components of different foundation elements.

CIV ENG 178 Applied Geophysics 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
The theory and practice of geophysical methods for determining the subsurface distribution of physical rock and soil properties. Measurements of gravity and magnetic fields, electrical and electromagnetic fields, and seismic velocity are interpreted to map the subsurface distribution of density, magnetic susceptibility, electrical conductivity, and mechanical properties.

CIV ENG 179 Geosystems Engineering Design 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Geosystem engineering design principles and concepts. Fundamental aspects of the geomechanical and geoenvironmental responses of soil are applied to analyze and design civil systems, such as earth dams and levees, earth retention systems, building and bridge foundations, solid-waste fills, and tailings dams. Students form teams to design geotechnical aspects of a civil project and prepare/present a design document. Field trip to a project site.

CIV ENG 180 Life-Cycle Design and Construction 4 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
Course encompasses two design aspects of a civil and environmental engineering system: 1) Design of whole system, component, or life-cycle phase, subject to engineering standards and constraints, and 2) production system design (e.g., cost estimation and control, scheduling, commercial and legal terms, site layout design). Students form teams to address real-life projects and prepare project documentation and a final presentation.

Prerequisites:
CIV ENG 175; CIV ENG 120 recommended

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.

Instructor: Bray

Foundation 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.

Instructor: Bray, Sitar, Soga

Geosystems Engineering Design: Read Less [-]

Rules & Requirements

Prerequisites: CIV ENG 167

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

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

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

Instructor: Horvath

Life-Cycle Design and Construction: Read Less [-]
CIV ENG 186 Design of Cyber-Physical Systems 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Design and prototype of large-scale technology intensive systems. Design project incorporating infrastructure systems and areas such as transportation and hydrology; for example, watershed sensor networks, robot networks for environmental management, mobile Internet monitoring, open societal scale systems, crowd-sources applications, traffic management. Design of sensing and control systems, prototyping systems, and measures of system performance. Modeling, software and hardware implementation. Design of Cyber-Physical Systems: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 191

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
Instructors: Bayen, Glaser, Sengupta
Design of Cyber-Physical Systems: Read Less [-]

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

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Alternative to final exam.
Instructor: Variano
Special Topics in Civil and Environmental Engineering: Read Less [-]

CIV ENG 191 Civil and Environmental Engineering Systems Analysis 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
This course is organized around five real-world large-scale CEE systems problems. The problems provide the motivation for the study of quantitative tools that are used for planning or managing these systems. The problems include design of a public transportation system for an urban area, resource allocation for the maintenance of a water supply system, development of repair and replacement policies for reinforced concrete bridge decks, traffic signal control for an arterial street, scheduling in a large-scale construction project.
Civil and Environmental Engineering Systems Analysis: Read More [+]
Rules & Requirements
Prerequisites: CIV ENG 93 and ENGIN 7

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructors: Bayen, Madanat, Sengupta
Formerly known as: 152
Civil and Environmental Engineering Systems Analysis: Read Less [-]

CIV ENG 192 The Art and Science of Civil and Environmental Engineering Practice 1 Unit
Terms offered: Fall 2017, Fall 2016, Fall 2015
A series of lectures by distinguished professionals designed to provide an appreciation of the role of science, technology, and the needs of society in conceiving projects, balancing the interplay of conflicting demands, and utilizing a variety of disciplines to produce unified and efficient systems. The Art and Science of Civil and Environmental Engineering Practice: Read More [+]
Rules & Requirements
Prerequisites: Senior standing in Civil Engineering

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
The Art and Science of Civil and Environmental Engineering Practice: Read Less [-]
CIV ENG 193 Engineering Risk Analysis 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
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 2020, Fall 2019, Spring 2019
Supervised research. Students who have completed 3 or more upper division courses may pursue original research under the direction of one of the members of the staff. A final report or presentation is required. A maximum of 4 units of H194 may be used to fulfill the technical elective requirement.
Honors Undergraduate Research: Read More [+]
Rules & Requirements
Prerequisites: Upper division technical GPA 3.3, consent of instructor and faculty advisor
Repeat rules: Course may be repeated for credit up to a total of 8 units.

Hours & Format
Fall and/or spring: 15 weeks - 3-4 hours of independent study per week
Summer:
6 weeks - 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: Letter grade. Alternative to final exam.
Honors Undergraduate Research: Read Less [-]

CIV ENG 197 Field Studies in Civil Engineering 1 - 4 Units
Terms offered: Spring 2020, Fall 2019, Summer 2019 10 Week Session
Supervised experience in off-campus companies relevant to specific aspects and applications of civil engineering. Written report required at the end of the semester.
Field Studies in Civil Engineering: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 1-4 hours of fieldwork per week
Summer:
6 weeks - 2.5-10 hours of fieldwork per week
8 weeks - 1.5-7.5 hours of fieldwork per week
10 weeks - 1.5-6 hours of fieldwork per week

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.
Field Studies in Civil Engineering: Read Less [-]

CIV ENG 198 Directed Group Study for Advanced Undergraduates 1 - 4 Units
Terms offered: Spring 2020, Fall 2019, Spring 2019
Group study of a selected topic or topics in civil engineering.
Directed Group Study for Advanced Undergraduates: Read More [+]
Rules & Requirements
Prerequisites: Senior standing in engineering
Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.
Repeat rules: Course may be repeated for credit without restriction.

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

Additional Details
Subject/Course Level: Civil and Environmental Engineering/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.
Directed Group Study for Advanced Undergraduates: Read Less [-]
CIV ENG 199 Supervised Independent Study
1 - 4 Units
Terms offered: Spring 2020, Fall 2019, Summer 2019 3 Week Session
Supervised independent study.
Supervised Independent Study: Read More [+]

Rules & Requirements

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

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/Undergraduate

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

Supervised Independent Study: Read Less [-]