

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 five nationally-ranked 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. Suggestions are listed for elective courses and the capstone design project here (<http://www.ce.berkeley.edu/undergrad/curriculum/emphasis>).

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, please 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 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, please 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/archive/2014-15/undergraduate/degree-programs/environmental-engineering>)

GeoSystems (<http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/geosystems>)

Structural Engineering (<http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/structural-engineering>)

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All technical courses (courses in engineering, mathematics, chemistry, physics, statistics, biological sciences, and computer science) 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, please see the College Requirements tab.

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

Lower-division Requirements

MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
CHEM 1A & 1AL	General Chemistry and General Chemistry Laboratory ¹	4
or CHEM 4A	General Chemistry and Quantitative Analysis	
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
Basic Science Elective: Select one of the following:		
PHYSICS 7C	Physics for Scientists and Engineers	
CHEM 1B	General Chemistry	
CHEM 4B	General Chemistry and Quantitative Analysis	
BIOLOGY 1B	General Biology Lecture and Laboratory ²	4
or CIV ENG 70	Engineering Geology	
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
CIV ENG 11	Engineered Systems and Sustainability ²	3
or CIV ENG 70	Engineering Geology	

CIV ENG C30/ MEC ENG C85	Introduction to Solid Mechanics	3
CIV ENG 60	Structure and Properties of Civil Engineering Materials	3
CIV ENG 92	Introduction to Civil and Environmental Engineering	1
CIV ENG 93	Engineering Data Analysis	3

- 1 CHEM 4A is intended for students majoring in Chemistry, Chemical Engineering, or a closely-related field.
- 2 CIV ENG 70 cannot be used to fulfill both requirements.

Upper-division 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; structural engineering, mechanics, and materials; or transportation engineering.

Suggestions are listed for elective courses and the capstone design project here. (<http://www.ce.berkeley.edu/undergrad/curriculum/emphasis>)

In addition to the requirements listed below, students may choose up to 3 units of Free Electives, in order to meet the 120 units required for graduation. Free electives can be any technical or non-technical course of the student's interest, offered by any department at UC Berkeley, with no restrictions.

CIV ENG 100	Elementary Fluid Mechanics	4
CIV ENG 130N	Mechanics of Structures	3
CIV ENG 192	The Art and Science of Civil and Environmental Engineering Practice	1

Engineering Science Elective: Choose one of the following:

ENGIN 115	Engineering Thermodynamics
MEC ENG 40	Thermodynamics
MEC ENG 104	Engineering Mechanics II
MEC ENG C10	Course Not Available

Design Elective: Choose one of the following:

CIV ENG 105	Environmental Fluid Mechanics Design	
CIV ENG 112	Environmental Engineering Design	
CIV ENG 122N	Design of Steel Structures & CIV ENG 12 and Structural Steel Design Project ¹	
CIV ENG 123N	Design of Reinforced Concrete Structures & CIV ENG 123L and Structural Concrete Design Project ¹	
CIV ENG 153	Transportation Facility Design	
CIV ENG 177	Foundation Engineering Design	
CIV ENG 180	Life-Cycle Design and Construction ¹	4
CIV ENG 186	Design of Cyber-Physical Systems	

Select four courses from the Elective Core:

CIV ENG 103	Introduction to Hydrology
CIV ENG 111	Environmental Engineering
CIV ENG 120	Structural Engineering
CIV ENG 155	Transportation Systems Engineering
CIV ENG 167	Engineering Project Management
CIV ENG 175	Geotechnical and Geoenvironmental Engineering

CIV ENG 191	Civil and Environmental Engineering Systems Analysis
-------------	--

Engineering Electives: Select at least 15 additional units of upper-division technically-oriented engineering coursework offered in the College of Engineering or the Department of Chemical Engineering ²

- 1 For Design Electives that are 4 units, 1 of the 4 units can be applied toward the 15-unit Engineering Electives requirement.
- 2 The 15 units of Engineering Electives cannot include:
 1. Any course taken on a *Pass/No Pass* basis; or
 2. Any of the following courses: BIO ENG 100, ENGIN 125, ENGIN 130AC, ENGIN 140, ENGIN 157AC, IND ENG 172, IND ENG 185, IND ENG 186, IND ENG 190, IND ENG 191, IND ENG 192, MEC ENG 106, MEC ENG 190K, MEC ENG 191K, and CHM ENG 185.

Students in the College of Engineering must complete 120 semester units with the following provisions:

1. Completion of the requirements of one Engineering major program (<http://coe.berkeley.edu/students/guide/departments>) of study.
2. A minimum overall grade point average of 2.000 (C average) and a minimum 2.000 grade point average in upper division technical course work required of the major.
3. The final 30 units must be completed in residence in the College of Engineering on the Berkeley campus in two consecutive semesters.
4. All technical courses (math, science & engineering), required of the major or not, must be taken on a letter graded basis (unless they are only offered P/NP).
5. Entering freshman 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. 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.

Humanities and Social Science Requirement

To promote a rich and varied educational experience outside of the technical requirements for each major, the College of Engineering has a Humanities and Social Sciences breadth requirement, which must be completed to graduate. This requirement is built into all the Engineering programs of study. The requirement includes two approved reading and composition courses and four additional approved courses, within which a number of specific conditions must be satisfied.

1. Complete a minimum of six courses (3 units or more) from the approved Humanities/Social Sciences (H/SS) lists (<http://coe.berkeley.edu/hssreq>).
2. Two of the six courses must fulfill the Reading and Composition Requirement. These courses must be taken for a letter grade (C- or better required), and **MUST** be completed by no later than the end of the sophomore year (4th semester of enrollment). The first half of R&C, the "A" course, must be completed by the end of the freshman year; the second half of R&C, the "B" course, by no later than the end of the sophomore year. For detailed lists of courses that fulfill Reading and Composition requirements, please see the Reading and Composition page (<http://guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/engineering/reading-composition-requirement>) in this bulletin.

3. The four additional courses must be chosen from the H/SS comprehensive list. These courses may be taken on a Pass/Not Passed Basis (P/NP).

4. At least two of the six courses must be upper division (courses numbered 100-196).

5. At least two courses must be from the same department and at least one of the two must be upper division. This is called the *Series requirement. AP tests can be combined with a course to complete the series requirement. For example, AP History (any) combined with an upper division History course would satisfy the series requirement

6. One of the six courses must satisfy the campus American Cultures Requirement. For detailed lists of courses that fulfill American Cultures requirements, please see the American Cultures page (<http://guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/engineering/american-cultures-requirement>) in this bulletin.

7. A maximum of two exams (Advanced Placement, International Baccalaureate, or A-Level) may be used toward completion of the H/SS requirement. Visit this link (<http://coe.berkeley.edu/exams>)

8. No courses offered by an Engineering department (IEOR, CE, etc.) other than BIOE 100, CS C79, ENGIN 125, ENGIN 130AC, 157AC, ME 191K and ME 191AC may be used to complete H/SS requirements.

9. Courses may fulfill multiple categories. For example, if you complete City and Regional Planning 115 and 118AC that would satisfy the series requirement, the two upper division courses requirement and the American Cultures Requirement.

10. The College of Engineering (COE) 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 Humanities and Social Science requirement. Our requirement is different than that of L & S, so the guidelines posted on the top of each L & S breadth list do NOT apply to COE students.

11. Foreign language courses MAY be used to complete H/SS requirements. L & S does not allow students to use many language courses, so their lists will not include all options open to Engineering students. For a list of language options, visit <http://coe.berkeley.edu/FL>

*NOTE: for the Series Requirement: The purpose of the series requirement is to provide depth of knowledge in a certain area. Therefore, a two-course sequence not in the same department may be approved by petition, in cases in which there is a clear and logical connection between the courses involved.

For more detailed information regarding the courses listed below (e.g., elective information, GPA requirements, etc.), please see the Major Requirements tab.

	Freshman			
	Fall	Units	Spring	Units
Chemistry: CHEM 1A & CHEM 1AL or CHEM 4		3-4	ENGIN 7	4
MATH 1A		4	MATH 1B	4
BIOLOGY 1B or CIV ENG 70		4	PHYSICS 7A	4
CIV ENG 92		1	Reading and Composition Course from List B	4

Reading and Composition course from List A		4		16
		16-17		16
			Sophomore	
	Fall	Units	Spring	Units
CIV ENG 60		3	CIV ENG 11 (if CIV ENG taken freshman year)	0-3
CIV ENG 70 (if not taken freshman year)		0-3	CIV ENG 93	3
PHYSICS 7B		4	CIV ENG C30	3
MATH 53		4	MATH 54	4
			Basic Science Elective	4
		11-14		14-17
			Junior	
	Fall	Units	Spring	Units
CIV ENG 100		4	CIV ENG 130N	3
Humanities/Social Sciences course		3-4	Engineering Science Elective	3
Two courses from the Elective Core		6	Two courses from the Elective Core	6
			Humanities/Social Sciences course	3-4
		13-14		15-16
			Senior	
	Fall	Units	Spring	Units
CIV ENG 192		1	Design Elective	0-4
Design Elective (can be taken either Fall or Spring)		0-4	Engineering Electives	6-9
Engineering Electives		6-9	Humanities/Social Sciences course	3-4
Humanities/Social Sciences course		3-4	Free Elective	3
		10-18		12-20
Total Units: 107-132				

Mission

The Civil Engineering undergraduate program educates engineering leaders who will contribute to solving societal problems by improving the civil infrastructure, resource protection, natural hazard mitigation, and the efficient and sustainable functioning of engineered and natural systems in California, the United States, and the world. These objectives are achieved by:

- Educating students with fundamental mathematical, scientific, and engineering knowledge to have a significant and positive long-term impact on the field of civil and environmental engineering.
- Inspiring students and preparing them for successful professional careers, for further studies in high-quality graduate programs in engineering or other professional fields, and for a lifetime of learning.
- Emphasizing the importance of professional and personal ethics, business and management leadership, and service to society.

Learning Goals for the Major

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

Faculty Advisors

Each student in CEE is assigned a faculty adviser in Civil and Environmental Engineering. Students are notified of the name of their advisor shortly after they arrive at Berkeley.

Faculty advisors (and, indeed, all faculty members) hold regularly scheduled office hours throughout the school year for the purpose of helping with course content; giving general advice on courses, career objectives, graduate school, letters of recommendation, and summer internships.

Students are required to meet with their faculty advisor each semester prior to their TeleBears appointment to receive their advisor code. This code allows them to access the TeleBears Registration system.

College of Engineering Advising

Students are also assigned an Engineering Student Services (ESS) adviser in the College of Engineering. ESS advisers monitor progress towards the degree, explain graduation requirements, interpret College of Engineering policy, and explain the petition process.

Departmental Advising

CEE's undergraduate advisor answers registration questions, describes courses, interprets departmental policy, and makes referrals to resources on campus. The Department's undergraduate advisor is located in the CEE Academic Affairs Office, 750 Davis Hall.

Further Information

More advising resources can be found on the CEE Advising website (<http://www.ce.berkeley.edu/undergrad/advising>) .

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. For further information on student organizations, please

see the Undergraduate Student Life page on the Civil and Environmental Engineering website (<http://www.ce.berkeley.edu/undergrad/life>) .

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. For further information on undergraduate research opportunities, please see the Undergraduate Student Life page on the Civil and Environmental Engineering website (<http://www.ce.berkeley.edu/undergrad/life>) .

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

CIV ENG 11 Engineered Systems and Sustainability 3 Units

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

Rules & Requirements

Prerequisites: Chemistry 1A, Mathematics 1A

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Harley, Horvath, Nelson

CIV ENG 24 Freshman Seminars 1 Unit

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

CIV ENG C30 Introduction to Solid Mechanics 3 Units

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

Rules & Requirements

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

Hours & Format

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

Summer:

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Armero, Papadopoulos, Zohdi

Also listed as: MEC ENG C85

CIV ENG W30 Introduction to Solid Mechanics 3 Units

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

Objectives & Outcomes

Course Objectives: To learn statics and mechanics of materials

Student Learning Outcomes: - Correctly draw free-body

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

Rules & Requirements

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

Hours & Format

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

Summer:

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

Online: This is an online course.

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Govindjee, Sanjay

Also listed as: MEC ENG W85

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

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Monteiro, Ostertag

CIV ENG 70 Engineering Geology 3 Units

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

Rules & Requirements

Prerequisites: Chemistry 1A (may be taken concurrently)

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Glaser, Sitar

CIV ENG 92 Introduction to Civil and Environmental Engineering 1 Unit

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

CIV ENG 93 Engineering Data Analysis 3 Units

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

Rules & Requirements

Prerequisites: Engineering 7

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Der Kiureghian, Hansen, Madanat, Rubin

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

Rules & Requirements

Prerequisites: Consent of instructor

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

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

Rules & Requirements

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Chow, Stacey, Variano

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

Rules & Requirements

Prerequisites: 100 or Mechanical Engineering 106 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Variano

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

Rules & Requirements

Prerequisites: 93 and 100

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Thompson

CIV ENG 105 Environmental Fluid Mechanics Design 3 Units

Hands-on design course in applied fluid mechanics. Course goes beyond basic examples of fluid flow to include detailed discussion of real-world environmental engineering. Class team projects are used to explore real fluid mechanics, e.g., engineering for air quality or design for sea level rise mitigation. Specific project topics vary by offering and include interdisciplinary design issues from structural, geotechnical, environmental and/or transportation engineering.

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Chow, Stacey, Variano

CIV ENG C106 Air Pollution 3 Units

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Goldstein

Also listed as: EPS C180/ESPM C180

CIV ENG 107 Climate Change Mitigation 3 Units

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Nazaroff

CIV ENG 111 Environmental Engineering 3 Units

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Alvarez-Cohen, Nazaroff, Nelson, Sedlak

CIV ENG 111L Water and Air Quality Laboratory 1 Unit

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

Rules & Requirements

Prerequisites: Civil Engineering 111 (may be taken concurrently)

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Alvarez-Cohen, Nazaroff, Nelson, Sedlak

CIV ENG 112 Environmental Engineering Design 3 Units

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

Rules & Requirements

Prerequisites: Civil and Environmental Engineering 100, 111

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Hermanowicz

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

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

Rules & Requirements

Prerequisites: 111 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Nelson

CIV ENG 114 Environmental Microbiology 3 Units

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

Rules & Requirements

Prerequisites: Chemistry 1A-1B

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Alvarez-Cohen

CIV ENG 115 Water Chemistry 3 Units

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Sedlak

CIV ENG C116 Chemistry of Soils 3 Units

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

Rules & Requirements

Prerequisites: Civil Engineering 111 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Sposito

Also listed as: ESPM C128

CIV ENG 120 Structural Engineering 3 Units

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

Rules & Requirements

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Moehle

CIV ENG 121 Advanced Structural Analysis 3 Units

Theory and application of structural analysis. Stiffness and flexibility methods, with emphasis on the direct stiffness method. Equilibrium and compatibility. Virtual work. Response of linear and simple nonlinear structures to static loads. Use of computer programs for structural analysis. Modeling of two- and three-dimensional structures. Verification and interpretation of structural response.

Rules & Requirements

Prerequisites: 120

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Filippou

CIV ENG 122L Structural Steel Design Project 1 Unit

Introduction to one or more comprehensive structural design problems. Design teams will conceive structural system; determine design loads; conduct preliminary and final design of structure and its foundation; prepare construction cost estimate; prepare final report containing project description, design criteria, cost estimate, structural drawings, and supporting calculations; and make "client" presentations as required.

Rules & Requirements

Prerequisites: Civil and Environmental Engineering 122N

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Astaneh, Stojadinovic

CIV ENG 122N Design of Steel Structures 3 Units

Introduction to materials and methods of steel construction; behavior and design of tension members, compression members, flexural members and beam-columns; design of welds, bolts, shear connections and moment connections; design of spread footings or other foundation elements, introduction to design of earthquake-resistant steel structures including concentrically braced frames and moment frames.

Rules & Requirements

Prerequisites: Civil and Environmental Engineering 120 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Astaneh, Stojadinovic

Formerly known as: Civil and Environmental Engineering 122

CIV ENG 123L Structural Concrete Design Project 1 Unit

Introduction to one or more comprehensive structural design problems. Design teams will conceive structural system; determine design loads; conduct preliminary and final design of structure and its foundation; prepare construction cost estimate; prepare final report containing project description, design criteria, cost estimate, structural drawings, and supporting calculations; make "client" presentations as required.

Rules & Requirements

Prerequisites: Civil and Environmental Engineering 123N

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Mahin, Moehle, Mosalam, Panagiotou

CIV ENG 123N Design of Reinforced Concrete Structures 3 Units

Introduction to materials and methods of reinforced concrete construction; behavior and design of reinforced concrete beams and one-way slabs considering deflections, flexure, shear, and anchorage; behavior and design of columns; design of spread footings or other foundation elements; design of earthquake-resistant structures; introduction to prestressed concrete.

Rules & Requirements

Prerequisites: 120 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Mahin, Moehle, Mosalam, Panagiotou

Formerly known as: Civil and Environmental Engineering 123

CIV ENG 124 Structural Design in Timber 3 Units

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

Rules & Requirements

Prerequisites: 120

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Mahin, Filippou

CIV ENG 130N Mechanics of Structures 3 Units

Elastic and plastic stress and deformation analysis of bars, shafts, beams, and columns; energy and variational methods; plastic analysis of structures; stability analysis of structures; computer-aided mathematical techniques for solution of engineering problems and modular computer programming methods.

Rules & Requirements

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Filippou, Govindjee, Li

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

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Also listed as: MEC ENG C180

CIV ENG 140 Failure Mechanisms in Civil Engineering Materials 3 Units

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

Rules & Requirements

Prerequisites: 60

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Ostertag

CIV ENG 153 Transportation Facility Design 3 Units

A capstone class with the objective to design transportation facilities based on operational capacity, site constraints, and environmental design considerations. Emphasis on airports, including landside and airside elements, and environmental assessment and mitigation techniques.

Rules & Requirements

Prerequisites: 155

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Hansen

CIV ENG 155 Transportation Systems Engineering 3 Units

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

Rules & Requirements

Prerequisites: Sophomore standing in engineering or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Cassidy, Daganzo, Hansen, Kanafani, Madanat

CIV ENG 156 Infrastructure Planning and Management 3 Units

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Walker

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

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

Rules & Requirements

Prerequisites: 60

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Monteiro

CIV ENG 166 Construction Engineering 3 Units

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

Rules & Requirements

Prerequisites: Upper division standing, 167 recommended

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Horvath

CIV ENG 167 Engineering Project Management 3 Units

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

Rules & Requirements

Prerequisites: 93 (can be taken concurrently) or equivalent

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Ibbs, Tommelein

CIV ENG 171 Introduction to Geological Engineering 3 Units

Geological and geophysical exploration for structures in rock; properties and behavior of rock masses; rock slope stability; geological engineering of underground openings; evaluation of rock foundations, including dams. No final examination.

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Glaser

CIV ENG 173 Groundwater and Seepage 3 Units

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

Rules & Requirements

Prerequisites: Senior standing in engineering or science, 100 recommended

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Rubin, Sitar

CIV ENG 174 Engineering Geomatics 3 Units

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

CIV ENG 175 Geotechnical and Geoenvironmental Engineering 3 Units
Soil formation and identification. Engineering properties of soils.

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Bray, Pestana, Seed, Sitar

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

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Pestana, Sitar

CIV ENG 177 Foundation Engineering Design 3 Units

Principles of foundation engineering. Shear strength of soil and theories related to the analysis and design of shallow and deep foundations, and retaining structures. Structural design of foundation elements; piles, pile caps, and retaining structures. The course has a group project that incorporates both geotechnical and structural components of different foundation elements.

Rules & Requirements

Prerequisites: CE 175 required, CE 120 recommended

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructors: Bray, Seed

CIV ENG C178 Applied Geophysics 3 Units

The theory and practice of geophysical methods for determining the subsurface distribution of physical rock and soil properties. Measurements of gravity and magnetic fields, electrical and electromagnetic fields, and seismic velocity are interpreted to map the subsurface distribution of density, magnetic susceptibility, electrical conductivity, and mechanical properties.

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Rector

Also listed as: EPS C178

CIV ENG 180 Life-Cycle Design and Construction 4 Units

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

Rules & Requirements

Prerequisites: Civil and Environmental Engineering 167

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructor: Horvath

CIV ENG 186 Design of Cyber-Physical Systems 3 Units

Design and prototype of large-scale technology intensive systems. Design project incorporating 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.

Rules & Requirements

Prerequisites: 191

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Bayen, Glaser, Sengupta

CIV ENG 191 Civil and Environmental Engineering Systems Analysis 3 Units

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

Rules & Requirements

Prerequisites: 93, Engineering 7 or 77

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

Instructors: Bayen, Madanat, Sengupta

Formerly known as: 152**CIV ENG 192 The Art and Science of Civil and Environmental Engineering Practice 1 Unit**

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

Rules & Requirements

Prerequisites: Senior standing in civil and environmental engineering

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/ Undergraduate

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

CIV ENG 193 Engineering Risk Analysis 3 Units

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

Rules & Requirements

Prerequisites: Upper division standing

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

Instructor: Der Kiureghian

CIV ENG H194 Honors Undergraduate Research 3 - 4 Units

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

Rules & Requirements

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

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

Hours & Format

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

Summer:

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

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

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

Rules & Requirements

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

Hours & Format

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

Summer:

6 weeks - 2.5-10 hours of fieldwork per week

8 weeks - 1.5-7.5 hours of fieldwork per week

10 weeks - 1.5-6 hours of fieldwork per week

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

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

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

Rules & Requirements

Prerequisites: Senior standing in engineering

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

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

Hours & Format

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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

CIV ENG 199 Supervised Independent Study 1 - 4 Units

Supervised independent study.

Rules & Requirements

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

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

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

Hours & Format

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

Summer:

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

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

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

Additional Details

Subject/Course Level: Civil and Environmental Engineering/
Undergraduate

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