188B. Materials Design Project (4) Laboratory—4 hours; discussion—1 hour. Prerequisite: course 188A. Major materials design experience involving analysis of real materials synthesis/processing/fabrication and technical applications including critical assessments of economic, manufacturing, and ethical constraints. Various principles of materials science are integrated into a culminating design project. (Deferred grading only, pending completion of sequence.) GE credit: SciEng [OL, SE, SL, VL, WE.—II (III) Sen]

190C. Research Group Conferences (1) Discussion—1 hour. Prerequisite: consent of instructor; group study of selected topics. (P/NP grading only.)—II, III, (I, II, III)

198. Directed Group Study (1-5) Lecture—1-5 hours. Prerequisite: consent of instructor. Group study of selected topics. (P/NP grading only.)

199. Special Study for Advanced Undergraduates (1-5) Prerequisite: consent of instructor. (P/NP grading only.)

Graduate

230. Fundamentals of Electron Microscopy (3) Lecture—2 hours; lecture/discussion—1 hour. Prerequisite: course 162. Principles and techniques of scanning and transmission of electron microscopy used in the study of materials will be described. Emphasis upon practical applications. Offered in alternate years.—(II.)

230L. Laboratory for Electron Microscopy (2) Laboratory—6 hours. Prerequisite: course 230 concurrently. Practical application of techniques of electron scanning and transmission microscopy including x-ray microanalysis. Offered in alternate years.—(II.)

232. Advanced Topics in Transmission Electron Microscopy (3) Lecture—1 hour; discussion—2 hours. Prerequisite: course 230. Advanced course in the techniques of electron microscopy including analytical techniques, problem solving, practicalities, and high resolution imaging. Offered in alternate years.—(II.)

232L. Laboratory for Advanced Transmission Electron Microscopy (2) Discussion—1 hour, laboratory—3 hours. Prerequisite: course 230L. Laboratory in advanced transmission electron microscopy techniques relevant to specific graduate research projects in materials science. Offered in alternate years.—(II.)

241. Principles and Applications of Dislocation Mechanics (4) Lecture—3 hours; discussion—1 hour. Prerequisite: graduate standing in Engineering; consent of instructor. Concepts in dislocation theory are applied to explain plasticity of crystalline solids. Glide and climb of dislocations, strain hardening, recrystallization, theories of creep processes and interaction of dislocation with solute atoms, precipitates and impurity clouds are discussed. Offered in alternate years.—(II.)

243. Kinetics of Phase Transformation in Engineering Materials (3) Lecture—3 hours. Prerequisite: graduate standing in Engineering and consent of instructor; course 160 recommended. Theory of alloying, kinetics of phase changes, homogeneous and heterogeneous transformation, transformation by shear, order-disorder reactions. Offered in alternate years.—(II.) (III) Groza

244. Interaction of Materials and their Environment (3) Lecture—3 hours. Prerequisite: Engineering 45 and 105A, or consent of instructor. Thermodynamic and kinetic foundations of the corrosion and oxidation processes. Practical aspects of corrosion control and prevention. Stress-corrosion and gas-embrittlement phenomena. Surface and microscopic, and atmospheric corrosion. Offered in alternate years.—(II.)

248. Fracture of Engineering Materials (3) Lecture—3 hours. Prerequisite: course 174. Description of the failure of materials by crack propagation. Topics include the stress fields about elastic cracks, the Griffith-Irwin analysis, descriptions of plastic zones, fracture toughness testing, microstructural aspects of fracture at elevated temperatures. Offered in alternate years.—(I.) Gibling

249. Mechanisms of Fatigue (3) Lecture—3 hours. Prerequisite: course 174 or consent of instructor; course 248 recommended. Microstructural description of the mechanisms of fatigue in metals. Topics include a phenomenological treatment of cyclic deformation, dislocation processes in cyclic deformation, fatigue crack nucleation, Stage I crack growth, threshold effects and high temperature cyclic deformation. Offered in alternate years.—(I.) Gibling

250A-F. Special Topics in Polymer and Fiber Science (3) Lecture—3 hours. Prerequisite: course 147 or consent of instructor. Selected topics of current interest in polymer and fiber sciences. Topics will vary each time the course is offered. (Same course as Textiles 55.)

251. Applications of Solid State Nuclear Magnetic Resonance Spectroscopy (3) Lecture—3 hours. Prerequisite: graduate standing in chemistry, physics or engineering, or consent of instructor. Fundamental principles of solid state NMR spectroscopy and principles of advanced NMR techniques for analyzing structure of solid materials.—(III.) (Sen)

260. Advanced Thermodynamics of Solids (4) Lecture/discussion—4 hours. Prerequisite: course 160. Thermodynamic principles, formalism and their application to solid materials. Specific examples from ceramic and solid state systems. Use of thermo-dynamic approach in developing understanding of and constraints for processes in real systems. Offered in alternate years.—(I.) Kim

262. Advanced Topics in Structure of Materials (4) Lecture—3 hours; discussion—1 hour. Prerequisite: course 162; course 174 recommended; graduate standing in Engineering or consent of instructor. Nature of microstructure in engineering materials. Crystalline and noncrystalline structures, with special emphasis on grain boundary segregation in the development of polycrystalline microstructure and the radial distribution of impurities in materials. Not open for credit to students who previously completed (cancelled) course 245. Offered in alternate years.—(I.)

264. Transport Phenomena in Materials Processes (4) Lecture/discussion—4 hours. Prerequisite: graduate standing in Engineering. Thermodynamic driving forces and atomic-scale mechanisms underlying diffusion mass transport in materials. Nucleation, growth and coarsening dynamics of phase transformations. Not open for credit to students who previously completed course 240.—(II, (II, III)

272. Advanced Functional Properties of Materials (4) Lecture/discussion—4 hours. Prerequisite: graduate standing in Physics, Chemistry, and Engineering. Fundamental physical properties of solid materials important to solid state devices, specifically electronic, magnetic, and optical properties. Topics include band structures, metals, superconductors, semiconductors, ferroelectrics, optical properties, and magnetic properties and implications of these properties into devices.—(I.) Moule, Takamura

274. Advanced Mechanical Properties of Materials (4) Lecture—3 hours; discussion—1 hour. Prerequisite: course 174. Comprehensive study of mechanical properties of materials, with special attention to dislocations and deformation and fracture control mechanisms. Mechanical properties of conventional engineering materials as well as advanced materials such as nanocrystalline solids and thin films are considered. Offered in alternate years.—(II.) Gibling

282. Glass: Science and Technology (3) Lecture—2 hours, extensive writing—1 hour. Prerequisite: graduate standing in Chemistry, Physics or Engineering, or consent of instructor. Modern paradigms in glass science and their applications to technologies. Relation of macroscopic properties of glasses and glass-forming liquids to atomic-level structures, including principles of formation, relaxation, transport phenomena, nucleation, crystallization and phase separation in glasses. Offered in alternate years.—(II.)

289A-G. Special Topics in Materials Science (1-5) Lecture and/or laboratory. Prerequisite: consent of instructor. Special topics in: (A) Electronic Materials; (B) Ceramics and Minerals; (C) Physics and Chemistry of Materials; (D) Materials Processing; (E) Materials Science and Forensics; (F) Biomaterials; (G) Surface Chemistry of Metal Oxides. May be repeated for credit when topic differs.—(I, III, (I, II, III)

290C. Graduate Research Conference (1) Discussion—1 hour. Prerequisite: consent of instructor. Individual and/or group conference on problems, progress, and techniques in materials science and engineering research. May be repeated for credit.—(S/U grading only)—I, II, III, (I, II, III)


298. Group Study (1-5) Prerequisite: consent of instructor. (S/U grading only)

Professional

390. The Teaching of Materials Science (1) Discussion—1 hour. Prerequisite: meet qualifications for teaching assistant and/or associate-in in materials science and engineering. Participation as a teaching assistant or associate-in in a designated engineering course. Methods of teaching discussion groups or laboratory sections, writing and grading quizzes, use of laboratory equipment, and grading laboratory reports. May be repeated two times for credit.—(S/U grading only)—I, II, III, (I, II, III)

Engineering: Civil and Environmental

Courses of Interest offers programs as described in Engineering: Civil and Environmental Science.

Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jason T. DeJong, Ph.D.</td>
<td>Professor</td>
</tr>
</tbody>
</table>

Academic Senate Distinguished Teaching Award

College of Engineering

Sashi K. Kunnath, Ph.D., Chairperson of the Department 530-752-0586

Department Office. 2001 Qahsi Hall 530-752-0586, http://cee.engr.ucdavis.edu

Fall 2011 and on Revised General Education (GE): AH—Arts and Humanities; SE—Science and Engineering; SS—Social Sciences; AAGH—American Cultures; DD—Domestic Diversity; WRT—Writing Experience;

Pre-Fall 2011 General Education (GE): ArtH—Arts and Humanities; SCi—Science and Engineering; SocSci—Social Sciences; Div—Domestic Diversity; WRT—Writing Experience

Engineering: Civil and Environmental

261
Yuwee Fan, Ph.D., Associate Professor
Timothy R. Ginn, Ph.D., Professor
John T. Harvey, Ph.D., Associate Professor
Boris Jeremic, Ph.D., Professor
Amit Kanvinde, Ph.D., Associate Professor
M. Levent Kavvas, Ph.D., Professor
Aliosa Kendall, Ph.D., Associate Professor
Michael J. Kleeman, Ph.D., Professor
Sashi K. Kunnath, Ph.D., Professor
Bruce L. Kutter, Ph.D., Professor
Frank J. Lave, Ph.D., Professor
Kenneth J. Loh, Ph.D., Assistant Professor
Jay R. Lund, Ph.D., Professor
Mark P. Modera, Ph.D., Professor
Brian Maroney, D.Engr., Adjunct Assistant Professor
Edward D. Schroeder, Ph.D., Professor Emeritus
Karl M. Romstad, Ph.D., Professor Emeritus
Melvin R. Ramey, Ph.D., Professor Emeritus
I.M. Idriss, Ph.D., Professor Emeritus
James A. Cheney, Ph.D., Professor Emeritus
Leonard R. Hefele, Ph.D., Professor Emeritus
Academic Senate Distinguished Teaching Award, UC Davis Prize for Teaching and Scholarly Achievement
Verne H. Scott, Ph.D., Professor Emeritus
I.M. Idriss, Ph.D., Professor Emeritus
Ian P. King, Ph.D., Professor Emeritus
Bruce E. Larock, Ph.D., Professor Emeritus
Miguel A. Mariño, Ph.D., Professor Emeritus
(Civil and Environmental Engineering; Land, Air and Water Resources)
Patricia L. Moktarian, Ph.D., Professor Emerita
Gerald T. Orlob, Ph.D., Professor Emeritus
Otto G. Raabe, Ph.D., Professor Emeritus
Melvin R. Ramey, Ph.D., Professor Emeritus
Karl M. Romstad, Ph.D., Professor Emeritus
Academic Senate Distinguished Teaching Award, UC Davis Prize for Teaching and Scholarly Achievement
Edward D. Schroeder, Ph.D., Professor Emeritus
Academic Senate Distinguished Teaching Award
Verne H. Scott, Ph.D., Professor Emeritus
Chih-Kang Shen, Ph.D., Professor Emeritus
Michael A. Tafti, Ph.D., Professor Emeritus
George Tchobanoglous, Ph.D., Professor Emeritus

Affiliated Faculty
Norman A. Abrahamson, Ph.D., Adjunct Professor
Brian Maroney, D.Engr., Adjunct Assistant Professor

The Civil and Environmental Engineering Programs

Mission. The Department of Civil and Environmental Engineering integrates research, education, and professional service in areas related to civil infrastructure and the environment. We provide the professional and intellectual foundations that students need to become both practicing engineers and socially responsible citizens.

Program Educational Objectives. The objectives of the Civil Engineering undergraduate program at the University of California, Davis are to produce civil and environmental engineers who (1) are proficient in the fundamentals of engineering science, analytical and quantitative reasoning, and design; and (2) are able to apply these skills in developing safe, sustainable, economical, and environmentally sound solutions to civil engineering problems. Exposure to the profession through postgraduate research, (3) grow professionally in their careers through continued development of technical and management skills, and (4) assume responsible roles of professional licensure, and assumption of the responsibilities of engineering practice, and (4) understand the needs and represent the diversity of the program’s constituencies, thereby serving the needs of society and the profession.

The constituency of the CEE program includes our students and those organizations or employers that might join during career paths spanning professional practice, research, and teaching. Specifically, these constituents may include consulting firms and organizations, state and federal agencies or laboratories, universities, cities and counties, contractors, civil-product manufacturers and suppliers, and environmental organizations.

Study Abroad and Civil Engineering. The department offers courses in locations such as Ireland and Italy through the Summer Abroad Program. Students may apply for admission to the civil engineering program at an international institution, such as the University of Dublin, by participating in an Education Abroad Program. The department encourages interested students to participate in both Summer Abroad and Education Abroad Programs. Please consult with the undergraduate staff advisor in the department for more information. Often students are in their junior or senior year of study when they participate in this option.

Civil Engineering Undergraduate Program

The Civil Engineering program is accredited by the Engineering Accreditation Commission of ABET; see http://www.abet.org.

Students are encouraged to adhere carefully to all prerequisite requirements. The instructor is authorized to drop students from a course for which stated prerequisites have not been completed. Exclusive of General Education units, the minimum number of units required for the Civil Engineering major is 153 (77 units in lower division and 76 units in upper division).

Lower Division Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 21A-21B-21C-21D</td>
<td>16</td>
</tr>
<tr>
<td>Mathematics 22A-22B</td>
<td>6</td>
</tr>
<tr>
<td>Physics 9C</td>
<td>8</td>
</tr>
<tr>
<td>Chemistry 2C</td>
<td>5</td>
</tr>
<tr>
<td>Geology 50-SL</td>
<td>10</td>
</tr>
<tr>
<td>Chemistry 2A-2B or 2AH-2BH</td>
<td>10</td>
</tr>
<tr>
<td>Civil and Environmental Engineering 3</td>
<td>8</td>
</tr>
<tr>
<td>Civil and Environmental Engineering 3</td>
<td>8</td>
</tr>
<tr>
<td>Civil and Environmental Engineering 3</td>
<td>8</td>
</tr>
</tbody>
</table>

(Civil and Environmental Engineering 3 is designed for lower division students and is not open to upper-division students. Students taking this course will substitute four units of additional upper-division Civil and Environmental Engineering coursework.)

One course from: Civil and Environmental Engineering 19, Engineering 6, or Computer Science Engineering 30

Engineering 35, 45 or 45Y

Civil and Environmental Engineering 16

English 3 or University Writing Program 1, 1V, or 1Y, or Comparative Literature 1, 2, 3, or 4, or Native American Studies 5

Communication 1 or 2

Upper Division Requirements: Areas of Specialization

Undergraduates may emphasize one or more of the following areas of specialization, or generalize across all areas. You are urged to consult a departmental advisor when developing your individual program.

Generalization

Introduction to Civil and Environmental Engineering

Specialization

Environmental Engineering

The focus of this area is on the management and improvement of air, land, and water quality in the face of increasing population, expanding industrialization, and global warming. Examples of environmental engineering problems include innovative analysis and design of air, water, wastewater, and solid waste treatment systems; mathematical modeling of natural and engineered systems; sampling, and transport and transformation of natural and anthropogenic pollutants; and modeling of air pollutant emissions.


Geotechnical Engineering. This area deals with civil infrastructure and environmental problems that require quantifying the behavior of geologic materials such as soils and rocks. Examples of geotechnical engineering problems include foundations for buildings and bridges, earthwork (such as dams, tunnels, highways), earthquake hazards (such as ground motions, liquefaction, soil-structure interaction), and geo-environmental problems (ground water flow, subsurface contaminant transport and remediation).

Suggested Advisers. R. W. Boulanger, Y. F. Dafalias, J. T. Delong, J. T. Harvey, B. Jeremic, B. L. Kutter

Structural Engineering and Structural Mechanics. The focus of this area is the conception, design, analysis, construction, and life-cycle modeling of all types of civil infrastructure, including buildings, bridges, dams, ports, highways, and industrial facilities. Structural materials include metals, reinforced concrete, timber, and advanced composites. Loads range from earthquakes to adverse environmental conditions. Structural mechanics emphasizes theoretical and computational tools that may be used in structural engineering.


Transportation Planning and Engineering. This area deals with the movement of people and goods in a manner consistent with society’s environmental (such as air and water quality) and socio-economic (such as equity and mobility) goals.

Transportation engineering applies engineering, economic, and behavioral science principles to the planning, analysis, design, and operation of transportation systems, such as highways, transit, and air transport. Transportation planning involves the formulation and analysis of transportation policy, program, and project alternatives in consideration of societal goals, budgetary constraints, economic objectives, and technological feasibilities.


Water Resources Engineering. This area includes hydrology, hydraulics, fluid mechanics, and water resources systems planning and design. Hydrology deals with quantifying and understanding all aspects of the hydrologic cycle, including the relationships between precipitation, runoff, ground-water, and surface water. Water quality and contaminant transport issues are linked to hydrologic conditions. Hydraulics and fluid mechanics deal with flows in pipes, open-channel systems, and natural systems, such as lakes and estuaries. Water resources systems planning and design deals with the comprehensive development of all water resources to meet the multiple needs of industry, agriculture, municipalities, recreation, and other activities.


Civil Engineering

Upper Division Required Courses

Engineering 102, 103, 104, 104L, 105, 106
Civil and Environmental Engineering 114, 190
Geotechnical: Civil and Environmental Engineering 140, 143, 148B, 150
Geotechnical: Civil and Environmental Engineering 171 and 171 Lab and at least one course from Civil and Environmental Engineering 173, 175, 179
Structures: Civil and Environmental Engineering 130 and at least one course from Civil and Environmental Engineering 131, 132, 135, 136, 137, 138, 139
Transportation: Civil and Environmental Engineering 161, 162 or 179 and at least one course from Civil and Environmental Engineering 162, 163, 165, 179
Water Resources: Civil and Environmental Engineering 141 and 141 Lab and at least one course from Civil and Environmental Engineering 142, 144, 145, 146, 155
Minor Design Requirement: You must complete at least two of the following courses as part of the Group Option or Civil & Environmental Engineering elective requirement: Civil & Environmental Engineering 127, 128, 143, 148A, 149, 153, 162, 165, 178, Engineering Applied Science 188, Anthropology 104N, 191, Agricultural and Rural Economics 175, 176, Atmospheric Science 116, Community and Regional Development 142, 154, 172, Environmental Science and Policy 161, 162, 172, 191, Environmental Toxicology 101, 102A, Geology 130, 134, Landscape Architecture 180** Nature and Culture 120, Plant Sciences 101, 141, 150, 162, may include Landscape Architecture 3**
M.S. and Ph.D.; Designated Ph.D. emphasis available in Biotechnology
http://ceee.engr.ucdavis.edu
530-752-1441
With over thirty faculty members, over $20 million in annual research expenditures and over 240 graduate students, the Department of Civil and Environmental Engineering integrates research, education and professional service in areas related to civil infrastructure and the environment. Graduate students benefit from close working relationships with professors who are the leading international experts in their field. They are supported in their study and research by robust funding, and they have access to state-of-the-art research facilities. For example, one of the experimental laboratories that constitutes NEEES, the Network for Earthquake Engineering Simulation, http://neeucs.ucdavis.edu, has the largest centrifuge of its kind in the nation and gives researchers access to their peers at other unique centers via high-speed networks. Since 1960, researchers at the J. Amorochy Hydraulics Laboratory (JAHL) have served the state of California by solving ecological, biological, environmental and hydraulic engineering problems. Students may also have the opportunity to work in one of the many environmental engineering labs or the structural testing facilities in the department. Our graduates go on to serve the profession and academy by advancing the leading edge of fundamental knowledge, as well as engineering practice.
Generous financial support is available in the form of research assistantships, teaching assistantships, fellowships and financial aid. About 75% of the graduate students in our program are able to enroll.
Sustainability in the Built Environment Minor
All courses must be taken for a letter grade. A grade of C- or better is required for all courses used to satisfy minor requirements with an overall GPA in minor requirement courses of 2.00 or better.


Sustainability in the Built Environment Minor
30


Student enrollment requests will be reviewed by the instructor to ensure that a balanced group of students with different experiences, majors or expertise are able to enroll.
* Due to variability in series course offering, consent of minor advisor is required.
Minor advisors: F. Loge, A. Kendall
The Graduate Program in Civil and Environmental Engineering

Earthquake engineering
Environmental engineering
Environmental planning and management
Geotechnical engineering
Hydraulics and fluid mechanics
Hydrology
Structural engineering
Structural health monitoring
Structural mechanics
Systems planning and design
Transportation engineering
Transportation planning and design
Water resources engineering

Research Facilities and Partnerships:
- Center for Watershed Sciences
- Center for Water-Energy Efficiency
- Institute of Transportation Studies
- J. Amorochy Hydraulics Laboratory (JAHL)
- NSF Center for Nanoscale Engineering
- Nano-Engineering and Smart Structures Technologies
- NSF NEEES Geotechnical Centrifuge
- Pavement Research Center
- Tahoe Environmental Research Center
- Western Cooling Efficiency Center

Complete Information on our website.

Courses in Engineering:
Civil and Environmental (ECI)
Course Offerings for Pre-Fall 2011

98. Directed Group Study (1-5)
Prerequisite: consent of instructor and lower division standing. (P/NP grading only.) GE credit: SE.

99. Special Undergraduates (1-5)
Prerequisite: consent of instructor; lower division standing. (P/NP grading only.) GE credit: SE.

Upper Division

114. Probabilistic Systems Analysis for Civil Engineers (4)
Lecture—4 hours. Prerequisite: C or better in Mathematics 21C. Probabilistic concepts and models in engineering, including analysis of engineering experimental and field data. Introduction to stochastic processes and models of engineering systems. Not open for credit to students who have completed Statistics 109A. GE credit: SciEng | QL, SE.—I, II, III, (I, II, III)

Upper Division

115. Computer Methods in Civil & Environmental Engineering (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Engineering & Computer Science Engineering 100E, Mathematics 205A, and Mathematics 228. Open to Civil Engineering majors only. Presentation, implementation and application of numerical algorithms and computer models for the solution of practical problems in Civil and Environmental Engineering. GE credit: SciEng | SE.—I, II, III, (I, II, III)

119. Parallel Processing for Engineering Applications (4)
Lecture—4 hours. Prerequisite: upper division—3 hours. Prerequisite: C programming or consent of instructor. Fundamental skills in parallel computing for engineering applications; emphasis on structured parallel program development and memory parallel clusters. Not open for credit to students who have completed course 119B. Offered in alternate years. GE credit: SciEng | SE—Kleeman, Jeremic

123. Urban Systems and Sustainability (4)
Lecture—4 hours. Prerequisite: upper division standing. Systems-level approach of how to evaluate and then modify sustainability of urban systems based on interaction with natural environments. Topics include: definition/metrics of urban sustainability; system analyses of urban systems; enabling technology, policies, legislation; measures and modification of ecological footprints. GE credit: SciEng or SocSci, Div, Wrt | ACGH, DD, SS, VL, WS, WE—Kendall

125. Building Energy Performance (4)
Lecture—4 hours. Prerequisite: upper division standing in Engineering. Open to students in the College of Engineering. Mechanisms of energy consumption in buildings including: thermal loads, ventilation, air infiltration, thermal energy distribution, and HVAC systems; energy performance simulation; methods and strategies of energy efficiency. GE credit: SciEng | SE—Kleeman, Jeremic

126. Integrated Planning for Green Civil Systems (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Physics 9C or Landscape Architecture 60 or Design 14.5 or Environmental Science and Policy 100 or Nature and Culture 120 or Anthropology 100 or Statistics 32 or Plant Sciences 101; consent of instructor. Working within multi-disciplinary teams, a heuristic problem-solving model, and multiple realistic constraints, an integrated design process will be applied to the planning of a project-based green and sustainable civil system. GE credit: SciEng | SE—Kleeman, Jeremic

127. Integrated Design for Green Civil Systems: Senior Design Experience (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: course 126; consent of instructor. Restricted to senior level standing. Working within multi-disciplinary teams and a heuristic, project-based learning environment, a green and sustainable civil system will be designed. Evaluate various design options under architectural, structural, and environmental constraints, and present designs through oral and written presentations. GE credit: SciEng | SE—I, II, III, (I, II, III)

128. Integrated Construction for Green Civil Systems (4)
Lecture—2 hours; laboratory—6 hours. Prerequisite: course 127. Working within multidisciplinary teams, a heuristic learning environment, and multiple realistic constraints, an integrated design process will be applied to the construction of a project-based green and sustainable civil system. GE credit: SciEng | SE—Kleeman, Loge

130. Structural Analysis (4)
Lecture—4 hours. Prerequisite: C or better in Engineering 104, Mathematics 22A. Open to Civil Engineering majors only. Determination of determinate and indeterminate trusses, beams and frames. Plastic bending and limit analysis. GE credit: SciEng | QL, SE.—I, II, III, (I, II, III)

Lecture—3 hours; laboratory—3 hours. Prerequisite: C or better in Engineering 104; Engineering 6. Open to Engineering majors only. Matrix formulation and computer analysis of statically indeterminate structures. Stiffness, compatibility, and elastic analysis. GE credit: SciEng | SE—Kleeman, Loge

132. Structural Design: Metallic Elements (4)
Lecture—4 hours. Prerequisite: course 130. Design of metallic beams, columns, and other members for various types of loading and boundary conditions; design of columns; member performance within structural systems. GE credit: SciEng | SE, VL—II, III Bolander, Kanivn

135. Structural Design: Concrete Elements (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: course 130. Restricted to Civil Engineering, Civil Engineering/Materials Science and Engineering, and Materials Science and Engineering majors only. Strength design procedures for columns, rectangular beams, beams and of general cross-section. Building code requirements for bending, shear, axial load, combined stresses and bond. Introduction to prestressed concrete. GE credit: SciEng | QL, SE—III, (I, II, III) Chai

136. Building Design: Senior Design Experience (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: course 130 or 131; course 135 or 132. Restricted to senior level standing. Design of a building structure for a specific need under the multiple constraints of safety, serviceability, cost and aesthetics. Offered irregularly. GE credit: SciEng 

137. Construction Principles and Project Management (4)
Lecture—3 hours; laboratory—3 hours. Restricted to upper division standing in Engineering. Project management, with civil engineering construction and design applications, including project scope, schedule, resources, cost, quality, risk, and control. Construction industry overview. Interactions between planning, design, and construction operations. Contract issues. Project management software, field trips, guest lectures. Offered irregularly. GE credit: SciEng | SocSci, ACGH, QL, QH, SE or SS, VL, WE—II, (I, II) Harvey

138. Earthquake Loads on Structures (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 130 or 131. Determination of loads on structures due to earthquakes. Methods of estimating equivalent static lateral forces; response spectrum and time history analysis. Concepts of mass, damping and stiffness for typical structures. Design for inelastic behavior. Seismic code provisions and Code requirements. GE credit: SciEng | SE—Kleeman, Jeremic

139. Advanced Structural Mechanics (4)
Lecture—4 hours. Prerequisite: C or better in Engineering 104. Review of stress, strain, equilibrium, compatibility and, elastic material behavior. Plane stress and plane strain problems in elasticity; energy methods. Theories for unsymmetric bending, straight and curved beams. Beams on elastic foundations; stresses in plates and shells; elastic stability. GE credit: SciEng | SE—I, II Roashid, Sukumar

140. Environmental Analysis of Aqueous Systems (3)
Lecture—3 hours. Prerequisite: Chemistry 2B. Introduction to chemical principles underlying current practices in sampling and analysis of water and wastewater. GE credit: SciEng | SE.—I, II, III

140L. Environmental Analysis of Aqueous Systems Laboratory (1)
Lecture—3 hours. Prerequisite: Chemistry 2B or the equivalent; course 140 (may be taken concurrently). Restricted to Civil Engineering undergraduate and graduate students. Introduction to “wet chemical” and instrumental techniques commonly used in the examination of water and wastewater and associated data analysis. GE credit: SciEng | SE

141. Engineering Hydraulics (3)
Lecture—3 hours. Prerequisite: C or better in Engineering 103. Nature of flow of a real fluid; flow in pipe networks; flow in open channels; effects of gravity; flow forces on objects; boundary layers, lift and drag. GE credit: SciEng | SE.—I, II, III, (I, II, III) Bombardelli, Schladow, Younis

141L. Engineering Hydraulics Laboratory (1)
Laboratory—3 hours. Prerequisite: course 141 (may be taken concurrently). Open to Engineering students only. Laboratory experiments and demonstrations on flow measurements, frictional losses, open channel flow, jump, flow characteristics, and centrifugal pumps. GE credit: SciEng | SE.—I, II, III, (I, II, III) Bombardelli, Schladow, Younis

142. Engineering Hydrology (4)

143. Green Engineering Design and Sustainability (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: upper division standing. Restricted to Civil Engineering and Civil Engineering/Materials Science and Engineering majors only. Applications of concepts, goals, and metrics of sustainability, green engineering, and ecological design to the design of engineering systems. Life cycle analysis, waste audit and environmental management systems, economics of pollution prevention and sustainability, and substitute materials for products and processes. GE credit: SciEng | QL, SE, VL, WE

144. Groundwater Systems Design (4)
Lecture—4 hours. Prerequisite: course 141. Groundwater occurrence, distribution, and movement; groundwater flow systems; radial flow to wells and aquifer test character for management; groundwater contamination; solute transport by groundwater; fate and transport of subsurface contaminants. Groundwater supply and transport modeling. GE credit: SciEng | QL, SE, VL, WE

144L. Groundwater Systems Design Laboratory (1)
Laboratory—3 hours. Prerequisite: course 144, taken concurrently. Computer modeling of groundwater flows in heterogeneous, layered, gravelly, silted, and natural and engineered boundary conditions. Use of Groundwater Vistas computer program.—Ginn

145. Hydraulic Structure Design: Senior Design Experience (4)
Lecture—2 hours; discussion—1 hour; laboratory—3 hours. Prerequisite: C or better in course 141. Restricted to senior level standing. Project-based course covering the design of an integrated urban drainage system, including design alternatives, multiple realistic constraints (public
146. Water Resources Simulation (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103. Computer simulation techniques in the analysis, design and operation of surface water systems; modeling concepts and practices with application to surface runoff; water quality in rivers and streams and dispersion of contaminants in water bodies. GE credit: SciEng, Wrt | SE.—II, III. (II, III.) Younis

148A. Water Quality Management (4)
Lecture—4 hours. Prerequisite: C- or better in Chemistry 28B. Basic concepts of water quality measurement and regulation. Introduction to physical, biological and chemical processes in natural waters. Fundamentals of mass balances in water and waste-water treatment. GE credit: SciEng | SE.—II. (II.) Wurzel, Young.

148B. Water and Wastewater Treatment System Design: Senior Design Experience (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: C- or better in Engineering 103 and course 148A. Restricted to senior level standing. Design and evaluation of water and wastewater treatment systems. GE credit: SciEng | QL, SE, SL, WE.—III. (III.) Darby

149. Air Pollution (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Mathematics 21D, 228, Chemistry 28B, Atmospheric Science 121A or Engineering 103. Physical and technical aspects of air pollution. Emphasis on geo- physical control of air pollution meteorology as well as physical and chemical properties of pollutants. [Same course as Atmospheric Science 149.] GE credit: SciEng | QL, QL, SL.—I. (I.) Cappa

150. Air Pollution Control System Design: Senior Design Experience (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103, 105, 106; course 149. Restricted to senior level standing. Design and evaluation of air pollution control devices and systems. GE credit: SciEng | SE.—II, III. (II, III.) Cappa

153. Deterministic Optimization and Design (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Mathematics 21C and 22A; computer programming course. Optimization techniques such as linear programming, dynamic programming, and non-linear programming. Applications in civil engineering disciplines, including multiple realistic constraints, through computer-based course projects. GE credit: SciEng | QL, SE, SL.—I. (I.) Fan

155. Water Resources Engineering Planning (4)
Lecture—4 hours. Prerequisite: Engineering 106 or Economics 1A; course 114. Basic engineering planning concepts; role of engineering, economic, environmental and social information and analysis; institutional, political and legal aspects. Case studies and computer models illustrate the planning of water resource systems. GE credit: SciEng or SocSci, Wrt | SE, SL, SL, WE.—I. (I.) Lund

161. Transportation System Operations (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in Engineering 6 [or the equivalent] and 102. Principles of transportation system operations; traffic and bonds and methods of measurement; models of transportation operations and congestion applied to urban streets and freeways. GE credit: SciEng | QL, SE.—II, III. (II, III.) Zhang

162. Transportation Land Use Sustainable Design: Senior Design Experience (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: C- or better in course 161 or 163. Restricted to senior level standing. Interactions between land use and transportation systems design. Generalized design and implementation of local and regional strategies to satisfy multiple constraints including cost, effectiveness and environmental sustainability. Oral, poster, and written presentation required. GE credit: SciEng | SE, SL.—II, III, IV. (II, III, IV.) Niemeier

163. Energy and Environmental Aspects of Transportation (4)

165. Transportation Policy (3)
Lecture—3 hours. Transportation and associated environmental problems confronting urban areas, and prospective technological and institutional solutions. Draws upon concepts and methods from economics, engineering, political science and environmental studies. Offered in alternate years. GE credit: SciEng | SS, Wrt | QL, SE or SS.—(I.) Sperling

171. Soil Mechanics (4)
Lecture—4 hours. Prerequisite: C- or better in Engineering 104, Engineering 103 [may be concurrent]; course 171L. Emphasis on Civil Engineering and Materials Science and Engineering majors only. Soil formations, mass-volume relationships, soil classification, effective stress, settlement behavior, compaction, soil suction, consolidation, strength, states of stress and failure, lateral earth pressures, and slope stability. GE credit: SciEng | QL, SE.—II, III. (II, III.) Kutter

171L. Soil Mechanics Laboratory (1)
Laboratory—3 hours. Prerequisite: course 171 must be taken concurrently. Laboratory studies utilizing standard testing methods to determine physical, mechanical and hydraulic properties of soil and demonstration of basic principles of soil behavior. GE credit: SciEng | SE.—II, III, (II, III.) Kutter

173. Foundation Design: Senior Design Experience (4)
Lecture—4 hours. Prerequisite: course 171. Restricted to senior level standing. Soil exploration and determination of properties for design; design of shallow and deep foundations for bearing capacity and settlement behavior; structural selection and evaluation of foundation alternatives; excavation support and dewatering; major design experience and design report preparation. GE credit: SciEng | SE—II, III. (II, III.) Boulanger

175. Geotechnical Earthquake Engineering (4)
Lecture—4 hours. Prerequisite: C- or better in course 171. Earthquake sources and ground motions. Cyclic behavior, hysteretic effects, consequences, and mitigation of effects of liquefaction. NEES (Net- work for Earthquake Engineering Simulation) equipment and techniques for studying earthquake engineering with focus on liquefaction problems. GE credit: SciEng | QL, SE.—II, III. (II, III.) Kutter

179. Pavement Engineering (4)
Lecture—3 hours; discussion/lab—3 hours. Prerequisite: C- or better in Engineering 104. Pavement types (rigid, flexible, unbound); asphalt, crushed stone, base, binder and surface course materials; flexible pavement design; rehabilitation and construction; construction quality; asphalt concrete mix design. GE credit: SciEng | QL, SE, SI, VL.—I. (I.) Harvey

189A-J. Selected Topics in Civil Engineering (1-5)
Prerequisite: consent of instructor. Directed group study of selected topics with separate sections in (A) Environmental Engineering; (B) Hydraulic and Hydrologic Engineering; (C) Engineering Planning; (D) Geotechnical Engineering; (E) Structural Engineering; (F) Structural Mechanics; (G) Transportation Engineering; (H) Transportation Planning; (I) Water Resources Engineering; (J) Water Resources Planning. May be repeated for credit when the topic is different. GE credit SciEng | SE.—II, III, (II, III.) Kutter

190. The Civil Engineer in Society (2)
Lecture—1 hour; laboratory—3 hours. Open to upper division Civil Engineering majors. The Civil Engineering profession; introduction to concepts in business, management, law and ethics; professional development including the importance of professional licensure and a discussion of professional ethical and societal issues related to civil engineering. GE credit: SocSci | QL, SS.—II, III. (II, III.) Kunneth

190C. Research Group Conferences in Civil and Environmental Engineering (1)
Discussion—1 hour. Prerequisite: upper division standing in Civil and Environmental Engineering; consent of instructor. Research group conferences. May be repeated for credit. (P/NP grading only.) GE credit: SE.—II, III, (II, III.)

192. Internship in Engineering (1-5)
Internship. Prerequisite: upper division standing; approval of project proposal by faculty advisor. Subject to internship. Supervised work experience in civil engineering. May be repeated for credit. (P/NP grading only.) GE credit: SE.

198. Directed Group Study (1-5)
Directed Group Study. Prerequisite: consent of instructor. (P/NP grading only.) GE credit: SE.

199. Special Study for Advanced Undergraduates (1-5)
Prerequisite: senior standing in engineering and at least a B average. (P/NP grading only.) GE credit: SE.

Graduate

201. Introduction to Theory of Elasticity (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 104. Fundamental equations of elasticity in three dimensions; plane stress and plane strain; flexure and torsion of bars of various shapes. Introduction to variational and approximate methods. —I. (I.) Rashid

203. Inelastic Behavior of Solids (3)
Lecture—3 hours. Prerequisite: course 201. Fundamentals of theories of plasticity, viscoelasticity and viscoplasticity for solids. offered in alternate years.—Dafalias

211. Advanced Matrix Structural Analysis (4)
Lecture—4 hours. Prerequisite: course 201. Tensor formulation of the field equations for continuum mechanics, including large deformation effects. Invariance and symmetry requirements. Introduction to nonlinear thermoelasticity and thermodynamics. Solution of three-dimensional problems. Selected topics. Offered in alternate years. —Dafalias

260. Fracture Mechanics (4)
Lecture—4 hours. Prerequisite: course 210; Engineering 104. Linear and nonlinear fracture mechanics, stress analysis, energy concepts, brittle fracture criteria, path independent integrals, Dugdale-Barenblatt model, general cohesive zone models, ductile fracture criteria, crack tip plasticity and propagating cracks, fatigue. Application of numerical methods for fracture mechanics. Offered in alternate years.—Rashid

211. Advanced Matrix Structural Analysis (4)
Lecture—4 hours. Prerequisite: course 131. Analysis of complex frameworks by the displacement method; treatment of tapered beams, curved beams, and beams on elastic foundations; partially rigid connections; geometric and material nonlinearities; buckling; flexibility-based formulations; FEM-software for nonlinear analysis of structures. —I. (I.) Kunnath
alternative fuels, electric propulsion, and IVHS. Analysis of market demand and travel behavior, environmental impacts in treating petroleum. (Same course as Environmental Science and Policy 252.) Offered in alternate years—III. Sperring


254. Discrete Choice Analysis of Travel Demand (4) Lecture—4 hours. Prerequisite: course 114. Behavioral and statistical principles underlying the formulation and estimation of discrete choice models. Practical application of discrete choice models to characterization of choice behavior, hypothesis testing, and forecasting. Emphasis on computer exercises using real-world data sets. (Same course as Geography 279.)—III. (III.) Mohktirian

256. Urban Traffic Management and Control (4) Lecture—4 hours. Prerequisite course 114. Basic concepts and models related to the branch of traffic science that deals with the movement of vehicles on a road network, including travel speed, time, congestion concepts, and following speed and headways of vehicles. Recommended. Elements of graph theory, a survey of pertinent optimization techniques, extreme principles in network flow problems, deterministic equilibrium assignment, stochastic equilibrium assignment, extensions of equilibrium assignments and dynamic transportation network assignment.—II. (II.) Zhang

258. Transportation Planning in Developing Countries (3) Lecture—3 hours. Prerequisite: course 160 or consent of instructor. Investigation of the role of transportation investments and policies in the development of regions and countries. Emphasis on identifying appropriate technologies, policies, and planning methods for designing transportation systems in regions of differing socioeconomic, geographic, and institutional settings. Offered in alternate years.—III. (III.) Sperring

259. Asphalt and Asphalt Mixes (4) Lecture—4 hours. Prerequisite: course 179 or consent of instructor. Technical and asphalt mixture design and their use in civil engineering structures, with primary emphasis on pavements. Asphalt, aggregate properties and effects on mix properties. Design, construction, recycling, recent choice modes and research. Offered in alternate years.—(II.) Harvey

260. Sediment Transport (4) Lecture—4 hours. Prerequisite: course 141 or equivalent. Sediment transport in hydrologic systems. Processes, characteristics, and environmental impacts. Physical aspects of river mechanics, boundary conditions, coordinates transformation and grid generation, finite-difference solution techniques, applications to two-dimensional momentum and pollutant transport in rivers. Offered in alternate years.—(II.) Younis

264A. Transport, Mixing and Water Quality in Rivers and Lakes (4) Lecture—4 hours. Prerequisite: courses 141 and 240. Principal causes of mixing and transport in rivers, lakes and reservoirs, and their impacts on water quality. Topics include advection/diffusion; tides; transverse mixing; longitudinal dispersion; sediment transport; nutrient cycling; computer modeling of estuaries. Course restricted to civil systems. Offered in alternate years.—Schladow


266. Applied Stochastic Methods in Engineering (4) Lecture—4 hours. Prerequisite: course 114 or Mathem atics 131 or Statistics 330A or 131A. Mathematics 118A (may be taken concurrently). Stochastic processes classification; Gaussian random fields; stochastic calculus in mean square; Ito and Stratonovich representations; Ito’s formula; Fokker-Planck equation; stochastic differential equations with random coefficients. Offered in alternate years.—Kavvas

267. Water Resource Management (3) Lecture—3 hours. Prerequisite: courses 114, 141, and 142; course 153 recommended. Engineering in the context of development and management. Use of computer modeling to improve water management. (Same course as Geography 212.)—I. (I.) Lund

268. Infrastructure Economics (3) Lecture—3 hours. Prerequisite: Economics 1A, Engineering 106 or the equivalent. Economics applied to infrastructure engineering planning, operations, maintenance, and management problems; microeconomic and macroeconomic theories; benefit-cost analysis; effect of uncertainty; optimization economics; non-classical economics; public finance. Offered in alternate years.—(I.) Lund

269. Transportation-Air Quality: Theory and Practice (3) Lecture—3 hours; laboratory—3 hours. Prerequisite: course 149 or the equivalent. Health and regulatory aspects of airborne pollutants. Principles of modeling vehicle emissions. Conformity issues and the regulatory framework. Regional and micro-scale modeling. Offered in alternate years.—Niemier

270. Advanced Water Resources Management (3) Lecture—3 hours. Prerequisite: courses 153 and 267 or the equivalent. Discussion of technical papers related to planning theory, system maintenance, regionalization, mult-objective methods, risk analysis, institutional issues, optimization formulation, economic development, forecasting, operations, and other topics. Offered in alternate years.—Lund

271. Inverse Problems (4) Lecture—4 hours. Prerequisite: courses 114 and 144 or equivalents. Inverse calibration of distributed parameter models, using data representing model outputs. Forward and inverse mappings, stability, uniqueness, and parameter optimization formulation of inverse problems, maximum likelihood and other objective functions, indirect and direct approaches, solution by UCODE in hands-on project format.—(I.) Ginn


272C. Multiphase Reactive Transport (4) Lecture—4 hours. Prerequisite: courses 142, 144, 148A. Multiphase flow including diffusion, transport multiple phases. Advection/dispersivity transport, chemical equilibrium, and mass transformation kinetics. Natural chemical/microbiological processes including sorption, competition, and diffusive mass transfer. Eulerian and Lagran- gean averaging methods. Applications to contaminant remediation problems in river and subsurface hydrology. Offered in alternate years.—(II.) Ginn

273. Water Resource Systems Engineering (3) Lecture—3 hours. Prerequisite: courses 114 and 153 or the equivalent. Planning, design, and management of water resource systems. Application of deterministic and stochastic optimization techniques. Water allocation, capacity expansion, and design and operation of reservoir systems. Surface water and groundwater management. Offered in alternate years.—(I.) Lund

275. Hydrologic Time-Series Analysis (4) Lecture—4 hours. Prerequisite: course 114 and 142. Application of statistical methods for analysis and modeling of hydrologic events. Emphasis is placed on spectral analysis and prediction of hydrologic sequences using time series methodology. Offered in alternate years.—(III.) Kavvas


277A. Computational River Mechanics I (4) Lecture—4 hours. Prerequisite: Applied Science Engineering 115, course 141 (both may be taken concurrently). Unsteady open channel flows, computation of water surface profiles, shallow water equa- tions, St. Venant equations, method of characteristics, finite difference methods, stability and accuracy of explicit and implicit schemes, flood routing in simple and compound channels, advec- tion of plumes. Not open to students who have completed course 277.—I. (I.) Younis

277B. Computational River Mechanics II (4) Lecture—4 hours. Prerequisite: course 277A. Open channel flows, physical aspects of river mechanics, formulation of depth-averaged transport equations, boundary conditions, coordinates transformation and grid generation, finite-difference solution techniques, applica- tions to two-dimensional momentum and pollutant transport in rivers. Offered in alternate years.—(III.) Younis

277C. Turbulence and Mixing Processes (4) Lecture—4 hours. Prerequisite: graduate standing. Nature of turbulent flows, conservation equations, momentum, heat, and energy transport equations, free and well-bounded flows, body forces and mixing, rough- ness effects, turbulence modeling and simulation. Offered in alternate years.—(III.) Younis


278A. Hydrodynamics (3) Lecture—3 hours. Prerequisite: course 141. Perturbation methods. Basic water governs. Governing equa- tions for fluid motion on a rotating earth. Rotation effects, vorticity dynamics, Ekman layer. Stratifica- tion effects, internal waves and turbulent mixing. Combined effects. Offered in alternate years.—(II.) Younis

279. Advanced Mechanisms of Fluids (4) Lecture—4 hours. Prerequisite: course 141. Rota- tional flows. Navier-Stokes equations and solutions for laminar flow; boundary layer equations and solu-
tion techniques. Nature of turbulence. Reynolds equations. Introduction to turbulence modeling. Offered in alternate years.—Brian J. Bird

280A. Nonlinear Finite Elements for Elastic-Plastic Problems (4)
Lecture—4 hours. Prerequisite: course 171. State of the art finite element methods and tools for elastoplastic problems, including computational techniques based on the finite element method and the theory of elastoplasticity. Offered in alternate years.—III. Jeremic

280B. Nonlinear Dynamic Finite Elements (4)
Lecture—4 hours. Prerequisite: consent of instructor. State of the art computational methods and tools for analyzing linear and nonlinear dynamics problems. Offered in alternate years.

281A. Advanced Soil Mechanics (4)
Lecture—4 hours. Prerequisite: course 171. Site investigation and soil characterization within the context of slope stability analysis.—II. [Iii] DeJong

282. Pavement Design and Rehabilitation (4)
Lecture—4 hours. Prerequisite: course 179 or consent of instructor. Advanced pavement design and structural/functional condition evaluation for concrete and asphalt pavements. Highways, airfields, port facilities; new facilities, rehabilitation, reconstruction. Mechanistic-empirical procedures, materials, climate and traffic characterization. Use of current design methods; recent developments and research. Offered in alternate years.—II. Harvey

283. Physical-Chemical Aspects of Soil Behavior (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: course 171. Study of the geotechnical behavior of soils considering transport, transport, mineralogy, soil-fluid-liquid-states, surface tension, particle mechanics, shape, fabric, and structure. Laboratory exercises demonstrate effects of fundamental interparticle forces (contact, Van Der Waals, capillarity, and chemical). Offered in alternate years.—I. Kutter

284. Theoretical Geomechanics (4)

286. Advanced Foundation Design (4)
Lecture—4 hours. Prerequisite: course 173. Design and analysis of pile and pier foundations, including seismic effects; deep excavation systems; tie-back, nailing, and anchor systems; cofter dams; loads on buried conduits; ground modification techniques; and other related topics.—III. [Ili] DeJong

287. Geotechnical Earthquake Engineering (4)
Lecture—4 hours. Prerequisite: courses 138 and 281A. Characteristics and estimation of earthquake ground motions; soil-foundation interaction and local site response; liquefaction potential and remediation; residual strength and stability considerations; ground deformations; dynamic soil-structure interaction.—III.

288. Earth and Rockfill Dams (4)
Lecture—4 hours. Prerequisite: courses 281A and 281B (may be taken concurrently). Site selection; design considerations; layout; seismic effects including compilation of fault movements; construction; environmental considerations, instrumentation; maintenance remediation and retrofit of existing dams. Offered in alternate years.—II.

289A-I. Selected Topics in Civil Engineering (1-5)
Lecture, laboratory, or combination. Prerequisite: consent of instructor. Directed group study of special topics with separate sections in (A) Environmental Engineering; (B) Hydraulics and Hydrologic Engineering; (C) Engineering Planning; (D) Geotechnical Engineering; (E) Structural Engineering; (F) Structural Mechanics; (G) Transportation Engineering; (H) Transportation Planning; (I) Water Resources Engineering; (J) Water Resources Planning. May be repeated for credit.—I, III, III; I, II, III

290. Seminar (1)
Seminar—1 hour. Discussion of current graduate research, and guest lectures on recent advances. Oral presentation of individual study. Course required of graduate degree candidates. (S/U grading only)—I, II, III, I, II, III

290C. Graduate Research Conference (1)
Discussion—1 hour. Research problems, progress, and techniques in civil engineering. May be repeated for credit. (S/U grading only)—I, II, III, I, II, III

290E. Group Study (1-5)
Prerequisite: consent of instructor. (S/U grading only)

299. Research (1-12)
(S/U grading only.)—I, II, III, I, II, III

Professional

390. The Teaching of Civil Engineering (1)
Discussion—1 hour. Prerequisite: meet qualifications for teaching assistant and/or associate in Civil Engineering. Participation as teaching assistant or associate in a designated engineering course. Methods of leading discussion groups or laboratory sections, writing and grading quizzes, use of laboratory equipment, report writing and grading. May be repeated for total of 9 units. (S/U grading only)—I, II, III, I, II, III

The Computer Science and Engineering major (below) prepares students to do further work in hardware, software, and information technology, to provide innovative, creative solutions for societal needs. The Computer Science Engineering major has fewer free electives. The CS major’s more generous electives make it easier to complete a minor or double major. A key theme of the Computer Science Engineering curriculum is the hardware/software interaction, a theme reflected in the courses required and the orientation of the courses themselves.

The Computer Science and Engineering major provides students with a solid background in mathematics, physics, chemistry, and electronic circuits and systems, all supporting the computer hardware and computer software courses that constitute the focus of the curriculum.

Mission. The University of California, Davis, is, first and foremost, an institution of learning and teaching, committed to serving the needs of society. The Department of Computer Science and Engineering contributes to the mission in three ways. First, its undergraduate and graduate education programs seek to educate students in the fundamental principles of computer science and the skills needed to solve the complex technological problems of modern society. The breadth of coursework provides a framework for lifelong learning and an appreciation for multidisciplinary activities. Second, through its research programs, the department contributes to the development and progress of computer science, and software and information technology, to provide innovative, creative solutions for societal needs. Finally, the department disseminates its research to enhance collaborations with the public sector, further interdisciplinary interests that benefit society, and

Charles U. Martel, Ph.D., Professor
Norman S. Matloff, Ph.D., Professor
Distinguished Graduate Mentoring Award
Michael Neff, Ph.D., Assistant Professor
Ronald A. Olsson, Ph.D., Professor
Academic Senate Distinguished Teaching Award
Raju Pandey, Ph.D., Associate Professor
Philip Roggow, Ph.D., Professor
Zhendong Su, Ph.D., Associate Professor
Professor Emeritus
Lawrence T. Kou, Ph.D., Professor
Peter Linz, Ph.D., Professor
Rajiv F. Walters, Ph.D., Professor
Academic Senate Distinguished Teaching Award

The Computer Science and Engineering Program
The Department of Computer Science administers two curricula: Computer Science and Engineering in the College of Engineering, and Computer Science in the College of Letters and Science. It also administers two minors: Computer Science in the College of Letters and Science, and Computational Biology in the College of Engineering. For information on the Computer Science curriculum and minor, see Computer Science, on page 216.

The Computer Science Engineering major (below) prepares students to do further work in hardware, software, and systems, all supporting the computer hardware and computer software courses that constitute the focus of the curriculum.

Mission. The University of California, Davis, is, first and foremost, an institution of learning and teaching, committed to serving the needs of society. The Department of Computer Science and Engineering contributes to the mission in three ways. First, its undergraduate and graduate education programs seek to educate students in the fundamental principles of computer science and the skills needed to solve the complex technological problems of modern society. The breadth of coursework provides a framework for lifelong learning and an appreciation for multidisciplinary activities. Second, through its research programs, the department contributes to the development and progress of computer science, and software and information technology, to provide innovative, creative solutions for societal needs. Finally, the department disseminates its research to enhance collaborations with the public sector, further interdisciplinary interests that benefit society, and

Computer Science Engineering

(College of Engineering)
Nina Amenta, Ph.D., Chairperson of the Department
2063 Kemper Hall
5307/27/7004; http://www.cs.ucdavis.edu

Faculty
Nina Amenta, Ph.D., Professor
Zhaojun Bai, Ph.D., Professor
Matthew Bishop, Ph.D., Professor
Hao Chen, Ph.D., Associate Professor
Ian Davidson, Ph.D., Associate Professor
Premkumar D. Deo, Ph.D., Professor
Raisa D’Souza, Ph.D, Associate Professor
Matthew K. Sanfors, Ph.D., Associate Professor
Matthew Franklin, Ph.D., Professor
Dipak Ghosal, Ph.D., Professor
Todd J. Green, Ph.D., Assistant Professor
Daniel Gutfleisch, Ph.D., Professor
Francisco Gygi, Ph.D., Professor
Bernd Hamann, Ph.D., Professor
Kenneth I. Joy, Ph.D., Professor
Ilias Tagkopoulos, Ph.D., Associate Professor
Zhendong Su, Ph.D., Associate Professor
Bertram Luderscher, Ph.D., Professor
Kwan-Liu Ma, Ph.D., Professor
Charles U. Martel, Ph.D., Professor
Norman S. Matloff, Ph.D., Professor
Academic Senate Distinguished Teaching Award
Michael Neff, Ph.D., Assistant Professor
Ronald A. Olsson, Ph.D., Professor
Academic Senate Distinguished Teaching Award
Raju Pandey, Ph.D., Associate Professor
Philip Roggow, Ph.D., Professor
Zhendong Su, Ph.D., Associate Professor
Professor Emeritus
Lawrence T. Kou, Ph.D., Professor
Peter Linz, Ph.D., Professor
Rajiv F. Walters, Ph.D., Professor
Academic Senate Distinguished Teaching Award

The Department of Computer Science administers two curricula: Computer Science and Engineering in the College of Engineering, and Computer Science in the College of Letters and Science. It also administers two minors: Computer Science in the College of Letters and Science, and Computational Biology in the College of Engineering. For information on the Computer Science curriculum and minor, see Computer Science, on page 216.

The Computer Science Engineering major prepares students to do further work in hardware, software, theory, or electronics, either in industry or in postgraduate study.

The primary differences between the Computer Science Engineering major and the Computer Science majors are the extent of course work covering hardware and the flexibility of the curriculum. The Computer Science Engineering major develops a solid understanding of the entire machine, including hands-on experience with its hardware components. The Computer Science major has some course work on hardware, at the digital-design level, on simulators. The Computer Science Engineering major has fewer free electives. The CS major’s more generous electives make it easier to complete a minor or double major. A key theme of the Computer Science Engineering curriculum is the hardware/software interaction, a theme reflected in the courses required and the orientation of the courses themselves.

The Computer Science and Engineering major provides students with a solid background in mathematics, physics, chemistry, and electronic circuits and systems, all supporting the computer hardware and computer software courses that constitute the focus of the curriculum.

Mission. The University of California, Davis, is, first and foremost, an institution of learning and teaching, committed to serving the needs of society. The Department of Computer Science and Engineering contributes to the mission in three ways. First, its undergraduate and graduate education programs seek to educate students in the fundamental principles of computer science and the skills needed to solve the complex technological problems of modern society. The breadth of coursework provides a framework for lifelong learning and an appreciation for multidisciplinary activities. Second, through its research programs, the department contributes to the development and progress of computer science, and software and information technology, to provide innovative, creative solutions for societal needs. Finally, the department disseminates its research to enhance collaborations with the public sector, further interdisciplinary interests that benefit society, and