soil-fluid-electrolyte systems, surface tension, particle mechanics, shape, fabric, and structure. Laborato-
ries demonstrate effects of fundamental interparticle forces (contact, Van Der Waals, capillarity and chemical). Offered in alternate years. — F. Kutter

284. Theoretical Geomechanics (4)
Lecture—4 hours. Prerequisite: course 171. Elastic-
ity, plasticity, micromechanics, coupled behavior and large deformations for geometalries. Prediction of stress-strain-volume change behavior of geomate-

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, and large deformations for geomaterials. May be repeated for credit. — F. W. S. (F. W. S.)

290. Seminar (1-5)
Discussion—1 hour. Research problems, progress, and techniques in civil engineering. May be repeated for credit. (S/U grading only).— F. W. S. (F. W. S.)

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

296. Topics in Water and Environmental Engineering (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Directed group study in Water Resources Engineering. May be repeated for credit. (S/U grading only).— F. W. S. (F. W. S.)
Computer Science and Engineering Undergraduate Program

The Computer Science and Engineering program is accredited by the Engineering Accreditation Commission of ABET; see http://www.abet.org. The mission of ABET; see http://www.engineering.org. Undergraduate Program Objectives. We seek to provide undergraduate students with a thorough understanding of the key principles and practices of computing, while preparing them to be productive and effective in an increasingly diverse workforce. We equip our students with the knowledge in mathematics, basic sciences, and engineering fundamentals and an ability to apply this knowledge to practical problems. We endeavor to provide a rich set of computing programs that are creative and productive in multidisciplinary work teams; this breadth, in its broadest context, will form the basis for an appreciation and interest in life-long learning. We provide students with the opportunities to design and conduct experiments, and to collect and analyze data in core, as well as more specialized, areas of computer science. We provide students with breadth in the humanities and social sciences so they learn to communicate effectively, understand professional and ethical issues in society, and appreciate the interrelatedness between computing and society. We educate graduate students to be our next generation of teachers or leaders in industry, or to pursue meaningful, creative research in industry, government, or academia. Research.—We develop and use research programs that produce fundamental scientific advances, as well as useful technological innovations, while simultaneously training the next generation of researchers and leaders in the field of computer science.

Integrated Degree Program. An integrated B.S./M.S. plan in Computer Science allows Davis students in Computer Science, Computer Science Engineering, or Computer Engineering to complete a master's degree in Computer Science in one year. Formal coursework for the master's degree is reduced by six units for these students. Students can begin graduate studies immediately after completing their B.S. degree. More information is available in the graduate section of the College of Engineering Bulletin, or at http://www.cs.ucdavis.edu/graduate/bs-ms.html.

Computer Science and Engineering Required Courses

Mathematics

- 21A 21B 21C 21D 16
- 22A or 67 3 4
- 22B 3
- 9A 9B 9C 9D 19
- Chemistry 2A 5
- Computer Science Engineering 20, 30, 40, 60 16
- Computer Science Engineering 50 or Electrical and Computer Engineering 70 4
- Engineering 17 4
- English 3 or University Writing Program 1, 1V 1V or Comparative Literature 1, 2, 3, or

4, or Native American Studies 5 (grade of C- or better required) 4
Communication 1 4

Upper Division Requirements:

Upper Division Required Courses

- Computer Science Engineering 132, 140A, 150, 152A 156, 160, 188, 193A 193B 32
- Computer Science Engineering 120 or 122A 4
- Electrical and Computer Engineering 172 9
- Computer Science electives 15
- Engineering courses numbered 120 to 189 inclusive; one approved course of 3 to 5 units from Computer Science and Engineering 122 or 193A; Electrical and Computer Engineering 180A, 1808; Economics 122; Linguistics 177; Psychology 120. No course can count as both computer science and engineering elective.

Upper Division Composition Requirement

- Upper-Division Composition Exam.

Computational Biology Minor

The minor in Computational Biology will provide students with engineering, physical science or biological science majors the foundations necessary to build efficient computational models and algorithms to use state-of-the-art techniques for scientific analysis and create scalable infrastructure environments for biological and biotechnological applications. Students must take a total of 19-24 upper division units, with two required courses and 11-12 units of upper division electives, as specified below. A minimum GPA of 2.0 is required for coursework in the minor. Students should note that most of the courses listed below have lower division prerequisites. In particular, required course Computer Science Engineering 122A has a prerequisite chain of Computer Science Engineering courses.

Requirements:

- Computer Science Engineering 122A; 124 Electives...
- At least one biology course from the following: Molecular & Cellular Biology 121 122, 182; Evolution and Ecology 100, 101, 102, 103, 131; Biological Sciences 101, 104, 122
- At least one computational or statistics course from the following: Computer Science Engineering 130, 132, 140, 145, 158, 160, 165A, 170, 177; Statistics 130A, 141; Biotechnology 150; Biological Sciences 132
- At least one computer science and bioinformatics course from the following: Computer Science Engineering 129; Biological Sciences 132; Biomedical Engineering 150

Minor Advisers. T. Pham, N. Coulier, V. Filkow, D. Gusfield, P. Koehl, I. Tagkopoulos

Courses in Engineering: Computer Science (ECS)

Lower Division

10. Introduction to Programming (4)

Lecture—3 hours; discussion/lab.—3 hours. Not open to students who have completed course 12 or Engineering 6; open to students who have completed course 30. GE credit: SciEng|QL, SE, SF, W, S.

11. Introduction to Media Computation (4)

Lecture—3 hours; discussion/lab.—1 hour. Introduction to key computational ideas necessary to understand and produce digital media. Fundamentals of programming are covered as well as an overview of how media are represented and transmitted in digital form. Aimed primarily at non-computer science students. Two units of credit for students that have completed course 10 or 6.

12. Introduction to Computation (4)

Lecture—3 hours; discussion/lab.—1 hour. Not open to students who have completed course 30. Computer uses in modern society. Emphasis on uses in nonscientific disciplines. Includes word processing, spreadsheets, web-page creation, elementary programming, basic computer organization, the Internet, the uses of computers and their influence on society. Course not intended for CS or CSE majors. Two units of credit allowed to students who have completed Plant Science 21. GE credit: SciEng|QL, SE, WF, W, F, W, S.

20. Discrete Mathematics for Computer Science (4)

Lecture—3 hours; discussion.—1 hour. Prerequisite: Mathematics 16A or 21A (may be taken concurrently). Elements of mathematical and logical reasoning. Study of countable sets, Big O and related notations. Recursion and solutions of recurrence relations. Combinatorics. Probability on finite probability spaces. Graph theory. GE credit: SciEng|QL, SE, WF, W, S, W, S.

30. Programming and Problem Solving (4)

Lecture—3 hours; discussion.—1 hour. Prerequisite: Mathematics 16A or 21A (may be taken concurrently). Elements of mathematical and logical reasoning. Study of countable sets, Big O and related notations. Recursion and solutions of recurrence relations. Combinatorics. Probability on finite probability spaces. Graph theory. GE credit: SciEng|QL, SE, WF, W, S, W, S.

40. Software Development and Object-Oriented Programming (4)

Lecture—3 hours; discussion.—1 hour. Prerequisite: course 30 or the equivalent with a grade of C- or better. Pass one open to Computer Science, Computer Science Engineering, Computer Engineering, and Electrical Engineering Majors only.

50. Computer Organization and Machine-Dependent Programming (4)

Lecture—3 hours; discussion.—1 hour. Prerequisite: course 40 or the equivalent with a grade of C- or better. Pass one open to Computer Science, Computer Science Engineering, and Computer Engineering Majors only.

Fall 2011 and on Revised General Education (GE) Arts and Humanities; Science and Engineering; Social Sciences; AGCM—American Cultures; DDM—Domestic Diversity; OL—Oral Skills; OQ—Quantitative; SL—Scientific; VL—Visual; WC—World Cultures; WE—Writing Experience
60. Data Structures and Programming (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: courses 20, 40, or equivalent; grade of C- or better in corresponding course. Design and analysis of data structures for a variety of applications. Trees, heaps, searching, sorting, hashing, graphs. Extensive programming. GE credit: SciEng|QL, SE.—F, W, S. (F, W, S.) Davis

89A. Special Topics in Computer Science; Computer Science Theory (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topics in Computer Science Theory. May be repeated for credit when topic differs. GE credit: SciEng|QL, SE.—F, W, S. (F, W, S.) Davis

89B. Special Topics in Computer Science; Architecture (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topics in Architecture. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89C. Special Topics in Computer Science; Programming Languages and Compilers (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topics in Programming Languages and Compilers. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89D. Special Topics in Computer Science; Operating Systems (1-5)
Lecture; laboratory; laboratory/laboratory. Prerequisite: consent of instructor. Special topics in Operating Systems. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89E. Special Topics in Computer Science; Software Engineering (1-5)
Lecture; laboratory; laboratory/laboratory. Prerequisite: consent of instructor. Special topics in Software Engineering. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89F. Special Topics in Computer Science; Databases (1-5)
Lecture; laboratory; laboratory/laboratory. Prerequisite: consent of instructor. Special topics in Databases. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89G. Special Topics in Computer Science; Artificial Intelligence (1-5)
Lecture; laboratory; laboratory/laboratory. Prerequisite: consent of instructor. Special topics in Artificial Intelligence. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89H. Special Topics in Computer Science; Computer Graphics (1-5)
Lecture; laboratory; laboratory/laboratory. Prerequisite: consent of instructor. Special topics in Computer Graphics. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89I. Special Topics in Computer Science; Networks (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topics in Networking. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89J. Special Topics in Computer Science; Operating System Design (1-5)
Lecture; laboratory; laboratory/laboratory. Prerequisite: consent of instructor. Special topics in Computer-Aided Design. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89K. Special Topics in Computer Science; Scientific Computing (1-5)
Lecture; laboratory; laboratory/laboratory. Prerequisite: consent of instructor. Special topics in Scientific Computing. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

89L. Special Topics in Computer Science; Computer Science (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topics in Computer Science. May be repeated for credit when topic differs. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

92. Internship in Computer Science (1-5)
Internship. Prerequisite: lower division standing; project approved by period of internship. Supervised work experience in computer science. May be repeated for credit. (P/NP grading only.)

98. Directed Group Study (1-5)
(P/NP grading only.) Offered irregularly.

99. Special Study for Lower Division Students (1-5)
(P/NP grading only.)

Upper Division

120. Theory of Computation (4)

122A. Algorithm Design and Analysis (4)

122B. Algorithm Design and Analysis (4)

124. Theory and Practice of Bioinformatics (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 10 or 30 or Engineering 6; Statistics 12 or 13 or 32 or 100 or 131A or Mathematics 135A; Biological Science 2A or Molecular and Cellular Biology 10. Pass One open to Computer Science, Computer Science Engineering, and Biotechnology majors only. Fundamental biological, mathematical and algorithmic models underlying bioinformatics and systems biology; sequence analysis, database search, genome annotation, clustering and classification, functional gene networks, regulatory network inference, phylogenetic trees, applications of common bioinformatics tools in molecular biology and genetics. GE credit: SciEng|QL, SE.—F, W, S. (F, W, S.) Tagkopoulos

127. Cryptography (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 20 or Mathematics 108. Pass One open to Computer Science and Computer Science Engineering Majors only. The theory and practice of cryptographic techniques used in computer security. Encryption (secret-key and public-key), message authentication, digital signatures, entity authentication, key distribution, and other cryptographic protocols. The social context of cryptography. GE credit: SciEng|QL, SE.—Franklin, Rogaway

129. Computational Structural Bioinformatics (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: courses 20 or 140A; consent of instructor. Pass One open to Computer Science and Computer Engineering Majors only. Matrix-vector approach using MATLAB for floating-point arithmetic, error analysis, data interpolation, least squares data fitting, quadrature, zeroes, optimization and matrix eigenvalues and singular values. Parallel computing for matrix operations and essential matrix factorizations. GE credit: SciEng|SE.—F, W, S. (F, W, S.)

132. Probability and Statistical Modeling for Computer Science (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 40; course 50 or Engineering Electrical and Computer 70; Mathematics 21C; Mathematics 22A or 22B or 16. Pass One open to Computer Science and Computer Engineering Majors only. Univariate and multivariate distributions, estimation and model building. Markov/Hidden Markov models. Applications to data mining, networks, search engines, software engineering, gaming, artificial intelligence. GE credit: SciEng|QL, SE.—F, W, S. (F, W, S.) Ghosal, Matloff

140A. Programming Languages (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 20 or Electrical Computer Engineering 70; course 60. Pass One open to Computer Science, Computer Science Engineering, and Computer Engineering Majors only. Syntactic definition of programming languages. Introduction to programming language features including variables, data types, data abstraction, object-orientation, scoping, parameter disciplines, exception handling. Non-imperative programming languages. Comparative study of several high-level programming languages. GE credit: SciEng|SE.—F, W, S. (F, W, S.) Olsson, Nitta, Su

140B. Programming Languages (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 140A. Pass One open to Computer Science and Computer Science Engineering Majors only. Continuation of programming language principles. Further study of programming paradigms such as functional and logic; additional programming language paradigms such as concurrent (parallel); key implementation issues for those paradigms; and programming language semantics. Offered in alternate years. GE credit: SciEng|SE.—Levitt, Olsen, Panedy

142. Compilers (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 20, 140A; consent of instructor. Pass One open to Computer Science and Computer Science Engineering Majors only. Principles and techniques of lexical analysis, parsing, semantic analysis, code generation, and code optimization. Implementation of compilers. GE credit: SciEng|SE.—Panedy, Su

145. Scripting Languages and Their Applications (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: programming skill at the level of course 60. Pass One open to Computer Science and Computer Science Engineering Majors only. Goals and philosophy of scripting languages, with Python and R as prime examples. Applications include networki...
data analysis and display, and graphical user inter-
faces (GUIs). Offered in alternate years. GE credit: SciEng | SE — F, W
150. Operating Systems and System
Programming (4)
Lecture—3 hours; discussion—1 hour. Prerequisite:
course 40, course 50 or Electrical and Computer
Engineering 170. Pass One open to Computer
Science, Computer Science Engineering, and Computer
Engineering Majors only. Basic concepts of operat-
ing systems and system programming. Processes and
interprocess communication/synchronization; vir-
ing systems and system programming. Processes and
interfaces (GUIs). Offered in alternate years. GE credit: SciEng | SE — W, S
158. Programming on Parallel
Architectures (4)
Lecture—3 hours; discussion—1 hour. Prerequisite:
courses 150 and 154B recommended. Pass One open to
Computer Science and Computer Science Engineering
Majors only. Techniques for software
development using the shared-memory and message-
passing paradigms, on parallel architectures and
networks of workstations, multiprocessors, and other
techniques for synchronization. Introduction to paral-
lel algorithms. GE credit: SciEng | SE — F (F) Gygi
160. Software Engineering (4)
Lecture—3 hours; discussion—1 hour. Prerequisite:
courses 140 and 160. Pass One open to Computer
Science and Computer Science Engineering Majors only. 
Requirements, specification, design, implementation,
testing, and verification of large software systems. 
Study and use of software engineering methodolo-
gies. Team programming. GE credit: SciEng | SE — F, W (F, W) Nitta
163. Information Interfaces (4)
Lecture—3 hours; discussion—1 hour. Prerequisite:
course 60. Pass One open to Computer Science and 
Computer Science Engineering Majors only. Art and science of information visualization and interfaces for 
information systems. Design principles of human-
computer interaction. Visual and navigational aspects of
nonspatial and higher dimensional data. Imple-
mentations, performance issues, tradeoffs, and eval-
uation of interactive information systems. GE credit: 
SciEng | SE, VL — W, W (W) Mo
165A. Database Systems (4)
Lecture—3 hours; discussion—1 hour. Prerequisite:
course 60. Pass One open to Computer Science and 
Computer Science Engineering Majors only. Data-
base modeling and design, operational issues, query
processing, transaction management. GE credit: SciEng | SE — F (F) Nitta
165B. Database Systems (4)
Lecture—3 hours; discussion—1 hour. Prerequisite:
course 165A. Pass One open to Computer Science and 
Computer Science Engineering Majors only. Data-
base modeling and design, operational issues, query
processing, transaction management. GE credit: SciEng | SE — S (S)
170. Introduction to Artificial
Intelligence (4)
Lecture—3 hours; discussion—1 hour. Prerequisite:
course 60. Pass One open to Computer Science and 
Computer Science Engineering Majors only. Design 
and implementation of intelligent computer systems. 
Knowledge representation and organization. Mem-
ory and inference. Problem solving. Natural lan-
guage processing. GE credit: SciEng | SE — W (W) Davidson
171. Machine Learning (4)
Lecture—3 hours; discussion—1 hour. Pass One open to Computer Science and Computer 
Science Engineering Majors only. Introduction to machine 
learning. Supervised and unsupervised learning, 
including classification, regression, decision-tree 
construction, and clustering using machine learning 
techniques. Applications of machine learning to 
other fields. GE credit: SciEng | SE — F (F) Tagkoupoulos
173. Image Processing and Analysis (4)
Lecture—3 hours; discussion—1 hour. Prerequisite:
course 60, Mathematics 67 or C- or better in Mathe-
matics 22A. Pass One open to Computer Science and Computer Science Engineering Majors only.

Techniques for automated extraction of high-level information from images generated by cameras, 
threedimensional surface sensors, and medical devices. Typical applications include detection of 
objects in various types of images and describing populations of biological specimens appearing in 
medical images. GE credit: SciEng | SE — S (S)
189D. Special Topics in Computer Science; Operating Systems (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Operating Systems. May be repeated for credit when topic differs. GE credit: SciEng | SE — F, W, S, F, W, S.

189E. Special Topics in Computer Science; Software Engineering (1-3)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Software Engineering. May be repeated for credit when topic differs. GE credit: SciEng | SE — F, W, S, F, W, S.

189F. Special Topics in Computer Science; Databases (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Databases. May be repeated for credit when topic differs. GE credit: SciEng | SE — F, W, S, F, W, S.

189G. Special Topics in Computer Science; Artificial Intelligence (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Artificial Intelligence. May be repeated for credit when topic differs. GE credit: SciEng | SE — F, W, S, F, W, S.

189H. Special Topics in Computer Science; Computer Graphics (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Computer Graphics. May be repeated for credit when topic differs. GE credit: SciEng | SE — F, W, S, F, W, S.

189I. Special Topics in Computer Science; Networks (1-5)
Lecture; laboratory; laboratory. Prerequisite: consent of instructor. Special topic in Networks. May be repeated for credit when topic differs. GE credit: SciEng | SE — F, W, S, F, W, S.

189K. Special Topics in Computer Science; Scientific Computing (1-5)
Lecture; laboratory; laboratory. Prerequisite: consent of instructor. Special topic in Scientific Computing. May be repeated for credit when topic differs. GE credit: SciEng | SE — F, W, S, F, W, S.

189L. Special Topics in Computer Science; Computer Science (1-5)
Lecture; laboratory; laboratory. Prerequisite: consent of instructor. Special topic in Computer Science. May be repeated for credit when topic differs. GE credit: SciEng | SE — F, W, S, F, W, S.

189M. Special Topics in Computer Science; Computer Security (1-5)
Lecture; laboratory; laboratory. Prerequisite: consent of instructor. Special topic in Computer Security. May be repeated for credit when topic differs. Offered irregularly.

189N. Special Topics in Computer Science; Bioinformatics and Computational Biology (1-5)
Lecture; laboratory; laboratory. Prerequisite: consent of instructor. Special topic in Bioinformatics and Computational Biology. May be repeated for credit when topic differs. Offered irregularly.

190C. Research Group Conferences in Computer Science (1)
Discussion—1 hour. Prerequisite: upper division standing in Computer Science and Engineering; consent of instructor. Research group conferences. May be repeated for credit. (P/NP grading only.)—F, W, S, F, W, S.

190X. Senior Seminar (2)
Seminar—2 hours. Prerequisite: senior standing. Examination of a special topic in a small group setting.

192. Internship in Computer Science (1-5)
Internship. Prerequisite: completion of a minimum of 84 units; project approval prior to period of internship. Supervised work in computer science. May be repeated for credit. (P/NP grading only.)

193A. Senior Design Project (2)
Lecture—1 hour; laboratory 3 hours. Prerequisite: course 160 recommended (may be concurrent) or consent of instructor. Pass One open to Computer Science Engineering Majors only; Pass Two open to Computer Science and Computer Science Engineering Majors only. Team design project involving analysis, design, implementation and evaluation of a large-scale problem involving computer and computational systems. The project is supervised by a faculty member. Students must take course 193A and 193B to receive credit. (Deferred grading only, pending completion of sequence.) GE credit: SciEng | SE — F, W, S.

193B. Senior Design Project (2)
Lecture—1 hour; laboratory—3 hours. Prerequisite: IP grade in course 193A. Pass One open to Computer Science Engineering Majors only; Pass Two open to Computer Science and Computer Science Engineering Majors only. Team design project involving analysis, design, implementation and evaluation of a large-scale problem involving computer and computational systems. The project is supervised by a faculty member. Students must take course 193A and 193B to receive credit. (Deferred grading only, pending completion of sequence.) GE credit: SciEng | SE — F, W, S.

197T. Tutoring in Computer Science (1-3)
Discussion—1 hour; laboratory/discussion—3-6 hours. Prerequisite: consent of instructor. Restricted to upper-division students. Tutoring in computer science courses, especially introductory courses. (P/NP grading only.)—F, W, S, F, W, S.

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

199. Special Study for Advanced Undergraduates (1-5)
(P/NP grading only.)

199FA. Student Facilitated Course Development (1-4)
Prerequisite: course 3 or University Writing Program 1; consent of instructor. STU FAC. Under the supervision of a faculty member, an undergraduate student plans and develops a course which will offer under 98F/198F. (P/N grading only.) Offered irregularly.

199FB. Student Facilitated Teaching (1-4)
Prerequisite: course 199FA; consent of instructor. STU FAC. Under the supervision of a faculty member, an undergraduate student teaches a course under 98F/198F. (P/N grading only) Offered irregularly.

The Graduate Program in Computer Science
Doctoral and Masters degrees in Computer Science are offered by the interdisciplinary Graduate Group in Computer Science. Please see http://www.cs.ucdavis.edu/mgcs for more information.

Graduate (201A. Advanced Computer Architecture (4)
Lecture—3 hours; term paper. Prerequisite: course 154B or Electrical Engineering 170; course 150. Pass 1 and Pass 2 open to Graduate Students in Computer Science only. Modern research topics and methods in computer architecture. Design implications of memory latency and bandwidth limitations. Performance enhancement via within-processor and between-processor parallelism. Term project involving minor-thesis or major-thesis extension/modifications of work in the research literature. Not open for credit to students who have completed course 250A. —F (F) Farrens

201B. High-Performance Uniprocessor (4)
Lecture—3 hours; term paper. Prerequisite: course 201A. Pass 1 and Pass 2 open to Graduate Students in Computer Science only. Maximizing uniprocessor performance. Barriers to high performance; solutions to the problems; historical and current processor designs. Not open for credit to students who have completed course 250B. Offered in alternate years. —(W) Farrens

210C. Parallel Architectures (4)
Lecture—3 hours; project—1 hour. Prerequisite: course 201A. Evolution of parallel architectures from special-purpose machines to commodity servers. Emphasis on recent machines and applications that drive them. Not open for credit to students who have completed course 250C.

203. Novel Computing Technologies (4)
Lecture—3 hours; project—1 hour. Prerequisite: course 201A. Pass One and Pass Two open to Graduate Students in Computer Science only. Novel computing technologies that could revolutionize computer architecture. Quantum computing technologies, including algorithms, devices, and fault tolerance. A survey of other unconventional technologies including nanoscale electronics, MEMS devices, biological devices, and nanotechnology. Offered in alternate years. —(W) Chong

220. Theory of Computation (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 120, 122A. Pass 1 and Pass 2 open to Graduate Students in Computer Science only. Computational methods related to systems and synthetic biology. An overview of machine learning techniques related to the analysis of biological data, biological networks, Predictive modeling and simulation of biological systems. Topics on biological circuit construction. —F (F) Tagkopoulos

222A. Design and Analysis of Algorithms (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 122A, Statistics 31A recommended. Pass One and Pass Two open to Graduate Students in Computer Science only. Techniques for designing efficient algorithms, analyzing their complexity and applying these algorithms to a broad range of applications. Methods for recognizing and dealing with difficult problems. —S. (F) Gysev

222B. Advanced Design and Analysis of Algorithms (4)
Lecture—3 hours; project—1 hour. Prerequisite: course 222A. Pass One and Pass Two open to Graduate Students in Computer Science only. Advanced topics in complexity theory including problem classification. The classes P, NP, P-space, co-NP, Matching and network flow algorithms. Matrix multiplication. Approximation algorithms. —(W) Ousfield, Franklin, Martel, Ragman

223. Parallel Algorithms (4)
Laboratory/discussion—3 hours; project—1 hour. Prerequisite: course 222A. Pass One and Pass Two open to Graduate Students in Computer Science only. Models of parallel computer systems including PRAMs, loosely coupled systems and interconnection networks. Parallel algorithms for classical problems and general techniques for their design and analysis. Proving lower bounds on parallel computation in several settings. Offered in alternate years. —(F) Amenta, Martel
224. String Algorithms and Applications in Computational Biology (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: course 122A. Pass One and Pass Two open to Graduate Students in Computer Science only. Algorithms that operate on strings. Pattern matching, sets of patterns, random pattern matching, suffix trees and applications, inexact similarity, parametric sequence alignment, applications to DNA sequencing and protein database searching. Offered in alternate years.—(W.) Gusfield

225. Graph Theory (3) 
Lecture—3 hours. Prerequisite: graduate standing in electrical engineering or computer science or consent of instructor. Pass One and Pass Two open to Graduate Students in Computer Science only. Fundamental concepts. Vector spaces and graphs. Planar graphs: Whitney’s and Kuratowski’s theorems. Topological parameters: packings and coverings. Connectivity: Menger’s theorem. Hamilton graphs: Tait’s theorem. Graph factorization: Tutte’s theorem. Graph coloring: Brooks’ and Vizing’s theorems. —S. (W.) Uhlilfield

226. Computational Geometry (4) 
Lecture—3 hours. Prerequisite: courses 175, 222A. Pass One and Pass Two open to Graduate Students in Computer Science only. Mathematics of unstructured data. Algorithms for data structures, diagrams, occlusions, and arrangements. Applications in computer graphics, concentrating on problems in three-dimensions. Offered in alternate years. —(S.) Amenta, Max Amenta

227. Modern Cryptography (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: course 220 or 222A. Pass One and Pass Two open to Graduate Students in Computer Science only. Modern cryptography as a discipline emphasizing formal definitions and proofs of security. One-way functions, pseudorandomness, encryption, digital signatures, zero-knowledge, secure protocols. Offered in alternate years. —(W.) Rogaway

228. Cryptography for E-Commerce (4) 
Lecture—2 hours; discussion—1 hour. Prerequisite: course 222A. Pass One and Pass Two open to Graduate Students in Computer Science only. Cryptographic primitives and protocols of importance to e-commerce, present and future, including context distribution mechanisms, payment mechanisms, pricing mechanisms, anonymity and privacy mechanisms, fair exchange mechanisms. Offered in alternate years. —(W.) Franklin

229. Advanced Computational Structural Bioinformatics (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: graduate standing. Pass One and Pass Two open to Graduate Students in Computer Science only. Algorithms and techniques for large-scale scientific computation, including basics for high performance computing, iterative methods, discrete approximation, fast Fourier transform, Poisson solvers, particle methods, spectral graph partition and its applications. Offered in alternate years. —(S.) Bai

230. Applied Numerical Linear Algebra (4) 
Laboratory/discussion—3 hours; discussion—1 hour. Prerequisite: course 120 or Engineering Applied Mathematics 167. Pass One and Pass Two open to Graduate Students in Computer Science only. Numerical linear algebra (NLA) with emphasis on applications in engineered systems, perturbation analysis, rounding error analyses of fundamental NLA algorithms.—S. (S.) Gygi

231. Large-Scale Scientific Computation (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: course 120. Pass One and Pass Two open to Graduate Students in Computer Science only. Algorithms and techniques for large-scale scientific computation, including basics for high performance computing, iterative methods, discrete approximation, fast Fourier transform, Poisson solvers, particle methods, spectral graph partition and its applications. Offered in alternate years. —(S.) Bai

232. Computational Functional Genomics (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: course 124; graduate standing in Computer Science or Life Sciences. Pass One and Pass Two open to Graduate Students in Computer Science only. Bioinformatics methods for analysis and inference of functional relationships among genes using large-scale genomic data, including methods for integration of gene expression, promoter sequence, RNA/DNA binding sites, and other aspects in modeling of biological networks. —(W.) Filkov

235A. Computer and Information Security (4) 
Lecture—3 hours; project. Prerequisite: course 226A; courses 120, 150 recommended. Pass One and Pass Two open to Graduate Students in Computer Science only. Modern topics in computer security, including: protection, access control, operating systems security, network security, applied cryptography, cryptographic protocols, secure programming practices, self languages, mobile code, malware, privacy and anonymity, and case studies from real-world systems. Not open for credit to students who have taken course 225. —(F.) Chen

235B. Foundations of Computer and Information Security (4) 
Lecture—3 hours; project. Prerequisite: course 226A; courses 120, 150 recommended. Pass One and Pass Two open to Graduate Students in Computer Science only. Theoretical foundations of methods used to protect data in computer and communication systems. Access control matrix and undecidability of security policies; Bell-Lapuda, Biba, Chinese Wall models; non-interference and non-deducibility; information flow and the confinement problem. Not open for credit to students who have taken course 235. — (W.) Bishop

236. Computer Security: Intrusion Detection Based Approach (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: course 150, 153 recommended. Pass One and Pass Two open to Graduate Students in Computer Science only. Conception of intrusion detection, anomaly detection based machine learning, signature-based detection using pre-empted response to attacks using artificial intelligence planning, tracing intruders based on principal component analysis, security policy languages. Offered in alternate years. —(S.) D’Souza

240. Programming Languages (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: courses 140A; 142. Pass One and Pass Two open to Graduate Students in Computer Science only. Introduction to the lambda calculus. Additional topics will include higher-order programming languages, in-depth semantic theory and models of language implementation. —(W.) Su

242. Translation of Programming Languages (4) 
Lecture—3 hours; laboratory—3 hours. Prerequisite: course 240. Pass One and Pass Two open to Graduate Students in Computer Science only. Lexical analysis, parsing, storage management, symbol table design, semantic analysis, and code generation; LR, LL, or LALR grammars. Compiler-constructors. —(S.) Pandey

243. Code Generation and Optimization (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: course 201A or Engineering Electrical and Computer Engineering 270. Pass One and Pass Two open to Graduate Students in Computer Science only. Compiler optimizations for performance, code size and power reduction. Topics include control and data-flow analysis, reductions, loop optimizations, register allocation, local and global instruction scheduling, and modulo scheduling. —(W.) Wilken

244. Principles of Concurrent Programming (4) 
Lecture—3 hours; laboratory—3 hours. Prerequisite: courses 215, 250. Pass One and Pass Two open to Graduate Students in Computer Science only. Foundation concepts and applications of concurrent programming; concurrency and derivation; synchronization mechanisms in program- ming languages; distributed programming techniques; case studies of languages. —(F.) Olsson

247. Concurrent Programming Languages (4) 
Lecture—3 hours; laboratory—3 hours. Prerequisite: course 140A, 150. Pass One and Pass Two open to Graduate Students in Computer Science only. Language design parameters. Models of parallel machines. Load balancing. Scalability. Portability. Efficiency measures. Design and implementation techniques for several classes of concurrent programming languages (such as object-oriented, functional, logic, and constraint programming languages). —(F.) Olsson, Pandey

251. Operating Systems (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: course 150. Pass One and Pass Two open to Graduate Students in Computer Science only. Models, design, implementation, performance evaluation in operating systems. Algorithms, internal architectures for file systems, processor scheduling, Controllability, recovery, security. OS kernel-level programming. Special topics embedded systems, real-time systems, device driver, NPU (Network Processing Unit). —(S.) Najm

252. Computer Networks (4) 
Lecture—3 hours; laboratory—3 hours. Prerequisite: course 152B. Pass One and Pass Two open to Graduate Students in Computer Science only. Internet protocol based computer networks applications, transport network layer protocols. High speed LAN technologies; Ethernet, Asynchronous Transfer Mode (ATM). Delay models in data networks: analysis of multicast techniques in polling, ring, random access net- works. Multimedia applications requirements and design. —(S.) Ghosal, Mukherjee, Mohapatra

253. Network Theory and Applications (4) 
Lecture/discussion—4 hours. Prerequisite: Mathemati- cs 22A; Mathematics 22B; Statistics 13 or 120; experience with computer software; or consent of instructor. Develops the mathematical theory underlying growth, structure and function of networks with applications to physical, social, biological and engi- neering systems. Topics include social network analysis, epidemiology, phase transitions, software and algorithms, routing and search control, cascading failures. Some topics as Mechanical & Aeronauti- cal Engineering 251. Offered in alternate years. —(D.) D’Souza

255. Resource Management in Wireless Communication Networks (4) 
Lecture—3 hours; discussion—1 hour. Prerequisite: course 252A. Advanced research issues in wireless communication networks, including multi-user diver- sity and cross-layer optimization, basic network information theory, NIMO systems and the impact on networks, and dynamics spectrum management. Offered in alternate years. —(S.) Liu

256. Performance Evaluation (4) 
Lecture—3 hours; project—1 hour. Prerequisite: courses 20, 152A, 152A-B or Electrical and Com- puter Engineering 170, Statistics 131A; courses 120, 150 recommended. Pass One and Pass Two open to Graduate Students in Computer Science only. Use of simulation and queuing theory in computer and communication system design. Applications to pro- cessor scheduling, memory hierarchies; I/O systems; packet and circuit switched networks; fault-tolerance; computer networks applications. Not open for credit to students who have completed course 256A. Offered in alternate years. —(W.) Ghosal, Matloff, Mohapatra, Mukherjee
257. Mobile and Wireless Networks (4) Lecture—3 hours; independent study. Prerequisite: course 252. Pass One and Pass Two open to Graduate Students in Computer Science and Electrical and Computer Engineering only. Fundamental techniques in design of second generation wireless networks: cellular network and protocols, medium access control, handoff control, channel allocation, and mobility management, wireless data networks, Internet mobility and Personal Communication Services (PCS). Third generation wideband systems, novel technologies. Offered in alternate years. —(F) Ghosal, Mohapatra, Mukherjee

258. Networking Architecture and Resource Management (4) Lecture—3 hours; project. Prerequisite: course 152A or Electrical Engineering 173A. Pass One and Pass Two open to Graduate Students in Computer Science and Electrical and Computer Engineering only. Concepts and design principles of computer networks. Network architectures, protocol mechanisms and implementation principles (transport/network/data-link layers), network algorithms, router mechanisms, design requirements of applications simulations, modeling and performance analysis. (Same course as Electrical & Computer Engineering 273.) Offered in alternate years. —(W) Chua, Mohapatra


260. Software Engineering (4) Lecture—3 hours; project. Prerequisite: course 142; course 160 recommended. Pass One and Pass Two open to Graduate Students in Computer Science only. Advanced techniques for domain-specific software reuse. —(W) Devanbu

261. Program Verification (4) Lecture—3 hours; discussion—1 hour. Prerequisite: Mathematics 125 or Philosophy 112 or familiarity with first-order logic; knowledge of an iterative and functional programming language. Methods of proving correctness of programs with respect to formal specifications, with attention to those suited for employing automated deduction. Logic background, syntax execution. Techniques suited to iterative programming, methods from denotational semantics, termination, dynamic logic and proofs of concurrent programs. Offered in alternate years. —(F) Levitt


265. Distributed Database Systems (4) Lecture—3 hours; discussion—1 hour. Prerequisite: course 165A. Pass One and Pass Two open to Graduate Students in Computer Science only. Concept of distributed database systems and architectures, distributed database design, distributed query processing and optimization, transaction management and concurrency control, heterogeneous and multidatabase systems. —(S) Ludescher

266. Spatial Databases (4) Lecture—3 hours; discussion—1 hour. Prerequisite: course 165A. Concepts, models, and architectures for spatial access methods, query processing, spatio-temporal data management, moving objects, spatial data mining. Offered in alternate years. —(W) Ludescher

267. Wide-Area Distributed Information Systems (4) Lecture—3 hours; discussion—1 hour. Prerequisite: course 152B or 165A. Pass One and Pass Two open to Graduate Students in Computer Science only. Wide-area distributed information systems, data broadcasting, online transaction services, service differentiation, information retrieval, Web caching. Offered in alternate years. —(S)

268. Scientific Data and Workflow Management (4) Lecture—3 hours. Prerequisite: course 165A. Scientific data integration, metadata, knowledge representation, ontologies, scientific workflow design and management. Offered in alternate years. —(F) Ludescher

270. Artificial Intelligence (3) Lecture—3 hours. Prerequisite: courses 140A, 172. Pass One and Pass Two open to Graduate Students in Computer Science only. Concepts and techniques underlying the design and implementation of models of human performance on intelligent tasks. Representation of high-level knowledge structures. Models of memory and inference. Natural language and story understanding. Common sense planning and problem solving. —(W) Levitt

271. Machine Learning and Discovery (4) Lecture—3 hours; project—1 hour. Prerequisite: course 170. Pass One and Pass Two open to Graduate Students in Computer Science only. Artificial intelligence techniques for information discovery by computers. Fundamental problems in machine learning and discovery. Systems that learn from examples, analogies, and solved problems. Systems that discover numerical and qualitative relationships. Projects centering on implementation and evaluation. Offered in alternate years. —(S) Levitt, Vemuri

272. Information Visualization (4) Lecture—3 hours; laboratory—3 hours. Prerequisite: course 163 or 175 recommended. Pass One and Pass Two open to Graduate Students in Computer Science only. Advanced topics in information visualization: perceptually effective display methods, color design and selection, interaction models and techniques, focus-context techniques, distortion methods, large graph visualization techniques, visual data mining methods, and evaluation methods. —(W) Ma

273. Applied Visual Computing (4) Lecture—3 hours; laboratory—3 hours. Prerequisite: graduate standing. Visual computing paradigms, current visualization technologies, principles of 3-D graphics, user interaction and exploratory visualization. Offered in alternate years. —(F) Hamann, Joy, Ma, Max

274. Automated Deduction (4) Lecture—3 hours; discussion—1 hour. Prerequisite: Mathematics 125 or Philosophy 112 or familiarity with first-order logic. Techniques of mechanical theorem proving. Methods based on resolution and term-rewriting. Decision procedures. Induction. Applications to program verification and plan generation. Study existing mechanical theorem provers. Offered in alternate years. —(S) Levitt

275A. Advanced Computer Graphics (4) Lecture—3 hours; laboratory—3 hours. Prerequisite: course 175 or 177 or 179 or 176B. Pass One and Pass Two open to Graduate Students in Computer Science only. Advanced topics in computer graphics. Hidden surface models, rendering of various surface types, subdivision methods, triangle meshes, antialiasing, modeling techniques. —(W) (W)

275B. Advanced Computer Graphics (4) Lecture—3 hours; laboratory—3 hours. Prerequisite: course 175 or 177 or 179. Pass One and Pass Two open to Graduate Students in Computer Science only. Advanced topics in computer graphics and geometric modeling. Topics taken from advanced research papers in computer graphics, image synthesis, visualization and rendering. Discussion of current research in the field. Offered in alternate years. —(W) Joy, Hamann, Ma

276. Advanced Volume Visualization (4) Lecture—3 hours; discussion—1 hour. Prerequisite: course 177. Pass One and Pass Two open to Graduate Students in Computer Science only. Applications, available tools and techniques, the challenges confronting the field of volume visualization, and some of the advanced topics in the field. Emphasis on advanced software and hardware techniques to achieve interactive visualization. Offered in alternate years. —(S) Hamann, Joy, Ma, Max

277. Computer-Aided Geometric Design (4) Lecture—3 hours; laboratory—3 hours. Prerequisite: course 175. Mathematical techniques for the definition and manipulation of curves and surfaces. Bezier curves and surfaces, B-spline curves and surfaces, subdivision surfaces, wavelets. Integration into various computer graphics rendering models, visualization systems and computer-aided design systems. Offered in alternate years. —(S) Hamann, Joy

279. Computer Animation (4) Lecture—3 hours; discussion—1 hour. Prerequisite: course 175 or 275. Pass One and Pass Two open to Graduate Students in Computer Science only. Course surveys current research and fundamental techniques that lie behind character animation tools. Emphasis on improving techniques for modeling and animation, and how physics, motion capture data, the arts and psychology literature, and interactive techniques can be used towards this goal. Offered in alternate years. —(F)

280. Virtual Reality Technology (4) Lecture—3 hours; discussion—1 hour. Prerequisite: course 175. Pass One and Pass Two open to Graduate Students in Computer Science only. Fundamentals and principles of Virtual Reality (VR) technology. Potential and limits for its useful application. Developing a complete virtual reality application. Offered in alternate years. —(S) Joy

289A. Special Topics in Computer Science: Computer Science Theory (1-5) Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Computer Science Theory. May be repeated for credit when topic differs. —(F, W, S) (F, W, S)

289B. Special Topics in Computer Science: Architecture (1-5) Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Computer Science Architecture. May be repeated for credit when topic differs. —(F, W, S) (F, W, S)

289C. Special Topics in Computer Science: Programming Languages and Compilers (1-5) Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Programming Languages and Compilers. May be repeated for credit when topic differs. —(F, W, S) (F, W, S)

289D. Special Topics in Computer Science: Operating Systems (1-5) Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Operating Systems. May be repeated for credit when topic differs. —(F, W, S) (F, W, S)

289E. Special Topics in Computer Science: Software Engineering (1-5) Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Software Engineering. May be repeated for credit when topic differs. —(F, W, S) (F, W, S)

289F. Special Topics in Computer Science: Databases (1-5) Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Databases. May be repeated for credit when topic differs. —(F, W, S) (F, W, S)

Fall 2011 and on Revised General Education (GE) ARt—Arts and Humanities; SS—Science and Engineering; Ss—Social Sciences; ACGH—American Cultures; DD—Domestic Diversity; DO—Oriental Studies, QM—Quantitative; SL—Scientific; VL—Visual; WCWorld Cultures; WE—Writing Experience Pre-Fall 2011 General Education (GE): ArtHum—Arts and Humanities; SciEng—Science and Engineering; SocSci—Social Sciences; Div—Domestic Diversity; Wrt—Writing Experience Quarter Offered: F—Fall; W—Winter, S—Spring, Su—Summer; 2017/2018 offering in parentheses
289G. Special Topics in Computer Science: Artificial Intelligence (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Artificial Intelligence. May be repeated for credit when topic differs. — F, W, S. (F, W, S.)

289H. Special Topics in Computer Science: Computer Graphics (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Computer Graphics. May be repeated for credit when topic differs. — F, W, S. (F, W, S.)

289I. Special Topics in Computer Science; Networks (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Networks. May be repeated for credit when topic differs. — F, W, S. (F, W, S.)

289J. Special Topics in Computer Science; Computer-Aided Design (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Computer-Aided Design. May be repeated for credit when topic differs. — F, W, S. (F, W, S.)

289K. Special Topics in Computer Science; Scientific Computing (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Scientific Computing. May be repeated for credit when topic differs. — F, W, S. (F, W, S.)

289L. Special Topics in Computer Science; Computer Science (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Computer Science. May be repeated for credit when topic differs. — F, W, S. (F, W, S.)

289N. Special Topics in Bioinformatics and Computational Biology (1-5)
Lecture; laboratory; lecture/laboratory. Prerequisite: consent of instructor. Special topic in Bioinformatics and Computational Biology. May be repeated for credit when topic differs. Offered irregularly.

290. Seminar in Computer Science (1-5)
Seminar — 1 hour. Participating seminar; discussion and presentation of current research and development in computer science. (S/U grading only.) — F, W, S. (F, W, S.)

290C. Graduate Research Group Conference (1-5)
Discussion — 1 hour. Research problems, progress and techniques in computer science. May be repeated for credit. (S/U grading only.) — F, W, S. (F, W, S.)

293A. Research in Computer Science (1-5)
Lecture — 1 hour. Prerequisite: graduate standing in computer science. Pass One and Pass Two open to Graduate Students in Computer Science only. Study of research topics in computer science, Ph.D. level research methodologies (experimental, applied and theoretical). Study skills necessary to successfully find/solve significant research problems. Finding and successful interacting with a research advisor. Ethical issues in research/collaborative work. (S/U grading only.) — F, W, S. (F, W, S.)

293B. Research in Computer Science (1-5)
Lecture — 1 hour. Prerequisite: graduate standing in computer science; graduate standing in computer science. 293A recommended. Pass One and Pass Two open to Graduate Students in Computer Science only. Study of Ph.D. level research methodologies (experimental, applied and theoretical), presenting research results for the computer science community. Study skills necessary to successfully find/solve significant research problems. (S/U grading only.) — W (W/W) Martel

298. Group Study (1-5)
Lecture, laboratory, or combination. Prerequisite: consent of instructor. (S/U grading only.)

299. Research (1-12)
(S/U grading only.)

Professional

390. The Teaching of Computer Science (1-2)
Discussion — 1 hour. Prerequisite: meet qualifications for teaching assistant and/or associate-in in Pass One and Pass Two open to Graduate Students in Computer science only. Computer Science Computer. Participating assistant or associate-in in a designated engineering course. Methods of leading discussion groups or laboratory sections, writing and grading quizzes, use of laboratory equipment, and grading laboratory reports. May be repeated for credit. (S/U grading only.) — F, W, S. (F, W, S.)

396. Teaching Assistant Training Practicum (1-3)
Prerequisite: graduate standing. May be repeated for credit. (S/U grading only.)

Engineering: Electrical and Computer Engineering

Department Office. 2064 Kemper Hall 530-752-0583; http://www.ece.ucdavis.edu

Faculty

Khaled Abdel-Ghaffar, Ph.D., Professor Venkatesh Akella, Ph.D., Professor Hussain Al-Ammari, Ph.D., Associate Professor Rajeev Amritharajah, Ph.D., Professor Bevan Bova, Ph.D., Professor G. R. Baker, Ph.D., Professor Srinath Chowdhury, Ph.D., Associate Professor Chen-Nee Chuah, Ph.D., Professor Shugang “Robert” Cui, Ph.D., Professor Zhi Ding, Ph.D., Professor Soheil Ghiasian, Ph.D., Associate Professor Kane Q. Gu, Ph.D., Associate Professor A. Nazli Gündes, Ph.D., Professor Joshua Hihath, Ph.D., Assistant Professor Charles E. Hunt, Ph.D., Professor Paul J. Hurst, Ph.D., Professor Saff Islam, Ph.D., Professor Andre Knoesen, Ph.D., Professor H. Brian Kolker, Ph.D., Associate Professor Bernard C. Levy, Ph.D., Professor Stephen H. Lewis, Ph.D., Professor Xiaoxiang "Leo" Liu, Ph.D., Assistant Professor Neville C. Luhmann, Ph.D., Assistant Professor Omered Momeni, Ph.D., Assistant Professor John Owens, Ph.D., Professor Anti-Vu Pham, Ph.D., Professor Erkin Seker, Ph.D., Assistant Professor Kent Wilken, Ph.D., Professor Jerry M. Woodall, Ph.D., Professor S.J. Ben Yoo, Ph.D., Professor Qing Zhao, Ph.D., Professor Emeriti Faculty

V. Ralph Alpagut, Ph.D., Professor Emeritus Robert W. Bower, Ph.D., Professor Emeritus Tsu-Shuan Chang, Professor Emeritus John N. Churchill, Ph.D., Professor Emeritus Jean-Pierre Colinge, Ph.D., Professor Emeritus K. Wayne Current, Ph.D., Professor Emeritus Andrew J. Dienes, Ph.D., Professor Emeritus

Richard C. Dorf, Ph.D., Professor Emeritus Herman J. Fink, Ph.D., Professor Emeritus C. E. Ford, Ph.D., Professor Emeritus

Academic Senate Distinguished Teaching Award William A. Gardner, Ph.D., Professor Emeritus Mohammad S. Ghiaumi, Ph.D., Professor Emeritus/Dean Emeritus

Affiliated Faculty

Shu Lin, Ph.D., Adjunct Professor Augusto Santin, Ph.D., Adjunct Professor Diego Yankelevich, Ph.D., Adjunct Professor

The Electrical and Computer Engineering Undergraduate Programs

The department administers two undergraduate curricula in the College of Engineering: (1) the Electrical Engineering curriculum and (2) the Computer Engineering curriculum.

Integrated Degree Program (IDP). The IDP leads to both the Bachelor of Science and the Master of Science degrees. The program provides a student the opportunity to obtain superior breadth and depth of technical material. The IDP program in the Department of Electrical and Computer Engineering is available only to UC Davis undergraduates with strong academic records enrolled in the Electrical Engineering, Computer Engineering, Electronic Materials Engineering or Applied Physics curricula. Applicants in their junior year must apply for the IDP by March 31. For more information on IDP, see http://www.ece.ucdavis.edu.

Mission. Under its land grant status, the University of California has a mission to provide the state with the trained workforce it needs and to advance knowledge and research in directions that contribute to the general welfare of the state and the nation. The Department of Electrical and Computer Engineering contributes to the mission of the University in three ways. First, its undergraduate and graduate education programs seek to provide students with an understanding of the fundamental principles of electrical and computer engineering, the skills needed to solve the complex technological problems of modern society and the ability to continue to learn and develop throughout their careers. Second, through its research programs, the department contributes to the development and progress of electronics, communications, and computer technology. Finally, the department helps to transfer the results of its industry through publication, public service and professional activities.

Objectives. Teaching—To provide undergraduate students with sufficient breadth to allow them to participate in teams, continue their own education after graduation and select a focus area intelligently; to provide undergraduate students with sufficient depth in a narrower discipline to allow them to develop the ability to solve complex engineering problems. To educate the students in the graduate program to be leaders in industry or to do meaningful research in industry, government or academia. Research—to develop and maintain research programs that produce useful technological advances while simultaneously training the next generation of researchers and leaders; to update and/or shift the foci of these programs in response to the needs of the industry and the nation; to provide a stimulating environment that encourages our graduate students to develop their abilities as far as possible.