Electrical Engineering and Computer Sciences

Overview

The Department of Electrical Engineering and Computer Sciences (EECS) offers one of the strongest research and instructional programs in this field anywhere in the world. Our key strength is our cross-disciplinary, team-driven projects. The integration of Electrical Engineering (EE) and Computer Science (CS) forms the core, with strong interactions that extend into biological sciences, mechanical and civil engineering, physical sciences, chemistry, mathematics, and operations research. Our programs have been consistently ranked in the top three nationwide and worldwide by various organizations that rank academic programs.

Each year, top students from all parts of the world are attracted to UC Berkeley by the excellence of the faculty; the breadth of educational opportunities in EECS and campuswide; the proximity to the vibrant California high-tech economy; and the Berkeley environment. The department's close ties to the industry, coupled with its commitment to engineering research and education, ensure that students get a rigorous, relevant, and broad education.

Faculty members at Berkeley are committed to research and discovery at the highest level, informed and creative teaching, and the creative desire to excel. The distinction of the EECS faculty has been recognized in a long list of prestigious honors and awards, including two National Medals of Science, three ACM Turing Awards, three IEEE Medals of Honor, 36 members of the National Academy of Engineering, seven members of the National Academy of Sciences and 14 fellows of the American Academy of Arts and Sciences.

Unlike many institutions of similar stature, regular faculty teach the vast majority of our courses, and the most exceptional teachers are often also the most exceptional researchers. The department's list of active teaching faculty includes seven winners of the prestigious Berkeley Campus Distinguished Teaching Award.

The mission of the EECS Department has three parts:

1. Educating future leaders in academia, government, industry, and entrepreneurial pursuit, through a rigorous curriculum of theory and application that develops the ability to solve problems, individually and in teams;
2. Creating knowledge of fundamental principles and innovative technologies, through research within the core areas of EECS and in collaboration with other disciplines, that is distinguished by its impact on academia, industry and society; and
3. Serving the communities to which we belong, at local, national, and international levels, with a deep awareness of our ethical responsibilities to our profession and to society.

Our strategy to accomplish this mission is simple: recruit and retain the very best faculty, students, and staff, and then empower them to direct and drive the creation and dissemination of knowledge. We know that we have succeeded in this mission when our students succeed, becoming leaders and serving society.

Electrical Engineering began on the Berkeley campus more than a century ago, with the hiring of the first electrical engineer, Clarence Cory, into the College of Mechanics. The early days focused on electric power

production and distribution, and Cory's laboratory, in fact, provided the first light and power to the entire campus.

The evolution since then has been dramatic, accelerating rapidly in the latter half of the 20th century. The development of our world-class computer science faculty followed naturally from the synergies between electronics, systems theory, and computing. In the 21st century, EECS has become a broader field, defined more by its intellectual approach to engineering problems than by particular technical solutions. Broadly, EECS harnesses physical processes to perform logical functions, and hence easily extends beyond its core technology base in electronics to, for example, biological systems.

Current strengths in biosystems and computational biology, nanotechnology, artificial intelligence, concurrent and distributed systems, embedded systems, novel devices (such as organic semiconductors), robotics, advanced networking, computer security and trusted computing, energy, and sensor networks, complement beautifully our traditional strengths in physical electronics, integrated circuits, operating systems and networking, graphics and human-computer interaction, communications systems, computer architecture, control theory, signal processing, the theory of computing, programming languages, scientific computing, electronic design automation, power systems, and database management systems. Many of our current research projects are focused on enormous societal challenges and opportunities such as energy efficiency, network intelligence, transportation systems, security, and health care. More than any other engineering discipline, EECS bridges the physical world and the semantic one, creating technologies to serve humanity.

Organizationally, the Department of Electrical Engineering and Computer Sciences smoothly integrates its world-class faculty with dedicated staff and extremely active and involved student groups. Our undergraduate programs recognize the daunting intellectual breadth of the field by offering a great deal of flexibility. These programs are accredited by ABET, Inc. (http://www.abet.org) and by the CAC, (http://www.abet.org/accreditation) the Computing Accreditation Commission of ABET, Inc.

Our graduate programs emphasize research, preparing students for leadership positions in industrial labs, government, or academia. Our laboratory and computing facilities are among the best anywhere, and have conceived many transformative inventions. Our research programs are well funded, and nearly all of our graduate students receive full financial support.

Computing Service Courses

Students may earn a total of at most five units of credit toward graduation for courses labeled as "computing service" courses, which include at Berkeley the COMPSCI 9 series courses and COMPSCI 10 (and the following COMP SCI courses no longer taught COMPSCI 3, COMPSCI 3L, COMPSCI 3S, and ENGIN 110). Students will receive no more than one unit of credit for each computing science course taken after the first or after any of the CS 61 courses. Any units beyond these limits will not count toward graduation, although they will count for the sole purpose of determining whether the study list falls within the minimum and maximum unit loads.

Undergraduate Programs

Computer Science (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/computer-science) : BA (major program offered through the College of Letters and Science)

Electrical Engineering and Computer Sciences (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/electrical-engineering-computer-sciences) : BS (with concentrations in Electrical and Computer Engineering or Computer Science and Engineering)

Electrical Engineering and Computer Sciences/Materials Science and Engineering (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/electrical-engineering-computer-sciences-materials) : BS (Joint Major)

Electrical Engineering and Computer Sciences/Nuclear Engineering (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/electrical-engineering-computer-sciences-nuclear-joint-major) : BS (Joint Major)

Graduate Programs

Electrical Engineering and Computer Sciences (http://guide.berkeley.edu/archive/2014-15/graduate/degree-programs/electrical-engineering-computer-sciences) : MEng, MS, PhD

Master of Advanced Study in Integrated Circuits (http://guide.berkeley.edu/archive/2014-15/graduate/degree-programs/integrated-circuits/#abouttheprogramtext) : MAS-IC

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Computer Science

COMPSCI 3L Introduction to Symbolic Programming 4 Units
Introduction to computer programming, emphasizing symbolic computation and functional programming style. Students will write a project of at least 200 lines of code in Scheme (a dialect of the LISP programming language).
Rules & Requirements

Prerequisites: High school algebra

Credit Restrictions: Students may remove a deficiency in 3 by taking 3L.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 6 hours of laboratory per week

Summer: 8 weeks - 2 hours of lecture and 12 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Clancy

COMPSCI 3S Introduction to Symbolic Programming (Self-Paced) 1 - 4 Units
The same material as 3 but in a self-paced format; introduction to computer programming, emphasizing symbolic computation and functional programming style, using the Scheme programming language. Units assigned depend on amount of work completed. The first two units must be taken together.
Rules & Requirements

Prerequisites: High school algebra

Credit Restrictions: Refer to computer science service course restrictions. Course may be repeated up to 4 units.

Repeat rules: Course may be repeated for a maximum of 4 units.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of self-paced and 3-9 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 9A Matlab for Programmers 2 Units
Introduction to the constructs in the Matlab programming language, aimed at students who already know how to program. Array and matrix operations, functions and function handles, control flow, plotting and image manipulation, cell arrays and structures, and the Symbolic Mathematics toolbox.
Rules & Requirements

Prerequisites: Programming experience equivalent to that gained in Computer Science 10; familiarity with applications of matrix processing

Credit Restrictions: Refer to computer science service course restrictions.

Repeat rules: Course may be repeated for a maximum of 4 units.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 9C C for Programmers 2 Units
Self-paced course in the C programming language for students who already know how to program. Computation, input and output, flow of control, functions, arrays, and pointers, linked structures, use of dynamic storage, and implementation of abstract data types.
Rules & Requirements

Prerequisites: Programming experience with pointers (or addresses in assembly language) and linked data structures equivalent to that gained in Computer Science 9B or 61A, or Engineering 7

Credit Restrictions: Refer to computer science service course restrictions.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 9D Scheme and Functional Programming for Programmers 2 Units
Self-paced course in functional programming, using the Scheme programming language, for students who already know how to program. Recursion; higher-order functions; list processing; implementation of rule-based querying.
Rules & Requirements

Prerequisites: Programming experience similar to that gained in Computer Science 10 or Engineering 7

Credit Restrictions: Refer to computer science service course restrictions.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 9E Productive Use of the UNIX Environment 2 Units
Use of UNIX utilities and scripting facilities for customizing the programming environment, organizing files (possibly in more than one computer account), implementing a personal database, reformatting text, and searching for online resources.
Rules & Requirements

Prerequisites: Programming experience similar to that gained in Computer Science 61A or Engineering 7; DOS or UNIX experience

Credit Restrictions: Refer to computer science service course restrictions.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 9F C++ for Programmers 2 Units
Self-paced introduction to the constructs provided in the C++ programming language for procedural and object-oriented programming, aimed at students who already know how to program.
Rules & Requirements

Prerequisites: Programming experience equivalent to that gained in Computer Science 9B or 61A, or Engineering 7

Credit Restrictions: Refer to computer science service course restrictions in the <General Catalog>.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 9G JAVA for Programmers 2 Units
Self-paced course in Java for students who already know how to program. Applets; variables and computation; events and flow of control; classes and objects; inheritance; GUI elements; applications; arrays, strings, files, and linked structures; exceptions; threads.
Rules & Requirements

Prerequisites: 9C or 9F or 61A plus experience with object-oriented programming or C-based language

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 9H Python for Programmers 2 Units
Introduction to the constructs provided in the Python programming language, aimed at students who already know how to program. Flow of control; strings, tuples, lists, and dictionaries; CGI programming; file input and output; object-oriented programming; GUI elements.
Rules & Requirements

Prerequisites: Programming experience equivalent to that gained in Computer Science 10

Credit Restrictions: Refer to computer science service course restrictions.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 10 The Beauty and Joy of Computing 4 Units
An introduction to the beauty and joy of computing. The history, social implications, great principles, and future of computing. Beautiful applications that have changed the world. How computing empowers discovery and progress in other fields. Relevance of computing to the student and society will be emphasized. Students will learn the joy of programming a computer using a friendly, graphical language, and will complete a substantial team programming project related to their interests.
Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture, 1 hour of discussion, and 4 hours of laboratory per week

Summer: 8 weeks - 4 hours of lecture, 2 hours of discussion, and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Garcia, Harvey

COMPSCI W10 The Beauty and Joy of Computing 4 Units
This course meets the programming prerequisite for 61A. An introduction to the beauty and joy of computing. The history, social implications, great principles, and future of computing. Beautiful applications that have changed the world. How computing empowers discovery and progress in other fields. Relevance of computing to the student and society will be emphasized. Students will learn the joy of programming a computer using a friendly, graphical language, and will complete a substantial team programming project related to their interests.
Rules & Requirements

Credit Restrictions: Students will receive no credit for W10 after taking 10. A deficient grade in 10 may be removed by taking W10.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of web-based lecture and 5 hours of web-based discussion per week

Summer: 8 weeks - 4 hours of web-based lecture and 10 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Garcia, Harvey

COMPSCI 39J Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

Prerequisites: Priority given to freshmen and sophomores

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

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of seminar per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 39K Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

Prerequisites: Priority given to freshmen and sophomores

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

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of seminar per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 39M Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

Prerequisites: Priority given to freshmen and sophomores

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

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of seminar per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 39N Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

Prerequisites: Priority given to freshmen and sophomores

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

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of seminar per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 39P Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

Prerequisites: Priority given to freshmen and sophomores

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

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of seminar per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 39Q Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

Prerequisites: Priority given to freshmen and sophomores

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

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of seminar per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 39R Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

Prerequisites: Priority given to freshmen and sophomores

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

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of seminar per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 47A Completion of Work in Computer Science 61A 1 Unit
Implementation of generic operations. Streams and iterators. Implementation techniques for supporting functional, object-oriented, and constraint-based programming in the Scheme programming language. Together with 9D, 47A constitutes an abbreviated, self-paced version of 61A for students who have already taken a course equivalent to 61B.
Rules & Requirements

Prerequisites: 61B or equivalent, 9D, and consent of instructor

Credit Restrictions: Students will receive no credit for 47A after taking 61A.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of self-paced per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 47B Completion of Work in Computer Science 61B 1 Unit
Iterators. Hashing, applied to strings and multi-dimensional structures. Heaps. Storage management. Design and implementation of a program containing hundreds of lines of code. Students with sufficient partial credit in 61B may, with consent of instructor, complete the credit in this self-paced course.

Rules & Requirements

Prerequisites: A course in data structures, 9G or equivalent, and consent of instructor

Credit Restrictions: Students will receive no credit for 47B after taking 61B.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of self-paced per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 47C Completion of Work in Computer Science 61C 1 Unit
MIPS instruction set simulation. The assembly and linking process. Caches and virtual memory. Pipelined computer organization. Students with sufficient partial credit in 61C may, with consent of instructor, complete the credit in this self-paced course.

Rules & Requirements

Prerequisites: Experience with assembly language including writing an interrupt handler, 9C or equivalent, and consent of instructor

Credit Restrictions: Students will receive no credit for 47C after taking 61C.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of self-paced per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Garcia

COMPSCI 61A The Structure and Interpretation of Computer Programs 4 Units
Introduction to programming and computer science. This course exposes students to techniques of abstraction at several levels: (a) within a programming language, using higher-order functions, manifest types, data-directed programming, and message-passing; (b) between programming languages, using functional and rule-based languages as examples. It also relates these techniques to the practical problems of implementation of languages and algorithms on a von Neumann machine. There are several significant programming projects.

Rules & Requirements

Prerequisites: Mathematics 1A (may be taken concurrently); programming experience equivalent to that gained in 3 or the Advanced Placement Computer Science A course

Credit Restrictions: Students will receive no credit for Computer Science 61A after completing Computer Science 47A or Computer Science 61AS. A deficient grade in Computer Science 61AS may be removed by taking Computer Science 61A.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1.5 hours of discussion, and 1.5 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture, 3 hours of discussion, and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Garcia, Hilfinger

COMPSCI 61AS The Structure and Interpretation of Computer Programs (Self-Paced) 1 - 4 Units

Introductory programming and computer science. Abstraction as means to control program complexity. Programming paradigms: functional, object-oriented, client/server, and declarative (logic). Control abstraction: recursion and higher order functions. Introduction to asymptotic analysis of algorithms. Data abstraction: abstract data types, type-tagged data, first class data types, sequences implemented as lists and as arrays, generic operators implemented with data-directed programming and with message passing. Implementation of object-oriented programming with closures over dispatch procedures. Introduction to interpreters and compilers. There are several significant programming projects. Course may be completed in one or two semesters. Students must complete a mimimum of two units during their first semester of 61AS.

Rules & Requirements

Prerequisites: Mathematics 1A (may be taken concurrently). Programming experience equivalent to that gained in 10 or the Advanced Placement Computer Science A course is recommended, but is not essential; students without this experience will begin at an earlier point in the online course

Credit Restrictions: Students will receive no credit for Computer Science 61AS after completing Computer Science 47A or Computer Science 61A. A deficient grade in Computer Science 61A may be removed by taking Computer Science 61AS.

Repeat rules: Course may be repeated for a maximum of 4 units.Course may be repeated for a maximum of 4 units.

Hours & Format

Fall and/or spring: 15 weeks - 6 hours of laboratory per week

Summer:
6 weeks - 15 hours of laboratory per week
8 weeks - 11 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Garcia, Harvey, Hilfinger

COMPSCI 61B Data Structures 4 Units

Fundamental dynamic data structures, including linear lists, queues, trees, and other linked structures; arrays strings, and hash tables. Storage management. Elementary principles of software engineering. Abstract data types. Algorithms for sorting and searching. Introduction to the Java programming language.

Rules & Requirements

Prerequisites: 61A or Engineering 7

Credit Restrictions: Students will receive no credit for 61B after taking 47B or 61BL. Deficiency in 61BL may be removed by taking 61B.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 2 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture, 2 hours of discussion, and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Hilfinger, Shewchuk

COMPSCI 61BL Data Structures and Programming Methodology 4 Units

The same material as in 61B, but in a laboratory-based format.

Rules & Requirements

Prerequisites: 61A or Engineering 7

Credit Restrictions: Students will receive no credit for 61BL after taking 47B or 61B. Deficiency in 61B may be removed by taking 61BL.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 6 hours of laboratory per week

Summer: 8 weeks - 2 hours of lecture and 12 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Hilfinger

COMPSCI 61C Machine Structures 4 Units
The internal organization and operation of digital computers. Machine architecture, support for high-level languages (logic, arithmetic, instruction sequencing) and operating systems (I/O, interrupts, memory management, process switching). Elements of computer logic design. Tradeoffs involved in fundamental architectural design decisions.
Rules & Requirements

Prerequisites: 61A, along with either 61B or 61BL, or programming experience equivalent to that gained in 9C, 9F, or 9G

Credit Restrictions: Students will receive no credit for 61C after taking 47C or 61CL. Deficiency in 61C may be removed by taking 61CL.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 2 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture, 2 hours of discussion, and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Garcia, Franklin, Katz, Patterson

COMPSCI 61CL Machine Structures (Lab-Centric) 4 Units
The same material as in 61C but in a lab-centric format.
Rules & Requirements

Prerequisites: 61A, along with 61B or 61BL, or programming experience equivalent to that gained in 9C, 9F, or 9G

Credit Restrictions: Students will receive no credit for 61CL after taking 47C or 61C. Deficiency in 61C may be removed by taking 61CL.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture, 1 hour of discussion, and 4 hours of laboratory per week

Summer: 8 weeks - 4 hours of lecture, 2 hours of discussion, and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Garcia, Patterson

COMPSCI 70 Discrete Mathematics and Probability Theory 4 Units
Logic, infinity, and induction; applications include undecidability and stable marriage problem. Modular arithmetic and GCDs; applications include primality testing and cryptography. Polynomials; examples include error correcting codes and interpolation. Probability including sample spaces, independence, random variables, law of large numbers; examples include load balancing, existence arguments, Bayesian inference.
Rules & Requirements

Prerequisites: Sophomore mathematical maturity, and programming experience equivalent to that gained in 3 or the Advanced Placement Computer Science A course

Credit Restrictions: Students will receive no credit for 70 after taking Mathematics 55.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Papadimitriou, Rao, Sinclair, Trevisan, Vazirani, Wagner

COMPSCI C79 Societal Risks and the Law 3 Units
Defining, perceiving, quantifying and measuring risk; identifying risks and estimating their importance; determining whether laws and regulations can protect us from these risks; examining how well existing laws work and how they could be improved; evaluting costs and benefits. Applications may vary by term. This course cannot be used to complete engineering unit or technical elective requirements for students in the College of Engineering.
Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Also listed as: POL SCI C79/STAT C79

COMPSCI 97 Field Study 1 - 4 Units
Students take part in organized individual field sponsored programs with off-campus companies or tutoring/mentoring relevant to specific aspects and applications of computer science on or off campus. Note Summer CPT or OPT students: written report required. Course does not count toward major requirements, but will be counted in the cumulative units toward graduation.
Rules & Requirements

Prerequisites: Consent of instructor (see department adviser)

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

Hours & Format

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

Summer:
6 weeks - 2.5-10 hours of fieldwork per week
8 weeks - 2-7.5 hours of fieldwork per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 98 Directed Group Study 1 - 4 Units
Seminars for group study of selected topics, which will vary from year to year. Intended for students in the lower division.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 99 Individual Study and Research for Undergraduates 1 - 2 Units
A course for lower division students in good standing who wish to undertake a program of individual inquiry initiated jointly by the student and a professor. There are no other formal prerequisites, but the supervising professor must be convinced that the student is able to profit by the program.
Rules & Requirements

Prerequisites: GPA of 3.4 or better

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

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 146L Programmable Digital Systems Laboratory 2 Units
Hardware description languages for digital system design and
interactions with tool flows. Design, implementation, and verification of
digital designs. Digital synthesis, partitioning, placement, routing, and
simulation for Field-Programmable Gate Arrays. Large digital-system
design concepts. Project design component – example, a full processor
implementation with peripherals.
Objectives & Outcomes

Student Learning Outcomes: This course is a one-time offering to
supplement the EE141 course offered in the Fall 2014, with a lab and
project section that cover the design of larger digital systems on a
programmable chip platform (FPGA). The EE141 lectures in the Fall 2014
already covered the necessary lecture material, so students who took the
EE141 lab in the Fall of 2014 will have a chance to expand their skills into
the area of FPGA Digital System Design. Hence the pre-requisite for this
course is that a student has taken the EE141 course in the Fall 2014.

Rules & Requirements

Prerequisites: Computer Science 61C, Electrical Engineering 105
recommended and Electrical Engineering 141 (taken Fall 2014) -
mandatory

Credit Restrictions: Students will receive no credit for Computer
Science 146L after taking Fall 2014 version of Computer Science 150.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Stojanovic

COMPSCI C149 Introduction to Embedded Systems 4 Units
This course introduces students to the basics of models, analysis tools,
and control for embedded systems operating in real time. Students learn
how to combine physical processes with computation. Topics include
models of computation, control, analysis and verification, interfacing with
the physical world, mapping to platforms, and distributed embedded
systems. The course has a strong laboratory component, with emphasis
on a semester-long sequence of projects.
Rules & Requirements

Prerequisites: 20N; Computer Science 61C; Computer Science 70 or
Math 55

Credit Restrictions: Students will receive no credit for Electrical
Engineering C149/Computer Science C149 after
taking Electrical
Engineering C249M/Computer Science C249M. Students may remove a
deficient grade in Electrical Engineering C149/Computer Science C149
after taking Electrical Engineering 124.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Lee, Seshia

Also listed as: EL ENG C149

COMPSCI 150 Components and Design Techniques for Digital Systems
5 Units
Basic building blocks and design methods to contruct synchronous digital
systems, such as general purpose processors, hardware accelerators,
and application specific processors. Representations and design
methodologies for digital systems. Logic design using combinatorial and
sequential circuits. Digital system implementation considering hardware
descriptions languages, computer-aided design tools, field-programmable
gate array architectures, and CMOS logic gates and state elements.
Interfaces between peripherals, processor hardware, and software.
Formal hardware laboratories and substantial design project.
Rules & Requirements

Prerequisites: Computer Science 61C, Electrical Engineering 40

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Katz, Pister, Wawrzynek

COMPSCI 152 Computer Architecture and Engineering 4 Units
Instruction set architecture, microcoding, pipelining (simple and complex). Memory hierarchies and virtual memory. Processor parallelism: VLIW, vectors, multithreading. Multiprocessors.
Rules & Requirements

Prerequisites: 61C

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Asanovic, Culler, Kubiatowicz, Wawrzynek

COMPSCI 160 User Interface Design and Development 4 Units
The design, implementation, and evaluation of user interfaces. User-centered design and task analysis. Conceptual models and interface metaphors. Usability inspection and evaluation methods. Analysis of user study data. Input methods (keyboard, pointing, touch, tangible) and input models. Visual design principles. Interface prototyping and implementation methodologies and tools. Students will develop a user interface for a specific task and target user group in teams.
Rules & Requirements

Prerequisites: Computer Science 61B or 61BL

Credit Restrictions: Students will receive no credit for Computer Science 160 after taking Computer Science 260A.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Agrawala, Canny, Hartmann, Paulos

COMPSCI 161 Computer Security 4 Units
Introduction to computer security. Cryptography, including encryption, authentication, hash functions, cryptographic protocols, and applications. Operating system security, access control. Network security, firewalls, viruses, and worms. Software security, defensive programming, and language-based security. Case studies from real-world systems.
Rules & Requirements

Prerequisites: 61C (Machine Structures), plus either 70 (Discrete Mathematics) or Mathematics 55

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Paxson, Song, Tygar, Wagner

COMPSCI 162 Operating Systems and System Programming 4 Units
Basic concepts of operating systems and system programming. Utility programs, subsystems, multiple-program systems. Processes, interprocess communication, and synchronization. Memory allocation, segmentation, paging. Loading and linking, libraries. Resource allocation, scheduling, performance evaluation. File systems, storage devices, I/O systems. Protection, security, and privacy.
Rules & Requirements

Prerequisites: Computer Science 61B, 61C, and 70

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 0 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture, 2 hours of discussion, and 0 hours of laboratory per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Joseph, Kubiatowicz, Stoica

COMPSCI 164 Programming Languages and Compilers 4 Units
Survey of programming languages. The design of modern programming
languages. Principles and techniques of scanning, parsing, semantic
analysis, and code generation. Implementation of compilers, interpreters,
and assemblers. Overview of run-time organization and error handling.
Rules & Requirements

Prerequisites: 61B and 61C

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Bodik, Hilfinger, Necula

COMPSCI 168 Introduction to the Internet: Architecture and Protocols 4
Units
This course is an introduction to the Internet architecture. We will focus
on the concepts and fundamental design principles that have contributed
to the Internet's scalability and robustness and survey the various
protocols and algorithms used within this architecture. Topics include
layering, addressing, intradomain routing, interdomain routing, reliable
delivery, congestion control, and the core protocols (e.g., TCP, UDP, IP,
DNS, and HTTP) and network technologies (e.g., Ethernet, wireless).
Rules & Requirements

Prerequisites: Computer Science 61B and 162

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Katz, Paxson, Ratnasamy, Shenker, Stoica

COMPSCI 169 Software Engineering 4 Units
Ideas and techniques for designing, developing, and modifying large
software systems. Function-oriented and object-oriented modular design
techniques, designing for re-use and maintainability. Specification and
documentation. Verification and validation. Cost and quality metrics and
estimation. Project team organization and management. Students will
work in teams on a substantial programming project.
Rules & Requirements

Prerequisites: Computer Science 61B and 61C, and either Computer
Science 70 or Mathematics 113

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Brewer, Fox, Necula, Sen

COMPSCI 170 Efficient Algorithms and Intractable Problems 4 Units
Concept and basic techniques in the design and analysis of algorithms;
models of computation; lower bounds; algorithms for optimum search
trees, balanced trees and UNION-FIND algorithms; numerical and
algebraic algorithms; combinatorial algorithms. Turing machines, how to
count steps, deterministic and nondeterministic Turing machines, NP-
completeness. Unsolvable and intractable problems.
Rules & Requirements

Prerequisites: Computer Science 61B and 70

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Demmel, Papadimitriou, Rao, Wagner, Vazirani

COMPSCI 172 Computability and Complexity 4 Units
Finite automata, Turing machines and RAMs. Undecidable, exponential, and polynomial-time problems. Polynomial-time equivalence of all reasonable models of computation. Nondeterministic Turing machines. Theory of NP-completeness: Cook's theorem, NP-completeness of basic problems. Selected topics in language theory, complexity and randomness.
Rules & Requirements

Prerequisites: 170

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Papadimitriou, Seshia, Sinclair, Vazirani

COMPSCI 174 Combinatorics and Discrete Probability 4 Units
Permutations, combinations, principle of inclusion and exclusion, generating functions, Ramsey theory. Expectation and variance, Chebychev's inequality, Chernov bounds. Birthday paradox, coupon collector's problem, Markov chains and entropy computations, universal hashing, random number generation, random graphs and probabilistic existence bounds.
Rules & Requirements

Prerequisites: 170

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Bartlett, Papadimitriou, Sinclair, Vazirani

COMPSCI 176 Algorithms for Computational Biology 4 Units
Algorithms and probabilistic models that arise in various computational biology applications: suffix trees, suffix arrays, pattern matching, repeat finding, sequence alignment, phylogenetics, genome rearrangements, hidden Markov models, gene finding, motif finding, stochastic context free grammars, RNA secondary structure. There are no biology prerequisites for this course, but a strong quantitative background will be essential.
Rules & Requirements

Prerequisites: Computer Science 70 and 170. Experience programming in a language such as C, C++, Java, or Python

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Song

COMPSCI 184 Foundations of Computer Graphics 4 Units
Techniques of modeling objects for the purpose of computer rendering: boundary representations, constructive solids geometry, hierarchical scene descriptions. Mathematical techniques for curve and surface representation. Basic elements of a computer graphics rendering pipeline; architecture of modern graphics display devices. Geometrical transformations such as rotation, scaling, translation, and their matrix representations. Homogeneous coordinates, projective and perspective transformations. Algorithms for clipping, hidden surface removal, rasterization, and anti-aliasing. Scan-line based and ray-based rendering algorithms. Lighting models for reflection, refraction, transparency.
Rules & Requirements

Prerequisites: Computer Science 61B or 61BL; programming skills in C, C++, or Java; linear algebra and calculus

Credit Restrictions: Students will receive no credit for Comp Sci 184 after taking Comp Sci 284A.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: O'Brien, Sequin, Barsky, Ramamoorthi, Agrawala

COMPSCI 186 Introduction to Database Systems 4 Units
Access methods and file systems to facilitate data access. Hierarchical, network, relational, and object-oriented data models. Query languages for models. Embedding query languages in programming languages. Database services including protection, integrity control, and alternative views of data. High-level interfaces including application generators, browsers, and report writers. Introduction to transaction processing. Database system implementation to be done as term project.
Rules & Requirements

Prerequisites: 61B and 61C

Credit Restrictions: Students will receive no credit for Comp Sci 186 after taking Comp Sci 286A.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Franklin, Hellerstein

COMPSCI 188 Introduction to Artificial Intelligence 4 Units
Ideas and techniques underlying the design of intelligent computer systems. Topics include search, game playing, knowledge representation, inference, planning, reasoning under uncertainty, machine learning, robotics, perception, and language understanding.
Rules & Requirements

Prerequisites: Computer Science 61A; Computer Science 61B; Computer Science 70

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Abbeel, Klein, Russell

COMPSCI 189 Introduction to Machine Learning 4 Units
Theoretical foundations, algorithms, methodologies, and applications for machine learning. Topics may include supervised methods for regression and classication (linear models, trees, neural networks, ensemble methods, instance-based methods); generative and discriminative probabilistic models; Bayesian parametric learning; density estimation and clustering; Bayesian networks; time series models; dimensionality reduction; programming projects covering a variety of real-world applications.
Rules & Requirements

Prerequisites: Mathematics 53 and 54; Computer Science 70; Computer Science 188 or consent of instructor

Credit Restrictions: Students will receive no credit for Comp Sci 189 after taking Comp Sci 289A.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Abbeel, Bartlett, Darrell, El Ghaoui, Jordan, Klein, Malik, Russell

COMPSCI C191 Quantum Information Science and Technology 3 Units
This multidisciplinary course provides an introduction to fundamental conceptual aspects of quantum mechanics from a computational and informational theoretic perspective, as well as physical implementations and technological applications of quantum information science. Basic sections of quantum algorithms, complexity, and cryptography, will be touched upon, as well as pertinent physical realizations from nanoscale science and engineering.
Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructors: Crommie, Vazirani, Whaley

Also listed as: CHEM C191/PHYSICS C191

COMPSCI 194 Special Topics 1 - 4 Units
Topics will vary semester to semester. See the Computer Science
Division announcements.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 195 Social Implications of Computer Technology 1 Unit
Topics include electronic community; the changing nature of work;
technological risks; the information economy; intellectual property;
privacy; artificial intelligence and the sense of self; pornography and
censorship; professional ethics. Students will lead discussions on
additional topics.
Rules & Requirements

Credit Restrictions: Students will receive no credit for 195 after taking
C195/Interdisciplinary Field Study C155 or H195.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Harvey

COMPSCI H195 Honors Social Implications of Computer Technology 3
Units
Topics include electronic community; the changing nature of work;
technological risks; the information economy; intellectual property;
privacy; artificial intelligence and the sense of self; pornography and
censorship; professional ethics. Students may lead discussions on
additional topics.
Rules & Requirements

Credit Restrictions: Student will receive no credit for H195 after taking
195 or C195.

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Instructor: Harvey

COMPSCI H196A Senior Honors Thesis Research 1 - 4 Units
Thesis work under the supervision of a faculty member. To obtain credit
the student must, at the end of two semesters, submit a satisfactory
thesis to the Electrical Engineering and Computer Science department
archive. A total of four units must be taken. The units many be distributed
between one or two semesters in any way. H196A-H196B count as
graded technical elective units, but may not be used to satisfy the
requirement for 27 upper division technical units in the College of Letters
and Science with a major in Computer Science.
Rules & Requirements

Prerequisites: Open only to students in the computer science honors
program

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI H196B Senior Honors Thesis Research 1 - 4 Units
Thesis work under the supervision of a faculty member. To obtain credit the student must, at the end of two semesters, submit a satisfactory thesis to the Electrical Engineering and Computer Science department archive. A total of four units must be taken. The units many be distributed between one or two semesters in any way. H196A-H196B count as graded technical elective units, but may not be used to satisfy the requirement for 27 upper division technical units in the College of Letters and Science with a major in Computer Science.

Rules & Requirements

Prerequisites: Open only to students in the computer science honors program

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 197 Field Study 1 - 4 Units
Students take part in organized individual field sponsored programs with off-campus companies or tutoring/mentoring relevant to specific aspects and applications of computer science on or off campus. Note Summer CPT or OPT students: written report required. Course does not count toward major requirements, but will be counted in the cumulative units toward graduation.

Rules & Requirements

Prerequisites: Consent of instructor (see department adviser)

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

Hours & Format

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

Summer:
6 weeks - 2.5-10 hours of fieldwork per week
8 weeks - 2-7.5 hours of fieldwork per week

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units
Group study of selected topics in Computer Sciences, usually relating to new developments.

Rules & Requirements

Prerequisites: 2.0 GPA or better; 60 units completed

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

Hours & Format

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

COMPSCI 199 Supervised Independent Study 1 - 4 Units
Supervised independent study. Enrollment restrictions apply.

Rules & Requirements

Prerequisites: Consent of instructor and major adviser

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

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

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

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

Additional Details

Subject/Course Level: Computer Science/Undergraduate

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

Electrical Engineering and Computer Sciences

EL ENG 16A Designing Information Devices and Systems I 4 Units
This course and its follow-on EE16B focus on the fundamentals of designing and building modern information devices and systems that interface with the real world. The course sequence provides a comprehensive introduction to core EECS topics in circuit design, signals, and systems in an application-driven context. The courses are delivered assuming mathematical maturity and aptitude at roughly the level of having completed MATH 1A-1B, and are aimed at entering students as well as non-majors seeking a broad introduction to the field.
Rules & Requirements

Credit Restrictions: Students will receive no credit for Electrical Engineering 16A after completing Electrical Engineering 20 or 40.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructors: Alon, Ayazifar, Lustig, Maharbiz, Subramanian, Tomlin, Courtade, Niknejad, Sahai

EL ENG 16B Designing Information Devices and Systems II 4 Units
This course is a follow-on to Electrical Engineering 16A, and focuses on the fundamentals of designing and building modern information devices and systems that interface with the real world. The course sequence provides a comprehensive introduction to core EECS topics in circuit design, signals, and systems in an application-driven context. The courses are delivered assuming mathematical maturity and aptitude at roughly the level of having completed MATH 1A-1B, and are aimed at entering students as well as non-majors seeking a broad introduction to the field.
Rules & Requirements

Prerequisites: Electrical Engineering 16A, Designing Information Devices and Systems I

Credit Restrictions: Students will receive no credit for Electrical Engineering 16B after completing Electrical Engineering 20 or 40.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructors: Alon, Ayazifar, Lustig, Maharbiz, Subramanian, Tomlin

EL ENG 20 Structure and Interpretation of Systems and Signals 4 Units
Mathematical modeling of signals and systems. Continous and discrete signals, with applications to audio, images, video, communications, and control. State-based models, beginning with automata and evolving to LTI systems. Frequency domain models for signals and frequency response for systems, and sampling of continuous-time signals. A Matlab-based laboratory is an integral part of the course.
Rules & Requirements

Prerequisites: Mathematics 1B

Credit Restrictions: Students will receive no credit for Electrical Engineering 20N after completing Electrical Engineering 20. A deficient grade in Electrical Engineering 20 may be removed by taking Electrical Engineering 20N.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Zakhor

EL ENG 24 Freshman Seminar 1 Unit
The Freshman Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. Freshman seminars are offered in all campus departments, and topics may vary from department to department and semester to semester.
Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 25 What Electrical Engineers Do--Feedback from Recent Graduates 1 Unit
A Berkeley Electrical Engineering and Computer Sciences degree opens the door to many opportunities, but what exactly are they? Graduation is only a few years away and it's not too early to find out. In this seminar students will hear from practicing engineers who recently graduated. What are they working on? Are they working in a team? What do they wish they had learned better? How did they find their jobs?
Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Boser

EL ENG 40 Introduction to Microelectronic Circuits 4 Units
Fundamental circuit concepts and analysis techniques in the context of digital electronic circuits. Transient analysis of CMOS logic gates; basic integrated-circuit technology and layout.
Rules & Requirements

Prerequisites: Mathematics 1B

Credit Restrictions: Students will receive one unit of credit for 40 taking 42 and no credit after taking 100.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture, 2 hours of discussion, and 6 hours of laboratory per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 42 Introduction to Digital Electronics 3 Units
This course serves as an introduction to the principles of electrical engineering, starting from the basic concepts of voltage and current and circuit elements of resistors, capacitors, and inductors. Circuit analysis is taught using Kirchhoff's voltage and current laws with Thevenin and Norton equivalents. Operational amplifiers with feedback are introduced as basic building blocks for amplication and filtering. Semiconductor devices including diodes and MOSFETS and their IV characteristics are covered. Applications of diodes for rectification, and design of MOSFETs in common source amplifiers are taught. Digital logic gates and design using CMOS as well as simple flip-flops are introduced. Speed and scaling issues for CMOS are considered. The course includes as motivating examples designs of high level applications including logic circuits, amplifiers, power supplies, and communication links.
Rules & Requirements

Prerequisites: Mathematics 1B

Credit Restrictions: Students will receive no credit for 42 after taking 40 or 100.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 43 Introductory Electronics Laboratory 1 Unit
Using and understanding electronics laboratory equipment such as oscilloscope, power supplies, function generator, multimeter, curve-tracer, and RLC-meter. Includes a term project of constructing and testing a robot or other appropriate electromechanical device.
Rules & Requirements

Prerequisites: 42 (may be taken concurrently) or equivalent or consent of instructor

Hours & Format

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

Summer: 8 weeks - 3.5 hours of laboratory per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 97 Field Study 1 - 4 Units
Students take part in organized individual field sponsored programs with off-campus companies or tutoring/mentoring relevant to specific aspects and applications of computer science on or off campus. Note Summer CPT or OPT students: written report required. Course does not count toward major requirements, but will be counted in the cumulative units toward graduation.
Rules & Requirements

Prerequisites: Consent of instructor (see department adviser)

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

Hours & Format

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

Summer:
6 weeks - 2.5-10 hours of fieldwork per week
8 weeks - 2-7.5 hours of fieldwork per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 98 Directed Group Study for Undergraduates 1 - 4 Units
Group study of selected topics in electrical engineering, usually relating to new developments.
Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 99 Individual Study and Research for Undergraduates 1 - 4 Units
Supervised independent study and research for students with fewer than 60 units completed.
Rules & Requirements

Prerequisites: Freshman or sophomore standing and consent of instructor. Minimum GPA of 3.4 required

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

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

Hours & Format

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

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 100 Electronic Techniques for Engineering 4 Units
This course serves as an introduction to the principles of electrical engineering, starting from the basic concepts of voltage and current and circuit elements of resistors, capacitors, and inductors. Circuit analysis is taught using Kirchhoff's voltage and current laws with Thevenin and Norton equivalents. Operational amplifiers with feedback are introduced as basic building blocks for amplification and filtering. Semiconductor devices including diodes and MOSFETS and their IV characteristics are covered. Applications of diodes for rectification, and design of MOSFETs in common source amplifiers are taught. Digital logic gates and design using CMOS as well as simple flip-flops are introduced. Speed and scaling issues for CMOS are considered. The course includes as motivating examples designs of high level applications including logic circuits, amplifiers, power supplies, and communication links.
Rules & Requirements

Prerequisites: Mathematics 1B

Credit Restrictions: Students will receive one unit of credit for 100 after taking 42 and no credit after taking 40.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture, 2 hours of discussion, and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 105 Microelectronic Devices and Circuits 4 Units
This course covers the fundamental circuit and device concepts needed to understand analog integrated circuits. After an overview of the basic properties of semiconductors, the p-n junction and MOS capacitors are described and the MOSFET is modeled as a large-signal device. Two port small-signal amplifiers and their realization using single stage and multistage CMOS building blocks are discussed. Sinusoidal steady-state signals are introduced and the techniques of phasor analysis are developed, including impedance and the magnitude and phase response of linear circuits. The frequency responses of single and multi-stage amplifiers are analyzed. Differential amplifiers are introduced.

Rules & Requirements

Prerequisites: 40

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG C106A Introduction to Robotics 4 Units
An introduction to the kinematics, dynamics, and control of robot manipulators, robotic vision, and sensing. The course covers forward and inverse kinematics of serial chain manipulators, the manipulator Jacobian, force relations, dynamics, and control. It presents elementary principles on proximity, tactile, and force sensing, vision sensors, camera calibration, stereo construction, and motion detection. The course concludes with current applications of robotics in active perception, medical robotics, and other areas.

Rules & Requirements

Prerequisites: EE 120 or equivalent, consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Bajcsy

Formerly known as: Electrical Engineering C125/Bioengineering C125

Also listed as: BIO ENG C125

EL ENG C106B Robotic Manipulation and Interaction 4 Units
This course is a sequel to Electrical Engineering C106A/Bioengineering C125, which covers kinematics, dynamics and control of a single robot. This course will cover dynamics and control of groups of robotic manipulators coordinating with each other and interacting with the environment. Concepts will include an introduction to grasping and the constrained manipulation, contacts and force control for interaction with the environment. We will also cover active perception guided manipulation, as well as the manipulation of non-rigid objects. Throughout, we will emphasize design and human-robot interactions, and applications to applications in manufacturing, service robotics, tele-surgery, and locomotion.

Rules & Requirements

Prerequisites: Electrical Engineering C106A/Bioengineering C125 or consent of the instructor

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructors: Bajcsy, Sastry

Also listed as: BIO ENG 125B

EL ENG 113 Power Electronics 4 Units
Power conversion circuits and techniques. Characterization and design of magnetic devices including transformers, reactors, and electromagnetic machinery. Characteristics of bipolar and MOS power semiconductor devices. Applications to motor control, switching power supplies, lighting, power systems, and other areas as appropriate.

Rules & Requirements

Prerequisites: 105 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 117 Electromagnetic Fields and Waves 4 Units
Review of static electric and magnetic fields and applications; Maxwell's equations; transmission lines; propagation and reflection of plane waves; introduction to guided waves, microwave networks, and radiation and antennas. Minilabs on statics, transmission lines, and waves.
Rules & Requirements

Prerequisites: 40, Mathematics 53, 54, knowledge of phasor analysis (e.g. as taught in 105)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 1.5 hours of laboratory per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Formerly known as: 117A-117B

EL ENG 118 Introduction to Optical Engineering 3 Units
Fundamental principles of optical systems. Geometrical optics and aberration theory. Stops and apertures, prisms, and mirrors. Diffraction and interference. Optical materials and coatings. Radiometry and photometry. Basic optical devices and the human eye. The design of optical systems. Lasers, fiber optics, and holography.
Rules & Requirements

Credit Restrictions: Students will receive no credit for Electrical Engineering 118 after taking Electrical Engineering 218A. A deficient grade in Electrical Engineering 119 may be removed by taking Electrical Engineering 118.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Waller

Formerly known as: Electrical Engineering 119

EL ENG 120 Signals and Systems 4 Units
Continuous and discrete-time transform analysis techniques with illustrative applications. Linear and time-invariant systems, transfer functions. Fourier series, Fourier transform, Laplace and Z-transforms. Sampling and reconstruction. Solution of differential and difference equations using transforms. Frequency response, Bode plots, stability analysis. Illustrated by analysis of communication systems and feedback control systems.
Rules & Requirements

Prerequisites: 20N, Mathematics 53, 54

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of lecture and 1 hour of recitation per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 121 Introduction to Digital Communication Systems 4 Units
Introduction to the basic principles of the design and analysis of modern digital communication systems. Topics include source coding, channel coding, baseband and passband modulation techniques, receiver design, and channel equalization. Applications to design of digital telephone modems, compact disks, and digital wireless communication systems. Concepts illustrated by a sequence of MATLAB exercises.
Rules & Requirements

Prerequisites: 120, 126

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 122 Introduction to Communication Networks 4 Units
This course focuses on the fundamentals of the wired and wireless communication networks. The course covers both the architectural principles for making these networks scalable and robust, as well as the key techniques essential for analyzing and designing them. The topics include graph theory, Markov chains, queuing, optimization techniques, the physical and link layers, switching, transport, cellular networks and Wi-Fi.
Rules & Requirements

Prerequisites: Computer Science 70. Computer Science 70

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 123 Digital Signal Processing 4 Units
Discrete time signals and systems: Fourier and Z transforms, DFT, 2-dimensional versions. Digital signal processing topics: flow graphs, realizations, FFT, chirp-Z algorithms, Hilbert transform relations, quantization effects, linear prediction. Digital filter design methods: windowing, frequency sampling, S-to-Z methods, frequency-transformation methods, optimization methods, 2-dimensional filter design.
Rules & Requirements

Prerequisites: 120

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 126 Probability and Random Processes 4 Units
This course covers the fundamentals of probability and random processes useful in fields such as networks, communication, signal processing, and control. Sample space, events, probability law. Conditional probability. Independence. Random variables. Distribution, density functions. Random vectors. Law of large numbers. Central limit theorem. Estimation and detection. Markov chains.
Rules & Requirements

Prerequisites: 20

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 127 Optimization Models in Engineering 4 Units
This course offers an introduction to optimization models and their applications, ranging from machine learning and statistics to decision-making and control, with emphasis on numerically tractable problems, such as linear or constrained least-squares optimization.
Rules & Requirements

Prerequisites: MATH 54 or equivalent or consent of instructor

Credit Restrictions: Students will receive no credit for Electrical Engineering 127 after taking Electrical Engineering 227A.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: El Ghaoui

EL ENG C128 Feedback Control Systems 4 Units
Analysis and synthesis of linear feedback control systems in transform and time domains. Control system design by root locus, frequency response, and state space methods. Applications to electro-mechanical and mechatronics systems.
Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Also listed as: MEC ENG C134

EL ENG 129 Neural and Nonlinear Information Processing 3 Units
Principles of massively parallel real-time computation, optimization, and information processing via nonlinear dynamics and analog VLSI neural networks, applications selected from image processing, pattern recognition, feature extraction, motion detection, data compression, secure communication, bionic eye, auto waves, and Turing patterns.
Rules & Requirements

Prerequisites: 120 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Chua

EL ENG 130 Integrated-Circuit Devices 4 Units
Overview of electronic properties of semiconductor. Metal-semiconductor contacts, pn junctions, bipolar transistors, and MOS field-effect transistors. Properties that are significant to device operation for integrated circuits. Silicon device fabrication technology.
Rules & Requirements

Prerequisites: 40 or 100

Credit Restrictions: Students will receive no credit for El Eng 130 after taking El Eng 230A.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 134 Fundamentals of Photovoltaic Devices 4 Units
This course is designed to give an introduction to, and overview of, the fundamentals of photovoltaic devices. Students will learn how solar cells work, understand the concepts and models of solar cell device physics, and formulate and solve relevant physical problems related to photovoltaic devices. Monocrystalline, thin film and third generation solar cells will be discussed and analyzed. Light management and economic considerations in a solar cell system will also be covered.
Rules & Requirements

Prerequisites: 40 or 100 or Engineering 45

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Arias

EL ENG 137A Introduction to Electric Power Systems 4 Units
Overview of conventional electric power conversion and delivery, emphasizing a systemic understanding of the electric grid with primary focus at the transmission level, aimed toward recognizing needs and opportunities for technological innovation. Topics include aspects of a.c. system design, electric generators, components of transmission and distribution systems, power flow analysis, system planning and operation, performance measures, and limitations of legacy technologies.
Rules & Requirements

Prerequisites: PHYSICS 7B; Electrical Engineering 40, 100, or Engineering 45; or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: von Meier

EL ENG 137B Introduction to Electric Power Systems 4 Units
Overview of recent and potential future evolution of electric power systems with focus on new and emerging technologies for power conversion and delivery, primarily at the distribution level. Topics include power electronics applications, solar and wind generation, distribution system design and operation, electric energy storage, information management and communications, demand response, and microgrids.
Rules & Requirements

Prerequisites: Electrical Engineering 137A or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: von Meier

EL ENG 140 Linear Integrated Circuits 4 Units
Single and multiple stage transistor amplifiers. Operational amplifiers. Feedback amplifiers, 2-port formulation, source, load, and feedback network loading. Frequency response of cascaded amplifiers, gain-bandwidth exchange, compensation, dominant pole techniques, root locus. Supply and temperature independent biasing and references. Selected applications of analog circuits such as analog-to-digital converters, switched capacitor filters, and comparators. Hardware laboratory and design project.
Rules & Requirements

Prerequisites: Electrical Engineering 105

Credit Restrictions: Students will receive no credit for El Eng 140 after taking El Eng 240A.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructors: Alon, Sanders

EL ENG 141 Introduction to Digital Integrated Circuits 4 Units
CMOS devices and deep sub-micron manufacturing technology. CMOS inverters and complex gates. Modeling of interconnect wires. Optimization of designs with respect to a number of metrics: cost, reliability, performance, and power dissipation. Sequential circuits, timing considerations, and clocking approaches. Design of large system blocks, including arithmetic, interconnect, memories, and programmable logic arrays. Introduction to design methodologies, including hands-on experience.
Rules & Requirements

Prerequisites: Electrical Engineering 40; Electrical Engineering 105 and Computer Science 150 recommended

Credit Restrictions: Students will receive no credit for Electrical Engineering 141 after taking Electrical Engineering 241A.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructors: Alon, Rabaey

EL ENG 142 Integrated Circuits for Communications 4 Units
Analysis and design of electronic circuits for communication systems, with an emphasis on integrated circuits for wireless communication systems. Analysis of noise and distortion in amplifiers with application to radio receiver design. Power amplifier design with application to wireless radio transmitters. Radio-frequency mixers, oscillators, phase-locked loops, modulators, and demodulators.
Rules & Requirements

Prerequisites: EL ENG 20 and El Eng 140

Credit Restrictions: Students will receive no credit for El Eng 142 after taking El Eng 242A.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 143 Microfabrication Technology 4 Units
Integrated circuit device fabrication and surface micromachining technology. Thermal oxidation, ion implantation, impurity diffusion, film deposition, expitaxy, lithography, etching, contacts and interconnections, and process integration issues. Device design and mask layout, relation between physical structure and electrical/mechanical performance. MOS transistors and poly-Si surface microstructures will be fabricated in the laboratory and evaluated.
Rules & Requirements

Prerequisites: 40 and PHYSICS 7B

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 144 Fundamental Algorithms for Systems Modeling, Analysis, and Optimization 4 Units
The modeling, analysis, and optimization of complex systems requires a range of algorithms and design software. This course reviews the fundamental techniques underlying the design methodology for complex systems, using integrated circuit design as example. Topics include design flows, discrete and continuous models and algorithms, and strategies for implementing algorithms efficiently and correctly in software. Laboratory assignments and a class project will expose students to state-of-the-art tools.
Rules & Requirements

Prerequisites: 20; Computer Science 70 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructors: Keutzer, Lee, Roychowdhury, Seshia

EL ENG C145B Medical Imaging Signals and Systems 4 Units
Biomedical imaging is a clinically important application of engineering, applied mathematics, physics, and medicine. In this course, we apply linear systems theory and basic physics to analyze X-ray imaging, computerized tomography, nuclear medicine, and MRI. We cover the basic physics and instrumentation that characterizes medical image as an ideal perfect-resolution image blurred by an impulse response. This material could prepare the student for a career in designing new medical imaging systems that reliably detect small tumors or infarcts.
Rules & Requirements

Prerequisites: Electrical Engineering 20 and Engineering 7 or equivalent; Knowledge of Matlab or linear algebra assumed

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Conolly

Also listed as: BIO ENG C165

EL ENG C145L Introductory Electronic Transducers Laboratory 3 Units
Laboratory exercises exploring a variety of electronic transducers for measuring physical quantities such as temperature, force, displacement, sound, light, ionic potential; the use of circuits for low-level differential amplification and analog signal processing; and the use of microcomputers for digital sampling and display. Lectures cover principles explored in the laboratory exercises; construction, response and signal to noise of electronic transducers and actuators; and design of circuits for sensing and controlling physical quantities.
Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Derenzo

Also listed as: BIO ENG C145L

EL ENG C145M Introductory Microcomputer Interfacing Laboratory 3 Units
Laboratory exercises constructing basic interfacing circuits and writing 20-100 line C programs for data acquisition, storage, analysis, display, and control. Use of the IBM PC with microprogrammable digital counter/timer, parallel I/O port. Circuit components include anti-aliasing filters, the S/H amplifier, A/D and D/A converters. Exercises include effects of aliasing in periodic sampling, fast Fourier transforms of basic waveforms, the use of the Hanning filter for leakage reduction, Fourier analysis of the human voice, digital filters, and control using Fourier deconvolution. Lectures cover principles explored in the lab exercises and design of microcomputer-based systems for data acquisitions, analysis and control.
Rules & Requirements

Prerequisites: 40, COMPSCI 61B or a working knowledge of ANSI C programming or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Derenzo

Also listed as: BIO ENG C145M

EL ENG C145O Laboratory in the Mechanics of Organisms 3 Units
Introduction to laboratory and field study of the biomechanics of animals and plants using fundamental biomechanical techniques and equipment. Course has a series of rotations involving students in experiments demonstrating how solid and fluid mechanics can be used to discover the way in which diverse organisms move and interact with their physical environment. The laboratories emphasize sampling methodology, experimental design, and statistical interpretation of results. Latter third of course devoted to independent research projects. Written reports and class presentation of project results are required.
Rules & Requirements

Prerequisites: Integrative Biology 135 or consent of instructor; for Electrical Engineering and Computer Science students, Electrical Engineering 105, 120 or Computer Science 184

Credit Restrictions: Students will receive no credit for C135L after taking 135L.

Hours & Format

Fall and/or spring: 15 weeks - 6 hours of laboratory, 1 hour of discussion, and 1 hour of fieldwork per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Formerly known as: Integrative Biology 135L

Also listed as: BIO ENG C136L/INTEGBI C135L

EL ENG 146L Application Specific Integrated Circuits Laboratory 2 Units
This is a lab course that covers the design of modern Application-Specific Integrated Circuits (ASICs). The labs lay the foundation of modern digital design by first setting-up the scripting and hardware description language base for specification of digital systems and interactions with tool flows. Software testing of digital designs is covered leading into a set of labs that cover the design flow. Digital synthesis, floorplanning, placement and routing are covered, as well as tools to evaluate design timing and power. Chip-level assembly is covered, instantiation of custom IP blocks: I/O pads, memories, PLLs, etc. The labs culminate with a project design – implementation of a 3-stage RISC-V processor with register file and caches.
Objectives & Outcomes

Course Objectives: This course is a one-time offering to supplement the CS150 course offered in the Fall 2014, with a lab and project section that cover the Application-Specific Integrated Circuit Design. The CS150 lectures in the Fall 2014 already covered the necessary lecture material, so students who took the CS150 lab in the Fall of 2014 will have a chance to expand their skills into the area of Application-Specific Integrated Circuit design.
Hence the pre-requisite for this course is that a student has taken the CS150 course in the Fall 2014.

Rules & Requirements

Prerequisites: Electrical Engineering 40; Electrical Engineering 105 recommended and Computer Science 150 (taken Fall 2014) - mandatory

Credit Restrictions: Students will receive no credit for Electrical Engineering 146L after taking Fall 2014 version of Electrical Engineering 141/241A.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Stojanovic

EL ENG 147 Introduction to Microelectromechanical Systems (MEMS) 3 Units
This course will teach fundamentals of micromachining and microfabrication techniques, including planar thin-film process technologies, photolithographic techniques, deposition and etching techniques, and the other technologies that are central to MEMS fabrication. It will pay special attention to teaching of fundamentals necessary for the design and analysis of devices and systems in mechanical, electrical, fluidic, and thermal energy/signal domains, and will teach basic techniques for multi-domain analysis. Fundamentals of sensing and transduction mechanisms including capacitive and piezoresistive techniques, and design and analysis of micmicromachined miniature sensors and actuators using these techniques will be covered.
Rules & Requirements

Prerequisites: Electrical Engineering 40 or 100 or consent of instructor

Credit Restrictions: Students will receive no credit for El Eng 147 after taking El Eng 247A.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructors: Maharbiz, Nguyen, Pister

EL ENG C149 Introduction to Embedded Systems 4 Units
This course introduces students to the basics of models, analysis tools, and control for embedded systems operating in real time. Students learn how to combine physical processes with computation. Topics include models of computation, control, analysis and verification, interfacing with the physical world, mapping to platforms, and distributed embedded systems. The course has a strong laboratory component, with emphasis on a semester-long sequence of projects.
Rules & Requirements

Prerequisites: 20N; Computer Science 61C; Computer Science 70 or Math 55

Credit Restrictions: Students will receive no credit for Electrical Engineering C149/Computer Science C149 after
taking Electrical Engineering C249M/Computer Science C249M. Students may remove a deficient grade in Electrical Engineering C149/Computer Science C149 after taking Electrical Engineering 124.

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructors: Lee, Seshia

Also listed as: COMPSCI C149

EL ENG 192 Mechatronic Design Laboratory 4 Units
Design project course, focusing on application of theoretical principles in electrical engineering to control of a small-scale system, such as a mobile robot. Small teams of students will design and construct a mechatronic system incorporating sensors, actuators, and intelligence.
Rules & Requirements

Prerequisites: 120, Computer Science 61B or 61C, 150 or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture and 10 hours of laboratory per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

Instructor: Fearing

EL ENG 194 Special Topics 1 - 4 Units
Topics will vary semester to semester. See the Electrical Engineering announcements.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG H196A Senior Honors Thesis Research 1 - 4 Units
Thesis work under the supervision of a faculty member. A minimum
of four units must be taken; the units may be distributed between one
and two semesters in any way. To obtain credit a satisfactory thesis
must be submitted at the end of the two semesters to the Electrical and
Engineering and Computer Science Department archive. Students who
complete four units and a thesis in one semester receive a letter grade
at the end of H196A. Students who do not, receive an IP in H196A and
must enroll in H196B.
Rules & Requirements

Prerequisites: Open only to students in the Electrical Engineering and
Computer Science honors program

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

Grading/Final exam status: Letter grade. This is part one of a year long
series course. A provisional grade of IP (in progress) will be applied and
later replaced with the final grade after completing part two of the series.
Final exam required.

EL ENG H196B Senior Honors Thesis Research 1 - 4 Units
Thesis work under the supervision of a faculty member. A minimum
of four units must be taken; the units may be distributed between one
and two semesters in any way. To obtain credit a satisfactory thesis
must be submitted at the end of the two semesters to the Electrical and
Engineering and Computer Science Department archive. Students who
complete four units and a thesis in one semester receive a letter grade
at the end of H196A. Students who do not, receive an IP in H196A and
must enroll in H196B.
Rules & Requirements

Prerequisites: Open only to students in the Electrical Engineering and
Computer Science honors program

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

Grading/Final exam status: Letter grade. This is part two of a year long
series course. Upon completion, the final grade will be applied to both
parts of the series. Final exam required.

EL ENG 197 Field Study 1 - 4 Units
Students take part in organized individual field sponsored programs with
off-campus companies or tutoring/mentoring relevant to specific aspects
and applications of computer science on or off campus. Note Summer
CPT or OPT students: written report required. Course does not count
toward major requirements, but will be counted in the cumulative units
toward graduation.
Rules & Requirements

Prerequisites: Consent of instructor (see department adviser)

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

Hours & Format

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

Summer:
6 weeks - 2.5-10 hours of fieldwork per week
8 weeks - 2-7.5 hours of fieldwork per week

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 198 Directed Group Study for Advanced Undergraduates 1 - 4
Units
Group study of selected topics in electrical engineering, usually relating to
new developments.
Rules & Requirements

Prerequisites: 2.0 GPA or better; 60 units completed

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

Hours & Format

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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

EL ENG 199 Supervised Independent Study 1 - 4 Units
Supervised independent study. Enrollment restrictions apply.
Rules & Requirements

Prerequisites: Consent of instructor and major adviser

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

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

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

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

Additional Details

Subject/Course Level: Electrical Engineering/Undergraduate

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