

semiconductor lasers, optoelectronic devices, native defects in semiconductors, low-dimensional quantum structures) *1

Sanjit K. Mitra, Ph.D., UC Berkeley, Professor Emeritus, (digital signal and image processing, computer-aided design and optimization)

Louise E. Moser, Ph.D., University of Wisconsin, Professor (distributed systems, computer networks, software engineering, fault-tolerance, formal specification and verification, performance evaluation)

Venkatesh Narayanamurti, Ph.D., Cornell University, Professor Emeritus (transport, semiconductor heterostructures, nanostructures, scanning tunneling microscopy and ballistic electron emission microscopy, phonon physics)

Pierre M. Petroff, Ph.D., UC Berkeley, Professor (self assembling nanostructures in semiconductors and ferromagnetic materials, spectroscopy of nanostructures, nanostructure devices, semiconductor device reliability) *1

Lawrence Rabiner, Ph.D., Massachusetts Institute of Technology, Distinguished Professor (digital signal processing: intelligent human-machine interaction, digital signal processing, speech processing and recognition; telecommunications)

John J. Shynk, Ph.D., Stanford University, Professor (adaptive filtering, array processing, wireless communications, blind equalization, neural networks)

John G. Skalnik, D. Eng., Yale University, Professor Emeritus (solar cells, general device technology, effects of non-ideal structures)

Pochi Yeh, Ph.D., California Institute of Technology, Professor (phase conjugation, nonlinear optics, dynamic holography, optical computing, optical interconnection, neural networks, and image processing)

*1 Joint appointment with Materials

*2 Joint appointment with Computer Science

Affiliated Faculty

Bassam Bamieh, Ph.D. (Mechanical Engineering)

Elizabeth Belding, Ph.D. (Computer Science)

Francesco Bullo, Ph.D. (Mechanical Engineering)

Ranjit Deshmukh, Ph.D. (Environmental Studies)

Yufei Ding, Ph.D. (Computer Science)

Miguel Eckstein, Ph.D. (Psychological & Brain Sciences)

Chandra Krintz, Ph.D. (Computer Science)

Eric McFarland, Ph.D., (Chemical Engineering)

Kunal Mukherjee, Ph.D. (Materials)

Shuji Nakamura, Ph.D. (Materials)

Tim Sherwood, Ph.D. (Computer Science)

William Wang, Ph.D. (Computer Science)

Electrical and Computer Engineering is a broad field encompassing many diverse areas such as computers and digital systems, control, communications, computer engineering, electronics, signal processing, electromagnetics, electro-optics, physics and fabrication of electronic and photonic devices. As in most areas of engineering, knowledge of mathematics and the natural sciences is combined with engineering fundamentals and applied to the theory, design, analysis, and implementation of devices and systems for the benefit of society.

The Department of Electrical and Computer Engineering offers programs leading to the degrees of bachelor of science in electrical engineering or bachelor of science in computer engineering. (Please see the "Computer Engineering" section for further information.) The undergraduate curriculum in electrical engineering is designed to provide students with a solid background in mathematics, physical sciences, and traditional electrical engineering topics as presented above. A wide range of program options, including computer engineering; microwaves; communications, control, and signal processing; and semiconductor devices and applications, is offered. The department's Electrical Engineering undergraduate program is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>. It is one of the degrees recognized in all fifty states as leading to eligibility for registration as a professional engineer.

The undergraduate major in Electrical Engineering prepares students for a wide range of positions in business, government, and private industrial research, development, and manufacturing organizations.

Students who complete a major in electrical engineering may be eligible to pursue a California teaching credential. Interested students should consult the credential advisor in the Graduate School of Education.

Under the direction of the Associate Dean for Undergraduate Studies, academic advising services are jointly provided by advisors in the College of Engineering, as well as advisors in the department. Students who plan to change to a major in the department should consult the ECE student office. Departmental faculty advisors are assigned to students to assist them in choosing senior elective courses.

Counseling is provided to graduate students through the ECE graduate advisor. Individual faculty members are also available for help in academic planning.

Mission Statement

The Department of Electrical and Computer Engineering seeks to provide a comprehensive, rigorous and accredited educational program for the graduates of California's high schools and for post-graduate students, both domestic and international. The department has a dual mission:

- **Education:** We will develop and produce excellent electrical and computer engineers who will support the high-tech economy of California and the nation. This mission requires that we offer a balanced and timely education that includes not only strength in the fundamental principles but also experience with the practical skills that are needed to contribute to the complex technological infrastructure of our society. This approach will enable each of our graduates to continue learning throughout an extended career.
- **Research:** We will develop relevant and innovative science and technology through our research that addresses the needs of industry, government and the scientific community. This technology can be transferred through our graduates, through industrial affiliations, and through publications and presentations.

We provide a faculty that is committed to education and research, is accessible to students, and is highly qualified in their areas of expertise.

Educational Objectives

The educational objectives of the Electrical Engineering Program identify what we hope that our graduates will accomplish within a few years after graduation.

1. We expect our graduates to make positive contributions to society in fields including, but not limited to, engineering.
2. We expect our graduates to have acquired the ability to be flexible and

adaptable, showing that their educational background has given them the foundation needed to remain effective, take on new responsibilities and assume leadership roles.

3. We expect some of our graduates to pursue their formal education further, including graduate study for master's and doctoral degrees.

Student Outcomes

Upon graduation, students from the EE program at UCSB are expected to have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Undergraduate Program

Bachelor of Science—Electrical Engineering

A minimum of 189 units is required for graduation. A complete list of requirements for the major can be found on page 52.

Schedules should be planned to meet both General Education and major requirements.

The department academic advisor can suggest a recommended study plan for electrical engineering freshmen and sophomores. Each student is assigned a departmental faculty advisor who must be consulted in planning the junior and senior year programs.

The required 32 units (8 courses) of departmental electives are taken primarily in the senior year, and they permit students to develop depth in specialty areas of their choice. The 32 units of departmental electives must include at least 2 sequences, one of which must be an approved EE Senior Capstone Design/Project course sequence. A student's elective course program must be approved by a departmental faculty advisor. The advisor will check the program to ensure satisfaction of the departmental requirements. A wide variety of elective programs will be considered acceptable.

Three matters should be noted: (1) students who fail to attain a grade-point average of at least 2.0 in the major may be denied the privilege of continuing in the major, (2) a large majority of electrical and computer engineering courses have prerequisites which must be completed successfully. Successful completion of prerequisite courses means receiving a grade of C- or better in prerequisite courses except for Mathematics 3A-B, Mathematics 4A-B and Mathematics 6A and 6B which require a grade of C or better to apply these courses as prerequisites, (3) courses required for the pre-major or major, inside or outside of the Department of Electrical Engineering, cannot be taken for the passed/not passed grading option. They must be taken for letter grades.

Bachelor of Science—Computer Engineering

This major is offered jointly by the Department of Computer Science and the Department of Electrical and Computer Engineering. For information about this major, see page 25.

Electrical & Computer Engineering Courses

Many of the ECE courses are restricted to ECE majors only. Instructor and quarter offered are subject to change.

LOWER DIVISION

1A. Computer Engineering Seminar

(1) STAFF

Prerequisite: Open to computer engineering majors only. Seminar: 1 hour

Introductory seminar to expose students to a broad range of topics in Computer Engineering.

1B. Ten Puzzling Problems in Computer Engineering

(1) PARHAMI

Prerequisite: Open to pre-computer engineering and

computer engineering majors only.

Not open for credit for those who have taken ECE 1

Gaining familiarity with, and motivation to study, the field of computer engineering, through puzzle-like problems that represent a range of challenges facing computer engineers in their daily problem-solving efforts and at the frontiers of research.

3. Introduction to Electrical Engineering

(4) STAFF

Prerequisites: Open to EE majors only. Lecture, 3 hours; laboratory, 2 hours

Introduction to fundamental design problems in Electrical Engineering through programming in Python. Includes basics of software engineering, algorithm design, data structures, with design problems derived from signals systems. Specific areas will include 1-D and 2-D signal processing, basic transforms and applications.

5. Introduction to Electrical & Computer Engineering

(4) STAFF

Prerequisite: Open only to Electrical Engineering and Computer Engineering majors. Lecture: 2 hours; Laboratory: 3 hours

Aims at exposing freshmen students to the different sub-fields within Electric and Computer Engineering. Composed of lectures by different faculty members and a weekly laboratory based on projects that are executed using the Arduino environment.

10A. Foundations of Analog and Digital Circuits & Systems

(3) STAFF

Prerequisites: Mathematics 2A-B or 3A-B or Mathematics 3AH-3BH, and Mathematics 3C or 4A or 4AI with a minimum grade of C; and, Math 4B or 4BI or 5A with a minimum grade of C (may be taken concurrently); Physics 3 or 23 (may be taken concurrently); open only to electrical engineering and computer engineering majors. Lecture: 3 hours

Not open for credit for those who have received a C- or higher in ECE 2A.

The objective of the course is to establish the foundations of analog and digital circuits. The course will introduce the student to the power of abstraction, resistive networks, network analysis, nonlinear analysis and the digital abstraction. (F)

10AL. Foundations of Analog and Digital Circuits and Systems Lab

(2) STAFF

Prerequisite: ECE 10A (may be taken concurrently) with a C- or better grade. Laboratory: 4 hours

Not open for credit for those who have received a C- or higher in ECE 2A.

The goal of 10AL is to provide the student with a hands-on application of the concepts discussed in ECE 10A. The lab will introduce the use of microcontrollers as a data acquisition system, network analysis, resistors, nonlinear analysis and digital abstraction.

10B. Foundations of Analog and Digital Circuits and Systems

(3) STAFF

Prerequisite: ECE 10A with a C- or better grade.

Lecture: 3 hours

Not open for credit for those who have received a C- or higher in ECE 2B.

The objective of the course is to introduce the MOSFET both as a simple digital switch and as controlled current source for analog design. The course will cover basic digital design, small-signal analysis, charge storage elements and operational amplifiers. (W)

10BL. Foundations of Analog and Digital Circuits and Systems Lab

(2) STAFF

Prerequisite: ECE 10B (may be taken concurrently) with a C- or better grade. Laboratory: 4 hours

Not open for credit for those who have received a C- or higher in ECE 2B.

The goal of 10BL is to provide the student with a hands-on application of the concepts discussed in ECE 10B. The lab will utilize the microcontroller to introduce students to the understanding of datasheets for both digital and analog circuits, single-stage