

Electrical and Computer Engineering

Department Head: Tamal Bose
Location: Engineering Laboratory 149
Phone: (435) 797-2840
FAX: (435) 797-3054
E-mail: info@ece.usu.edu
WWW: http://www.ece.usu.edu

Undergraduate Advisor: Kathleen E. Bayn, Engineering 310,
(435) 797-2705, kathy.bayn@usu.edu

Graduate Program Coordinator: Scott E. Budge,
Engineering Laboratory 113, (435) 797-3433,
scott.budge@ece.usu.edu

Degrees offered: Bachelor of Science (BS), Master of Engineering (ME), Master of Science (MS), Electrical Engineer (EE), and Doctor of Philosophy (PhD) in Electrical Engineering; BS in Computer Engineering

Graduate specializations: Communications, Microelectronics (VLSI), Microwaves, and Signal Processing

Undergraduate Programs

Department Mission Statement

The mission of the Electrical and Computer Engineering (ECE) Department is to develop students into outstanding electrical and computer engineers. The department is dedicated to superb teaching, research, and service.

Program Descriptions

The ECE Department offers a balanced curriculum of classwork, laboratory work, and design experiences to prepare students for careers as practicing engineers. The Bachelor of Science programs in Electrical Engineering and Computer Engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET). The research program of the department, which includes undergraduates as well as graduate students, is internationally acclaimed in the fields of aerospace instrumentation and measurements, image compression, communications, electromagnetics, controls, and robotics.

Electrical Engineering

The Electrical Engineering program is dedicated to producing engineers who: (1) contribute to engineering practice, advance engineering knowledge, and contribute to the good of society; (2) are advancing their education in engineering and other professions; and (3) take a leadership role in engineering and society.

Each student is given a solid foundation in electricity, electronics, signals, and systems, with individual practical experience. Upon this basic foundation the students then build expertise in advanced areas, stressing actual design practice, to prepare them for productive engineering careers. The specialty areas can be categorized into the following: analog and digital electronics, controls, signal processing, communications, and microwave engineering.

Computer Engineering

The Computer Engineering program is dedicated to producing engineers who: (1) apply fundamental principles to solve practical engineering problems; (2) are continually engaged in professional, personal, and community development; (3) are implementing well-planned, top-down designs of complex systems; and (4) function well as team members and interact well with other professionals and nonengineers.

Building on a solid curriculum in computing hardware and software, the program begins with a strong foundation in electricity, digital logic design, and computer science, then leads into advanced software engineering and microcomputer systems. Advanced courses provide experience in formal design methods, high-performance architectures, data communications, concurrent programming, and real-time and embedded systems. Students are also required to complete advanced course sequences in computer science.

Students in the BS programs in both electrical engineering and computer engineering are permitted and encouraged to take courses in the other program. Many courses, such as controls, digital signal processing, and robotics, draw heavily on skills in both areas.

Assessment

In addition to the regular national accreditation, the ECE Department employs a number of means to assess the quality of departmental programs. The primary indicator is the success of ECE graduates in obtaining professional employment. At several intervals following graduation, the department keeps track of student placement. Other major tools include annual quantitative assessment of program objectives, semi-annual reviews of the curriculum and facilities by the ECE Industrial Advisory Board, interviews of undergraduate and graduate students upon completion of their programs, regular monitoring of faculty members by peers, and periodic surveys of ECE graduates working in industry.

Requirements

Prior to entry into the upper-division classes, the student must meet the standards for entry into the Professional Engineering Program. Additional information concerning these items is given in the College of Engineering write-up (pages 107-109). It is the responsibility of students to be aware of these rules and procedures; however, advisor assistance is available.

Admission to Pre-Professional Program. Admission requirements for students desiring to major in Electrical Engineering or Computer Engineering are the same as those governing admission to the College of Engineering (see pages 107-109), *except* that students must also be “calculus ready.” That is, they must: (1) achieve a score of 27 or higher on the math ACT test; (2) complete MATH 1050 and 1060 *or* MATH 1210; or (3) achieve an AP score of at least 3 on the AB Calculus or BC Calculus test.

Bachelor of Science in Electrical Engineering. The program leading to a Bachelor of Science degree in electrical engineering is nominally a four-year program. The required program consists of a basic foundation of mathematics, science, computer science, engineering fundamentals, and laboratory and design experiences. Elective courses providing for one or more areas of technical specialization, communication skills, and University Studies complete the program and prepare students for productive and rewarding careers in the electrical engineering profession.

Bachelor of Science in Computer Engineering. The program leading to a Bachelor of Science in computer engineering is nominally a four-year program. The required program consists of a basic foundation of mathematics, science, computer science, engineering fundamentals, and laboratory and design experiences. Elective courses providing for one or more areas of technical specialization, communication skills, and University Studies complete the program and prepare students for productive and rewarding careers in the computer engineering profession.

Required Courses are shown in the accompanying paragraphs; however, because of differences in high school or transfer student preparation, it is strongly recommended that students meet with the college academic advisor to plan a detailed semester-by-semester schedule for completing the preprofessional requirements. Particular attention must be paid to course prerequisites, requiring some students to take longer than four semesters to complete the preprofessional program. Students transferring into the department should consult with the college academic advisor for transfer credit evaluation and proper placement in the curriculum.

AP and CLEP credit may be used to meet some of the required technical and University Studies courses. Details concerning courses acceptable as electives are available from the Electrical and Computer Engineering Department.

Electrical Engineering

Preprofessional Program

MATH 1210, 1220, 2210, 2250; CS 1700, 1720; ECE 1010, 2410, 2420, 2530, 2540; PHYX 2210, 2220; ENGL 2010.

Professional Program

MATH 5710; ECE 3410, 3420, 3620, 3640, 3710, 3820, 3870, 4310, 4840, 4850, 5530; Math/Science Elective; University Studies Breadth; Electrical Engineering Electives; Technical Electives; University Studies Depth

Computer Engineering

Preprofessional Program

MATH 1210, 1220, 2250, 3310; CS 1700, 1720, 2200, 2370; ECE 1010, 2410, 2420, 2530, 2540; PHYX 2210, 2220; ENGL 2010.

Professional Program

MATH 5710; CS 3100; ECE 3410, 3620, 3640, 3710, 3720, 3820, 3860, 4740, 4840, 4850, 5530; Math/Science Elective; University Studies Breadth; Computer Engineering Electives; Computer Science Electives; Technical Electives; University Studies Depth

Student Research Opportunities

Undergraduate students are extensively involved with research activities in the department. Electrical engineering majors and computer engineering majors have presented papers at research conferences and have won prizes. They have also designed satellites for deployment from the space shuttle. Electrical and Computer Engineering faculty members are dedicated to helping students and providing a challenging and interesting learning atmosphere. For additional information, see the *Research* section under *Graduate Programs* (page 189).

Financial Support

Scholarships, assistantships, grants-in-aid, and work-study programs are available through the University. In addition, the department employs undergraduate and graduate students to assist in engineering research and development.

Concurrent BS/Master’s Program

The concurrent BS/Master’s program allows engineering students to begin taking graduate-level classes during their senior year. This permits them to complete requirements for *both* the BS degree *and* the master’s degree concurrently during two years. Students in this program have a greater selection of graduate courses, since many graduate courses are taught during alternate years. In addition, the student’s senior design project could be a start for a graduate design project or thesis. After completing their BS degree, students in the program can earn a master’s degree in only one additional year. Both the BS and the master’s degree can generally be earned with 150 total credits, although students should note that a Plan C MS requires 3 extra credits. Finally, students with a master’s degree can expect a much higher starting salary following graduation. (For more information, see *College of Engineering* section of this catalog, page 109.)

Graduate Programs

Admission Requirements

See general admission requirements on pages 90-91. Applicants with a bachelor’s degree in Electrical or Computer Engineering from an ABET accredited program and having a 3.25 GPA or better can generally be admitted without restriction. Additional coursework in electrical and computer engineering fundamentals may be required in individual cases. Students must take the general GRE exam; however, the subject GRE is not required. All graduate students are expected to have a working knowledge of a computer language (preferably C).

Applications will be considered throughout the year. However, students desiring financial aid should submit application materials by December 15 to be considered for the following fall semester.

No applications will be considered until all required information arrives in the office of the School of Graduate Studies.

Degree Requirements

Specific requirements for the ME, MS, EE, and PhD degrees are outlined below; these are in addition to the general requirements of the School of Graduate Studies. All graduate degree programs in the ECE Department require a grade of *B-* or better in all courses applied toward the requirements listed below.

Master of Engineering (ME) and Master of Science (MS). The ME degree is based on coursework and is designed to give graduates a strong practical foundation. The MS degree requires substantial thesis or project work in a specific area and prepares students for advanced study or advanced work in that area. The MS degree has two options. Under Plan A, the student completes a thesis. Under Plan B, the student prepares an engineering project report.

If a student chooses an MS degree, changing to the ME degree is only possible by approval of the major professor, ECE graduate committee, and the department head.

The MS and ME degrees require successful completion of 30 credits of 5000-level or above coursework in a program approved by the student's supervisory committee, with the following stipulations:

Master of Science

1. At least 12 credits of ECE coursework must be completed at or above the 6000 level.
2. MS Plan A students must complete 6 credits of Thesis Research (ECE 6970).
3. MS Plan B students must complete 3 credits of Thesis Research (ECE 6970) and 3 credits of Design Project (ECE 6950).
4. MS students must have a one- to two-page, double-spaced thesis or project proposal approved by their committee when a project has been identified.

Master of Engineering

1. At least 18 credits of ECE coursework must be completed at or above the 6000 level.
2. At least two ECE courses with substantial lab components must be completed at or above the 5000 level.

All Master's Students

1. At least 3 credits of ECE coursework must be completed at the 7000 level.
2. One credit of ECE 6800 (Electrical Engineering Colloquium) must be completed as soon as possible.
3. Each master's student must form a committee and have a program of study approved by the end of his or her first semester.
4. No more than 10 credits of 5000-level coursework may be applied toward a master's degree.
5. Any exceptions to the master's requirements must be approved by the student's committee and the ECE Graduate Committee.

A course in technical and professional writing, or equivalent writing experience, is required for MS students prior to beginning the thesis. MS students may, at the discretion of their supervisors, be required to hire an editor to bring the thesis or paper into acceptable form.

Electrical Engineer. The Electrical Engineer degree is awarded for the successful completion of an advanced program of 60 credits of academic work beyond the BS, or 30 credits beyond the MS, and a comprehensive engineering report earning an additional 10 credits. The degree requirements are the same as those for the PhD listed below, except that the comprehensive examination need not be taken and the engineering report is given in lieu of the original research dissertation, reducing the total credits required for the PhD. The degree differs from the PhD by preparing the student for professional engineering work, rather than for research.

Doctor of Philosophy. The PhD is awarded for the successful completion of an advanced program of academic work and original research. A flexible program is planned individually by each candidate in consultation with his or her faculty supervisory committee.

The PhD program is expected to include 60 credits of coursework beyond the BS degree or 30 credits of coursework beyond the MS degree, plus 30 credits of dissertation research. The coursework generally represents two years of study beyond the MS degree, with up to 20 credits being taken outside the Electrical and Computer Engineering Department.

Once the student has completed at least 45 and not more than 60 graduate credits, he or she must pass a comprehensive examination based on graduate-level courses. Near the end of the program, the results of the original (publishable) research work will be presented and publicly defended as a dissertation.

Research

The department conducts extensive research through the following centers:

1. Center for Self-Organizing Intelligent Systems (CSOIS)
2. National Center for the Design of Molecular Function (NCDMF)
3. Space Dynamics Laboratory (SDL)
4. Anderson Center for Wireless Teaching and Research
5. Center for High-Speed Information Processing (CHIP)
6. Center for Advanced Imaging LADAR (CAIL)

Research activities include: robotics, control systems, digital system design, computer networks, concurrent systems, antennas, space systems, image processing, digital signal processing, wireless communications, acoustics, electromagnetic compatibility, and LADAR systems.

Financial Assistance

All applicants who are accepted academically are automatically considered for financial aid. Virtually all successful graduate students in the department do receive some level of financial aid during their degree program.

Electrical and Computer Engineering Faculty

Professors

Doran J. Baker, electromagnetics, infrared measurements, engineering systems in space

Tamal Bose, digital signal processing, communications

Joe R. Doupnik, communications, computers

H. Scott Hinton, photonic switching, Dean of College of Engineering

Todd K. Moon, communications and signal processing

Kevin L. Moore, controls

Linda S. Powers, biophysics, molecular engineering

Gardiner S. "Dyke" Stiles, concurrent systems

Adjunct Professor

Heng-Da Cheng, pattern recognition, image processing

Trustee Professor Emeritus

Kay D. Baker, electronics, space science

Professors Emeritus

Robert W. Gunderson, control systems, pattern recognition, robotics

Ronney D. Harris, microwaves, transmission line circuits, atmospheric modeling

William L. Jones, integrated circuits

Alan W. Shaw, electromagnetics, controls, microcomputers

Allan J. Steed, electro-optics, aerospace measurement systems

Ronald L. Thurgood, computers, database systems

Clair L. Wyatt, infrared, electro-optical systems

Associate Professors

Scott E. Budge, signal processing, image processing

Charles M. Swenson, space science and space engineering

Paul A. Wheeler, microprocessors, acoustics

Research Associate Professor

Paul D. Israelsen, integrative services, digital systems design

Adjunct Associate Professors

John C. Kemp, robotics, electro-optics

Tsung-Cheng Shen, physics

Gene A. Ware, computer systems

Associate Professor Emeritus

Duane G. Chadwick, remote sensors, instrumentation

Assistant Professors

Matthew D. Berkemeier, computers, robotics, controls

Annette Bunker, computer engineering

Yangquan Chen, control systems

Jacob H. Gunther, communications and signal processing

Randy J. Jost, electromagnetics, microwave engineering, solid state electronics

George K. Liang, electromagnetics

Michael W. Tompkins, space engineering

Research Assistant Professor

Hui Fang Dou, precision instruments, mechatronics

Adjunct Research Assistant Professor

Steven R. Wassom, controls

Adjunct Assistant Professor

Charles R. Tolle, controls

Course Descriptions

Electrical and Computer Engineering (ECE), pages 375-379