

ELECTRICAL AND COMPUTER ENGINEERING

The School of Electrical and Computer Engineering is highly recognized throughout the nation for its student-centered, laboratory intensive curriculum. It is a partner of choice for employers seeking well-educated, highly-motivated and uniquely creative college graduates dedicated to life-long learning. The School has devoted professors who serve, instruct and mentor undergraduate and graduate students pursuing Bachelor of Science (BS), Master of Engineering (MEng), Master of Science (MS), or Doctorate (PhD) degrees in electrical engineering (EE) or a BS degree in computer engineering (CpE). The Bachelor of Science in Electrical Engineering degree program (BSEE) and the Bachelor of Science in Computer Engineering degree program (BSCpE) are accredited by the Engineering Accreditation Commission of ABET, www.abet.org/ (<https://www.abet.org/>).

Electrical engineers and computer engineers have been at the center of the technological revolution that has occurred over the past 100 years. Marvels such as the transistor, radio, telephone, television, internet, microprocessor, computer, tablet, radar system, motor, wind generator, GPS, smart phone, laser, microwave oven, electric car, pacemaker, antenna, and the flat panel display, to name only a handful, have resulted from the hard work and creative talents of electrical engineers and computer engineers. And since electricity and computers are essential in a modern society, the electrical engineer and the computer engineer will always be in high demand.

Electrical engineering encompasses many exciting subdisciplines including energy systems, machines, power electronics, analog electronics, digital electronics, mixed-signal electronics, VLSI chips, instrumentation, sensors, signal processing, machine vision, artificial intelligence, communications, control systems, robotics, wireless devices, electromagnetic fields, photonics, embedded controllers, networking, software development, biomedical devices and computer architecture. The School encompasses all of these subdisciplines in its curriculum or research activities.

Computer Engineering is a relatively young engineering discipline that combines a strong foundation of electrical engineering with elements of computer science, including hardware and software integration, and design. Computer engineering includes digital logic design, computer architecture, digital data communications, computer and sensor interfacing, microprocessors, digital control, VLSI circuits and systems, operating and software systems, and computer arithmetic.

Beyond creating technology, electrical engineers and computer engineers of tomorrow must be aware of the social, economic, ethical and environmental impact of their respective technologies. They must also communicate effectively, possess excellent teamwork skills, and understand, perform and complete the process of engineering design. The undergraduate programs in electrical engineering and computer engineering at Oklahoma State University equip graduates with these critical skills.

Undergraduate Program Educational Objectives

The BSEE and BSCpE Educational Objectives reflect the aspirational expectations for our electrical engineering and computer engineering graduates after they enter their professional careers. Specifically:

- Our Graduates will be widely employed across the range of subdisciplines within electrical engineering and computer engineering, and will be highly sought after by industrial, academic, non-profit and governmental organizations.
- Our Graduates will compete in a technologically changing world, collaborate in a diverse workforce, and communicate effectively their knowledge and ideas to colleagues, employers, customers and stakeholders.
- Our Graduates will be recognized leaders, team players, problem solvers, innovators and entrepreneurs in their profession.
- Our Graduates will identify and contribute to solving grand-challenge problems that improve the lives of people in Oklahoma, the United States, and around the world, serving their communities and their profession to produce a lasting, significant and positive impact.
- Our Graduates will abide by the highest ethical standards of professional practice in a technologically changing, professional environment.
- Our Graduates will continue to develop professionally throughout their lives by being adaptive learners with a never ending desire to assimilate new knowledge and embrace new technologies.
- Our Graduates will have the knowledge to earn professional registration or certification in their field or earn an advanced post-graduate or professional degree should they choose.
- Our Graduates will make a positive difference in the world.

Undergraduate Program and Student Learning Outcomes

To support the aforementioned Program Educational Objectives, the School has established Student Learning Outcomes that are regularly assessed and expected of all students upon completion of their chosen program in Electrical Engineering or Computer Engineering. Attainment of the following outcomes prepares graduates to enter the professional practice of engineering:

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 judgments, 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 provide leadership, 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 judgment to draw conclusions;

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The undergraduate electrical engineering and computer engineering programs at Oklahoma State University prepare each graduate for a life-long professional career. During the first two years of study, students complete a carefully designed set of lower-division courses in the areas of electrical engineering, computer engineering, computer science, mathematics, physics, chemistry, humanities, and social sciences. After successfully completing these courses, students enroll in both required and elective upper-division courses in electrical engineering and computer engineering.

Electrical engineering and computer engineering students obtain fundamental knowledge and technical skills needed by tomorrow's professionals. Students pursuing a degree in Electrical Engineering are required prior to graduation to have taken a set of area courses in a single area in ECEN. These areas include a) control systems, digital signal processing, and communication systems, b) energy and power, c) computer systems and digital electronics, d) analog electronics, and e) microwaves and photonics. Students pursuing a degree in Computer Engineering are required to take specialized computer engineering courses dealing with microcontrollers, embedded controllers, robotics, computer architecture, discrete mathematics, digital logic design, networking, programming, coding, computing and digital electronics.

Instructional laboratories are a central part of the undergraduate curriculum to provide opportunities for hands-on experience in areas such as microcomputers, digital logic design, electronics, networks, instrumentation, optics, real-time digital signal processing, communications and electromagnetics. These laboratories are located in the College of Engineering, Architecture and Technology's new 70,000 ft² teaching facility, Endeavor, and are equipped with state-of-the-art, industrial-grade equipment.

Engineering design laboratories require students to solve open-ended, practical problems in a manner that demonstrate the students' ability to apply fundamental concepts, creativity and imagination. These problems have several possible outcomes; students must choose an acceptable approach and demonstrate that the optimal outcome has been met.

All electrical engineering and computer engineering students receive multiple engineering design experiences. The capstone design experience is a two-course sequence typically taken during the students' last two semesters of the BS program. The capstone experience gives students an opportunity to apply and demonstrate the skills that they have developed throughout the program. These design courses integrate theory, analysis, simulation, design and experimental skills to achieve a specific design outcome. Teamwork, communication skills, and the complete engineering design process—from problem definition to prototype that includes both presentation and documentation—are emphasized.

Student design teams receive individual project mentoring from an appropriate faculty member who provides project management advice and supervision. The capstone experience concludes with a formal public design demonstration, oral presentation and written report.

Degree Programs and Options

The School of Electrical and Computer Engineering (ECEN) offers a full range of undergraduate and graduate program choices that allow

students to excel in their careers. Specifically, the School of Electrical and Computer Engineering offers five degrees:

- Bachelor of Science in Electrical Engineering (BSEE)
- Bachelor of Science in Computer Engineering (BSCpE)
- Master of Engineering in Electrical Engineering (MEngEE, non-thesis)
- Master of Science in Electrical Engineering (MSEE, thesis)
- Doctor of Philosophy in Electrical Engineering (PhDEE)

Bachelor of Science:

- This degree program is designed to provide fundamental scientific and mathematical knowledge needed for an engineering education and an entry-level engineering career.
- Broad-based and in-depth technical courses are provided to teach the fundamentals of the electrical engineering and computer engineering professions.
- The degree focuses on analysis and design methods, laboratory and simulation experiences, and theoretical and practical problems.
- Requirements: 124 credits hours (BSEE) and 125 credit hours (BSCpE).

Master of Engineering:

- This degree program is tailored to students who wish to gain advanced knowledge and expertise in subject areas associated with their professional pursuits.
- This non-research, non-thesis instructional program is ideal for Distance Education students or for baccalaureate graduates interested in professional development.
- This program is available online.
- Requirements: 33 credit hours of coursework. Specific requirements for the MEngEE program are available on the web in the document entitled "Memorandum to Graduate Students"; see <https://ece.okstate.edu/>.

Master of Science:

- This degree program is tailored to students who wish to gain advanced knowledge in subject areas associated with their professional pursuits.
- The program emphasizes research as part of the learning experience and culminates with the defense of a thesis.
- This program is ideal for students who wish to pursue a PhD.
- This program is available online.
- Requirements: 24 credit hours of coursework and 6 credit hours of thesis research. Specific requirements for the MSEE program are available on the web in the document entitled "Memorandum to Graduate Students;" see <https://ece.okstate.edu/>.

Doctor of Philosophy:

- This degree program is tailored to students who desire to have a teaching and research career in academia or a research career in industry or government laboratories.
- This program is ideal for those students who have a passion to acquire in-depth knowledge.
- The program emphasizes the creation of new knowledge during the research process, the publication of that knowledge, and the defense of a dissertation.

- Requirements: 73 total credit hours beyond the BSEE/BSCpE degree. Specific requirements for the PhD program are available on the web in the document entitled "Memorandum to Graduate Students;" see <https://ece.okstate.edu/>.

Options: Students are also given the option to combine degrees to take advantage of common courses between various degrees, thereby reducing the total number of credit hours relative to non-combining options. These combining options are highly attractive from a financial and career point of view. That is, these options are less expensive and take less time. Knowledge gained in these degree programs adds value to what the student can do once or while employed. The current combining options are:

- Dual BSEE and BSCpE degrees (137 credit hours)
- Joint "4+1" BSEE/BSCpE plus MEngEE degrees (148/149 credit hours)

With effective planning, the dual BSEE and BSCpE program can be completed in four years by taking approximately 17 credit hours of courses each semester. It may take less time if students have Advanced Placement credit hours. This dual degree program allows a student to have a true comprehensive education across the electrical and computer engineering spectrum, thus preparing the student for just about any entry-level career in electrical engineering or computer engineering. The program effectively requires the completion of the BSCpE degree plus 12 additional credit hours in non-computer, electrical engineering courses. An advising sheet for the dual program is posted on the School's web page; <https://ece.okstate.edu/>. This sheet has been devised to assure that the degree requirements for both the BSCpE and BSEE degrees are satisfied in the most expeditious manner.

The "4+1" program—available only to OSU baccalaureate students—is a five-year accelerated program that combines the BSEE or BSCpE degree with the M.Eng.EE degree. It is designed to give students a broad-based undergraduate education in electrical engineering or computer engineering along with a highly in-depth graduate education in a few key areas. This program is ideal for those students who want advanced knowledge to enhance their competitiveness in the work force and to satisfy their longing for in-depth knowledge that cannot be obtained in the baccalaureate degrees. Specific requirements for the "4+1" program are available on the web in the document entitled "Memorandum to Graduate Students;" see <https://ece.okstate.edu/>.

ECEN has submitted a new Option in Software Engineering as part of the Computer Engineering degree for approval in fall 2021. As the title suggests the option emphasizes software solutions in the context of computer engineering applications with a focus on the software-hardware interface. A total of 128 credit hours (i.e., 3 credit hours beyond the CpE degree) is required to complete this option. Of those 128 credit hours, 12 credit hours of software specific courses, as approved and listed by the School, must be completed.

A degree in electrical engineering or computer engineering is an excellent foundation for other professional fields such as medicine and law. Many graduates also pursue advanced programs in business and management after earning a degree in engineering.

Courses

ECEN 2011 Experimental Methods I

Prerequisites: PHYS 2114 with a "C" or better or concurrent enrollment advisor permission required.

Description: Laboratory associated with ECEN 2714 taken mostly by transfer students who have completed a similar course as ECEN 2714 without the accompanying laboratory. Previously offered as ECEN 3013.

Credit hours: 1

Contact hours: Lab: 2 Contact: 2

Levels: Undergraduate

Schedule types: Lab

Department/School: Elec & Computer Engr

ECEN 2714 Fundamentals of Electric Circuits

Prerequisites: MATH 2153 with a "C" or better and (PHYS 2114 and MATH 2233 with a "C" or better or concurrent enrollment).

Description: Circuit analysis techniques including equivalent networks and mesh/node formulation of network equations; operational amplifiers; RL, RC and RLC transient and steady-state circuit analysis; energy and power; electrical measurements and instrumentation.

Credit hours: 4

Contact hours: Lecture: 3 Lab: 2 Contact: 5

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Elec & Computer Engr

ECEN 3020 Supervised Research Project

Prerequisites: Consent of instructor and ECEN department head.

Description: Supervised research project for qualified students. May be repeated no more than three times for a total of three credit hours. Offered for variable credit, 1-3 credit hours, maximum of 3 credit hours.

Credit hours: 1

Contact hours: Contact: 1 Other: 1

Levels: Undergraduate

Schedule types: Independent Study

Department/School: Elec & Computer Engr

ECEN 3113 Energy, Environment and Economics

Prerequisites: ECEN 3714 with a "C" or better.

Description: Topics relevant to understanding the close relationship between energy use, its impact on the environment, and overall economic implications. Green energy technologies (wind, solar, hydro) will be considered along with conventional techniques. Both conventional and non-conventional energy technologies will be discussed.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 3213 Computer Based Systems in Engineering

Prerequisites: CS 2433 with a "C" or better.

Description: A comprehensive introduction to technology and applications of microprocessors. Topics include computer hardware, software, programming, computation, interfacing, I/O, communication, data acquisition, data representation, and numerical analysis.

Applications of general-purpose and application-specific processors in various disciplines of engineering and engineering problem solving. Previously offered as ENSC 3213.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2 Contact: 4

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Elec & Computer Engr

ECEN 3233 Digital Logic Design

Description: Boolean algebra, optimization of logic networks. Design using SSI, and MSI, LSI components. ROM and PLA applications.

Analysis and design of clock sequential logic networks. Flip-flops, counters, registers. Asynchronous circuit design and analysis. Laboratory experience in implementing combinational and sequential logic devices.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2 Contact: 4

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Elec & Computer Engr

ECEN 3314 Electronic Devices and Applications

Prerequisites: ECEN 3714 and ENSC 2611 with a "C" or better and (PHYS 3313 or ECEN 3903 with a "C" or better).

Description: Semiconductor electronic components including MOSFETs, BJTs, JFETs, and OpAmps. Emphasis on device models and use of solid state electronic devices to analyze, synthesize and design amplifiers and switching circuits. SPICE simulations are extensively utilized. Basic building blocks for analog and digital applications. Theoretical concepts and methods are demonstrated and reinforced through laboratory exercises. Course previously offered as ECEN 3313.

Credit hours: 4

Contact hours: Lecture: 3 Lab: 2 Contact: 5

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Elec & Computer Engr

ECEN 3513 Signal Analysis

Prerequisites: ECEN 3714 with a "C" or better.

Description: Deterministic signals. Fourier series and Fourier transforms. Impulse response, convolution and correlation. Sampling theorem. Analog modulation techniques.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 3613 Applied Fields and Waves I

Prerequisites: MATH 2163 and ECEN 3714 with a "C" or better.

Description: Circuit model of transmission lines, wave propagation, energy transfer, impedance mismatch, and transients. Field analysis of voltage, current, resistance, capacitance, and inductance. Coupled circuits.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 3623 Applied Fields and Waves II

Prerequisites: ECEN 3613.

Description: Continuation of ECEN 3613. Plane-wave propagation in free space, power flow, reflection and transmission. Guided waves and resonators. Radiation and introduction to antenna systems. Boundary value problem analysis.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 3714 Network Analysis

Prerequisites: MATH 2233 and ECEN 2714 and PHYS 2114 with a grade of "C" or better.

Description: Advanced mathematical analysis techniques used in circuit analysis including Laplace transforms, Fourier transforms, and Fourier series. Circuit frequency response, Bode plots, and filters, including passive, active, low-pass, high-pass, and band-pass filters. Theory of linear circuits; two-port circuit models and parameters. Course previously offered as ECEN 3713.

Credit hours: 4

Contact hours: Lecture: 3 Lab: 2 Contact: 5

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Elec & Computer Engr

ECEN 3723 Systems I

Prerequisites: ENSC 3714 and ENSC 2113 with a "C" or better and (MATH 3013 with a "C" or better or concurrent enrollment).

Description: Physical and mathematical modeling of electrical and mechanical dynamic systems. Transient response of first and second order systems. Laplace transform techniques for solving differential equations, transfer functions, frequency response and resonance. Course previously offered as ECEN 3413.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 3903 Introduction to Semiconductor Devices

Prerequisites: PHYS 2114 with a "C" or better.

Description: Crystal structure, the quantum theory of solids. The physics of semiconductor materials and the p-n junction, with an emphasis on applications to semiconductor devices. Same course as PHYS 3313.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 3913 Solid State Electronic Devices

Prerequisites: ECEN 3714 with a "C" or better and (PHYS 3313 or ECEN 3903 with a "C" or better).

Description: Solid state physics basis of modern electronic devices. Introductory quantum mechanics. Energy bands in solids. Electronic properties of semiconductors. Junction diodes. Bipolar transistors. Field effect transistor.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4010 Special Topics

Prerequisites: ECEN 3233, and (ECEN 3213 or ENSC 3213) and ECEN 3714 with a "C" or better or advisor permission.

Description: Engineering topics not normally included in existing courses. Repeat credit may be earned with different course subtitles assigned. Offered for variable credit, 1-12 credit hours, maximum of 12 credit hours.

Credit hours: 1-12

Contact hours: Contact: 1-12 Other: 1-12

Levels: Undergraduate

Schedule types: Independent Study

Department/School: Elec & Computer Engr

ECEN 4013 Design of Engineering Systems

Prerequisites: (ECEN 3213 or ENSC 3213), ECEN 3233, and ECEN 3714 with a grade of "C" or better and ECEN 3613, ECEN 3513, ECEN 3314 and (ENGL 3323 with a grade of "C" or better or concurrent enrollment).

Description: Complete design cycle for several small design projects, each including establishing objectives, synthesis, analysis, construction, testing and evaluation. Use of modern lab equipment and fabrication techniques. Development of communication skills.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2 Contact: 4

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Elec & Computer Engr

ECEN 4024 Capstone Design

Prerequisites: ECEN 4013.

Description: Continuation of ECEN 4013. Student project teams design, build, test and present results for realistic projects from university and industrial sponsors. Formulation of specifications, consideration of alternative solutions, feasibility considerations, detailed system descriptions, economic factors, safety, reliability, aesthetics, ethics and social impact. Course previously offered as ECEN 4023.

Credit hours: 4

Contact hours: Lab: 8 Contact: 8

Levels: Undergraduate

Schedule types: Lab

Department/School: Elec & Computer Engr

ECEN 4030 Undergraduate Professional Practice

Prerequisites: Approval of ECEN department head.

Description: Experience in application of electrical engineering principles to typical problems encountered in industry. Solutions to the problems by student participation in the role of engineer or engineering intern. Offered for variable credit, 1-8 credit hours, maximum of 8 credit hours.

Credit hours: 1-8

Contact hours: Contact: 1-8 Other: 1-8

Levels: Undergraduate

Schedule types: Independent Study

Department/School: Elec & Computer Engr

ECEN 4133 Power Electronics

Prerequisites: ECEN 3714 with a grade of "C" or better.

Description: Power electronic devices, components, and their characteristics; DC to AC conversion; fundamentals of inverters and waveshaping devices; application aspects; control aspects; characteristics and state-of-the-art of advanced power inverter and power conditioning topologies.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4153 Power System Analysis and Design

Prerequisites: ECEN 3714, "C" or better.

Description: Power system component models from circuit theory. Formulation and design of the load flow model and the optimum economic generator allocation problem utilizing computer methods.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4213 Embedded Computer Systems Design

Prerequisites: (ECEN 3213 or ENSC 3213), ECEN 3233 and ECEN 3714 with a "C" or better.

Description: Design of microprocessor-based systems through proper integration of hardware and software. Serial and parallel communications, sensor interfacing, computer control of external devices, and color graphics hardware. Design of PASCAL and assembly language modules for optimum real-time system performance.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2 Contact: 4

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Elec & Computer Engr

ECEN 4233 High Speed Computer Arithmetic

Prerequisites: ECEN 3233, (ECEN 3213 or ENSC 3213) and ECEN 3714 with a "C" or better.

Description: Course covers computer arithmetic as applied to general purpose and application-specific processors. Focus is on developing high-speed arithmetic algorithms and understanding their implementation in VLSI technology at the gate level.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4243 Computer Architecture

Prerequisites: (ECEN 3213 or ENSC 3213), ECEN 3233, and ECEN 3714 with a "C" or better.

Description: Functional organization and hardware design of digital computer systems with emphasis on microprocessor-based systems. CPU organization, features of microprocessors including advanced 32-bit CPU's, memory system design including cache, virtual memory, error detection and correction, I/O operations, including direct memory access and peripheral interface design.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2 Contact: 4

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Elec & Computer Engr

ECEN 4273 Software Engineering

Prerequisites: (ECEN 3213 or ENSC 3213), ECEN 3233, CS 3653, and ECEN 3714 with a "C" or better.

Description: Functional organization and hardware design of digital computer systems with emphasis on microprocessor-based systems. CPU organization, features of microprocessors including advanced 32-bit CPU's memory system design including cache, virtual memory, error detection and correction, I/O operations, including direct memory access and peripheral interface design. Same course as CS 4273.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4283 Computer Networks

Prerequisites: (ECEN 3213 or ENSC 3213), ECEN 3233 and ECEN 3714 with a "C" or better.

Description: Computer networks, distributed systems and their systematic design. Introduction to the use, structure, and architecture of computer networks. Networking experiments to describe network topology. ISO reference model. Same course as CS 4283.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4303 Digital Integrated Circuit Design

Prerequisites: ECEN 3314 and (ECEN 3233 with a "C" or better).

Description: Theory of digital and electronics circuits. Digital logic families TTL, IIL, ECL, NMOS, CMOS, GaAs. Large signal models for transistors. Implementation at RAM and ROM. Circuit design for LSI and VLSI.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4313 Linear Electronics Circuit Design

Prerequisites: ECEN 3314.

Description: Overview of semiconductor device physics (MOSFETs and BJTs) and integrated-circuit design environment. Building blocks for analog systems (differential amplifiers, operational amplifiers, output stages, and voltage references). Understanding of frequency response (Bode plot, transfer function, pole-zero analysis, feedback, and stability). Extensive SPICE-based design for performance optimization and design tradeoffs.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4353 Communication Electronics

Prerequisites: ECEN 3314.

Description: Introduction to radio-frequency (RF) communication systems with a primary focus on transistor- and circuit-level analysis. Investigations of RF system properties (noise, linearity, and matching) modulation schemes, and transceiver architectures. Operation principles and basic design of low-noise amplifiers, mixers, power amplifiers, and oscillators.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4413 Automatic Control Systems

Prerequisites: ECEN 3723 or (MAE 3723 or MAE 3724).

Description: Properties of feedback control systems, mathematical models of basic components, state-variable models of feedback systems, time-domain analysis, stability, transform analysis, frequency domain techniques, root-locus design of single input single output systems and simple compensation techniques. Same course as MAE 4053.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4503 Random Signals and Noise

Prerequisites: ECEN 3513.

Description: Elementary concepts of probability, random variables. Random distributions and density functions. Operations on random variables such as expiration, variance and moments. Pairs of random variables. Introduction to random process. Applications on probability theory to practical problems and analysis of electrical systems using elementary concepts of probability.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 4523 Communication Theory**Prerequisites:** ECEN 4503.**Description:** Noise in modulation systems. Digital data transmission. Design of optimal receivers. Introduction to information theory.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 4533 Data Communications****Prerequisites:** ECEN 4503 prerequisite or concurrent enrollment.**Description:** Signal detection in noise. Tradeoffs between bandwidth signal-to-noise ratio and rate of information transfer. Transmission multiplexing and error handling. Elements of computer network design. Data link protocols.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 4613 Microwave Engineering****Prerequisites:** ECEN 3613.**Description:** Review of EM and transmission line theory. Microwave network theory: Impedance and admittance matrices, scattering matrix and S-parameters, ABCD and transfer matrices. Signal-flow diagrams. Matching circuits and microwave filters. Passive microwave devices: power dividers, hybrids, couplers, resonators, isolators, and circulators. Class projects such as radar, communication, imaging, or sensing systems.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 4743 Introduction to Biomedical Engineering Modeling and Systems****Prerequisites:** ECEN 4763.**Description:** An overview of the field of biomedical engineering and an introduction of the modeling approaches implemented in biomedical engineering. Topics include bio-electronics, biomechanics, compartmental modeling, bio-signal processing, biomedical optics, etc. The course will demonstrate a few of major fields of activity in which biomedical engineers are engaged and modeling approaches are implemented.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 4763 Introduction to Digital Signal Processing****Prerequisites:** ECEN 3513.**Description:** Introduction to discrete linear systems using difference equations and z-transforms. Discrete Fourier analysis. Design of digital filters. Sampling theorem. Applications of digital signal processing.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 4773 Real Time Digital Signal Processing****Prerequisites:** ECEN 4763.**Description:** DSP Processor architectures and programming. A/D, D/A, polled and interrupt-driven I/O. Realtime implementation of FIR/IIR filters, the FFT, and other DSP algorithms on special purpose DSP hardware from Motorola, Texas Instruments and others. Link between DSP theory and practical implementation.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 4823 Design of Optical Systems****Prerequisites:** ECEN 3714 with a "C" or better.**Description:** Introduction to optics through the design, construction, and characterization of optical systems. Emphasis on geometrical optics and spectroscopy. Course previously offered as ECEN 3813.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 2 Contact: 4**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Elec & Computer Engr**ECEN 4843 Design of Lasers and Systems****Prerequisites:** ECEN 3613.**Description:** Introduction of the design of lasers and optical systems based on lasers including the design, construction, and characterization of lasers. Gaussian beams and optics, laser gain materials, laser cavities, advanced topics. Course previously offered as ECEN 4813.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 2 Contact: 4**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Elec & Computer Engr**ECEN 5000 Thesis****Description:** A student studying for the master's degree will enroll in this course for a maximum of six credit hours. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Contact: 1-6 Other: 1-6**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Elec & Computer Engr**ECEN 5030 Professional Practice****Description:** Experience in application of electrical engineering principles to typical problems encountered in industry and government engineering design and development projects. Solutions to the problems require participation by the student in the role of junior engineer or engineer-intern. Problem solutions involve economics and ecological considerations as well as technology and must be adequately documented. Offered for variable credit, 1-8 credit hours, maximum of 8 credit hours.**Credit hours:** 1-8**Contact hours:** Contact: 1-8 Other: 1-8**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Elec & Computer Engr

ECEN 5060 Special Topics**Prerequisites:** Advisor permission.**Description:** Engineering topics not normally included in existing courses.

Repeat credit may be earned with different course subtitles assigned.

Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.

Credit hours: 1-6**Contact hours:** Contact: 1-6 Other: 1-6**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Elec & Computer Engr**ECEN 5070 Directed Studies****Prerequisites:** Consent of instructor.**Description:** Investigation outside of the classroom of topics not normally

covered in lecture courses. Offered for variable credit, 1-6 credit hours,

maximum of 6 credit hours.

Credit hours: 1-6**Contact hours:** Contact: 1-6 Other: 1-6**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Elec & Computer Engr**ECEN 5080 Fundamental Topics****Prerequisites:** Advisor permission.**Description:** Fundamental topics that are typically introduced in the senior year curriculum with additional depth and breadth commensurate with the graduate program. Repeat credit may be earned with difference course subtitles assigned. Offered for variable credit, 1-6 credit hours,

maximum of 9 credit hours.

Credit hours: 1-6**Contact hours:** Lecture: 1-6 Contact: 1-6**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5113 Power Systems Analysis by Computer Methods****Description:** Quasi-static control of power systems and analysis of power systems under abnormal operating conditions. Transient stability studies. Models formulated and solutions outlined for implementation on the computer.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5123 Engineering Systems Reliability Evaluation****Description:** Techniques and concepts needed for evaluating the long-term and short-term reliability of a system. Topics include static and spinning generation capacity; transmission, composite, interconnected, and dc system reliability evaluations; and power system security. Applications to systems other than power systems included. For students with little or no background in probability or statistics.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5133 Power Electronics and Renewables****Description:** Modeling and control aspects of power electronics for integrating renewable energy systems. Topics covered here will focus on power converter dynamics, indirect converter topologies, PWM technique, sliding mode control of converters, game theory based control, Maximum power point tracking, control of generators for different renewable energy systems. Simulation tools will be discussed as appropriate.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5153 Direct Energy Conversion****Description:** Energy conversion techniques and applications; thermo-electrics, thermionics, fuel cells, MHD and other processes involving electrical, mechanical and thermal energies. State-of-the-art developments in direct energy conversion using selected papers from journals and other publications. Gives the student a proper perspective of the possibilities and problems associated with satisfying future energy requirements.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5163 Cyber Physical Systems and Smart Grid****Prerequisites:** ECEN 4503.**Description:** A comprehensive overview of advanced cyber-physical technologies and ideas that make the power grid smart. Topics covered include: basics of electric power systems; fundamentals of smart grids; the role of measurement, communications and monitoring technologies in smart grids; integrated applications of control and information advancements in a smart grid; Distributed Energy Resources (DERs) including renewable energy resources, energy storage systems, electric vehicles, and demand response; various functions and tools for managing smart grids; and interoperability, standards, and cyber security in smart grids.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5193 Power Economics and Regulation****Prerequisites:** Vector calculus, familiarity with complex numbers.**Description:** Natural monopoly, regulated mono-polities. Power pricing. Deregulation and the Energy Policy Act of 1992. Bulk power markets, transmission access and wheeling. Economic dispatch and system operations. Security and reliability. Environmental externalities and Clean Air Act compliance. Procurement of new capacity and integrated resource planning. Co-generators and independent power producers.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr

ECEN 5223 Digital Systems Testing**Prerequisites:** ECEN 3233.**Description:** Testing of combinational and sequential circuits. Test generation techniques. Design of reliable and testable circuits and systems. Testing for LSI and VLSI.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5233 Embedded Sensor Networks****Prerequisites:** Graduate standing or consent of instructor.**Description:** Analysis and design of wireless networks, including the integration of sensing, computation, and wireless communication within an embedded system. Mobile sensor networks and body sensor networks. Real world application and new innovations.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5253 Digital Computer Design****Prerequisites:** ECEN 4243 or graduate standing.**Description:** Arithmetic algorithms and the design of the arithmetic/logic unit (ALU). Serial and parallel data processing; control and timing systems; microprogramming; memory organization alternatives; input/output interfaces. Same course as CS 5253.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5263 VLSI Digital Systems Design****Prerequisites:** ECEN 4303; ECEN 5253 recommended or graduate standing.**Description:** Design of very large-scale digital systems on a single chip. Review of MOS technology. Design rules imposed by fabrication techniques. Systematic structures for control and data flow; system timing; highly concurrent systems. Experimental opportunities available.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5283 Computer Vision****Prerequisites:** ECEN 4763.**Description:** Fundamental concepts and tools in computer vision. Image formation and camera calibration. Early vision: edge detection, feature extraction, texture analysis. Mid-level vision: clustering, segmentation and object detection. High-level vision: object recognition using principal component analysis (PCA) and video analysis by hidden Markov models (HMMs).**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5313 Analog Integrated Circuits****Description:** Advanced studies of analog CMOS IC design with an emphasis on EDA. Topics include bandgap reference, oscillators, PLL, linear regulators, DC-DC converters, low voltage, low power, and energy harvesting techniques.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5333 Semiconductor Devices****Prerequisites:** ECEN 3314 and PHYS 3313 or equivalent.**Description:** Semiconductor crystal structure and device fabrication, carrier distribution and transport, pn junction and diode, metal-semiconductor heterojunction, MOSFET, BJT and optoelectronic devices.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5363 Mixed-Signal Integrated Circuits****Description:** Analysis and design of CMOS mixed-signal IC for VLSI systems. Topics include comparators, switched-capacitor circuits, sample-and-hold, Nyquist and oversampling ADC/DAC, delta-sigma modulation, and digital calibration techniques.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5373 RF Microwave Circuit Design****Prerequisites:** ECEN 3314 and ECEN 4613.**Description:** Smith chart, single- and multi-port network, filter design, RF/microwave components and modeling, matching and biasing network, amplifier, oscillators and mixers.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5413 Optimal Control****Prerequisites:** ECEN 4413 or MAE 4053, ECEN 5713 or MAE 5713.**Description:** Optimal control theory for modern systems design. Specification of optimum performance indices. Dynamic programming, calculus of variations and Pontryagin's minimum principle. Iterative numerical techniques for trajectory optimization. Same course as MAE 5413.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr

ECEN 5433 Robotics Kinematics, Dynamics and Control**Prerequisites:** ECEN 4413 or MAE 4053 or consent of instructor.**Description:** Kinematic and dynamic analysis of robot manipulators. Inverse kinematics, motion planning and trajectory generation. Industrial practice in robot servo control. Dynamics and control in the presence of constraints. Actuators and sensors. Force sensors and vision systems. Robotic force control and its applications in industry. Passivity-based control algorithms. Advanced control techniques for motion and force control. Same course as MAE 5433.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5463 Nonlinear System Analysis and Control****Prerequisites:** ECEN 4413 or MAE 4053, ECEN 5713 or MAE 5713.**Description:** Failure of superposition of effects; phase-plane analysis; limit-cycles; Lyapunov stability; hyperstability and input-output stability; controllability and observability of nonlinear systems; feedback linearization; robust nonlinear control system design. Same course as MAE 5463. Course previously offered as ECEN 5723.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5473 Digital Control Systems****Prerequisites:** ECEN 4413 or MAE 4053.**Description:** Input-output and state-space representation of linear discrete-time systems. Approximate methods in discrete-time representation. Stability methods. Controllability, observability, state estimation, and parameter identification. Design and analysis of feedback control system using frequency-domain and state-space methods. Introduction to optimal control. Same course as MAE 5473. Course previously offered as ECEN 6413.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5483 Advanced Mechatronics Design****Prerequisites:** MAE 4733.**Description:** Optimizing C programming code for microcontrollers using the assembly language instruction set. RS-232 microcontroller communication protocol. Controller Area Network (CAN) communication protocol plus hands-on CAN bus development boards, advanced topics which could include but are not limited to sensor design, real time operating systems, and advanced communication protocols. Same course as MAE 5483.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5513 Stochastic Systems****Prerequisites:** ECEN 4503 or STAT 4033.**Description:** Theory and applications involving probability, random variables, functions of random variables, and stochastic processes, including Gaussian and Markov processes. Operations on random variables, transformation of random variables, single and multiple random variables, correlation, power spectral density, and stationary and non-stationary random processes. Random sums and sequences. Response of linear systems to stochastic processes. State-space formulation and covariance analysis. Same course as MAE 5513.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5533 Modern Communication Theory****Prerequisites:** ECEN 5513.**Description:** Noise as a random process, analog and digital signal detection in the presence of noise, optimum receiver design using signal space concepts and introduction to information theory. Trade-offs between bandwidth, signal-to-noise ratio and the rate of information transfer. Example system designs include earth satellite, deep space and terrestrial communication systems and computer communication networks.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5543 Data Transportation and Protection****Description:** Data and its representation; finite field matrices, pseudorandom sequences; information protection; space division networks; synchronization; and channel and error control.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5553 Telecommunications Systems****Prerequisites:** Graduate standing or consent of instructor.**Description:** Surveys the ways and means that voice, data and video are moved long distances. Covers computer networks (Ethernet LAN's, Internet WAN's); telephone systems (PSTN, VoIP and cellular telephony); video (MPEG, H.323, and IPTV); and last mile delivery systems.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr

ECEN 5573 Wireless Communication

Prerequisites: ECEN 4503 or STAT 4033.

Description: Wireless channel characterization: large-scale and small scale fading. Techniques to combat fading; diversity techniques, coding techniques, CDMA, OFDM, MIMO. Advanced communication systems such as 5G and Beyond cellular systems, mmWave and Terahertz communications, massive MIMO, and UAV-assisted communications.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 5613 Electromagnetic Theory

Prerequisites: ECEN 3613.

Description: First graduate level treatment of classical electromagnetic theory. Wave equation, potential theory, boundary conditions. Rectangular, cylindrical and spherical wave functions. Conducting and dielectric guiding structures. Scattering and radiation. Introduction to numerical techniques.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 5623 Antenna Theory

Prerequisites: ECEN 3613.

Description: Fundamental antenna parameters, including directivity, efficiency, radiation resistance, and pattern. Analysis of dipole, loop, aperture, broad-band, and traveling wave antennas. Array theory. Introduction to numerical techniques used in modern antenna design.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 5633 Radar Theory

Prerequisites: ECEN 3613; ECEN 4503 or ECEN 5513.

Description: Theoretical treatment of radar principles. Overview of radar systems and techniques, radar equation, integration of signals. Radar cross-section of single and multiple targets. Waveform design, resolution, ambiguities and accuracy. Range, speed and angular measurements. Detection of targets in noise. Statistical description of clutter. Signal processing techniques.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 5643 Antennas and Propagation for Wireless Communications

Prerequisites: ECEN 3613, ECEN 4503.

Description: Aspects of radiowave propagation for fixed and mobile communication systems. Review of Maxwell's equations and plane wave propagation, antenna principles. Reflection, refraction, diffraction, fading and scintillation, attenuation, ducting, diversity. Propagation in a cellular environment. Satellite communications.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 5683 Biomedical Optics

Description: Biomedical optics, also often termed as biophotonics, is highly interdisciplinary subject on applying light for diagnostic detection and manipulation of biological tissue. This course introduces fundamental concepts and principal technologies of biomedical optics or biophotonics to graduate students and upper-level undergraduate students. The course includes three parts: The first part discusses light-tissue interaction. The second part introduces approaches to modeling photon propagation in tissue. The third part details several representative light-based sensing and imaging technologies for probing biological tissues at different spatial, spectral, and temporal scales for either morphological or functional diagnosis. Topics of therapeutic use of light will also be discussed.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 5713 Linear Systems

Prerequisites: ECEN 4413 or MAE 4053.

Description: Introduction to the fundamental theory of finite-dimensional linear systems with emphasis on the state-space representation. Mathematical representations of systems; linear dynamic solutions; controllability, observability, and stability; linearization and realization theory; and state feedback and state observer. Same course as MAE 5713.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 5733 Neural Networks

Prerequisites: ECEN 5713 or MAE 5713.

Description: Introduction to mathematical analysis of networks and learning rules, and on the application of neural networks to certain engineering problems in image and signal processing and control systems. Same course as CHE 5733 and MAE 5733.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 5763 Digital Signal Processing

Prerequisites: ECEN 4763.

Description: Discrete-time signals and systems; transform analysis of linear systems; design and implementation of digital filters; analog to digital conversion, quantization effects, and oversampling; discrete Fourier transform and the FFT; Fourier analysis using the DFT; introduction to parametric signal modeling; and practical applications of digital signal processing.

Credit hours: 3

Contact hours: Lecture: 3 Contact: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Elec & Computer Engr

ECEN 5773 Intelligent Systems**Prerequisites:** ECEN 5713 or MAE 5713.**Description:** Introduction to the state-of-the art intelligent control and system successfully deployed to industrial and defense applications. Emerging intelligent algorithms (e.g., NN, FS, GA, EP, DES); intelligent control architecture (e.g., bottom-up, top-down, seminotics); reinforcement learning and hybrid systems; and case studies and design projects. Same course as MAE 5773.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5783 Medical Imaging****Prerequisites:** ECEN 4743.**Description:** A comprehensive introduction to the physics and engineering foundations of the standard medical imaging modalities used today. Topics include radiation, radiation-interaction with matter, X-ray radiography, ultrasonography, X-ray computed tomography, image reconstruction and analysis, magnetic resonance imaging, nuclear radiation based imaging, and image monitoring aspects of radiation therapy. The fundamental mathematics underlying each imaging modality is reviewed and the hardware needed to implement each system is examined.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5793 Digital Image Processing****Prerequisites:** ECEN 4763.**Description:** Digital image processing including image acquisition, enhancement, restoration, color image processing, morphological processing, segmentation, representation and description.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5803 Geometrical Optics****Prerequisites:** PHYS 3213 or consent of instructor.**Description:** Foundations of geometrical optics, geometrical theory of optical imaging, geometrical theory aberrations, image forming instruments. Same course as PHYS 5123.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5823 Physical Optics****Prerequisites:** PHYS 3213 or consent of instructor.**Description:** Multiple beam interference, diffractions, imaging, near field optical probes of matter, surface plasmons, light scattering from random media, optical coherence tomography- biomedical applications, negative materials, perfect lenses and super resolution. Same course as PHYS 5303.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5833 Fiber-Optic Communication Systems****Prerequisites:** ECEN 3613 or ECEN 4533.**Description:** The fundamentals of fiber-optic communication systems are described in detail. Fiber electromagnetic behaviors, laser and LED transmitters, photodetectors and semiconductor receivers and other hardware components are covered. System level design and integration concepts are covered including modulation schemes, multiplexing, dispersion and power budget, sampling, incoherent and coherent detection, error control, and network distribution. A historical framework shows how technical capabilities and growing communication needs forced fiber systems evolution.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 5843 Microelectronic Fabrication****Prerequisites:** ECEN 3314.**Description:** Contamination control and clean-room, vacuum systems, wafer manufacturing. Photolithography and alternative lithographic techniques. Physical and chemical vapor deposition, oxidation, etching, doping, packaging, formation of semiconductor devices and circuits. A series of Fabrication lab projects is conducted starting from bare silicon wafers to fabricate Optoelectronic circuits.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**Additional Fees:** ECEN Consumable Materials fee of \$120 applies.**ECEN 5853 Ultrafast Optoelectronics****Prerequisites:** ECEN 5833.**Description:** Principles in ultrafast lasers and terahertz radiation are discussed. Topics include generation, propagation, amplification, and measurement of femtosecond optical pulses. Generation, detection, and manipulation of terahertz waves as fundamentals to understand how time-domain spectroscopy and imaging work will be described. Selected advanced topics in ultrafast metamaterials and plasmonics will also be discussed.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr

ECEN 5923 Introduction to MEMS**Prerequisites:** ECEN 5843 or consent of instructor.**Description:** Fundamentals of Microsystems. Topics include: energy transduction mechanisms, energy dissipation modeling, energy methods, mechanics of small scale, fabrication process design, micromachining, electronic interface.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 6000 Dissertation****Prerequisites:** Consent of major professor.**Description:** Independent research for students continuing graduate study beyond the level of the MS degree. Offered for variable credit, 1-12 credit hours, maximum of 36 credit hours.**Credit hours:** 1-12**Contact hours:** Contact: 1-12 Other: 1-12**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Elec & Computer Engr**ECEN 6001 PhD Seminar Series****Prerequisites:** Approval of ECEN department head.**Description:** Seminar series for PhD studies and research.**Credit hours:** 1**Contact hours:** Lecture: 1 Contact: 1**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 6050 Preliminary PhD Research and Proposal****Prerequisites:** Consent of adviser.**Description:** Independent research and report of an advanced electrical engineering problem. Work performed serves as foundation of the oral PhD preliminary exam.**Credit hours:** 3**Contact hours:** Contact: 3 Other: 3**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Elec & Computer Engr**ECEN 6060 Special Topics****Prerequisites:** Advisor permission.**Description:** Advanced engineering topics not normally included in existing courses. Repeat credit may be earned with different course subtitles assigned. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Contact: 1-6 Other: 1-6**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Elec & Computer Engr**ECEN 6070 Advanced Directed Studies****Prerequisites:** Admission into PhD program and consent of instructor.**Description:** Investigation outside of the classroom of topics not normally covered in lecture courses. Offered for variable credit, 1-6 credit hours, maximum of 12 credit hours.**Credit hours:** 1-6**Contact hours:** Contact: 1-6 Other: 1-6**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Elec & Computer Engr**ECEN 6123 Special Topics in Power Systems****Prerequisites:** ECEN 5113.**Description:** Selected relevant current topics related to power system operation and planning.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 6253 Advanced Topics in Computer Architecture****Prerequisites:** ECEN 5253 or CS 5253.**Description:** Innovations in the architecture and organization of computers, with an emphasis on parallelism. Topics may include pipelining, multiprocessors, data flow, and reduction machines. Same course as CS 6253.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 6263 Advanced VLSI Design and Applications****Prerequisites:** ECEN 5223 and ECEN 5263.**Description:** System timing. Designing testable integrated circuits. Specialized parallel processing architectures. Application examples.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 6453 Adaptive Control****Prerequisites:** ECEN 5473 or ECEN 5713 or MAE 5473 or MAE 5713.**Description:** Analysis and design of control techniques that modify their performance to adapt to changes in system operation. Review of systems analysis techniques, including state variable representations, linearization, discretization, covariance analysis, stability, and linear quadratic Gaussian design. On-line parameter estimation, model reference adaptive systems, self-tuning regulators, stable adaptive systems. Same course as MAE 6453. Course previously offered as ECEN 6450.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 6483 Robust Multivariate Control Systems****Prerequisites:** ECEN 5713 or MAE 5713.**Description:** Introduction to multivariable systems: SISO robustness vs. MIMO robustness; multivariable system poles and zeros; MIMO transfer functions; multivariable frequency response analysis; multivariable Nyquist theorem; performance specifications; stability of feedback systems; linear fractional transformations (LFT's); parameterization of all stabilizing controllers; structured singular value; algebraic ricatti equations; H2 optimal control; H-infinity controller design. Same course as MAE 6483.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr

ECEN 6523 Information Theory**Prerequisites:** ECEN 5513 or consent of instructor.**Description:** Mathematical theory of information (Shannon theory) including information measure and transmission rates and capacities. Source coding theory including algebraic and error-correcting codes. Design of waiver-forms for noise immunity. Information transfer in learning systems.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 6803 Photonics I: Advanced Optics****Prerequisites:** ECEN 3813 or PHYS 3213 or consent of instructor.**Description:** Advanced optics including spectral and time characteristics of detectors, characteristics of lasers, time, spectral and spatial parameters of laser emission, interferometric techniques, and nonlinear effects such as two-photon absorption and second and third harmonic generations. Emphasis on ultrashort laser pulses. Same course as CHEM 6803 & PHYS 6803.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 6810 Photonics II: THz Photonics and THz-TD****Prerequisites:** ECEN 6803.**Description:** Concepts and techniques of driving electronic circuitry with ultra short laser pulses to generate and detect freely propagating pulses of THz electromagnetic radiation using several operational research systems. Same course as CHEM 6810 & PHYS 6810. Course previously offered as ECEN 6811. Offered for fixed credit, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lab: 2 Contact: 2**Levels:** Graduate**Schedule types:** Lab**Department/School:** Elec & Computer Engr**ECEN 6820 Photonics II: Spectroscopy II****Prerequisites:** ECEN 6803.**Description:** Operating principles and applications of laser spectroscopy of atoms, molecules, solids and complex fluids. Absorption, emission, photon correlation, coherence, time resolved Fourier transform. Raman spectroscopy and non-linear optical. Same course as CHEM 6820 & PHYS 6820. Course previously offered as ECEN 6821. Offered for fixed credit, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lab: 2 Contact: 2**Levels:** Graduate**Schedule types:** Lab**Department/School:** Elec & Computer Engr**ECEN 6823 Advanced Optical Techniques****Prerequisites:** ECEN 5853.**Description:** State-of-the-art optical devices and research methodologies. Investigation and discussion of contemporary developments in non-linear optical devices and laser applications. Includes both analytical and experimental techniques.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr**ECEN 6830 Photonics II: Spectroscopy III****Prerequisites:** ECEN 6803.**Description:** Advanced spectroscopic instruments and methods used for investigation of semi-conductors and solid state material. Stimulated emission characterized both in wavelength and in time. Time-resolved fluorescence measurements. Multiphotonic excitations. Fast measuring techniques, including subnanosecond detectors, picosecond streak cameras, and ultra fast four-wave mixing and correlation techniques. Time-dependent photoconductivity measurements. Same course as CHEM 6830 & PHYS 6830. Course previously offered as ECEN 6831. Offered for 1 fixed credit hour, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lab: 2 Contact: 2**Levels:** Graduate**Schedule types:** Lab**Department/School:** Elec & Computer Engr**ECEN 6840 Photonics III: Microscopy I****Prerequisites:** CHEM 3553 or consent of instructor.**Description:** The structure and imaging of solid surfaces. Basics of scanning probe microscopy (SPM). Contact and non-contact atomic force microscopy (AFM). Scanning tunneling microscopy (STM) in air. Same course as CHEM 6840 & PHYS 6840. Course previously offered as ECEN 6841. Offered for fixed credit hours, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lab: 2 Contact: 2**Levels:** Graduate**Schedule types:** Lab**Department/School:** Elec & Computer Engr**ECEN 6843 Advanced Microelectronic Fabrication****Prerequisites:** ECEN 5843.**Description:** Photolithography, wet and dry etching, thermal and electron beam evaporation, photomask design using L-Edit, silicon devices processing, quartz devices processing, silicon-on-sapphire devices processing. GaAs devices processing and MEMS devices processing.**Credit hours:** 3**Contact hours:** Lecture: 3 Contact: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Elec & Computer Engr

ECEN 6850 Photonics III: Microscopy II**Prerequisites:** CHEM 3553 or consent of instructor.**Description:** Advanced techniques of scanning probe microscopy (SPM). Magnetic force microscopy, Kelvin force microscopy, scanning probe microscopy (STM) in vacuum. Characterization of materials with SPM. Nanolithography with SPM. Device manufacturing and analysis. Same course as CHEM 6850 & PHYS 6850. Course previously offered as ECEN 6851. Offered for 1 fixed credit hour, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lab: 2 Contact: 2**Levels:** Graduate**Schedule types:** Lab**Department/School:** Elec & Computer Engr**ECEN 6860 Photonics III: Microscopy III and Image Processing****Prerequisites:** ECEN 5793.**Description:** Digital image processing, including projects. Image acquisition and display, image enhancement, geometric operations, linear and nonlinear filtering, image restoration, edge detection, image analysis, morphology, segmentation, recognition, and coding/compression. Same course as CHEM 6860 & PHYS 6860. Offered for fixed credit hours, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lab: 2 Contact: 2**Levels:** Graduate**Schedule types:** Lab**Department/School:** Elec & Computer Engr**ECEN 6870 Photonics IV: Synthesis and Devices I****Prerequisites:** ECEN 6803 and ECEN 6840.**Description:** Preparation of functional nanostructures and related optical/electronic devices. Physical and chemical methods of thin film deposition. Engineering of prototypes of light emitting diodes, sensors, optical limiting coatings, lithographic patterns. Same course as CHEM 6870 & PHYS 6870. Course previously offered as ECEN 6871. Offered for 1 fixed credit hour, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lab: 2 Contact: 2**Levels:** Graduate**Schedule types:** Lab**Department/School:** Elec & Computer Engr**ECEN 6880 Photonics IV: Semiconductor Devices, Testing and Characterization****Prerequisites:** ECEN 6803 and ECEN 6840.**Description:** Test and characterization of semiconductor and optoelectronic devices. Hall effect, four point probe, CV and IV measurements, optical pump-probe, photoluminescence and electro-optics sampling. Same course as CHEM 6880 & PHYS 6880. Course previously offered as ECEN 6881. Offered for 1 fixed credit hour, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lab: 2 Contact: 2**Levels:** Graduate**Schedule types:** Lab**Department/School:** Elec & Computer Engr**ECEN 6890 Photonics IV: Semiconductor Synthesis and Devices III****Prerequisites:** ECEN 6803.**Description:** Processing, fabrication and characterization of semiconductor optoelectronic devices in class 100/10000 cleanrooms. Cleanroom operation including general procedure for material processing and device fabrication. Device processing using a variety of processing such as mask aligner, vacuum evaporators and rapid thermal annealer. Testing using optical and electrical testing apparatus such as I-V, C-V, Hall, and optical spectral measurement systems. Same course as CHEM 6890 & PHYS 6890. Course previously offered as ECEN 6891. Offered for fixed 1 credit hour, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lab: 2 Contact: 2**Levels:** Graduate**Schedule types:** Lab**Department/School:** Elec & Computer Engr

Undergraduate Programs

- Computer Engineering, BSCP (<http://catalog.okstate.edu/engineering-architecture-technology/electrical-computer-engineering/computer-bscp/>)
- Computer Engineering: Software Engineering, BSCP (<http://catalog.okstate.edu/engineering-architecture-technology/electrical-computer-engineering/computer-software-engineering-bscp/>)
- Electrical Engineering, BSEE (<http://catalog.okstate.edu/engineering-architecture-technology/electrical-computer-engineering/electrical-bsee/>)

Graduate Programs

The School of Electrical and Computer Engineering offers three graduate degrees, all in electrical engineering: Master of Engineering (MEngEE), Master of Science (MSEE) and Doctor of Philosophy (PhDEE).

These graduate degree programs are flexible in course selection and emphasis. Both the Master of Engineering and the Master of Science programs are available online.

The Master of Engineering degree program is tailored to students who wish to gain advanced knowledge and expertise in subject areas associated with their professional pursuits. This non-research, non-thesis, instructional program is ideal for Distance Education students or for baccalaureate graduates interested in professional development to enhance their competitiveness in the workplace. It is well-suited for students who have little interest in a research-centric education.

The Master of Science degree emphasizes advanced mathematics, theory, design and research. It is intended for students interested in cutting-edge careers or who want to prepare for advanced research associated with the PhD program. This degree combines coursework with research that allows students to expand their knowledge in an in-depth area of electrical engineering or computer engineering. The MSEE program culminates with the defense of a thesis.

The Doctor of Philosophy degree is designed to prepare students for positions in academia, industry and government. This degree emphasizes the creation of new knowledge through the in-depth research process, as documented in the doctoral dissertation.

The School of Electrical and Computer Engineering also offers a "4+1" degree program that combines the BSEE/BSCpE degree programs with the MEngEE degree program. The "4+1" program is only available to OSU baccalaureate students. It is designed to be completed in five

years and to give students a broad-based undergraduate education in electrical engineering or computer engineering along with a highly in-depth graduate education in a few key areas. This program is ideal for those students who want advanced knowledge to enhance their competitiveness in the workforce and to satisfy their longing for in-depth knowledge that cannot be obtained in the baccalaureate degrees. Specific requirements for the “4+1” program are available on the web in the document entitled “Memorandum to Graduate Students;” see <https://ece.okstate.edu/>.

Students typically select coursework and participate in research and design projects in the following areas:

- Communication systems, cybersecurity and networks
- Control systems, robotics and mechatronics
- Analog, mixed-signal and RF electronics
- Computer architecture, VLSI digital circuits and arithmetic
- Electromagnetics and THz sciences
- Microcontrollers and embedded control
- Photonics and electro-optics
- Digital signal, image and video processing
- Energy and power
- Bioengineering

Admission Requirements

Admission to the Graduate College, as described under “General Regulations” in the “Graduate College” section of the University Catalog is required. Graduation from an electrical engineering or computer engineering program accredited by the ABET is required for admission to the School of Electrical and Computer Engineering. In addition, sufficient GRE scores are required for admission to the doctoral program in the School of Electrical and Computer Engineering.

Graduates from non-engineering fields such as mathematics, physics and computer science are also admitted to the School of Electrical and Computer Engineering graduate programs if an evaluation of the applicant’s official transcript indicates that the applicant is prepared to succeed in graduate-level course work in electrical and computer engineering, or can be expected to do so after a reasonable amount of remedial coursework has been completed. This condition also applies to graduates of unaccredited engineering programs and engineering technology programs.

Degree Requirements

The Master of Engineering degree in Electrical Engineering (MEngEE) is awarded to those students who successfully complete an approved plan of study. The degree requires 33 credit hours of coursework; a thesis is not required. The plan of study requires, at a minimum, 24 hours of 5000-level courses, covering four areas in electrical and computer engineering (designated by second digit of the course number). Most plans of study include additional 5000-level courses, depending upon the background and particular educational goals of the student. Additional remedial work in undergraduate electrical and computer engineering courses may be required for students who do not have a sufficient background in electrical engineering. Specific requirements for the MEngEE program are available on the web in the document entitled “Memorandum to Graduate Students;” see <https://ece.okstate.edu/> (<https://ceat.okstate.edu/ece/>).

The Master of Science degree in Electrical Engineering (MSEE) is awarded to those students who successfully complete an approved plan

of study. The degree requires 24 credit hours of coursework plus 6 credit hours for the thesis. In addition to the thesis requirement, the plan of study requires, at a minimum, 21 hours of 5000-level courses in at least two areas in electrical and computer engineering (designated by second digit of the course number). Most plans of study include additional 5000-level courses, depending upon the background and particular educational goals of the student. Each student is encouraged to include courses in supporting disciplines such as mathematics, physics, computer science or other engineering fields. Additional remedial work in undergraduate electrical and computer engineering courses may be required for students who do not have a sufficient background in electrical engineering. Specific requirements for the MSEE program are available on the web in the document entitled “Memorandum to Graduate Students;” see <https://ece.okstate.edu/> (<https://ceat.okstate.edu/ece/>).

The Doctor of Philosophy (PhDEE) degree is granted to recognize high achievement in coursework selected from the broad field of electrical and computer engineering. The degree is conferred on those who demonstrate the ability to perform independent research in a chosen field of specialization that generates new knowledge, as presented in a dissertation. For this degree the Graduate College requires a minimum of 73 credit hours of acceptable academic work beyond the bachelor’s degree, including credit for the dissertation. Specific requirements for the PhD program are available on the web in the document entitled “Memorandum to Graduate Students;” see <https://ece.okstate.edu/> (<https://ceat.okstate.edu/ece/>).

The School of Electrical and Computer Engineering also participates in several interdisciplinary degree programs (See “Graduate Programs” under “Industrial Engineering and Management,” and “Telecommunications Management” the “Graduate College” section of the Catalog.)

Faculty

Jeffrey L. Young, PhD, PE—Professor and Head

Professor and OSURF Endowed Chair: Jeffrey L. Young, PhD, PE

Regents Professor: Gary Yen, PhD

Associate Dean for CEAT Research, Professor and Henry Bellmon

Chair: Charles F. Bunting, PhD

Cal and Marilyn Vogt Professor: Guoliang Fan, PhD

Edward Joulain Endowed Chair and Professor in Engineering: James Stine, PhD

Professors: H. Jack Allison, PhD, PE (emeritus); Charles M. Bacon, PhD (emeritus); James E. Baker, PhD (emeritus); Richard L. Cummins, PhD (emeritus); Daniel R. Grischkowsky, PhD (emeritus); Martin T. Hagan, PhD, PE (emeritus); Louis Johnson, PhD (emeritus); Subhash Kak, PhD (emeritus); Jerzy S. Krasinski, PhD (emeritus); Daqing Piao, PhD; Rama Ramakumar, PhD, PE (emeritus); Ronald P. Rhoten, PhD, PE (emeritus); Weihua Sheng, PhD; Keith A. Teague, PhD, PE (emeritus); James C. West, PhD; Rao Yarlagadda, PhD (emeritus); Weili Zhang, PhD

Associate Professors: Qi Cheng, PhD; Chriswell G. Hutchens, PhD, PE (emeritus); Carl D. Latino, PhD (emeritus); George Scheets, PhD (emeritus)

Assistant Professors: Wooyeol Choi, PhD; Hantao Cui, PhD; Sabit Ekin, PhD; John Hu, PhD; Bingzhe Li, PhD; Hamidreza Nazari-pouya, PhD; John O’Hara, PhD; Ickhyun Song, PhD