SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

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General Information

The School of Electrical and Computer Engineering has a tradition of technological leadership demonstrated since its inception in 1906 at the University of Oklahoma. Historical highlights of the school include:

- 1906: Moved from Applied Science to College of Engineering
- 1972: Computer Science combined into the school
- 1992: Electrical Engineering and Computer Science split and became separate schools within the College of Engineering
- 1996: Curriculum reorganized to support both Electrical Engineering degrees and Computer Engineering degrees; the school was renamed the School of Electrical and Computer Engineering.

The faculty of the School of Electrical and Computer Engineering (ECE) is committed to excellence in teaching, quality research in selected areas of leading-edge technology, and the professional development of students.

Having Electrical Engineering and Computer Engineering in a single school offers the student an exciting combination of technologies with which to meet the design problems of the twenty-first century and an opportunity to develop hands-on skills at the device and system levels. Each degree is based on class offerings from both specialties within ECE, augmented by classes from the School of Computer Science and the Department of Engineering. With this balance, the student is prepared to handle both hardware and software design and analysis topics. Engineering research and career applications include bioengineering, communications, computer architecture, solid state devices and materials, electric power and radio frequency systems, image and signal processing, instrumentation and control systems, and linear and digital electronics.

Electrical and Computer Engineering Mission Statement

The mission of the School of Electrical and Computer Engineering is to provide a high-quality educational experience for undergraduate and graduate students.

Programs & Facilities

Labs & Facilities

Excellent facilities are available for advanced studies in digital systems, power systems, medical imaging, digital signal processing, intelligent transportation systems, alternate energy, GPS, weather radar and instrumentation, communication, opto-electronics and solid state electronics. The school operates and maintains a microprocessor lab, a power systems simulator lab, a digital signal processing lab and other instructional and research laboratories. The facilities are used to provide "hands-on" experience for students.

Quantum Device Laboratory

Unique to OU, the Quantum Device Laboratory is working on quantum engineered semiconductor structures at sub-nanometer scale for realizing functional devices and sub-systems with support from NSF, DoD, and DoE.

Scholarships

The school annually awards many scholarships to students with superior records to help defray the cost of their education. These scholarships are awarded on the basis of merit and need.

Undergraduate

Electrical Engineering

Program Educational Objectives (PEO)

The overarching ***Educational Objectives*** of the Electrical Engineering program are that our graduates will:

1. Be successfully engaged in their careers, leveraging specialized knowledge of Electrical Engineering
2. Pursue and apply new knowledge to solve constrained problems and develop new opportunities
3. Contribute to society through professional and ethical application of technology

We expect our BS Electrical Engineering graduates to successfully demonstrate abilities appropriate to these objectives within the first three-to-five years of receiving their Baccalaureate Degree in Electrical Engineering.

Computer Engineering

Program Educational Objectives (PEO)

The overarching ***Educational Objectives*** of the Computer Engineering program are that our graduates will:

1. Be successfully engaged in their careers, leveraging specialized knowledge of Computer Engineering
2. Pursue and apply new knowledge to solve constrained problems and develop new opportunities
3. Contribute to society through professional and ethical application of technology

We expect our BS Computer Engineering graduates to successfully demonstrate abilities appropriate to these objectives within the first three-to-five years of receiving their Baccalaureate Degree in Computer Engineering.

Electrical and Computer Engineering Undergraduate Student Outcomes

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 environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Bachelor of Science

Students enrolled in the School of Electrical and Computer Engineering (ECE) are offered a choice of two Bachelor of Science degrees. Curricula are designed to give a thorough understanding of the physical principals, the design process and the current technology in the student's chosen discipline.

- Computer Engineering, Bachelor of Science[1]
- Electrical Engineering, Bachelor of Science[2]

[1] Bachelor of Science in Computer Engineering accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the General Criteria and the Electrical, Computer, Communications, Telecommunication(s) and Similarly Named Program Criteria.

[2] Bachelor of Science in Electrical Engineering accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the General Criteria and the Electrical, Computer, Communications, Telecommunication(s) and Similarly Named Program Criteria.

Minor

The Electrical and Computer Engineering Minor allows students with similar math/science backgrounds to progress deeply into ECE subject areas that have strong relevance to their Major Degree and Career Objectives.

Accelerated Bachelor of Science/Master of Science

The Accelerated Bachelor of Science/Master of Science programs allow students to pursue a graduate degree in conjunction with the undergraduate degree requirements.

- Computer Engineering, B.S./Computer Science, M.S.
- Computer Engineering, B.S./Electrical and Computer Engineering, M.S.
- Electrical Engineering, B.S./Electrical and Computer Engineering, M.S.

Graduate

Graduate students have an opportunity to select a research topic in one of the many exciting research programs being pursued by our faculty. In many cases, these research programs have funding to support the student participants during the period of their thesis studies.

Master of Science

Electrical and Computer Engineering, Master of Science

Doctoral Program

Electrical and Computer Engineering, Ph.D.

Courses

ECE 2214 Digital Design 4 Credit Hours
Prerequisite: MATH 1823 or MATH 1914. Number systems, Boolean algebra, minimization procedures, combinational logic functions, introduction to sequential logic design, finite state machines and clocked (synchronous) sequential circuits. Analysis, synthesis and implementation are appropriately emphasized. (F, Sp)

ECE 2523 Probability, Statistics and Random Processes 3 Credit Hours
Prerequisite: ECE major or minor; MATH 2433 or MATH 2924. Covers the role of statistics in electrical and computer engineering and includes substantial exposure to applications appropriate to the discipline: basic probability; random variables, vectors and processes; time averages, expectations and laws of large numbers; stationarity, autocorrelation and spectral analysis; minimum mean squared error estimation; detection and linear filtering; IID, Markov, independent increment, counting, Gaussian and Poisson random processes. (F, Sp)

ECE 2713 Digital Signals and Filtering 3 Credit Hours
Prerequisite: ENGR 1411 or ENGR 3511 or concurrent enrollment; CS 1313 or CS 1321 or CS 1323 or CS 1324 or concurrent enrollment; and MATH 2423 or 2924. Digital signals and filter, discrete Fourier A and Z transforms, sampling. (F, Sp)

ECE 2723 Electrical Circuits I 3 Credit Hours
Prerequisites: ECE 2713 or concurrent enrollment in ECE 2713; MATH 2423 or 2924; PHYS 2524. Introduction to circuit elements and the laws of electrical science. Loop and nodal analysis solution methods. Thevenin and Norton equivalent circuits. Superposition and source transformation methods. Laplace transform analysis of electrical circuits. Guest lectures introducing advanced topics. (F, Sp)

ECE 2970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: Permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

ECE 3113 Energy Conversion I 3 Credit Hours
Prerequisite: ECE 2723 and ECE 3613. Survey of methods of energy conversion; field-energy force relationships, equations of motion, incremental motion transducers, transformer theory; introduction to rotating machines. (Sp)

ECE 3223 Microprocessor System Design 3 Credit Hours
Prerequisite: ECE 3773 or concurrent enrollment. Review of clocked sequential circuits; MSI/LSI devices and applications, including registers, busing, combinational functions; use of microprocessors and logic design using microprocessors. Emphasizes assembly of full functional units into workable systems. (F, Sp)

ECE 3323 Introduction to Solid State Electronic Devices 3 Credit Hours
Prerequisite: 3613. Introduction to quantum mechanics, crystal properties and growth of semiconductors, energy bands in solids, charge carriers in semi-conductors, excess carriers in semiconductors, and introduction to diodes and transistors. (F, Sp)

ECE 3440 Mentored Research Experience 3 Credit Hours
0 to 3 hours. Prerequisites: ENGL 1113 or equivalent, and permission of instructor. May be repeated; maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. Not for honors credit. (F, Sp, Su)

ECE 3613 Electromagnetic Fields I 3 Credit Hours
Prerequisite: ECE 2723 and MATH 2443 or MATH 2934 and Mathematics 3113. Electrostatic and magnetostatic fields and sources, boundary conditions; introduction to Laplace's and Poisson's equations; quasi-stationary and time-varying fields; Maxwell's equations and circuit concepts. (F, Sp)

ECE 3723 Electrical Circuits II 3 Credit Hours
Prerequisites: ECE 2713, ECE 2723; and MATH 3113 or concurrent enrollment in MATH 3113. Analysis of electrical circuits in both time and frequency domains. Continuation of AC circuit theory, use of two port network theorems, impulse response, convolution, and differential equations. Laplace and Fourier transform analysis of electrical circuits. (F, Sp)

ECE 3773 Electrical and Computer Engineering Circuits Laboratory 3 Credit Hours
Prerequisite: ECE 2214 and either ECE 3723 or concurrent enrollment in ECE 3723. Electrical laboratory procedures, circuit construction, debug and experimental Confirmation of the principles of circuit theory. Introduction to use of laboratory instrumentation, including skills in the use of the oscilloscope in the evaluation of DC and AC circuits. Use and application of diodes, operational amplifiers and programmable logic devices. (F, Sp)

ECE 3793 Signals and Systems 3 Credit Hours
Prerequisites: ECE 2713, ECE 2723, MATH 3113; and MATH 3333 or concurrent enrollment in MATH 3333. Linear systems; time domain analysis; frequency domain analysis; Fourier, Laplace and Z-transforms; introduction to communications and control. (F, Sp)

ECE 3813 Introductory Electronics 3 Credit Hours
Prerequisites: ECE 2713, and ECE 2723; CHEM 1315; and MATH 2443 or 2934 or concurrent enrollment in MATH 2443 or 2934. Small and large signal characteristics and models of electronic devices; analysis and design of elementary electronic circuits. (F, Sp)

ECE 3873 Electrical and Computer Engineering Electronics Laboratory 3 Credit Hours
Prerequisite: ECE 2523, ECE 3723, ECE 3773, ECE 3813, and ENGR 2002 or ENGR 2003. Electronic analog circuit design, simulation, construction, debugging and measurement of circuit behavior and noise using advanced instrumentation techniques; statistics-based circuit reliability theory; independent design skills development and technical writing. (F, Sp)

ECE 3960 Honors Reading 1-3 Credit Hours
Prerequisite: admission to Honors program. May be repeated; maximum credit six hours. Consists of topics designated by the instructor in keeping with the student's major program. Covers materials not usually presented in the regular courses. (F, Sp, Su)

ECE 3970 Honors Seminar 1-3 Credit Hours
Prerequisite: Admission to Honors program. May be repeated; maximum credit six hours. Projects covered will vary. Deal with concepts not usually presented in regular coursework.

ECE 3980 Honors Research 1-3 Credit Hours
Prerequisite: admission to Honors program. May be repeated; maximum credit six hours. provides an opportunity for the gifted Honors candidate to work on a special project in the student's field. (F, Sp, Su)

ECE 3990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: permission of instructor and junior standing. May be repeated once with change of content. Independent study may be arranged to study a subject not available through regular course offerings. (F, Sp, Su)

ECE G4113 Analysis of Electrical Transmission 3 Credit Hours
Prerequisite: 3113. Transmission and distribution of electrical energy, particularly addressing electrical transmission systems in the competitive energy market. (F)

ECE 4213 Digital Signal Processing 3 Credit Hours
(Slashlisted with 5213) Prerequisite: 3793. Discrete-time linear systems, finite duration impulse response digital filters, finite work length effects, spectral analysis, fast Fourier-transforms, two-dimensional signal processing and applications. No student may earn credit for both 4213 and 5213. (F)

ECE 4273 Digital Design Laboratory 3 Credit Hours
Prerequisite: Graduate standing, or ECE 3223 and ECE 3873. Design of digital systems with integrated circuits and MSI/LSI and microprocessor interfacing. (F, Sp)

ECE 4281 Engineering Co-Op Program 1 Credit Hour
(Crosslisted with AME, BME, C S, CEES, CH E, EPHY and ISE 4281) Prerequisite: Departmental permission and junior standing. May be repeated; maximum credit 6 hours. The Co-Op program provides students an opportunity to enhance their education via career exploration in related professional work experiences. Course assignments help students articulate their experiences by completing journals; mid-term paper; final paper and/or final presentation. Faculty receive an evaluation from the student's Co-Op supervisor who monitors performance. Faculty collaborate with the Co-Op supervisor to ensure student success. (F, Sp, Su)

ECE 4363 Optical Engineering 3 Credit Hours
(Slashlisted with ECE 5363) Prerequisite: ECE 3793. Underlying theory and design of optical systems. Interference, diffraction and coherence phenomena will be examined as a basis for studying the limits of optical system performance. Other topics include a detailed study of polarization, the interaction of light with various media and geometrical optics. No student may earn credit for both 4363 and 5363. (Sp)

ECE 4383 IC Fabrication Technology I 3 Credit Hours
(Slashlisted with ECE 5383) Prerequisite: 3323. A treatment of the theory and processes involved in the fabrication of integrated circuits. No student may earn credit in both 4383 and 5383. (F)

ECE G4413 Introduction to Control System Engineering 3 Credit Hours
Prerequisite: 3793. Analysis and synthesis of control systems; control systems performance and applications. (F)

ECE 4433 Measurement and Automation 3 Credit Hours
(Slashlisted with ECE 5433) Prerequisite: ECE 3793 or instructor permission or systems course in another major. Fundamentals of data acquisition and control. A series of design projects in data acquisition, logging and real-time analysis. Includes machine vision and image processing as well as vibration, motion and real-time control. No student may earn credit for both 4433 and 5433. (F)

ECE G4523 Introduction to Communication Theory 3 Credit Hours
Prerequisite: ECE 2523 and ECE 3793. An introductory treatment of statistical communication theory; description of a random process by auto-correlation and power spectral density functions, sources and properties of electrical noise, the effects of modulation, detection And filtering on signal information content, bandwidth and signal-to-noise ratio. (Sp)

ECE 4603 Radar Imaging 3 Credit Hours
(Slashlisted with ECE 5603) Prerequisite: senior standing or permission of instructor; ECE 3793. Course coverage includes radar signal models and phase histories, the types of processing steps used to focus radar data into high-resolution imagery, and fundamental behaviors and performance metrics of radar imaging. Course also investigates various radar imaging algorithms applied to range-Doppler imaging, synthetic aperture radar (SAR), inverse SAR, and angle-of-arrival (spatial) imaging. No student may earn credit for both 4603 and 5603. (Sp)

ECE G4613 Computer Architecture 3 Credit Hours
(Crosslisted with C S 4613) Prerequisite: ECE 3223 or C S 2614 or C S 2613. Covers basic concepts of computer system design and communication between components, along with current and historical examples of computer architecture. (F, Sp)

ECE 4623 Computer Hardware Design 3 Credit Hours
(Slashlisted with 5623) Prerequisite: 3223. Design of modern digital computing circuits, computer arithmetic, number systems, state machines, control units, data transfer, bus interfacing, VHDL language elements and usage, circuit simulation. No student may earn credit for both 4623 and 5623. (F)

ECE 4643 Radio Frequency and Microwave Engineering 3 Credit Hours
(Slashlisted with ECE 5643) Prerequisite: ECE 3613. Analysis of radio frequency (RF) and microwave components, circuits and systems using modern engineering tools and measurement instruments. No student may earn credit for both 4643 and 5643. (Sp)

ECE 4653 Digital Radar Systems 3 Credit Hours
(Slashlisted with ECE 5653) Prerequisite: ECE 3793. Modern and next-generation radar systems, with an emphasis on the digital receiver and post processing that follows the RF front-end. Several off-the-shelf receiver case studies will be conducted. These will focus on analog-to-digital converter (ADC) selection followed by software defined radio (SDR) concepts for field programmable gate array (FPGA) implementation. These receivers may also be used for communication systems and have other broad applications. No student may earn credit for both 4653 and 5653. (F)

ECE 4663 Radar Engineering 3 Credit Hours
(Crosslisted with METR 4663; Slashlisted with 5663) Prerequisite: Grade of C or better in 3613, or permission. Introduction to radar system designs and applications with emphasis on weather radar; radar system architecture and their functionalities and limitations of subsystems; theories of radar detection and estimation in a noisy and cluttered environment; existing technologies and advanced techniques to improve radar performance. No student may earn credit in both 4663 and 5663. (F)

ECE 4693 Antennas 3 Credit Hours
(Slashlisted with ECE 5693). Prerequisite: ECE 3613 and ECE 4703 or permission of instructor. Introduction to antenna theory and design. Course covers design, construction, and measurement of antennas including, but not limited to the following specific types; dipoles, loops, aperture, microstrip, and broadband antennas, as well as array theory. No student may earn credit for both 4693 and 5693. (Sp)

ECE 4703 Electromagnetic Fields and Wave Propagation 3 Credit Hours
(Slashlisted with ECE 5703). Prerequisite: ECE 3613. Maxwell's Equations, time-harmonic fields, plane waves, reflections on interfaces, waveguides and transmission lines, radiation, and antenna basics. No student may earn credit for both 4703 and 5703. (F, Sp)

ECE 4733 RF & Microwave Filter Design 3 Credit Hours
(Slashlisted with ECE 5733) Prerequisite: instructor permission. Introduction to advanced filter design. The use of filters is very widespread in all aspects of communication and radar systems. At the end of the semester, a student that has successfully embraced the subject will be able to design, fabricate, and test filters, using a range of different technologies and methods. No student may earn credit for both 4733 and 5733. (Sp)

ECE 4773 Laboratory (Special Projects) 3 Credit Hours
Prerequisite: 4273 or concurrent enrollment in 4273. Individually supervised special engineering problems of experimental nature. Laboratory (F, Sp) [V].

ECE G4813 Electronics 3 Credit Hours
Prerequisite: ECE 3813 and ECE 3873. Analysis and design of electronic circuits such as multi-stage amplifiers, feedback amplifiers, oscillators and power amplifiers. (Sp)

ECE G4823 Engineering Principles of the Human Body 3 Credit Hours
Prerequisites: ECE 2723, PHYS 2514, MATH 2423 or 2924. Introduction to the foundational engineering approach to analyzing the human body's anatomy and physiological function. Topics include muscle and forces, fluid dynamics of the lungs and cardiovascular system, electrical signals in the body, and vision and optics of the eye. (Sp)

ECE 4833 VLSI Digital System Design 3 Credit Hours
(Slashlisted with ECE 5833) Prerequisite: ECE 3223 and ECE 3873. An introduction to Very-Large-Scale Integrated (VLSI) systems design methods; complementary Metal-Oxide Semiconductor (CMOS) technology emphasized. VLSI Computer Aided Design (CAD) tools and CMOS layout rules and techniques. Project oriented. No student may earn credit for both 4833 and 5833. (F)

ECE 4853 Biomedical Signals and Systems 3 Credit Hours
(Slashlisted with ECE 5853) Prerequisite: ECE 3723 and ECE 3793, or equivalent courses in electrical circuits and signal processing, or permission of instructor. Comprehensive coverage of topics related to signals in humans. Emphasis on using engineering tools to interpret signals and underlying physiological principles. Focus on emerging engineering technologies, physiological knowledge and clinical application. No student may earn credit for both 4853 and 5853. (Sp)

ECE 4863 Bioinstrumentation 3 Credit Hours
Prerequisite: ECE 3723 or ECE 4813 or permission of instructor. A comprehensive coverage of topics related to principles, applications and design of medical instruments widely used in hospitals and clinical research. Emphasis is placed on general design concepts, discussions on a great variety of medical devices and medical device safety issues. Materials cover different levels and various aspects of human systems, such as heart, brain, circulation, respiration. (F, Sp)

ECE 4960 Directed Readings 1-4 Credit Hours
1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean. May be repeated; maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)

ECE 4970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: Senior standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

ECE 4973 Special Topics 3 Credit Hours
Prerequisite: Varies with course content. May be repeated with change of subject; maximum credit six hours in combination with 4990. Devoted to special topics in Electrical and Computer Engineering not covered in the current curriculum. (F, Sp, Su)

ECE 4990 Special Studies 1-3 Credit Hours
Prerequisite: Senior standing and permission. May be repeated with change of subject matter; maximum credit six hours in combination with 4973. Devoted to supervised individual studies of special topics (S/U Graded) in Electrical and Computer Engineering. (F, Sp, Su)

ECE 5123 Wireless Communications 3 Credit Hours
Prerequisite: 3793 or permission. Wireless communications principles, multiple access techniques, wireless networking, and systems and standards. (F)

ECE 5153 Emerging Topics in LTE-Advanced and 5G 3 Credit Hours
Prerequisite: Graduate standing. This course will train students to master the latest developments in the rapidly evolving landscape in wireless cellular networks, preparing them for working on emerging as well as near future wireless technologies. Focuses on selected topics for research and development of LTE-A and 5G cellular networks, such as PHY and MAC layer techniques suitable LTE-A & 5G; network densification techniques. (Sp)

ECE 5183 Quantum Information Theory 3 Credit Hours
Prerequisite: linear algebra. Introductory course of quantum information theory. Topics covered include quantum state, quantum measurement, quantum channels, No-Cloning Theorem, Bell's inequalities, entanglement, quantum dense coding, quantum teleportation, distance measures, quantum entropy, quantum mutual information, information of quantum channels. (F)

ECE 5213 Digital Signal Processing 3 Credit Hours
(Slashlisted with 4213) Prerequisite: 3793. Discrete-time linear systems, finite duration impulse response digital filters, infinite impulse response digital filters, finite word length effects, spectral analysis, fast Fourier-transforms, two-dimensional signal processing and applications. No student may earn credit for both 4213 and 5213. (F)

ECE 5223 Estimation and Identification 3 Credit Hours
Prerequisite: 5403 and 5523. Estimation and filtering, optimal filtering, modeling, parametric and nonparametric identification methods. (Sp)

ECE 5273 Digital Image Processing 3 Credit Hours
Prerequisite: 3793 or permission of instructor. This course covers the theory, methods, and applications of image enhancement, image restoration, image compression, image segmentation, image representation and description, and image recognition and interpretation. (Sp)

ECE 5303 Solid State Electronics I 3 Credit Hours
Prerequisite: 3323. Principles and applications of electronic properties of solids for devices with particular emphasis on semiconductor junction, bulk and field effect devices. (F)

ECE 5323 Opto-Electronics I 3 Credit Hours
Prerequisite: 3323 or Engineering 2313. Introduction to phenomenological and quantum mechanical theory of solids; introduction to lasers and masers with particular emphasis on the physical mechanisms underlying interactions between electromagnetic radiation and atomic systems. (F, Sp)

ECE 5343 Quantum Structures and Devices 3 Credit Hours
Prerequisite: ECE 3323 or permission of instructor. Theory and application of KP method, strain effects, electrical and optical properties of quantum structures, semiconductor quantum devices including quantum well infrared photodetectors, quantum cascade and interband cascade lasers, type-II superlattice detectors. (Sp)

ECE 5363 Optical Engineering 3 Credit Hours
(Slashlisted with 4363; Crosslisted with BME 5363) Prerequisite: ECE 3793. Underlying theory and design of optical systems. Interference, diffraction, and coherence phenomena will be examined as a basis for studying the limits of optical system performance. Other topics include a detailed study of polarization, the interaction of light with various media, and geometrical optics. No student may earn credit for both 4363 and 5363. (Sp)

ECE 5383 IC Fabrication Technology I 3 Credit Hours
(Slashlisted with ECE 4383) Prerequisite: 3323. A treatment of the theory and processes involved in the fabrication of integrated circuits. No student may earn credit for both 4383 and 5383. (F)

ECE 5393 Integrated Circuit Fabrication Technology II 3 Credit Hours
Prerequisite: ECE 5383. Students will gain hands-on experiences of cleanroom technologies of the semiconductor industry, including epitaxial crystal growth, photolithography,and some techniques such as SEM. (Sp)

ECE 5403 Linear Systems Analysis 3 Credit Hours
Prerequisite: Math 3333. In-depth background course in methods of linear analysis in systems engineering. Topics include least squares methods, singular value decomposition, continuous and discrete time linear dynamical systems, controllability and state transfer. (F)

ECE 5413 Control Theory 3 Credit Hours
Prerequisite: 4413, 5403. Controllability, optimal control and dynamic programming, LQR, observability, linear estimation and Kalman filter, realization theory. (Sp)

ECE 5423 Power System Protection 3 Credit Hours
Prerequisite: Graduate Standing and ECE 3113 (ECE 4113 is also preferred) or permission of instructor. This course facilitates a study into the main protection system elements and their design fundamentals for modern power systems. It covers the operating principles of different types of fault sensing and interrupting components as well as coordination strategies and device settings for typical power system configurations including: generator, transformer, busbar, transmission line and distribution feeder protection. (Sp, Irreg.)

ECE 5433 Measurement and Automation 3 Credit Hours
(Slashlisted with ECE 4433) Prerequisite: Graduate standing and ECE 3793, or instructor permission, or systems course in another major. Fundamentals of data acquisition and control. A series of design projects in data acquisition, logging and real-time analysis. Includes machine vision and image processing as well as vibration, motion and real-time control. No student may earn credit for both 4433 and 5433. (F)

ECE 5463 Advanced Computer Architecture 3 Credit Hours
(Crosslisted with C S 5463) Prerequisite: graduate standing. The design of modern programmable computer systems with emphases on exploiting parallelism at all levels, designing within constraints including energy consumption, and the impact of architecture on software design. Covers state of the art computer architecture, case studies and trends. (Sp)

ECE 5513 Communication Theory 3 Credit Hours
Prerequisite: 4523. Probability theory, stochastic processes, detection, extraction and predictions of signals in noise. (F)

ECE 5523 Random Signals 3 Credit Hours
Prerequisite: Graduate standing, ECE 2523, ECE 3793, or permission of instructor. This course explores random signals from two perspectives: random variables and random processes. Topics include probability, single and double random variables, and random vectors; concepts of stationarity and ergodicity; random signals as an input into linear systems and the statistical properties of their outputs; random signal parameters; and quality of estimators. (F)

ECE 5553 Telecommunications Technology 3 Credit Hours
Prerequisite: 3793. The ways and means by which voice, data and video traffic are moved long distances. Topics include data networks, telephone systems, video, and optical systems. (F)

ECE 5583 Information Theory and Probabilistic Programming 3 Credit Hours
Prerequisite: Graduate standing, and ECE 4523 or equivalent. Introductory course in information theory. Topics include asymptotic equipartition property, entropy, Fano's inequality, Huffman coding, lossy source coding theory, and channel coding theory. (F)

ECE 5603 Radar Imaging 3 Credit Hours
(Slashlisted with ECE 4603) Prerequisite: graduate standing or permission of instructor; ECE 3793. Course coverage includes radar signal models and phase histories, the types of processing steps used to focus radar data into high-resolution imagery, and fundamental behaviors and performance metrics of radar imaging. Course also investigates various radar imaging algorithms applied to range-Doppler imaging, synthetic aperture radar (SAR), inverse SAR, and angle-of-arrival (spatial) imaging. No student may earn credit for both 4603 and 5603. (Sp)

ECE 5623 Computer Hardware Design 3 Credit Hours
(Slashlisted with 4623) Prerequisite: 3223. Design of modern digital computing circuits, computer arithmetic, number systems, state machines, control units, data transfer, bus interfacing, VHDL language elements and usage, circuit simulation. No student may earn credit for both 4623 and 5623. (F)

ECE 5643 Radio Frequency and Microwave Engineering 3 Credit Hours
(Slashlisted with ECE 4643) Prerequisite: Graduate standing. Analysis of radio frequency (RF) and microwave components, circuits, and systems using modern engineering tools and measurement instruments. No student may earn credit for both 4643 and 5643. (Sp)

ECE 5653 Digital Radar Systems 3 Credit Hours
(Slashlisted with ECE 4653). Prerequisite: ECE 3793. Modern and next-generation radar systems, with an emphasis on the digital receiver and post processing that follows the RF front-end. Several off-the-shelf receiver case studies will be conducted. These will focus on analog-to-digital converter (ADC) selection followed by software defined radio (SDR) concepts for field programmable gate array (FPGA) implementation. These receivers may also be used for communication systems and have other broad applications. No student may earn credit for both 4653 and 5653. (F)

ECE 5663 Radar Engineering 3 Credit Hours
(Crosslisted with METR 5663; Slashlisted with 4663) Prerequisite: Grade of C or better in 3613, or permission of instructor. Introduction to radar system designs and applications with emphasis on weather radar; radar system architecture and their functionalities and limitations of subsystems; theories of radar detection and estimation in a noisy and cluttered environment; existing technologies and advanced techniques to improve radar performance. No student may earn credit in both 4663 and 5663. (F)

ECE 5673 Weather Radar Theory and Practice 3 Credit Hours
(Slashlisted with 4673, Crosslisted with METR 5673) Prerequisite: graduate standing, grade of C or better in Math 3113 and Physics 2524, or permission of instructor. Introduction to electromagnetic waves and propagation through the atmosphere, radar design trade-offs, antennas, transmitters, and coherent receivers; analysis of radar signals as noise-corrupted stochastic processes, with emphasis on digital signal processing for Doppler spectrum and moment estimation; implementation of processing algorithms using actual Doppler radar data. No student may earn credit for both 4673 and 5673. (F)

ECE 5683 Weather Radar Applications 3 Credit Hours
(Crosslisted with METR 5683) Prerequisite: graduate standing in Meteorology or Engineering, or permission of instructor. Interpretation of meteorological structures using weather radar. Introduces scatter from hydrometeors and refractive index variations. Presentation of quantitative precipitation estimation methods based on the radar reflectivity factor, attenuation, and dual-polarization observations. Also includes the fundamental concepts of clear-air echoes and the estimation of winds under non-precipitation conditions. (Sp)

ECE 5693 Antennas 3 Credit Hours
(Slashlisted with ECE 4693) Prerequisites: ECE 3613, ECE 4703, and permission of instructor. Introduction to antenna theory and design. Course covers design, construction, and measurement of antennas including, but not limited to the following specific types; dipoles, loops, aperture, microstrip, and broadband antennas, as well as array theory. No student may earn credit for both 4693 and 5693. (Sp)

ECE 5703 Electromagnetic Fields and Wave Propagation 3 Credit Hours
(Slashlisted with ECE 4703) Prerequisite: Graduate standing, ECE 3613 and permission of instructor. Maxwell's Equations, time-harmonic fields, plane waves, reflections on interfaces, waveguides and transmission lines, radiation, and antenna basics. No student may earn credit for both 4703 and 5703. (F, Sp)

ECE 5723 Radar Signal Processing 3 Credit Hours
Prerequisite: ECE 3793 or equivalent. Radar fundamentals: radar range equation, waveforms, detection and matched filtering, ambiguity functions. Processing and Applications: Pulse-Doppler radar, synthetic aperture radar (SAR), moving target indication (MTI), space time adaptive processing (STAP). (Sp)

ECE 5733 RF & Microwave Filter Design 3 Credit Hours
(Slashlisted with ECE 4733) Prerequisite: instructor permission. Introduction to advanced filter design. The use of filters is very widespread in all aspects of communication and radar systems. At the end of the semester, a student that has successfully embraced the subject will be able to design, fabricate, and test filters, using a range of different technologies and methods. No student may receive credit for both 4733 and 5733. (Sp)

ECE 5833 VLSI Digital System Design 3 Credit Hours
(Slashlisted with ECE 4833) Prerequisite: ECE 3223 and ECE 3873. An introduction to Very-Large-Scale Integrated (VLSI) systems design methods; complementary Metal-Oxide Semiconductor (CMOS) technology emphasized. VLSI Computer Aided Design (CAD) tools and CMOS layout rules and techniques. Project oriented. No student may earn credit for both 4833 and 5833. (F)

ECE 5843 Medical Imaging Systems 3 Credit Hours
Prerequisite: 3793 or Fourier transforms, or permission. Fundamental principles of medical image formation, image acquisition and image quality evaluation, Major medical imaging modalities, such as radiography, fluoroscopy, computed tomography, ultrasound, MRI, and nuclear medicine will be introduced. Clinical applications and limitations of each modality will also be analyzed. (Sp)

ECE 5853 Biomedical Signals and Systems 3 Credit Hours
(Slashlisted with 4853, Crosslisted with BME 5853) Prerequisites: ECE 3723 and ECE 3793, or equivalent course in electrical circuits and signal processing, or permission of instructor. Comprehensive coverage of topics related to signals in humans. Emphasis on using engineering tools to interpret signals and underlying physiological principles. Focus on emerging engineering technologies, physiological knowledge and clinical application. No student may earn credit for both 4853 and 5853. (Sp)

ECE 5863 Bioinstrumentation 3 Credit Hours
(Crosslisted with BME 5863) Prerequisite: ECE 4213 or permission of instructor. A comprehensive coverage of topics related to principles, applications, and design of medical instruments widely used in hospitals and clinical research. Emphasis is placed on general design concepts, discussions on a great variety of medical devices, and medical device safety issues. Materials cover different levels and various aspects of human systems, such as heart, brain, circulation, and respiration. (F, Sp)

ECE 5873 Advanced VLSI Design and Applications 3 Credit Hours
Prerequisite: ECE 4833 or ECE 5833. Design of sophisticated digital integrated circuits; special purpose architectures used where appropriate; silicon compiler and hardware description language used; project oriented. (Sp)

ECE 5880 Professional Internship 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing and 12 credit hours toward graduate degree. May be repeated; maximum credit six hours; grade equivalent to B or better required. Professional technical internship training in electrical and computer engineering, as part of M.S. or PhD degree requirements. A written report to be graded by a member of the graduate faculty is required. (F, Sp, Su)

ECE 5960 Directed Readings 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing and permission of department. May be repeated; maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)

ECE 5970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

ECE 5973 Special Topics in Electrical and Computer Engineering 3 Credit Hours
(Crosslisted with BME 5973) Prerequisite: Graduate standing and permission of instructor. May be repeated with change of content; maximum credit 12 hours. Selected topics of current research interest not covered by regularly scheduled coursework. (F, Sp, Su)

ECE 5980 Research for Master's Thesis 2-9 Credit Hours
Variable enrollment, permission of instructor required, two to nine hours; credit required for degree, six hours. (F, Sp, Su)

ECE 5990 Special Studies 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing or permission. May be repeated with change of subject matter; maximum credit nine hours. Devoted to special topics in electrical engineering not covered in the regular curriculum or to supervised individual study. (F, Sp, Su)

ECE 6613 Weather Radar Polarimetry 3 Credit Hours
(Crosslisted with METR 6613) Prerequisite: graduate standing. Provides fundamentals and principles of weather radar polarimetry through understanding wave scattering and propogation in geophysical media subject to turbulent mixing and filled with hydrometers and other objects. The relations between polarimetric radar observables and physical parameters will be established. The methods and algorithms for retrieving cloud and precipitation microphysics for weather quantification and forecast will be introduced. (F)

ECE 6813 Advanced Topics in Biomedical Engineering 3 Credit Hours
Prerequisite: 5843. May be repeated with change of content; maximum credit 12 hours. In-depth studies in biomedical engineering. Focus will be on advanced optoelectronic biomedical technologies, such as bioinstrumentation, biomedical imaging modalities. Students will learn the knowledge behind current technology and also research and development methods of applying future technology to clinical and biomedical applications. (Sp)

ECE 6950 Research in Electrical and Computer Engineering 1-4 Credit Hours
1 to 4 hours. Prerequisite: graduate standing and permission of instructor in Electrical and Computer Engineering. May be repeated; maximum credit 24 hours. Research in electrical and computer engineering occurring prior to the General Examination. (F, Sp, Su)

ECE 6960 Directed Readings 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing or permission of instructor. May be repeated; maximum credit six hours. Directed readings and/or literature review under the direction of a faculty member. (Irreg.)

ECE 6970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing or permission of instructor. May be repeated; maximum credit 12 hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or research and field projects. (Irreg.)

ECE 6980 Research for Doctoral Dissertation 2-16 Credit Hours
2 to 16 hours. Prerequisites: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (F, Sp, Su)

ECE 6990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)

Faculty

Last Name	First/Middle Name	Middle init.	OU Service start	Title(s), date(s) appointed	Degrees Earned, Schools, Dates Completed
Barnes	Ronald		2007	ASSOCIATE PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2013; GERALD TUMA PRESIDENTIAL PROFESSOR, 2016	PhD, Univ of Illinois, 2005; MS, Univ of Illinois, 2002; BS, Univ of Oklahoma, 1998

Cheng	Szeming		2006	ASSOCIATE PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING AT TULSA, 2013; ASSOCIATE PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2017; WILLIAM H. BARKOW PRESIDENTIAL PROFESSOR, 2018	PhD, Texas A&M Univ, 2004; MS, Univ of Hawaii, 2000; MPhil, Hong Kong Univ of Sci & Tech, 1997; BEng, Univ of Hong Kong, 1995
Cruz	Joao	R	1982	PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 1992; TILLEY CHAIR IN ELECTRICAL ENGINEERING, 2002	PhD, Univ of Houston, 1980; MS, Univ of Houston, 1977; BS, Univ of Porto, 1974
Fitzmorris	Cliff	W	2018	ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2018; ADJUNCT INSTRUCTOR OF CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE, 2010	MS, Univ of Oklahoma, 1995; BS Univ of Oklahoma, 1988
Fulton	Caleb		2011	ASSOCIATE PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2018; CIMMS FELLOW, 2012; PRESIDENT'S ASSOCIATES PRESIDENTIAL PROFESSOR, 2017	PhD, Purdue Univ, 2011; BS, Purdue Univ, 2006
Goodman	Nathan		2011	CIMMS FELLOW, 2012; DIRECTOR OF RESEARCH, ADVANCED RADAR RESEARCH CENTER, 2015; PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2016	PhD, Univ of Kansas, 2002; MS, Univ of Kansas, 1997; B, Univ of Kansas, 1995
Havlicek	Joseph		1997	PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2007; WILLIAMS COMPANIES FOUNDATION PRESIDENTIAL PROFESSOR, 2009; GERALD TUMA PRESIDENTIAL PROFESSOR, 2017	PhD, Univ of Texas, 1996; MS, Virginia Tech, 1988; BS, Virginia Tech, 1986
Imran	Ali		2014	ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2014	PhD, Univ of Surrey, 2011; MS, Univ of Surrey, 2007; BS, Univ of Engineering & Tech
Jiang	Ning		2007	ASSOCIATE PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2012; OKLAHOMA GAS AND ELECTRIC CO. PROFESSOR OF ELECTRICAL ENGINEERING, 2012	PhD, Univ of Texas, 2005; MS, Univ of Texas, 1998; M Engr, Chinese Acad of Science, 1994; BSc, Tsinghua Univ, 1991
Liu	Hong		2000	CHARLES B. JR. AND JEAN SMITH CHAIR IN ELECTRICAL AND COMPUTER ENGINEERING, 2000; GEORGE LYNN CROSS RESEARCH PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2007	PhD, Worcester Polytechnic Inst., 1992; MS, Beijing Inst. of Posts & Telecom, 1982; BS, Beijing Polytechnic Univ, 1977
McCann	Patrick		1990	GEORGE LYNN CROSS RESEARCH PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2006; HENRY J. FREEDE M.D. PROFESSOR OF ENGINEERING, 2010	PhD, Mass Inst of Tech, 1990; BS, Univ of California Berkeley, 1981
Metcalf	Justin	G	2018	ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2018	PhD, Univ of Kansas, 2015; MS, Univ of Kansas, 2011; BS, Kansas Sate Univ, 2006
Moses	Paul	S	2017	ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2017	PhD, Curtin Univ of Tech, 2012; BS, Curtin Univ of Tech, 2006
Qiu	Yuchen		2008	ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2016	PhD, Univ of Oklahoma, 2013; ME, Xi'an Jiaotong Univ, 2008; BE, Xi'an Jiaotong Univ, 2005
Refai	Hazem	H	2001	DIRECTOR, EMC TEST LAB, 2008; PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING AT TULSA, 2012; WILLIAMS CHAIR IN TELECOMMUNICATIONS NETWORKING, 2017; WILLIAMS PROFESSOR IN TELECOMMUNICATIONS NETWORKING	PhD, Univ of Oklahoma, 1999; MS, Univ of Oklahoma, 1993; BS, Aleppo, 1987
Ruyle	Jessica		2011	ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2011; CIMMS FELLOW, 2012	PhD, Univ of Illinois, 2011; MS, Univ of Illinois, 2008; BS, Texas A&M Univ, 2006

Salazar-Cerreño	Jorge	L	2015	CIMMS FELLOW, 2015; ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2015	PhD, Univ of Massachusetts, 2012; MA, Univ of Puerto Rico, 2002; BS, Universidad Privada Antenor Orrego, 1994
Shi	Zhisheng		1997	PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2006; GERALD TUMA PRESIDENTIAL PROFESSOR, 2008	PhD, Inst Albert-Ludwig Univ Freiburg; MS, Jilin Univ, 1987; BS, Jilin Univ, 1984
Sigmarsson	Hjalti		2011	ASSOCIATE PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2018; GERALD TUMA PRESIDENTIAL PROFESSOR, 2018; CIMMS FELLOW, 2012	PhD, Purdue Univ, 2010; MS, Purdue Univ, 2005; BS, Univ of Iceland, 2003
Sluss	James Jr.		1997	REGENTS PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2017	PhD, Univ of Virginia, 1989; MS, Univ of Virginia, 1986; BS, Marshall Univ, 1984
Tang	Choon Yik		2006	ASSOCIATE PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2013; GERALD TUMA PRESIDENTIAL PROFESSOR, 2016	PhD, Univ of Michigan, 2003; MS, Oklahoma State Univ, 1997; BS, Oklahoma State Univ, 1996
Weng	Binbin		2015	CLEANROOM ENGINEER, 2015; ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2018	MS, Zhejiang Univ, 2008; BS, Zhejiang Univ, 2005
Yang	Rui	Q	2007	PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2007	PhD, Nanjing Univ, 1987; MS, Nanjing Univ, 1984; BS, Zhejiang Univ, 1982
Yeary	Mark		2002	CIMMS FELLOW, 2007; C. B. HUDSON/ TORCHMARK PRESIDENTIAL PROFESSOR, 2010; PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2012; DIRECTOR, DEFENSE, SECURITY AND INTELLIGENCE RESEARCH INITIATIVE, 2015	PhD, Texas A&M Univ , 1999; MS, Texas A&M Univ, 1994; BS, Texas A&M Univ, 1992
Yu	Tian You		2002	CIMMS FELLOW, 2007; ADJUNCT ASSOCIATE PROFESSOR OF METEOROLOGY, 2008; GERALD TUMA PRESIDENTIAL PROFESSOR, 2012; PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2012	PHD, Univ of Nebraska, 2000; MS, National Central Univ, 1992; BS, National Central Univ, 1990
Zhang	Yan		2006	CIMMS FELLOW, 2007; PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2018; PRESIDENT'S ASSOCIATES PRESIDENTIAL PROFESSOR, 2015	PhD, Univ of Nebraska, 2004; MSEE, Beijing Inst of Tech, 2001; BS, Beijing Inst of Tech, 1998