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
- Electrical Engineering, Bachelor of Science

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

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Prerequisites and descriptions for each course can be found in the catalog or on the university website.
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; quasistationary 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 4393  Integrated Circuit Fabrication Technology II
3 Credit Hours
(Slashlisted with ECE 5393) Prerequisite: senior standing and ECE 4383. Students will gain hands-on experiences of cleanroom technologies of the semiconductor industry, including epitaxial crystal growth, photolithography, and some techniques such as SEM. No student may earn credit for both 4393 and 5393. (Sp)

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 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 PHV 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: 3223. Principles and applications of electronic properties of solids for devices with particular emphasis on semiconductor junctions, bulk and field effect devices. (F)

ECE 5323 Opto-Electronics I 3 Credit Hours
Prerequisite: 3223 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
(Slashlisted ECE 4393) 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. No student may earn credit for both 4393 and 5393. (Sp)

ECE 5403 Linear Systems Analysis 3 Credit Hours
Prerequisite: 4433. 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 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 5543  Telecom Network Design and Management  3 Credit Hours
Prerequisite: 3793. Introduction to basic issues in the design and management of telecommunications networks; Concepts will include those pertinent to telecommunications engineering and electrical and computer engineering, such as wide area network design principles that cater to Erlangian traffic. (Sp)

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 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 hydrometers 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 3783, 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 twelve 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 6213  Optical Information Processing  3 Credit Hours
(Crosslisted with BME 6213) Prerequisite: ECE 5213 and ECE 5353. Application of Fourier transforms, linear systems, and diffraction theory to the analysis of optical systems. Emphasis is on the use of optical systems for information processing, including image enhancement, pattern recognition, data processing, optical switching, and computing. (F)

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 propagation 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

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First/Middle Name</th>
<th>Middle init.</th>
<th>OU Service start</th>
<th>Title(s), date(s) appointed</th>
<th>Degrees Earned, Schools, Dates Completed</th>
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<tbody>
<tr>
<td>Chan</td>
<td>Kam</td>
<td>W</td>
<td>2013</td>
<td>ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2013</td>
<td>PhD, Univ of Rochester, 2005; MPH, Chinese Univ of Hong Kong, 1999; BS, Chinese Univ of Hong Kong, 1997</td>
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<td>Cheng Szeming</td>
<td>ASSOCIATE PROFESSOR</td>
<td>PhD, Texas A&amp;M Univ, 2004; MS, Univ of Hawaii, 2000; MPhil, 2003; BEng, 1995</td>
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<td>PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 1992; TILLEY CHAIR IN ELECTRICAL ENGINEERING, 2002</td>
<td>PhD, Univ of Houston, 1980; MS, Univ of Houston, 1977; BS, Univ of Porto, 1974</td>
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<td>Dyer John</td>
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<td>PhD, Univ of Oklahoma, 2008; MS, Univ of Oklahoma; 1995; BS, Univ of Oklahoma, 1993; BS, Univ of Oklahoma State Univ, 1985</td>
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<td>MS, Univ of Oklahoma, 1995; BS Univ of Oklahoma, 1988</td>
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<td>Goodman Nathan</td>
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<td>Havlicek Joseph</td>
<td>PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, 2007; WILLIAMS COMPANIES FOUNDATION PRESIDENTIAL PROFESSOR, 2009; GERALD TUMA PRESIDENTIAL PROFESSOR, 2017</td>
<td>PhD, Univ of Texas, 1996; MS, Virginia Tech, 1986; BS, Virginia Tech, 1986</td>
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<td>Liu Hong</td>
<td>CHARLES B. JR. AND</td>
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<td>Refai Hazem H</td>
<td>2001</td>
<td>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</td>
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<td>PhD</td>
<td>Univ of Massachusetts, 2012; MA, Univ of Puerto Rico, 2002; BS, Universidad Privada Antenor Orrego, 1994</td>
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<td>PhD</td>
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<td>Zhang Yan</td>
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<td>PhD, Univ of Delaware, 1993; MS, Shanghai Univ of Science and Tech, 1984; BS, Shanghai Univ of Science and Tech, 1982</td>
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