ELECTRICAL & COMPUTER ENGINEERING (ECE)

Course numbers with the # symbol included (e.g. #400) have not been taught in the last 3 years.

ECE 401 - Perspectives in Electrical and Computer Engineering
Credits: 4
An introductory course for electrical and computer engineering majors that introduces incoming students to the fundamental concepts of analysis and design. Concepts are presented through an examination of real-world problems. Students are introduced to electrical and computer engineering problem solving and design through active learning techniques in lecture and in a laboratory setting. Provides a context for the electrical engineering and computer engineering curriculum and introduces the profession and activities of electrical and computer engineering. Lab.
Attributes: Inquiry (Discovery)

ECE 444 - Bionics: Technology from Nature
Credits: 4
Bionics is the study of living systems with the intention of applying their principles to the design of useful technology for mankind. Students learn strategies to discover bio-inspired technology. The student investigates the fields of bio-inspired cyborgs, defense and attack mechanisms in biology leading to military applications including non-lethal weapons, bio-inspired sensors including brain-computer interfaces, bio-inspired robots, and animal and plants that generate energy for technology. Writing Intensive. Lab.
Attributes: Biological Science(Discovery); Discovery Lab Course; Biological Science GP 3B; Inquiry (Discovery); Writing Intensive Course

ECE 537 - Introduction to Electrical Engineering
Credits: 4
Fundamentals of electrical engineering. Topics are circuit elements; signal waveforms; circuit laws and theorems; transfer functions; free, forced, and steady state responses; power calculations; amplifiers; and magnetic circuits. Non-ECE majors only. Prereq: PHYS 408. Pre- or Coreq: MATH 527. Lab.

ECE 541 - Electric Circuits
Credits: 4
Linear passive circuits beginning with resistive circuits, power and energy relations, mesh and node analysis. Transient and steady-state behavior of simple circuits containing energy storage elements (capacitors, inductors). Introduction to linear active circuits using dependent source models and ideal op amps. Introduction to transfer function and frequency response concepts. For ECE majors only. Pre- or Coreq: MATH 426; PHYS 408. Lab.

ECE 543 - Introduction to Digital Systems
Credits: 4
Fundamental analysis and design principles. Number systems, codes, Boolean algebra, and combinational and sequential digital circuits. Lab: student-built systems using modern integrated circuit technology and an introductory design session on a CAD workstation. Lab.

ECE 548 - Electronic Design I
Credits: 4
Introduction to electronic design for analog signal processing. Linear op amp circuits for amplification and filtering. Use of Laplace techniques for filter specification; simple passive and op amp filter realizations. Discrete active devices (FET and BJT): operating characteristics, biasing considerations, canonical amplifier configurations including differential amplifiers. Prereq: ECE 541. Lab.

ECE 562 - Computer Organization
Credits: 4
Basic computer structure, including arithmetic, memory, control, and input/output units; the trade-offs between hardware, instruction sets, speed, and cost. Laboratory experiments involving machine language programming and I/O interfacing using microcomputers. Prereq: CS 410 or CS 415; ECE 543. Lab.

ECE 583 - Designing with Programmable Logic
Credits: 4
Design methodologies for implementing digital systems in programmable logic. Covers topics related to the design, implementation, and testing of programmable logic devices. Students are introduced to the Very-High-Speed Hardware Description Language (VHDL) entry language and simulation procedures, along with common logic synthesis tools. Programmable logic families, device architectures, and testing procedures are covered in detail. Laboratory exercises lead the student through the complete programmable logic design cycle. Each student is required to prototype a digital system starting with VHDL entry, functional and timing simulations, logic synthesis, device programming, logic probing, and systems verification. Prereq: ECE 562. Lab.

ECE 602 - Engineering Analysis
Credits: 4

ECE 603 - Electromagnetic Fields and Waves I
Credits: 4
Maxwell’s equations in integral and differential form with applications to static and dynamic fields. Uniform plane waves in free space and material media. Boundary conditions; simple transmission line theory; parallel plate and rectangular waveguides; simple radiating systems. Prereq: PHYS 408; ECE 602.

ECE 617 - Junior Laboratory I
Credits: 4
Application of laboratory instrumentation to the investigation of active and passive circuit characteristics; introduction to computer-aided design, analysis, and testing; development of report writing and oral presentation skills. Pre- or Coreq: ECE 633; ECE 651. Writing intensive.
Attributes: Writing Intensive Course

ECE 618 - Junior Laboratory II
Credits: 4
Laboratory exercises in the design and analysis of active circuits, techniques of signal processing, and the properties of distributed circuits. Continued development of report writing and oral presentation skills. Prereq: ECE 617. Pre- or Coreq: ECE 603. Writing intensive.
Attributes: Writing Intensive Course
ECE 633 - Signals and Systems I  
Credits: 3  
Mathematical characterization of continuous-time systems using time- 
and frequency-domain concepts. Properties of linear systems described 
by ordinary differential equations. Fourier analysis of signals and system 
frequency response functions. Applications to communication and 
control systems. Introduction to system simulation using computer 
methods. Prereq: MATH 527.

ECE 633H - Signals and Systems I/Honors  
Credits: 4  
Mathematical characterization of continuous-time systems using time- 
and frequency-domain concepts. Properties of linear systems described 
by ordinary differential equations. Fourier analysis of signals and system 
frequency response functions. Applications to communication and 
control systems. Introduction to system simulation using computer 
methods. Honors students will attend an additional one-hour meeting 
each week. Prereq: MATH 527, permission required.

ECE 634 - Signals and Systems II  
Credits: 3  
Transient response analysis of linear systems using Laplace transforms, 
application to feedback control systems. Introduction to discrete-time 
linear systems; system response determination using Z-transform; 
elementary design of digital filters and controllers. State variable 
formulation of dynamical systems. Prereq: ECE 633.

ECE 647 - Random Processes and Signals in Engineering  
Credits: 3  
Emphasis on applied engineering concepts such as component failure, 
quality control, noise propagation. Topics include random variables, 
probability distributions, mean and variance, conditional probability, 
correlation, power spectral density. Prereq: MATH 426; ECE 602.

ECE 647H - Random Processes and Signals/Honors  
Credits: 4  
Emphasis on applied engineering concepts such as component failure, 
quality control, noise propagation. Topics include random variables, 
probability distributions, mean and variance, conditional probability, 
correlation, power spectral density. Honors students attend an additional 
one-hour meeting each week. Prereq: MATH 426; ECE 602, permission 
required.

ECE 649 - Embedded Microcomputer Based Design  
Credits: 4  
An in-depth treatment of the design of embedded microcomputer 
systems. Topics include advanced architectures for embedded 
processors, hardware and software aspects of interfacing, handling 
interrupts, advanced programming including debugging of real time 
systems, embedded application implementations. Laboratory studies 
are required to reinforce theoretical and applied concepts in an actual 
embedded architecture. Prereq: ECE 562. Lab.

ECE 651 - Electronic Design II  
Credits: 4  
Design of fundamental circuit blocks in electronic systems. Multistage 
amplifiers; feedback systems and stability; power amplifiers. Nonlinear 
electronic circuits: oscillators, function generators; clippers and peak 
detectors; A/D and D/A conversion. Switching mode and logic circuits. 
Prereq: ECE 548.

ECE 681 - Teaching Experience  
Credits: 1  
Credit for assisting in the instruction of undergraduate laboratories. 
Available on a limited basis to students selected by the department 
chairperson. May be repeated for credit up to a total of 4 credits.

ECE 694 - Professional Principles of Engineering  
Credits: 1  
Provides background for the capstone design experience (ECE 791/ 
ECE 792). Topics include creativity, design methodology, specification 
development, project management, ethics, safety, reliability and 
preparation for oral and written reports. Includes initial capstone project 
selection. Prereq: ECE junior standing. Cr/F.

ECE 704 - Electromagnetic Fields and Waves II  
Credits: 4  
Loop antennas; aperture and cylindrical antennas; self and mutual 
impedance; receiving antennas and antenna arrays; bounded plane 
waves; rectangular and cylindrical waveguides; waveguide discontinuities 
and impedance matching; solid state microwave sources. Prereq: 
ECE 603.

ECE 711 - Digital Systems  
Credits: 4  
Principles, procedures and tools related to the design, implementation 
and testing of microprocessor-based embedded systems. Students 
prototype a complete embedded system using CAD tools, application 
specific integrated circuits, printed circuit board technology, and modern 
diagnostic/testing procedures and tools. Projects are designed to 
introduce diverse digital technologies. Lab.

ECE 714 - Introduction to Digital Signal Processing  
Credits: 4  
Introduction to digital signal processing theory and practice, including 
coverage of discrete time signals and systems, frequency domain 
transforms and practical spectral analysis, digital filter terminology and 
design, and sampling and reconstruction of continuous time signals. 
Laboratory component providing an introduction to DSP design tools 
and real-time algorithm implementation. Prereq: ECE 633. Lab.

ECE 715 - Introduction to VLSI  
Credits: 4  
Principles of VLSI (Very Large Scale Integration) systems at the physical 
level. CMOS circuit and logic design, CAD tools, CMOS system case 
studies. Students exercise the whole development cycle of a VLSI 
chip: design and layout performed during semester I. The chips are 
fabricated off campus and returned during semester II, when they are 
tested by students. An IA (continuous grading) grade is given at the end 
of semester I. Lab.

ECE 717 - Introduction to Digital Image Processing  
Credits: 4  
Digital image representation; elements of digital processing systems; 
multidimensional sampling and quantization; image perception by 
humans, image transformations including the Fourier, the Walsh, and 
the Hough Transforms; image enhancement techniques including 
image smoothing, sharpening, histogram equalization, and pseudo 
color processing; image restoration fundamentals; image compression 
techniques, image segmentation and use of descriptors for image 
representation and classification. Prereq: ECE 633; ECE 647. Lab.

ECE 724 - Ubiquitous Computing Fundamentals  
Credits: 4  
Ubiquitous computing, or ubicomp, explores embedded, interconnected 
computing devices that are part of everyday objects and activities. This 
course takes an interdisciplinary look at the foundations of ubiquitous 
computing. Topics include software and hardware for ubicomp, human-
computer interaction in ubicomp, and issues related to privacy and 
security in ubicomp. Students undertake a research project inspired by 
the material. Registration by permission only.
ECE 734 - Network Data Communications  
Credits: 4  
Introduces basic concepts related to data transmission equipment and physical interfaces, data communication protocols, and the Open System Interconnection (OSI) Reference Model. Includes physical layer hardware, signaling schemes, protocol packets, computer interfaces, error detection, signal integrity, and data transmission protocols relative to both wired and wireless networks. Introduces both logical and wide-area networks, and how a networking system is constructed, tested, and managed. Network design and testing exercises. Prereq: ECE 633; ECE 649. Lab. Electrical Engineering majors only.

ECE 757 - Fundamentals of Communication Systems  
Credits: 4  
Spectra of deterministic and random signals; baseband and bandpass digital and analog signaling techniques; transmitter and receiver architectures; performance analysis of digital and analog signaling in additive noise channels; carrier and symbol timing synchronization methods. Prereq: ECE 653; ECE 647. Lab.

ECE 758 - Communication System Design  
Credits: 4  
System-level design and implementation of communication hardware including: mixers, RF amplifiers, filters, oscillators and frequency synthesizers, modulators and detectors, carrier and symbol timing recovery subsystems. Issues in software-defined radio transmitter and receiver implementation. Communication link engineering including antenna selection and channel impairment effects. Prereq: ECE 651; ECE 757. Lab.

ECE #760 - Introduction to Fiber Optics  
Credits: 4  
Basic physical and geometric optics; solution of Maxwell’s equations for slab waveguides and cylindrical waveguides, of both step index and graded index profiles; modes of propagation and cutoff; polarization effects; ground and phase velocity; ray analysis; losses; fabrication; sources; detectors; couplers; splicing; cabling; applications; system design. Prereq: ECE 603. Lab.

ECE 772 - Control Systems  
Credits: 4  
Development of advanced control system design concepts such as Nyquist analysis; lead-lag compensation; state feedback; parameter sensitivity; controllability; observability; introduction to non-linear and modern control. Includes interactive computer-aided design and real-time digital control. Prereq: ECE 634. Lab. (Also offered as ME 772.)

ECE 775 - Applications of Integrated Circuits  
Credits: 4  

ECE 777 - Collaborative Engineering  
Credits: 4  
Study of processes in which engineers from diverse disciplines cooperate to specify, design, manufacture, test, market, and maintain a product. Classes are organized in both technical and nontechnical flexible modules. Technical topics are advanced and relevant to project being developed, such as related research, technology, design methodology, and CAD tools. Nontechnical topics include ISO 9000 quality system, engineering management, budget considerations, building, communication and leadership skills, and concurrent engineering principles. The course utilizes collaborative engineering by team development of an engineering project, often a research oriented proof-of-concept prototype. Prereq: permission. Lab. Also listed as TECH 750.

ECE 784 - Biomedical Instrumentation  
Credits: 4  
Principles of physiological and biological instrumentation design including transducers, signal conditioning, recording equipment, and patient safety. Laboratory includes the design and use of instrumentation for monitoring of electrocardiogram, electromyogram, electroencephalogram, pulse, and temperature. Current research topics, such as biotelemetry, ultrasonic diagnosis, and computer applications. Prereq: ECE 651. Lab.

ECE 791 - Senior Project I  
Credits: 2  
First semester of the capstone design experience. Students develop project plans, and prepare and present written and oral project proposals. The project plans must include aspects of design, implementation and evaluation. At the end of the semester, students prepare a written progress report. Prereq: ECE 694; ECE senior standing. Writing intensive.  
Attributes: Writing Intensive Course

ECE 791H - Senior Honors Project I  
Credits: 4  
First semester of the capstone honors senior thesis research. Students develop research plans, prepare and present written and oral research proposals. The research plans must include aspects of design, implementation and evaluation, similar to ECE 791. However, honors thesis research must also include independent research beyond the normal scope of ECE 791. At the end of the semester students prepare a written progress report. Prereq: ECE 694; ECE senior standing, permission required. Writing intensive.  
Attributes: Writing Intensive Course

ECE 792 - Senior Project II  
Credits: 2  
This course requires the completion of the capstone design experience begun in ECE 791. At the end of the semester students prepare written final project reports, and present their results in a research poster session. Prereq: ECE 791. Writing intensive.  
Attributes: Writing Intensive Course

ECE 792H - Senior Honors Project II  
Credits: 4  
This course requires the completion of the capstone honors thesis research begun in ECE 791H. At the end of the semester students prepare honors theses, and present their research results in a research poster session. ECE 791H/792H fulfills the requirement of one professional elective. Prereq: ECE 791H, permission required. Writing intensive.  
Attributes: Writing Intensive Course
ECE 795 - Electrical and Computer Engineering Projects
Credits: 1-4
Laboratory course. Student undertakes a project of mutual interest with an ECE faculty advisor. A written final report must be filed with the ECE Department. Prereq: permission.

ECE 796 - Special Topics
Credits: 1-4
New or specialized courses and/or independent study. Prereq: permission. 1 to 4 credits some sections may use credit/fail grading.