Electrical Engineering (ECE)

Courses

ECE 0822. Investing for the Future. 4 Credit Hours.
This class will teach you about seemingly complicated financial topics in a very comprehensible manner that will help you make informed financial decisions to ensure a secure financial future. We begin with identification of common financial problems among the "young, fabulous and broke" and how to avoid them. After thinking about life and financial priorities, we address why thinking about retirement now must be at the top of your list. We examine how to compute your retirement needs and how to get there, primarily with a focus on investing in common stock. You will learn how to think smart about big ticket purchases such as cars, housing, and graduate/professional education. Finally we will make sure you understand how to create a safety net to protect your future. NOTE: This course fulfills the Quantitative Literacy (GQ) requirement for students under GenEd and a Quantitative Reasoning (QA or QB) requirement for students under Core. Students cannot receive credit for this course if they have successfully completed FIN 0822, FIN 0922 or RMI 0822.

Course Attributes: GQ
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
MATH 0701 to 4999| Required Courses:1|Minimum Grade of C-|May not be taken concurrently
OR MC3 Y|May not be taken concurrently
OR MC4 Y|May not be taken concurrently
OR MC5 Y|May not be taken concurrently
OR MC6 Y|May not be taken concurrently
OR STA1 Y|May not be taken concurrently
OR STA2 Y|May not be taken concurrently
OR STT3 Y|May not be taken concurrently.

ECE 0832. Digital World 2020. 3 Credit Hours.
This course covers the fundamental principles of digital information capture, compression, storage, transmission, and management. The course intends to provide an overall view of the information infrastructure both at the implementation hardware and application software level suitable for non-engineering majors.

Department restrictions: May not be enrolled in one of the following: CST:Computer & Info Sci, Engineering:Elec Engineering
Field of Study Restrictions: May not be enrolled in one of the following Majors: Computer & Information Science, Electrical Engineering

Course Attributes: GS
Repeatability: This course may not be repeated for additional credits.

ECE 1012. Introduction to Electrical Engineering. 2 to 3 Credit Hours.
This course introduces basic concepts in Electrical and Computer Engineering, and demonstrates them in the context of real applications. Course topics include basics of DC and AC circuits, transistor, diode and operational amplifier circuits, digital logic gates and power supply operation. Students assemble and test a robot car or mouse as part of the class project.

Repeatability: This course may not be repeated for additional credits
Pre-requisites:
MATH 1022 to 4999| Required Courses:1|Minimum Grade of C-|May not be taken concurrently
OR MC6 Y|May not be taken concurrently.

ECE 1014. Evolution of Modern Electronic Systems. 3 Credit Hours.
Introduction to modern electronic systems such as telephone networks, television, radio, radar, and computers. Key discoveries such as the vacuum tube, transistor, and laser are covered. The fundamental operating principles are presented in a non-mathematical and historic context. The evolution of these technologies is presented in terms of the need for communication systems and their impact on society. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement.

Course Attributes: SB
Repeatability: This course may not be repeated for additional credits.

ECE 1022. Technology and You. 3 Credit Hours.
The practitioners of science are scientists. However, we never refer to the practitioners of technology as technologists; rather, they are always referred to as engineers. Therefore understanding the process of engineering is to understand the process of technological development. The engineer of today is either making an old technology better or developing a new technology. As will be illustrated in the readings, engineering is a human endeavor that has existed since the dawn of human kind. To understand engineering and its roots is to understand and appreciate one of humanity’s greatest assets. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement.

Course Attributes: SB
Repeatability: This course may not be repeated for additional credits.
ECE 1112. Electrical Applications. 2 Credit Hours.
This course introduces basic concepts in Electrical and Computer Engineering, and demonstrates them in the context of real applications. Course topics include basics of DC and AC circuits, transistor, diode and operational amplifier circuits, digital logic gates and power supply operation.

Co-requisites: ECE 1113
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
MATH 1022 to 4999 | Required Courses: 1 | Minimum Grade of C- | May not be taken concurrently
OR MC6 Y | May not be taken concurrently.

ECE 1113. Electrical Applications Laboratory. 1 Credit Hour.
Laboratory for ECE 1112 (0007): Electrical Applications. This is a hands-on lab based on the material covered in ECE 1112.

Co-requisites: ECE 1112
Repeatability: This course may not be repeated for additional credits.

ECE 2112. Electrical Devices & Systems I. 3 Credit Hours.
The purpose of this course is to teach non-Electrical Engineering major students the basics of Electrical circuits and systems, such as: voltage and current, electrical elements (resistors, inductors, capacitors), Kirchoff current and voltage laws, parallel and series connections, time domain vs. frequency domain analysis, AC power, three phase systems, electrical machines, operational amplifiers, semiconductor diodes and transistors.

Repeatability: This course may not be repeated for additional credits
Pre-requisites:
( PHYS 1062 | Minimum Grade of C- | May not be taken concurrently
OR PHYS 1022 | Minimum Grade of C- | May not be taken concurrently
AND MATH 1042 | Minimum Grade of C- | May not be taken concurrently
OR MATH 1942 | Minimum Grade of C- | May not be taken concurrently).

ECE 2113. Electrical Devices & Systems I Lab. 1 Credit Hour.
The purpose of this course is to teach non-Electrical Engineering major students the basics of Electrical circuits and systems in a laboratory environment and to reinforce the theoretical concepts of ECE 2112 by using experimentation.

Repeatability: This course may not be repeated for additional credits.

ECE 2122. Electrical Devices and Systems II. 4 Credit Hours.
Students will study circuit analysis using frequency domain techniques, Laplace Transforms, Operational amplifiers, elements of semiconductor devices, electronic circuits, and logic circuits. Students will work on practical applications relating primarily to the mechanical engineering discipline. The laboratory portion of this course allows students to undertake practical applications of the principles discussed in the lecture. NOTE: This course is for Mechanical Engineering majors only.

Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 2112 | Minimum Grade of D- | May not be taken concurrently
AND MATH 1042 | Minimum Grade of C- | May not be taken concurrently
OR MATH 1942 | Minimum Grade of C- | May not be taken concurrently).

ECE 2312. Electrical Engineering Science I. 3 Credit Hours.
Electric circuit fundamentals including DC and transient circuit analysis are covered in the course. Topics include independent and dependent sources, circuit elements such as resistors, inductors, capacitors and operational amplifiers, linearity, source transformation, Thevenin and Norton equivalent circuits, as well as the analysis and design of first and second order circuits.

Co-requisites: ECE 2313
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
MATH 1042 | Minimum Grade of C- | May be taken concurrently
OR MATH 1942 | Minimum Grade of C- | May be taken concurrently
OR MATH 1951 | Minimum Grade of C- | May be taken concurrently
OR MATH 2043 to 3080 | Required Courses: 1 | Minimum Grade of C- | May be taken concurrently
OR MA07 Y | May not be taken concurrently.

ECE 2313. Electrical Engineering Science I Lab. 1 Credit Hour.
This laboratory is concerned with the analysis and design of first and second order circuits with direct current (DC) power sources. This laboratory complements ECE 2312: Electrical Engineering Science I. Topics include independent and dependent sources, circuit elements such as resistors, inductors, capacitors, and operational amplifiers. We also investigate the concept of linearity and source transformation, Thevenin equivalent circuits, and Norton Equivalent circuits.

Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 2312 | Minimum Grade of C- | May be taken concurrently.
ECE 2322. Electrical Engineering Science II. 3 Credit Hours.
This course is concerned with the analysis of alternate current (AC) circuits. Sinusoidal steady-state analysis, AC power analysis, magnetically coupled circuits, and frequency responses are covered. Laplace transforms are introduced and are used to solve first, second and higher order differential equations. The use of Laplace transforms for circuit analysis is studied and applied.
Co-requisites: ECE 2323
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 2312|Minimum Grade of C-|May not be taken concurrently)
AND (MATH 3041|Minimum Grade of C-|May be taken concurrently).

ECE 2323. Electrical Engineering Science II Lab. 1 Credit Hour.
This course provides hands-on experience of the principles discussed in ECE 2322. Specifically students will gain practical experience on the use of various electrical equipment and their applications for measuring alternating current quantities.
Co-requisites: ECE 2322
Repeatability: This course may not be repeated for additional credits.

ECE 2612. Digital Circuit Design. 3 Credit Hours.
This course considers binary number systems, codes, truth tables and the fundamental operation of digital logic circuits. The implementation of combination and sequential digital logic is by a hardware description language in Verilog behavioral synthesis. Complex digital logic and state machine analysis and design are implemented in simulation and programmable gate array hardware.
Co-requisites: ECE 2613
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 2312|Minimum Grade of C-|May not be taken concurrently.

ECE 2613. Digital Circuit Design Laboratory. 1 Credit Hour.
Laboratory for ECE 2612: Digital Circuit Design. This course provides hands-on experience in digital circuits, gates, flip-flops etc.
Co-requisites: ECE 2612
Repeatability: This course may not be repeated for additional credits.

ECE 2922. Honors Electrical Engineering Science II. 3 Credit Hours.
Topics in this course include: sinusoidal analysis, power measurements, three-phase circuits, complex frequency and network functions, resonance, scaling, frequency response, two-port networks, Fourier series and transforms. This Honors course will be challenging and held to a high standard.
Cohort Restrictions: Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR
Co-requisites: ECE 2923
Course Attributes: HO
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 2312|Minimum Grade of C|May not be taken concurrently
AND MATH 1942|Minimum Grade of C-|May not be taken concurrently).

ECE 2923. Honors Electrical Engineering Science II Lab. 1 Credit Hour.
Topics in this course include: sinusoidal analysis, power measurements, three-phase circuits, complex frequency and network functions, resonance, scaling, frequency response, two-port networks, Fourier series and transforms. This Honors course will be challenging and held to a high standard.
Cohort Restrictions: Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR
Course Attributes: HO
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 2313|Minimum Grade of C|May not be taken concurrently
AND MATH 1942|Minimum Grade of C-|May not be taken concurrently).

ECE 3082. Independent Study in Electrical Engineering. 1 to 3 Credit Hour.
With the department chair's approval, students may complete a regular course during semesters the course is not offered in order to meet prerequisite or graduation requirements. An instructor supervises the student.
Repeatability: This course may be repeated for additional credit.

ECE 3091. Independent Research in Electrical Engineering. 1 to 3 Credit Hour.
Project assigned with the approval of the department chair and conducted under the supervision of a faculty sponsor.
Repeatability: This course may be repeated for additional credit.
ECE 3312. Microelectronics I. 3 Credit Hours.
Students study ideal and non ideal operational amplifier circuits, diodes in nonlinear circuit applications, bipolar junction transistors, field-effect transistors (JFETs), metal oxide semiconductor field effect transistors (MOSFETs), biasing techniques, gain and bandwidth, the design of amplifiers, and transistors as loads.

Co-requisites: ECE 3313
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 2322|Minimum Grade of C-|May not be taken concurrently.

ECE 3313. Microelectronics I Laboratory. 1 Credit Hour.
Electrical devices and circuits laboratory to be taken concurrently with Electrical Engineering 3312.

Co-requisites: ECE 3312
Repeatability: This course may not be repeated for additional credits.

ECE 3412. Classical Control Systems. 3 Credit Hours.
Students will learn the basic theory of analog (classical) control systems. The concept of what constitutes a system is learned as well as how to analyze a system by using input-output pairs. The importance of a transfer function and how it characterizes the behavior of a linear time invariant system will be studied. What a feedback system is and how it may change the behavior of a system is learned. Finally, students will learn how to analyze and design linear time invariant control systems using both time domain and frequency domain techniques.

Co-requisites: ECE 3413
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 3512|Minimum Grade of C-|May not be taken concurrently.

ECE 3413. Classical Control Laboratory. 1 Credit Hour.
Experimentation on selected topics in ECE 3412: Classical Control Systems.

Co-requisites: ECE 3412
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 3512|Minimum Grade of C-|May not be taken concurrently)
AND (MATH 3041|Minimum Grade of D-|May not be taken concurrently).

ECE 3512. Signals: Continuous and Discrete. 0 or 4 Credit Hours.
This course covers continuous time signal models, convolution, and superposition integral and impulse response. Students also study Fourier series and periodic signals, Parseval's theorem, energy spectral density, Fourier transform and filters, discrete time signals, difference equations, discrete Fourier transform, and discrete convolution.

Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 2322|Minimum Grade of C-|May not be taken concurrently)
AND (MATH 2043|Minimum Grade of C-|May not be taken concurrently).

ECE 3522. Stochastic Processes in Signals and Systems. 3 Credit Hours.
To provide the student with an understanding about probability, random variables and random processes and their applications to linear systems. Therefore, the student will learn about the various aspects of probability such as distribution and density functions, conditional probability and various types of random processes such as stationary and nonstationary, ergodic and random processes, the autocorrelation and crosscorrelation, power spectral density, white noise and frequency domain analysis of random signals and their evaluation in linear systems analysis.

Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 3512|Minimum Grade of C-|May not be taken concurrently.

ECE 3612. Microprocessor Systems. 3 Credit Hours.
Students study finite-state machines in process control, assembly language programming of the Intel i186EX 16-bit microprocessor and its hardware system implementation. Additional topics include: dynamic RAM read/write and DMA access, hardware interrupts, I/O port addressing, peripheral interface design, microprocessor addressing modes, op codes, and arithmetic computation.

Co-requisites: ECE 3613
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 2322|Minimum Grade of C-|May not be taken concurrently)
AND ECE 2612|Minimum Grade of C-|May not be taken concurrently
AND ECE 2613|Minimum Grade of D-|May not be taken concurrently).
ECE 3613. Microprocessor Systems Laboratory. 1 Credit Hour.
Laboratory for ECE 3612: Microprocessor Systems. This course provides hands-on experience in assembly language programming for Intel 186EX 16-bit microprocessor and its hardware system implementation. The laboratory assignments utilize 80X86 microprocessor simulations using Emu8086 (www.emu8086.com) and hardware experiments with the FlashLite186 microcomputer by JK Microsystems (www.jkmicro.com) with processor bus logic and output signal measurements using the TechTools DigiView logic analyzer in ECE 3613: Microprocessor Systems Laboratory.
Co-requisites: ECE 3612
Repeatability: This course may not be repeated for additional credits.

ECE 3622. Embedded System Design. 3 Credit Hours.
This course and co-requisite laboratory considers embedded systems in digital process control and digital signal processing using the Verilog hardware description language and behavioral synthesis using the programmable gate array. Topics include: the controller-datapath construct, nested modules, soft core processing elements, fixed and floating point arithmetic calculations in programmable hardware, interfacing to hard core peripherals and soft core microprocessors.
Co-requisites: ECE 3622
Repeatability: This course may not be repeated for additional credits
Pre-requisites: (ECE 3612|Minimum Grade of D-|May not be taken concurrently AND ECE 3613|Minimum Grade of D-|May not be taken concurrently).

ECE 3623. Embedded System Design Laboratory. 1 Credit Hour.
Laboratory for ECE 3622 (0245): Embedded System Design.
Co-requisites: ECE 3622
Repeatability: This course may not be repeated for additional credits.

ECE 3712. Introduction to Electromagnetic Fields and Waves. 3 Credit Hours.
Engineering applications of electromagnetic field theory including Coulomb's Law, Gauss' Law and Faraday's Law and applications of Poisson's equations with boundary values, Magnetic flux and the use of Gauss' and Ampere's Laws. The course will also consider transmission lines, the development of Maxwell's equations and the transmission of plane waves in free space and uniform, homogenous, isotropic media.
Repeatability: This course may not be repeated for additional credits
Pre-requisites: (PHYS 1062|Minimum Grade of C-|May not be taken concurrently AND ECE 2322|Minimum Grade of C-|May not be taken concurrently AND ENGR 2011|Minimum Grade of C-|May not be taken concurrently).

ECE 3722. Electromagnetic Wave Propagation. 3 Credit Hours.
This course considers the application of the time-harmonic Maxwell's equations to electromagnetic wave propagation, transmission lines, wave guides, antenna, and methods for numerical analysis. Matlab and computer aided design software is used for simulation of electromagnetic wave propagation in engineering applications.
Co-requisites: ECE 3723
Repeatability: This course may not be repeated for additional credits
Pre-requisites: ECE 3712|Minimum Grade of D-|May not be taken concurrently.

ECE 3723. Electromagnetic Wave Propagation Laboratory. 1 Credit Hour.
Laboratory for ECE 3722 (0222): Electromagnetic Wave Propagation.
Co-requisites: ECE 3722
Repeatability: This course may not be repeated for additional credits.

ECE 3732. Electromechanical Energy Systems. 3 Credit Hours.
Fundamentals of electromechanical energy conversion, electromechanical devices, and systems. Energy state functions, force-energy relationships, basic transducers, and introduction to AC and DC machines. DC motors and generators, synchronous motors and generators, induction motors, and transformers.
Repeatability: This course may not be repeated for additional credits
Pre-requisites: ((ECE 2322|Minimum Grade of C-|May not be taken concurrently AND ECE 3712|Minimum Grade of D-|May not be taken concurrently)) AND (MATH 3041|Minimum Grade of D-|May not be taken concurrently).
ECE 3822. Software Tools for Engineers. 3 Credit Hours.
The primary goal for this course is to teach engineers how to solve problems of scale using a variety of computer tools. The three main goals of this course are: (1) introduce students to the hierarchy of software tools (e.g., scripting languages, interpreted languages, compiled languages) used to solve engineering problems; (2) introduce the basics of Python, a scripting language that is a dominant tool in engineering; and (3) introduce Java, object-oriented design, and a number of Java-related software tools that automate testing, documentation and cross-compilation into web applications. A common thread throughout these topics is the decomposition of large-scale problems into smaller problems that can be solved using reusable modules. Good software engineering practices will be stressed throughout the course. The latter part of the course will involve developing a significant computer simulation of a real-world engineering system that involves real data and utilizes both Python and Java.

Repeatability: This course may not be repeated for additional credits
Pre-requisites: 
(CIS 1057|Minimum Grade of C-|May not be taken concurrently) AND (ENGR 2011|Minimum Grade of C-|May not be taken concurrently).

ECE 3912. Honors Signals: Continuous and Discrete. 4 Credit Hours.
This course covers continuous time signal models, convolution, and superposition integral and impulse response. Students also study Fourier series and periodic signals, Parseval’s theorem, energy spectral density, Fourier transform and filters, discrete time signals, difference equations, Z transforms, and discrete convolution. This honors course will be very challenging.

Cohort Restrictions: Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR
Course Attributes: HO
Repeatability: This course may not be repeated for additional credits
Pre-requisites: 
(ECE 2322|Minimum Grade of C-|May not be taken concurrently) AND (MATH 2043|Minimum Grade of C-|May not be taken concurrently).

ECE 3914. Honors Microprocessor Systems. 3 Credit Hours.
Students study finite-state machines in process control, assembly language programming of the Intel i186EX 16-bit microprocessor and its hardware system implementation. Additional topics include: dynamic RAM read/write and DMA access, hardware interrupts, I/O port addressing, peripheral interface design, microprocessor addressing modes, op codes, and arithmetic computation. A stimulating and challenging Honors course.

Cohort Restrictions: Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR
Co-requisites: ECE 3915
Course Attributes: HO
Repeatability: This course may not be repeated for additional credits
Pre-requisites: 
(ECE 2612|Minimum Grade of C-|May not be taken concurrently) AND ECE 2613|Minimum Grade of D-|May not be taken concurrently).

ECE 3915. Honors Microprocessor Systems Lab. 1 Credit Hour.
This course is the hardware and software laboratory in microprocessor systems.

Cohort Restrictions: Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR
Co-requisites: ECE 3914
Course Attributes: HO
Repeatability: This course may not be repeated for additional credits.

ECE 4110. Special Topics. 1 to 4 Credit Hour.
Topics vary by semester. See the course schedule for the specific topic each semester.
Field of Study Restrictions: Must be enrolled in one of the following Majors: Civil Engineering, Electrical Engineering, Engineering, Mechanical Engineering
Repeatability: This course may be repeated for additional credit.

ECE 4312. Microelectronics II. 3 Credit Hours.
This course emphasizes solving software design problems as well as advanced study of electronic devices and their application to linear, non-linear, and digital circuits. Further topics include: transistors, FET’s filters, oscillators, amplifiers, A/D, D/A, some integrated circuits, and VLSI systems.

Repeatability: This course may not be repeated for additional credits
Pre-requisites: 
ECE 3312|Minimum Grade of D-|May not be taken concurrently.

ECE 4322. VLSI Systems Design. 3 Credit Hours.
This course introduces the hierarchical design methodology of VLSI and the study of basic logic elements and design methods in MOS and CMOS, as well as the physics of MOS devices and the fabrication process. Design rules and computation of circuit parameters from layout, and system level design are further topics.

Repeatability: This course may not be repeated for additional credits
Pre-requisites: 
ECE 4312|Minimum Grade of D-|May not be taken concurrently.
ECE 4412. Modern Control Theory. 3 Credit Hours.
Analysis and design of control systems using state variable techniques, including discrete and continuous state variable analysis, linear vector spaces, eigenvalues, eigenvectors, controllability, observability, stability, state feedback design, and observer design.
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 3412|Minimum Grade of D-|May not be taken concurrently.

ECE 4422. Digital Control Systems. 3 Credit Hours.
Subjects for this course include: discrete data and digital control systems, signal conversions and processing, the Z transform and state variable techniques applied to digital control system, time and frequency domain analysis techniques, stability of digital control systems, etc. The students are required to design and implement a digital control system in groups and are assigned with different tasks.
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 3412|Minimum Grade of D-|May not be taken concurrently
AND ECE 4412|Minimum Grade of D-|May not be taken concurrently).

ECE 4512. Digital Communication Systems. 3 Credit Hours.
This course and co-requisite laboratory considers techniques of digital signaling and data communication with amplitude, frequency and phase modulation and demodulation in the presence of noise using MATLAB/Simulink simulation. Topics include: the optimum correlation receiver in baseband and bandpass systems, binary and multiple level signaling, time and frequency division multiplexing, error detection and correction, analog-to-digital conversion and traditional analog amplitude and frequency modulation.
Co-requisites: ECE 4513
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 3522|Minimum Grade of D-|May not be taken concurrently.

ECE 4513. Digital Communication Systems Laboratory. 1 Credit Hour.
Co-requisites: ECE 4512
Repeatability: This course may not be repeated for additional credits.

ECE 4522. Digital Signal Processing. 3 Credit Hours.
Course topics include: Discrete-time signals and systems, Random signals, Sampling process, Digital processing of analog signals, Discrete-time Fourier Transforms (DTFT), Filter types and characteristics, Filter design, Finite Impulse Response (FIR) systems, linear phase FIR filters, Infinite Impulse Response (IIR) systems, Discrete Fourier Transforms (DFT), Fast Fourier Transform (FFT), Circular convolution, Transfer functions, and Applications of digital signal processing.
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 3522|Minimum Grade of D-|May not be taken concurrently.

ECE 4532. Data and Computer Communication. 3 Credit Hours.
This course considers wired and wireless data transmission, communication networks and protocols, error detection and correction coding, spread spectrum modulation and demodulation. Topics include protocol architectures, flow and error control, multiplexing, code division multiple access 4G LTE cellular systems and embedded Ethernet.
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 4512|Minimum Grade of D-|May not be taken concurrently
AND ECE 4513|Minimum Grade of D-|May not be taken concurrently).

ECE 4542. Telecommunications Engineering. 3 Credit Hours.
This course considers digital data communication with complex modulation and error detection and correction in the presence of noise using MATLAB/Simulink simulation. Topics include: quadrature amplitude and continuous phase modulation, frequency hopping and spread spectrum modulation, linear, block, cyclic, convolutional and CRC codes, fading and multipath interference, Doppler shift in mobile environments and the performance of cellular and wireless communication systems.
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 4512|Minimum Grade of D-|May not be taken concurrently.

ECE 4612. Advanced Processor Systems. 3 Credit Hours.
This course focuses on Verilog hardware description language and its applications to digital hardware system design including CPU and memory, as well as synchronous and asynchronous events and multitasking in the design of computational and data communication processors. The course will also consider computer-aided-design software and simulators, and hardware description language compilers.
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 3622|Minimum Grade of D-|May not be taken concurrently
AND ECE 3623|Minimum Grade of D-|May not be taken concurrently).
ECE 4712. Modern Power Engineering and Electronics. 3 Credit Hours.
This course introduces the modern power systems and its changing landscape. Topics include the basics of power generation and transformers, AC transmission and distribution, power flow, economic dispatch, transient and stability analysis, short circuit analysis, and HVDC systems.

Repeatability: This course may not be repeated for additional credits

Pre-requisites:
(ECE 2322) Minimum Grade of C- (May not be taken concurrently
AND ECE 3312) Minimum Grade of D- (May not be taken concurrently).

ECE 5314. Microelectronics. 3 Credit Hours.
Advanced study of electronic devices and their applications to linear, non-linear, and digital circuits; transistors, FET’s, amplifiers, digital integrated circuits, and VLSI’s. Software design emphasized. A term project will be assigned.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate

Repeatability: This course may not be repeated for additional credits.

ECE 5324. VLSI System Design and Testing. 3 Credit Hours.
An introduction to a hierarchical design methodology of VLSI; study of basic logic elements and design methods in nMOS and CMOS; development of testable designs; the physics of MOS devices and fabrication processes; design rules and computation of circuit parameters from layout; system level design techniques; circuit structures with built-in self-test, design-for-test and self-checking features.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate

Repeatability: This course may not be repeated for additional credits

Pre-requisites:
ECE 5314) Minimum Grade of C (May not be taken concurrently.

ECE 5412. Control System Analysis. 3 Credit Hours.
Review of control concepts and application; state space representation of dynamical systems; controllability, observability; time invariant and time varying systems, design of full state feedback and output feedback systems; eigenstructure assignment; the linear quadratic regulator; Kalman filter; estimation and filtering; robust control via eigenstructure design, Kharitonov theorem, application examples.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate

Repeatability: This course may not be repeated for additional credits.

ECE 5512. Intro Digital Comm. 3 Credit Hours.
Baseband pulse, digital, and passband communications systems; properties and bandwidth of signals and noise; detection of signals in noise; signal-to-noise ratio (SNR); distortionless transmission and intersymbol interference; pulse code modulation; amplitude, phase and frequency modulation and demodulation; simulation of communication systems.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate

Repeatability: This course may not be repeated for additional credits.

ECE 5514. Digital Signal Processing Analysis. 3 Credit Hours.
Topics covered are: various types of digital signal processing (DSP) techniques such as convolution, correlation, and filtering, as well as Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) all pass and comb digital filters, the Discrete Fourier Transform, and the use of MATLAB as a tool for DSP software tasks. A term project will be assigned.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate

Repeatability: This course may not be repeated for additional credits.

ECE 5516. Introduction to Communication Networks. 3 Credit Hours.
Introduction to Internet and TCP and IP protocols, telephone networks, Local Area Networks, packet switching, ATM, and other related topics.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate

Repeatability: This course may not be repeated for additional credits.

ECE 5526. Engineering Principles of Computer Intrusion and Detection. 3 Credit Hours.
This course provides an introduction of computer intrusion and detection techniques. It gives theoretical and practical foundations necessary to continue further learning of computer security. We will study and analyze critical security vulnerabilities of software design and network and information systems. The learned skills are widely used by IT security analysts in industries. At the end of the class the students will be able to understand basic concepts of intrusion detection and traffic analysis from a practical point of view. This course will provide the tools and knowledge necessary to continue further learning in computer security and advance further in the profession.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate

Repeatability: This course may not be repeated for additional credits

Pre-requisites:
ECE 5516) Minimum Grade of B- (May not be taken concurrently.

ECE 5528. Introduction to Cryptography and Information Security. 3 Credit Hours.
This course covers the theory and practice of computer communications security. Topics include symmetric encryption, public and private key cryptography, message digests, digital signatures, secure email, and various types of authentication methods. We will review various cryptographic primitives, algorithms, intrusion attacks, and security protocols.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate

Repeatability: This course may not be repeated for additional credits.
ECE 5612. Advanced Processor Systems. 3 Credit Hours.
Hardware description language (Verilog) design of processor systems for digital signal processing and data communication. Projects will be assigned in simulation and synthesis of dataflow and processor architectures targeting field programmable gate arrays (FPGA).
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits.

ECE 5622. Introduction to Computer Architecture. 3 Credit Hours.
Instruction set architectures, Register Transfer Level hardware description. Data-path design. Controller design. Caches and memory systems. Addressing. Microprogramming. Computer arithmetic. Survey of current computers and microprocessors. Projects will include Verilog/VHDL implementation of data-path components and testing them on FPGAs.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits.

ECE 5712. Power Systems Engineering. 3 Credit Hours.
This course introduces the modern power systems and its changing landscape. The course covers the basics of power generation and transformers, and an introduction to power electronic devices, AC transmission and distribution, power flow, economic dispatch, transient and stability analysis, short circuit analysis, and HVDC systems, power system protection, power market deregulation.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits.

ECE 5714. Introduction to Intelligent Systems Engineering. 3 Credit Hours.
Introduction of the use of artificial intelligence techniques to develop intelligent systems. The course gives the student 1) an overview of what artificial intelligence is and its current state; 2) an overview of intelligent systems--what they are and their possible future role in society; 3) a practical and theoretical knowledge of expert systems, their development, implementation and maintenance and 4) an introduction to intelligent tutoring systems and to provide a perspective about the potential impact of these systems.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits.

ECE 5732. Electric Machines and Drives. 3 Credit Hours.
Fundamentals of electromechanical energy conversion, electric drives and systems. Transformers, DC machines, synchronous machines, induction motors, dq-transformation, vector control of induction motors, reluctance motors, single phase motors, brushless dc motor. Introduction to power electronics and their applications in power drives.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits.

ECE 8110. Special Topics in Electrical and Computer Engineering. 3 Credit Hours.
Selected advanced topics in various major research areas under electrical and computer engineering.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may be repeated for additional credit.

ECE 8324. Mixed Signal VLSI Design. 3 Credit Hours.
Basic MOS device physics, single state amplifiers, frequency response, op amps, switched capacitor circuits, short-channel effects, amplifier design for wireless communication, low power static RAM architectures, layout and packaging.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 5324|Minimum Grade of C|May not be taken concurrently.

ECE 8334. Nano Applications, MEMS & NEMS. 3 Credit Hours.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 5324|Minimum Grade of C|May not be taken concurrently.

ECE 8412. Optimal and Robust Control. 3 Credit Hours.
Concept of optimality, calculus of variations, Euler-Lagrange equation, Pontryagin’s minimum principle, Bellman’s equation, Kalman filter, uncertainties in physical systems; structured and unstructured uncertainties; application of the Lyapunov method to robust control problems; robust optimal control; state space design for finite and infinite horizon problems; H-infinity design.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 5412|Minimum Grade of C|May not be taken concurrently.
ECE 8414. Adaptive Control. 3 Credit Hours.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits.

ECE 8512. Signal Processing and Communication Theory. 3 Credit Hours.
Coherent and non-coherent detection of binary and M-ary signals in noise; waveform coding, linear block coding; convolutional, cyclic and turbo codes; error probability and bandwidth-efficiency plane in the design of digital communications systems; multipath and fading channels; simulation of communication systems.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 5512|Minimum Grade of C|May not be taken concurrently)
AND ENGR 5033|Minimum Grade of C|May not be taken concurrently).

ECE 8514. Applications in Digital Signal Processing. 3 Credit Hours.
FIR and IIR digital filter design, finite word length effects, filter banks, multirate signal processing, spectral analysis (classical, modern, parametric and nonparametric techniques), adaptive filtering (Wiener filter theory) and speech production, analysis, and processing tools and speech coding. Computer experiments using MATLAB will be an integral part of the course.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 5033|Minimum Grade of C|May not be taken concurrently.

ECE 8516. Design and Performance of Communication Networks. 3 Credit Hours.
An overview of the technologies, architectures and protocols used to build high-speed communication networks. Design and performance analysis techniques for computer communication networks. Topics will include: design and performance analysis of wired and wireless local networks, sensor networks, and Internet. Projects will include developing stochastic models, queuing analysis, and simulations.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 8514|Minimum Grade of C|May not be taken concurrently.

ECE 8524. Speech Signal Processing. 3 Credit Hours.
Spectral analysis of non-stationary signals, short-time Fourier transform, homomorphic filtering and filter bank, Speech compression, and synthesis techniques. Weiner filtering for speech enhancement.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 8514|Minimum Grade of C|May not be taken concurrently.

ECE 8525. Fundamentals of Speech Recognition. 3 Credit Hours.
This course introduces students to the theory and implementation of modern day speech recognition systems. We begin with a review of pattern recognition and machine learning, including topics such as Gaussian mixture models and Bayesian models. We then discuss the three main components of a speech recognition system: feature extraction, acoustic modeling and language modeling. We conclude the course with an overview of state of the art systems. Students will learn how to simulate and evaluate complex machine learning algorithms such as hidden Markov models and neural networks. Data-driven methodologies will be emphasized.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ENGR 5022|Minimum Grade of B-|May not be taken concurrently)
AND (ENGR 5033|Minimum Grade of B-|May not be taken concurrently).

ECE 8526. Information Theory. 3 Credit Hours.
Information Theory is a field that has been central to the development of modern communications and computing technologies. The goal of this course is to provide the student with a thorough understanding of the concepts of entropy and information, and how to apply these to real world problems such as speech recognition, language engineering, signal compression, and financial modeling. A secondary goal is to develop a mathematically rigorous understanding of methods for measuring and manipulating various measures of information in signals and systems.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ENGR 5022|Minimum Grade of B-|May not be taken concurrently)
AND (ENGR 5033|Minimum Grade of B-|May not be taken concurrently).
ECE 8527. Introduction to Machine Learning and Pattern Recognition. 3 Credit Hours.
Pattern recognition theory and practice is concerned with the design, analysis, and development of methods for the classification or description of patterns, objects, signals, and processes. At the heart of this discipline is our ability to infer the statistical behavior of data from limited data sets, and to assign data to classes based on generalized notions of distances in a probabilistic space. Many commercial applications of pattern recognition exist today, including voice recognition, fingerprint classification, and retinal scanners. Recent developments in statistical modeling using Bayesian techniques, neural networks, decision trees, fuzzy logic, and syntactic structures have accelerated the growth of pattern recognition applications. The objective of this course is to introduce fundamental methods of pattern recognition, both statistical and neural, with examples from several application areas.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ENGR 5022|Minimum Grade of B-|May not be taken concurrently)
AND (ENGR 5033|Minimum Grade of B-|May not be taken concurrently).

ECE 8528. Advanced Topics in Statistical Modeling for Engineering Applications. 3 Credit Hours.
This course builds on a basic knowledge of machine learning and reviews recent advances in the field. It is a research-oriented course intended to complement a student's thesis or dissertation research. The course will focus on a selection of emerging machine learning algorithms and analyze contemporary publications on these techniques. The emphasis will be on algorithms suited to large, complex data sets. Both supervised and unsupervised learning methodologies will be discussed. Applications will be drawn from several signal processing disciplines including speech, image and bioengineering applications.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ENGR 5022|Minimum Grade of B-|May not be taken concurrently)
AND (ENGR 5033|Minimum Grade of B-|May not be taken concurrently)
AND (ECE 8527|Minimum Grade of B-|May not be taken concurrently).

ECE 8529. Fundamentals of EEG Processing. 3 Credit Hours.
Electroencephalography (EEG) records electrical activity along the scalp, measuring spontaneous electrical activity of the brain. The signals measured along the scalp can be correlated with brain activity, which makes it a primary tool for diagnosis of brain-related illnesses. EEG specialists review these waveforms and develop a diagnosis. EEGs traditionally have been used to diagnose epilepsy and strokes. Other common clinical uses have been for diagnoses of coma, encephalopathies, brain death and sleep disorders. EEGs are increasingly being used to diagnose head-related trauma injuries and Alzheimer's disease. Hence, there is a growing need for expertise to interpret EEGs and, equally important, to understand how these conditions manifest themselves in the EEG signal. In this course we will discuss the techniques neurologists use to manually interpret EEGs. A vast archive of clinical EEG recordings will be studied. Since EEG signals are very low-level electrical signals, we will then discuss digital signal processing that is used to convert the raw electrical signals into visualizations that can be readily interpreted. We will also introduce machine learning techniques that are used to automatically interpret and transcribe these signals.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits.

ECE 8622. Advanced Computer Architecture. 3 Credit Hours.
Advanced course in the design and analysis of computer architecture. Topics will include instruction level parallelism, digital signal processors, network processors and multi-microprocessors. Projects will focus on the design, design analysis and FPGA implementations of computing systems.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 5322|Minimum Grade of C|May not be taken concurrently.

ECE 9324. VLSI Physical Design. 3 Credit Hours.
This course provides a comprehensive background in the principles and algorithms of VLSI physical design. The algorithms are presented in an intuitive manner so that the student can concentrate on the basic idea of the algorithms. The students are provided enough details to implement the algorithms.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 8324|Minimum Grade of C|May not be taken concurrently)
AND (ECE 5324|Minimum Grade of C|May not be taken concurrently).
ECE 9412. Nonlinear Control System. 3 Credit Hours.
Modeling of nonlinear systems, types of nonlinearity; Phase Plane Analysis, construction of phase portrait, limit cycle, saddle point; Existence and uniqueness of solutions, sensitivity; Lyapunov Stability, region of attraction, construction of Lyapunov functions; Perturbation Analysis variation of parameters, Method of averaging, Describing Functions, frequency domain analysis; Sliding Mode Control, sliding surface; Feedback Linearization, Lie algebra, state and output linearization, applications.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 8412|Minimum Grade of C|May not be taken concurrently.

ECE 9512. Detection, Estimation, and Modulation Theory. 3 Credit Hours.
Signal detection and estimation in white and non-white noise, MAP estimation, applications in data and telecommunications. Wiener and Kalman-Bucy filters, linear and non-linear modulation.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ENGR 5033|Minimum Grade of C|May not be taken concurrently.

ECE 9514. Adaptive Signal Processing. 3 Credit Hours.
Adaptive filter techniques such as Weiner filter, Linear Prediction, Least-Mean-Square, Recursive Least-Squares, Kalman Filtering algorithms. Introduction to the application of adaptive filters to communications, control, and speech processing.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
(ECE 5514|Minimum Grade of C|May not be taken concurrently
AND ECE 8514|Minimum Grade of C|May not be taken concurrently).

ECE 9524. Digital Image Processing. 3 Credit Hours.
P2D digital filters, digital image edge detection and segmentation, feature extraction, deblurring, wavelet transforms, JPEG image compression, Fourier optics.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 8514|Minimum Grade of C|May not be taken concurrently.

ECE 9622. Parallel Processing Architectures. 3 Credit Hours.
This course provides an in-depth study of the design, engineering, and evaluation of modern parallel computers. Design issues covered include: naming, replication, synchronization, latency, overhead, and bandwidth. Other topics include scalable multiprocessors and interconnection network design.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may not be repeated for additional credits
Pre-requisites:
ECE 8612|Minimum Grade of C|May not be taken concurrently.

ECE 9991. Directed Research. 1 to 6 Credit Hour.
Under the guidance of a faculty member, students will select a topic in electro-technology to be researched using at least five references. An extensive research paper must be submitted which will be reviewed by two faculty members. The project report must also be presented at an open seminar. Projects related to industrial applications are encouraged. For non-thesis students only.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may be repeated for additional credit.

ECE 9995. Project. 1 to 3 Credit Hour.
Under the guidance of a faculty member, students will select a topic in electro-technology to be researched using at least five references. Student present the research at an open seminar, and submits an extensive research paper, which will be reviewed by two faculty members. Projects related to industrial applications are encouraged. For non-thesis students only.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may be repeated for additional credit.

ECE 9996. Thesis. 1 to 3 Credit Hour.
Under the guidance of a faculty member, students will select a topic in electro-technology, and conduct research leading to submission and oral presentation of a thesis proposal and the final defense of the thesis. For thesis students only.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate
Repeatability: This course may be repeated for additional credit.