Electrical Engineering (EE)

EE-210 Circuits I 3 Credits
Corequisites: EE-211
Prerequisites: PHYS-224 and PHYS-225 and (MATH-102 or MATH-102H or MATH-102X)
Terms Offered: Summer, Fall, Winter, Spring
Fundamental DC and AC circuit analysis techniques are covered in this introductory course. Topics include circuit variables and elements; resistors, inductors, and capacitors; and sinusoidal steady-state analysis with power calculations.
Lecture: 3, Lab 0, Other 0

EE-211 Circuits I Lab 1 Credits
Corequisites: EE-210
Prerequisites: None
Terms Offered: Summer, Fall, Winter, Spring
An introductory laboratory course designed to reinforce the fundamental analysis techniques discussed in EE-210, Circuits I. Topics include: safe use of laboratory equipment and experimental verification of analysis techniques.
Lecture: 0, Lab 2, Other 0

EE-212 Applied Electrical Circuits 3 Credits
Corequisites: MATH-204, MECH-231L
Prerequisites: PHYS-224 and PHYS-225
Terms Offered: Summer, Fall, Winter, Spring
Application of electrical circuit components are covered in this course. Topics include: Ohm’s law and Kirchhoff’s laws; series and parallel circuits; voltage and current division rules; node-voltage and mesh-current methods; superposition; Thevenin’s, and Norton’s theorems; first- and second-order R-L-C circuits; steady-state analysis and power calculations for sinusoidally-varying (ac) sources; operational amplifiers; and diodes. This course will not satisfy the requirements of an Electrical or Computer Engineering degree.
Lecture: 3, Lab 0, Other 1

EE-240 Electromagnetic Fields and Applications 4 Credits
Prerequisites: PHYS-224 and PHYS-225
Terms Offered: Summer, Fall, Winter, Spring
Basics of electromagnetic fields and applications are studied. Topics include: vector analysis; gradient, divergence, and curl; electrostatic fields; electrostatic boundary-value problems; magnetostatic fields; magnetic circuits; and Maxwell’s equations for time-varying fields.
Lecture: 4, Lab 0, Other 0

EE-310 Circuits II 4 Credits
Prerequisites: EE-210 and (MATH-204 or MATH-204H)
Terms Offered: Summer, Fall, Winter, Spring
A second course in circuit analysis. Topics include: first-order and second-order transient circuit analysis, the Fourier series, three-phase circuits, resonance, filters, Bode plots and magnetically coupled circuits.
Lecture: 4, Lab 0, Other 0

EE-320 Electronics I 3 Credits
Corequisites: EE-321
Prerequisites: EE-210 and EE-211
Terms Offered: Summer, Fall, Winter, Spring
The basic building blocks used in electronic engineering are studied. Topics include: operational amplifiers; diodes; MOS and bipolar devices; basic transistor amplifier configurations; and MOSFET digital logic circuits.
Lecture: 3, Lab 0, Other 0

EE-321 Electronics I Laboratory 1 Credits
Corequisites: EE-320
Prerequisites: EE-210 and EE-211
Terms Offered: Summer, Fall, Winter, Spring
An introductory laboratory course designed to reinforce the topics in EE-320, Electronics I. Experiments include: PSPICE simulation, operational amplifiers; diodes; MOS and bipolar transistor configurations; MOSFET digital circuits.
Lecture: 0, Lab 2, Other 0

EE-325 Principles of Microelectronics Processing 4 Credits
Prerequisites: EE-320 and EE-321
Terms Offered: Summer, Fall, Winter, Spring
The principles of semiconductor processing for modern integrated circuits are covered in this introductory course. Topics include a brief review of semiconductor devices and semiconductor circuit families, modern CMOS technology and process flow, crystal growth, semiconductor processing, thin film deposition oxidation, etching, lithography and an introduction to clean room principles. Principles of manufacturing process control and modeling for manufacturability will be presented. Computed simulation will be extensively used where appropriate.
Lecture: 4, Lab 0, Other 0

EE-336 Continuous-Time Signals and Systems 4 Credits
Prerequisites: (MATH-204 or MATH-204H) and EE-210
Minimum Class Standing: Sophomore
Terms Offered: Summer, Fall, Winter, Spring
Introductory continuous-time signals and systems are studied. Topics include: definitions and properties of signals and systems, convolution, differential equations, Laplace transform with applications, Fourier series, and Fourier transform of continuous-time signals with applications.
Lecture: 4, Lab 0, Other 0

EE-338 Discrete-Time Signals and Systems 4 Credits
Prerequisites: (MATH-204 or MATH-204H) and EE-210
Minimum Class Standing: Sophomore
Terms Offered: Winter, Spring
Introductory discrete-time signals and systems are studied. Topics include: definitions and properties of signals and systems, sampling, convolution, difference equations, Z transform with applications, and the Fourier transform of discrete-time signals with applications.
Lecture: 4, Lab 0, Other 0

EE-340 Electromagnetic Wave Propagation 4 Credits
Prerequisites: EE-240
Terms Offered: Winter, Spring
Advanced concepts of electromagnetic fields are studied. Topics include: propagation of uniform plane waves in various material media; transmission line analysis; electromagnetic wave propagation in waveguides; and antennas.
Lecture: 4, Lab 0, Other 0
EE-342 Electrical Machines  4 Credits
Prerequisites: EE-310
Terms Offered: Winter, Spring
Operating principles and design concepts of various types of electrical machines are studied. Topics include: magnetic circuits, single-phase and three-phase transformers; dc motors and generators; three-phase alternators; synchronous motors, induction motors and single-phase motors.
Lecture: 3, Lab 2, Other 0

EE-344 Fundamentals of Power Systems  4 Credits
Prerequisites: EE-210 and EE-211
Terms Offered: Winter, Spring
Basic structure of electrical power systems and characteristics of power transmission lines, transformers and generators are studied. Topics include: representation of power systems; symmetrical three-phase fault analysis; symmetrical components; unsymmetrical fault computations; and network analyzers.
Lecture: 3, Lab 2, Other 0

EE-346 High Voltage Generation and Measurement Techniques  4 Credits
Prerequisites: EE-210 and EE-211 and EE-240
Terms Offered: Summer, Fall
Insulation overvoltage-tests are studied. Topics include: generation of high, direct, alternating, and impulse voltages; voltage multiplier circuits; resonant test circuits; resistive, capacitive and mixed high-voltage dividers; sphere gaps; electrostatic voltmeters, Kerr Cell; and electrostatic coupling, interference, and grounding and safety.
Lecture: 3, Lab 2, Other 0

EE-348 Electromagnetic Compatibility  4 Credits
Prerequisites: EE-210 and EE-211 and EE-240
Terms Offered: Summer, Fall
Issues involved in designing electrical and electronic systems to achieve electromagnetic compatibility are studied. Topics include: interference sources; government regulations limiting conducted and radiated emissions; electric and magnetic field noise coupling; grounding; filtering; shielding; electrostatic discharge; spectral analysis of electromagnetic interference; design methods for minimizing radiated emissions from digital circuits; and measurements of system emissions and susceptibility.
Lecture: 4, Lab 0, Other 0

EE-391 EE Special Topics  4 Credits
Prerequisites: None
Lecture: 4, Lab 0, Other 0

EE-399 EE Independent Study  4 Credits
Prerequisites: None
Lecture: 0, Lab 0, Other 0

EE-420 Electronics II  4 Credits
Prerequisites: EE-310 and EE-320 and EE-321
Terms Offered: Winter, Spring
Advanced concepts of electronic engineering are studied. Topics include: nonlinear circuits; active filters; differential and multistage amplifiers; pulse and switching circuits; integrated circuits; and electronic system design.
Lecture: 3, Lab 2, Other 0

EE-421 Energy Storage Sys w/ EV App  4 Credits
Prerequisites: EE-210 or EE-212
Terms Offered: Winter/Spring
The purpose of this course is to introduce the basics of energy storage systems. We will look at several competing energy storage concepts and management systems. The emphasis is on rechargeable Li-ion batteries for EV applications. The course will focus on the fundamentals of Li-ion batteries with respect to the physical principles of operation, design, manufacturing, modeling and state estimation. Students are required to complete research projects and independent review of research topics with approval of the instructor.
Lecture: 4, Lab 0, Other 0

EE-424 Power Electronics and Applications  4 Credits
Prerequisites: EE-310 and EE-320 and EE-321
Terms Offered: Winter, Spring
Speed control and dynamic representation of electric motors are studied. Topics include: characteristics of iodes; diacs; thyristors; and MOSFET's; thyristor gate firing circuits; operating principles of AC/DC, DC/DC and DC/AC converter circuits; and computer-aided state-space analysis of the dynamic response of the converter circuits.
Lecture: 3, Lab 2, Other 0

EE-427 Semiconductor Device Fundamentals  4 Credits
Prerequisites: EE-320
Terms Offered: Winter, Spring
Basic semiconductor theory for solid-state devices, diode theory, and applications of theory for transistors are studied. Topics include: energy bands, carrier statistics, equilibrium carrier concentrations, carrier transport, electrostatic devices, diode I-V characteristics, optical device applications, microwave device effects, and BJT, JFET, MESFET and MOSFET transistor models.
Lecture: 4, Lab 0, Other 0

EE-430 Communication Systems  4 Credits
Prerequisites: EE-310 and EE-320 and (MATH-258 or MATH-408) and (EE-336 or EE-338)
Terms Offered: Summer, Fall
The study of methods used in electronic communication systems. Topics include: Fourier Transforms; analysis of distortion over a communication channel; autocorrelation of deterministic and random signals; energy and power spectral density; amplitude modulation; frequency modulation; phase modulation; digital line coding and modulation; communication circuity.
Lecture: 4, Lab 0, Other 0

EE-432 Feedback Control Systems  4 Credits
Prerequisites: EE-310 and EE-336
Terms Offered: Summer, Fall
Time and frequency domain representations of control systems are studied. Topics include: stability criteria; root locus methods; frequency response techniques, s-plane design methods. Design and evaluation of control systems are supplemented with computer aided control system design software.
Lecture: 3, Lab 2, Other 0
EE-434 Digital Signal Processing  4 Credits  
Prerequisites: ECE-101 and EE-338  
Terms Offered: Winter, Spring  
Basic principles, design and applications of digital signal processing systems are presented. Topics include: review of discrete-time signals and systems, the z-transform, discrete-time Fourier analysis, the Discrete Fourier Transform, the Fast Fourier Transform, digital filter structures, FIR filters, and IIR filters. This course includes extensive use of MATLAB and experimental design projects using real-time signal processors.  
Lecture: 3, Lab 2, Other 0  

EE-444 Computational Methods in Power Systems  4 Credits  
Prerequisites: EE-344  
Terms Offered: Summer, Fall  
Matrix analysis of power system networks is studied. Topics include: power flow study of large scale interconnected power systems using Gauss-Seidel and Newton-Raphson methods; computer-aided short circuit analysis of large systems; economic operation of power networks; transient stability analysis; overvoltage calculations; and fundamentals of power system protection.  
Lecture: 4, Lab 0, Other 0  

EE-490 Senior Electrical Engineering Design Project  4 Credits  
Corequisites: EE-432  
Prerequisites: CE-320 and EE-240 and EE-310 and EE-320 and EE-321 and EE-336 and EE-338  
Minimum Class Standing: Senior  
Terms Offered: Summer, Fall  
Students will design, implement, document, and present a device or system as a significant capstone project. The project will emphasize electrical engineering, but will be multidisciplinary.  
Lecture: 2, Lab 4, Other 0  

EE-530 Digital Control Systems  4 Credits  
Prerequisites: (EE-338 and EE-432)  
Terms Offered: Winter, Spring  
Control of continuous-time processes using computer-based controllers is studied. Topics include: design of control algorithms for implementation on digital computers; modeling of discrete-time systems; application of z-transforms; stability analysis; root locus analysis; controller design via conventional techniques; state-space analysis and modeling; and design of control systems using state-space methods. Implementation of real-time digital controllers is performed in the lab.  
Lecture: 3, Lab 2, Other 0  

EE-582 Robot Dynamics and Control  4 Credits  
Corequisites: EE-432  
Prerequisites: None  
Terms Offered: Summer, Fall  
Principles of robot analysis, design, and operation are presented. Topics include: coordinate systems, kinematics and robot dynamics; feedback, feedforward, and adaptive methods for arm control; vision and intelligence; and mobile robots.  
Lecture: 4, Lab 0, Other 0