For a course to be used as a prerequisite, it must have been passed with a C- or better.

Courses numbered 100 to 299 = lower-division; 300 to 499 = upper-division; 500 to 799 = undergraduate/graduate.

EE 281L. Noncredit Internship (0).
Complements and enhances the student's academic program by providing an opportunity to apply and acquire knowledge in a workplace environment as an intern. Graded Cr/NCr. Prerequisite: departmental consent.

EE 282. Circuits I (4).
3 Classroom hours; 2 Lab hours. Electric circuit principles and methods of analysis. Includes DC circuits, network theorems, capacitance and inductance, AC circuit analysis, phasor plane techniques, complex power and balanced three-phase circuits. Corequisite: MATH 243.

EE 284. Circuits II (3).
Includes circuits with mutually coupled elements, transfer functions emphasizing frequency response, two-port networks, Laplace transforms and application to transient circuit analysis, and the application of computer-aided analysis software toward circuit analysis and design. Prerequisites: EE 282, MATH 243. Corequisite: MATH 555.

EE 285L. Programming with MATLAB for Electrical and Computer Engineers (1).
Develops a deeper understanding of electrical and computer engineering related programming and analysis. MATLAB is a strong high-level programming language which is popular in science and engineering fields. Once a student learns to develop solutions to electrical and computer engineering problems using MATLAB, the programming skills can be easily extended to other programming languages. These skills are critical for both industry and graduate studies. Course covers visualization, developing and solving equations for electrical and computer engineering, symbolic toolboxes, and advanced programming methods for electrical and computer engineering applications. Prerequisite: CS 211. Corequisite: EE 284.

EE 383. Signals and Systems (3).
Properties of signals and systems, convolution and its application to system response, Fourier series representation of periodic signals, Fourier transforms and continuous spectra, filters, time domain sampling and Z-transforms. Many of these topics include discrete as well as continuous systems. Prerequisites: EE 284, EE 285L and MATH 555.

EE 463. Applied Engineering Electromagnetics (3).
Maxwell's equations in integral and differential form. Transient and steady state response of circuits containing transmission lines with emphasis on applications in communications and digital electronics. Additional topics in optics and electromagnetic radiation as time permits. Prerequisites: MATH 344, PHYS 314.

EE 477. Selected Topics in Electrical Engineering (1-4).
New or special courses presented on sufficient demand. Repeatable for credit. Prerequisite: departmental consent.

EE 477A. Semiconductor Devices (3).
Covers the physics and applications of semiconductor devices: physics of semiconductor devices, energy bands, electrons and holes, P/N and metal semiconductor diodes, characteristics, operation, properties and limitations of bipolar transistors and field effect transistors (JFETS and MOSFETS), and PNPN devices. Prerequisite: PHYS 314.

EE 481. Cooperative Education (1).
Provides practical field experience, under academic supervision, that complements and enhances the student's academic program. Graded Cr/NCr. Prerequisite: departmental consent.

EE 481A. Cooperative Education (1).
Provides the student the opportunity to obtain practice in application of engineering principles by employment in an engineering-related job integrating coursework with a planned and supervised professional experience. Individualized programs must be formulated in consultation with, and approved by, appropriate faculty sponsors and cooperative education coordinators. Intended for students who will be working full time on their co-op assignments and need not be enrolled in any other course. Can be repeated for credit. Graded Cr/NCr. Prerequisite: departmental consent.

EE 481L. Noncredit Internship (0).
Complements and enhances the student's academic program by providing an opportunity to apply and acquire knowledge in a workplace environment as an intern. Graded Cr/NCr. Prerequisite: departmental consent.

EE 481N. Internship (1).
Complements and enhances the student's academic program by providing an opportunity to apply and acquire knowledge in a workplace environment as an intern. Graded Cr/NCr. Prerequisite: departmental consent.

EE 481P. Cooperative Education (1).
Provides the student the opportunity to obtain practice in application of engineering principles by employment in an engineering-related job integrating coursework with a planned and supervised professional experience. Individualized programs must be formulated in consultation with, and approved by, appropriate faculty sponsors and cooperative education coordinators. Students must enroll concurrently in a minimum of 6 hours of coursework including this course in addition to a minimum of 20 hours per week at their co-op assignments. Can be repeated for credit. Graded Cr/NCr. Prerequisite: departmental consent.

EE 488. Electric Machines and Transformers (4).
3 Classroom hours; 2 Lab hours. Theory and analysis of transformers, DC machines and AC machines. Includes single-phase and three-phase transformers, DC machines synchronous machines, and induction motors. Prerequisite: EE 282.

EE 492. Electronic Circuits I (4).
3 Classroom hours; 2 Lab hours. Introduces semiconductor devices and applications in discrete and integrated circuit design. Applications include, but are not limited to, op-amp circuits, rectification and transistor amplifiers. Corequisites: EE 284 and 285L.

EE 493. Electronic Circuits II (4).
3 Classroom hours; 2 Lab hours. An investigation of the theory and application of discrete and integrated circuits. Includes op-amp construction, frequency response, feedback and stability, power amplifiers and nonlinear integrated circuits. Prerequisite: EE 492.

EE 577. Special Topics in Electrical and Computer Engineering (1-4).
New or special courses presented on sufficient demand. Repeatable for credit. Prerequisite: departmental consent.

EE 577L. Renewable Energy Engineering (3).
Analysis and design of renewable energy systems, including solar, wind, hydroelectric, geothermal, and biomass systems. Analysis and design of energy storage systems that integrate with renewable energy systems. Integration of renewable energy systems with the electric power supply system. Prerequisites: Physics 314 and EE 282.
EE 577M. Real-Time Signal Processing Applications (3).
In most digital signal processing operations, it is assumed that we have sampled signals which are considered as digital signals. Often in classroom educations, these signals are usually stored for subsequent retrieval or synthesized when needed, for convenience for demonstrations or computer-based simulations. However, this does not allow for real-time processing of the signals. "Real-time" processing means guaranteed delivery of data by a certain time. This undergraduate elective course is hardware based with hands-on simulations to introduce students the analysis, design, and implementation of real-time digital signal processing (DSP) applications. The course first briefly introduces basic DSP theory, then focuses on practical, step-by-step framework that provides hands-on experience in real-time DSP to reinforce the basic DSP theory. Students are expected to learn how to use/apply the DSP theory in real-time applications. Prerequisites: EE 383 or equivalent, CS 211.

EE 585. Senior Design Project I (2).
3 Lab hours. A design project under faculty supervision chosen according to the student's interest. Does not count toward a graduate degree in electrical engineering, computer engineering or computer science. For undergraduate students only. This class should be taken in the semester prior to the one in which the student is going to graduate. Prerequisites: senior standing, CS 480 or EE 492. Corequisite: PHIL 354 or 385.

3 Classroom hours; 2 Lab hours. Fundamentals of communication systems; models and analysis of source, modulation, channel and demodulation in both analog and digital form. Reviews Fourier series, Fourier transform, DFT, probability and random variables. Studies in sampling, multiplexing, AM and FM analog systems, and additive white Gaussian noise channel. Additional topics such as PSK and FSK digital communication systems covered as time permits. Prerequisites: EE 383, IME 254.

EE 588. Advanced Electric Motors (3).
Advanced electric motor applications and theory. Includes single-phase motors, adjustable speed AC drive applications and stepper motors. Prerequisite: EE 488.

EE 595. Senior Design Project II (2).
3 Lab hours. A continuation of EE 585. For undergraduate students only. Will not count toward a graduate degree in electrical engineering, computer engineering or computer science. Prerequisite: EE 598.

EE 598. Electric Power Systems Analysis (3).
Analysis of electric utility power systems. Topics include analysis and modeling of power transmission lines and transformers, power flow analysis and software, and an introduction to symmetrical components. Prerequisite: EE 488.

EE 610. Introduction to Quantum Computing (3).
Introduction to the theory and practice of quantum computing. Topics covered include the basics of quantum mechanics, Dirac notation, quantum gates and circuits, entanglement, measurement, teleportation and algorithms. Prerequisite: MATH 511.

EE 684. Introductory Control System Concepts (3).
Cross-listed as ME 659. An introduction to system modeling and simulation, dynamic response, feedback theory, stability criteria, and compensation design. Prerequisites: EE 282 and MATH 555, or (2) EE 383.

EE 688. Power Electronics (4).
3 Classroom hours; 2 Lab hours. Deals with the applications of solid-state electronics for the control and conversion of electric power. Gives an overview of the role of the thyristor in power electronics application and establishes the theory, characteristics and protection of the thyristor. Presents controlled rectification, static frequency conversion by means of the DC link-converter and the cyclo converter, emphasizing frequency, and voltage control and harmonic reduction techniques. Also presents requirements of forced commutation methods as applied to AC-DC control and firing circuit requirement and methods. Introduces applications of power electronics to control AC and DC motors using new methods such as microprocessor. Prerequisites: EE 383, 488, 492.

EE 691. Integrated Electronics (3).
A study of BJT and MOS analog and digital integrated circuits. Includes BJT, BiMOS and MOS fabrication; application specific semi-custom VLSI arrays, device performance and characteristics; and integrated circuit design and applications. Prerequisites: EE 194, EE 493.

EE 697. Electric Power Systems Analysis II (3).
Analysis, design, modeling and simulation of high-voltage electric power transmission systems and rotating generators. Simulations include short circuit studies, economic dispatch and transient stability. Prerequisite: EE 598.

EE 726. Digital Communication Systems I (3).
Presents the theoretical and practical aspects of digital and data communication systems. Includes the modeling and analysis of information sources as discrete processes; basic source and channel coding, multiplexing and framing, spectral and time domain considerations related to ASK, PSK, DPSK, QPSK, FSK, MSK, and other techniques appropriate for communicating digital information in both base-band and band-pass systems; intersymbol interference, effects of noise on system performance, optimum systems and general M-ary digital systems in signal-space. Prerequisites: EE 586 and 754.

Covers the fundamental concepts of modeling and analysis of discrete event systems, with an emphasis on understanding computer and communication networks. Course begins with an in-depth introduction to discrete event systems (state space, transitions, and system classification). Subsequent topics include languages and automata (untimed, timed and stochastic timed automata). A unified modeling framework centered on automata is followed towards achieving a better understanding of complex systems. Prerequisites: EE 586 and 754.

A course in random processes designed to prepare the student for work in communications controls, computer systems information theory and signal processing. Covers basic concepts and useful analytical tools for engineering problems involving discrete and continuous-time random processes. Discusses applications to system analysis and identification, analog and digital signal processing, data compression parameter estimation, and related disciplines. Prerequisites: EE 383 and IME 254.

EE 777. Selected Topics in Electrical Engineering (1-4).
New or special courses presented on sufficient demand. Repeatable for credit. Prerequisite: departmental consent.

EE 777C. Network Programming (1-4).
Introduces techniques for developing TCP and UDP network clients, servers, and applications. Topics covered include sockets, client/server design alternatives, concurrent processes and threads, web applications, and security. Programming-intensive course that assumes some experience with programming in a high-level language. Prerequisite: CS 300 (or an equivalent course).
**EE 777OL. Digital Communications I Lab (1).**
Lab objective is for the students to implement and explore each block in a wireless communications system signal chain by combing LabVIEW software and the National Instrument (NI) Universal Software Radio Peripheral (USRP) hardware. Covers pseudorandom bit generation, path loss in wireless radio frequency (RF) communication channel, forward error correction (FEC) channel coding, wireless digital communications modulation, demodulation, synchronization (timing recovery), bit error rate (BER), and a multiple-input and single-output (MISO) wireless system.

**EE 782. Digital Signal Processing (3).**
Presents the fundamental concepts and techniques of digital signal processing. Time domain operations and techniques include difference equations and convolution summation. Covers Z-transform methods, frequency-domain analysis of discrete-time signals and systems, discrete Fourier transform, and fast Fourier transform. Emphasizes the frequency response of discrete-time systems and the relationship to analog systems. Prerequisite: EE 383.

**EE 784. Digital Control Systems (3).**
Studies the effects of sampling and quantization, discrete systems analysis, sampled-data systems and Z-domain and state space design. Prerequisite: EE 684 or ME 659.

**EE 790. Independent Study in Electrical Engineering (1-3).**
Arranged individual, independent study in specialized content areas in electrical engineering under the supervision of a faculty member. Repeatable for credit. Prerequisite: departmental consent.

**EE 792. Linear Systems (3).**
Review of mathematics relevant to state-space concepts. Formulation of state-variable models for continuous-time and discrete-time linear systems. Concepts of controllability, observability, stabilizability and detectability. Pole placement and observer design. State transformation techniques and their use in analysis and design of linear control systems. Prerequisite: EE 684 or ME 659.

**EE 796. Electric Power Distribution (3).**
Analysis, design, modeling and simulation of radial medium-voltage electric power distribution systems. Simulations include power flow and short circuit. Prerequisite: EE 598.