Joint Electrical Engineering

Courses

J E ENGR 2300 Introduction to Electrical Networks: 3 semester hours
Prerequisites: Electrical Engineering or Mechanical Engineering major. Elements, sources, and interconnects. Ohm's and Kirchoff's laws, superposition and Thevenin's theorem; the resistive circuit, transient analysis, sinusoidal analysis, and frequency response.

J E ENGR 2320 Introduction to Electronic Circuits: 3 semester hours
Prerequisites: J E ENGR 2300 and Electrical Engineering major. Introduction to contemporary electronic devices and their circuit applications. Terminal characteristics of active semiconductor devices. Incremental and D-C models of junction diodes, bipolar transistor (BJTs), and metal-oxide semiconductor field effect transistors (MOSFETs) are developed and used to design single-and multi-stage amplifiers, Models of the BJT and MOSFET in cutoff and saturation regions are used to design digital circuits.

J E ENGR 2330 Electrical and Electronic Circuits Laboratory: 3 semester hours
Prerequisites: J E ENGR 2300 and Electrical Engineering major. Lectures and laboratory exercises related to sophomore topics in introductory networks and basic electronics.

J E ENGR 2340 Electrical Laboratory for Mechanical Engineers: 1 semester hour
Prerequisites: J E ENGR 2300 (may be taken concurrently) and Mechanical Engineering major. Laboratory in introductory electrical circuits and devices of relevance to mechanical engineers.

J E ENGR 2600 Introduction to Digital Logic and Computer Design: 3 semester hours
Prerequisites: CMP SCI 1250 and Electrical Engineering major. Digital computers and digital information-processing system; Boolean algebra, principles and methodology of logical design; machine language programming; register transfer logic; microprocessor hardware, software, and interfacing; fundamental of digital circuits and systems; computer organization and control; memory systems; arithmetic unit design. Occasional laboratory exercises.

J E ENGR 3300 Engineering Electromagnetic Principles: 3 semester hours
Prerequisites: Electrical Engineering major. Electromagnetic theory as applied to electrical engineering; vector calculus; electrostatics and magnetostatics; Maxwell's equations, including Poynting's theorem and boundary conditions; uniform plane-wave propagation; transmission lines-TEM modes, including treatment of general, lossless line, and pulse propagation; introduction to guided waves; introduction to radiation and scattering concepts.

J E ENGR 3310 Electronics Laboratory: 3 semester hours
Prerequisites: J E ENGR 2300, J E ENGR 2330 and Electrical Engineering major. Laboratory exercises for juniors covering topics in computer-aided measurements, computer simulation, and electronic circuits.

J E ENGR 3320 Power, Energy and Polyphase Circuits: 3 semester hours
Prerequisites: J E ENGR 2300 and Electrical Engineering major. Fundamental concepts of power and energy; electrical measurements; physical and electrical arrangement of electrical power systems; polyphase circuit theory and calculations; principal elements of electrical systems such as transformers, rotating machines, control, and protective devices, their description and characteristics; elements of industrial power system design.

J E ENGR 3370 Electronic Devices and Circuits: 3 semester hours
Prerequisites: J E ENGR 2320 and Electrical Engineering major. Introduction to semiconductor electronic devices: transistors and diodes. Device electrical DC and high-frequency characteristics. Bipolar transistors, field-effect transistors for analog electronics applications. Transistors fabrication as discrete devices and as integrated-circuit chips. Large-signal analysis of transistor amplifiers: voltage gain, distortion, input resistance and output resistance. Analysis of multitransistor amplifiers: Darlington, Cascode, and coupled-pair configurations. Half-circuit concepts, differential-mode gain, common-mode gain, and differential-to-single-ended conversion. Transistor current sources, active loads, and power-amplifier stages. Applications to operational amplifiers and feedback circuits.

J E ENGR 3510 Signals and Systems: 3 semester hours
Prerequisites: J E ENGR 2300, J E MATH 3170 and Electrical Engineering major. Elementary concepts of continuous-time and discrete-time signals and systems. Linear time-invariant (LTI) systems, impulse response, convolution, Fourier series, Fourier transforms, and frequency-domain analysis of LTI systems. Laplace transforms, Z-transforms, and rational function descriptions of LTI systems. Principles of sampling and modulation. Students participate weekly in recitation sections to develop oral communications skills using class materials.

J E ENGR 3620 Computer Architecture: 3 semester hours
Prerequisites: J E ENGR 2600 and Electrical Engineering major. Study of interaction and design philosophy of hardware and software for digital computer systems: Machine organization, data structures, I/O considerations. Comparison of minicomputer architectures.

J E ENGR 4000 Independent Study: 1-3 semester hours
Prerequisites: Electrical Engineering major and consent of instructor. Opportunities to acquire experience outside the classroom setting and to work closely with individual members of the faculty. A final report must be submitted to the department. Open as a senior elective only. Hours and credit to be arranged. Credit variable, maximum credit per semester 3 hours. Maximum program total credit 3 hours.

J E ENGR 4050 Reliability and Quality Control: 3 semester hours
Prerequisites: MATH 1320 and Electrical Engineering major. An integrated analysis of reliability and quality control function in manufacturing. Statistical process control, analysis, reliability prediction, design, testing, failure analysis and prevention, maintainability, availability, and safety are discussed and related. Qualitative and quantitative aspects of statistical quality control and reliability are introduced in the context of manufacturing.

J E ENGR 4340 Solid State Power Circuits and Applications: 3 semester hours
Prerequisites: J E ENGR 2320, J E ENGR 3510, and Electrical Engineering major. Study of the strategies and applications of power control using solid-state semiconductor devices. Survey of generic power electronic converters. Applications to power supplies, motor drives, and consumer electronics. Introduction to power diodes, thyristors, and MOSEFETs.

J E ENGR 4350 Electrical Energy Laboratory: 3 semester hours
Prerequisites: J E ENGR 2330 and Electrical Engineering major. Experimental studies of principles important in modern electrical energy systems. Topics: power measurement, transformers, batteries, static frequency converters, thermoelectric cooling, solar cells, electrical lighting, induction, commutator, and brushless motors, synchronous machines.

J E ENGR 4360 Energy Alternatives: 3 semester hours
Same as J M ENGR 4360. Prerequisites: J E ENGR 2300 or J M ENGR 3200, and Electrical Engineering major or Mechanical Engineering major. This course introduces engineering analyses of the human uses of energy. Both non-renewable (e.g., oil, natural gas, coal, nuclear) and sustainable (e.g., hydropower, solar, wind, biomass) resources are covered. Topics include the engineer's role in harvesting, production, storage, conversion, delivery, and uses of energy. Students will learn system analysis, design, integration, optimization, and operational aspects of selected resources delivery systems, and end uses. Technical content will include site selection, conversion and delivery efficiency calculations, engineering economic analyses, control systems, and energy resource systematic classification. Students will be assessed based on homework, quizzes, tests, class participation, and projects.

J E ENGR 4410 Control Systems I: 3 semester hours
Same as J M ENGR 4310. Prerequisites: J E MATH 3170, J E ENGR 2300 and Electrical Engineering major or Mechanical Engineering major. Introduction to automatic control concepts. Block diagram representation of single and multiloop systems. Multi-input and multi-output systems. Control system components. Transient and steady-state performance; stability analysis; Routh, Nyquist, Bode, and root locus diagrams. Compensation using lead, lag and lead-lag networks. Synthesis by Bode plots and root-locus diagrams. Introduction to state-variable techniques, state-transition matrix, state-variable feedback.

J E ENGR 4440 Sensors and Actuators: 3 semester hours
Prerequisites: Electrical Engineering major. The course provides engineering students with basic understanding of two of the main components of any modern electrical or electromechanical system; sensors as inputs and actuators as outputs. This course is useful for those students interested in control engineering, robotics and systems engineering.

J E ENGR 4470 Robotics Laboratory: 3 semester hours
Prerequisites: Electrical Engineering major. Introduces the students to various concepts such as modeling, identification, model validation and control of robotic systems. The course focuses on the implementation of identification and control algorithms on a two-link robotic manipulator (the so-called pendubot) that will be used as an experimental testbed. Topics include: introduction to the mathematical modeling of robotic systems; nonlinear model, linearized model; identification of the linearized model: input-output and state-space techniques; introduction to the identification of the nonlinear model: energy-based techniques; model validation and simulation; stabilization using linear control techniques; a closer look at the dynamics; stabilization using nonlinear control techniques.

J E ENGR 4520 Power Systems Analysis: 3 semester hours
Prerequisites: J E ENGR 3320 and Electrical Engineering major. Introduction to the modeling and elements of power systems; machines, lines, and loads; load flow methods and applications; short circuit analysis using symmetrical components on symmetrical and unsymmetrical faults; methods of economic operation of power systems and contingency; state estimators, stability, and introduction of the independent system operator.

J E ENGR 4710 Communications Theory and Systems: 3 semester hours
Prerequisites: J E ENGR 3510, MATH 1320 and Electrical Engineering major. Introduction to the concepts of transmission of information via communication channels. Amplitude and angle modulation for the transmission of continuous-time signals. Analog-to-digital conversion and pulse code modulation. Transmission of digital data. Introduction to random signals and noise and their effects on communication. Optimum detection systems in the presence of noise. Elementary information theory. Overview of various communication technologies such as radio, television, telephone networks, data communication, satellites, optical fiber, and cellular radio.

J E ENGR 4730 Radar Systems: 3 semester hours
Prerequisites: J E ENGR 3510 and Electrical Engineering major. Overview of a radar system and examples of fielded radars. The block diagram representation of a radar. Review of signals. Introduction to common radar waveforms. How the environment can distort the waveform. Introduction to noise and clutter. How a target and clutter look like to a radar. Overview of the radar range equation and its multiple forms. Introduction and overview of noise sources present in a radar and their effect on performance. A more detailed look at radar waveforms in the presence of clutter and noise. Optimum detection systems in the presence of clutter and noise. Radar design from a systems engineering approach. Techniques to improve signal to noise ratio. A second look at fielded radars using what we have learned.

J E ENGR 4820 Digital Signal Processing: 3 semester hours
Prerequisites: J E ENGR 3510 and Electrical Engineering major. Introduction to analysis and synthesis of discrete-time linear time-invariant (LTI) systems. Discrete-time convolution, discrete-time Fourier transform, Z-transform, rational function descriptions of discrete-time LTI systems. Sampling, analog-to-digital conversion and digital processing of analog signals. Techniques for the design of finite impulse response (FIR) and infinite impulse response (IIR) digital filters. Hardware implementation of digital filters and finite register effects. The discrete Fourier transform and the fast Fourier transform (FFT) algorithm.

J E ENGR 4950 Fundamentals of Electrical Engineering Review: 1 semester hour
Prerequisites: Senior standing and Electrical Engineering major. A review and preparation of the most recent NCEES Fundamentals of Engineering (FE) Exam specifications for Electrical Engineering students is offered in a classroom setting. Exam strategies will be illustrated using examples.

J E ENGR 4980 Electrical Engineering Design Projects: 3 semester hours
Prerequisites: Senior standing and Electrical Engineering major. Working in teams, students address design tasks assigned by faculty. Each student participates in one or more design projects in a semester. Projects are chosen to emphasize the design process, with the designer choosing one of several paths to a possible result. Collaboration with industry and all divisions of the univesity is encouraged.

J E ENGR 4990 Electrical Engineering Senior Seminar: 1 semester hour
Prerequisites: Senior standing and Electrical Engineering major. This course focuses on personal and professional development to prepare graduates entering the electrical engineering profession. Topics may include personality characteristics, diversity, team dynamics, professionalism, early career development, graduate study, effective presentations, and case histories of electrical engineering projects. Performance is based on class participation, oral presentations, and written reports.