Joint Electrical Engineering

Courses

**J E ENGR 2300 Introduction to Electrical Networks: 3 semester hours**
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. 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. 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. 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**
Prerequisite: J CMP SC 1260. 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 Electro Magnetic Principles: 3 semester hours**
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. 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**
Prerequisite: J E ENGR 2300. Fundamental concepts of power and energy; electrical measurements; physical and electrical arrangement of electric power systems; polyphase circuit theory and calculations; principle 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 3360 Principles of Electronic Devices: 3 semester hours**
Introduction to the solid-state physics of electronic materials and devices, including semiconductors, metals, insulators, diodes and transistors, Crystals growth technology and fundamental properties of crystals. Electronic properties and band structure of electronic materials, and electron transport in semiconductor materials. Fabrication of pn junction diodes, metal-semiconductor junctions, and transistors and integrated circuit chips. Fundamental electrical properties of rectifying diodes and light-emitting diodes, bipolar transistors and field effect transistors. Device physics of diodes and transistors, large-signal electrical behavior and high-frequency properties.

**J E ENGR 3370 Electronic Devices and Circuits: 3 semester hours**

**J E ENGR 3510 Signals and Systems: 3 semester hours**
Prerequisites: J E ENGR 2300 and J E MATH 3170. 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**
Prerequisite: J E ENGR 2600. 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: Senior in Good Standing. 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: J E MATH 3260 or MATH 1320. 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**
Prerequisite: J E ENGR 2320, J E ENGR 3510. 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 MOSFETs.
J E ENGR 4350 Electrical Energy Laboratory: 3 semester hours
Prerequisites: J E ENGR 2330. 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
Prerequisites: J E ENGR 2300, or J M ENGR 3200. 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. Measure will consist of a mix of homework, quizzes, tests, class participation, and projects.

J E ENGR 4410 Control Systems I: 3 semester hours

J E ENGR 4440 Sensors and Actuators: 3 semester hours
Prerequisites: Senior standing. 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 4520 Power Systems Analysis: 3 semester hours
Prerequisite: J E ENGR 3320. 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 and J E MATH 3260. 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 4720 Internet Communications: 3 semester hours
This course will introduce and cover the architecture, protocols, security, and quality of service (QoS) of Internet Communications. Starting with the design principles and architecture of the Internet, communication applications such as Voice over IP (VoIP), video conferencing, and presence and instant messaging will be covered. Protocols developed by the Internet Engineering Task Force (IETF) including IP, TCP, UDP, DNS, SIP, XMPP, and ENUM will be studied. Latest areas of research including the Service Oriented Architecture (SOA) and peer-to-peer (P2P) architectures for Internet Communications will be covered.

J E ENGR 4820 Digital Signal Processing: 3 semester hours

J E ENGR 4950 Fundamentals of Electrical Engineering Review: 1 semester hour
Prerequisites: Senior standing. 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. 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 university is encouraged.