ELECTRICAL ENGINEERING (EENG)

EENG 160. DIGITAL CIRCUITS. 5 Credits.
Pre-requisites: MTHD 104 or equivalent.
Fundamentals of digital computer design including appropriate number systems, boolean algebra, and basic digital circuits. Methods introduced will include the use of Karnaugh Maps and the Quine-Mckluskey procedure. Computer laboratory work will involve the use of current software for the design, analysis, and simulation of digital circuits.

EENG 163. INTRODUCTION TO EMBEDDED SYSTEMS AND ELECTRICAL ENGINEERING. 5 Credits.
Pre-requisites: EENG 160 with a minimum grade ≥C.
This course provides an introduction to Electrical Engineering while exploring the fundamentals of Embedded System using Python. Topics include programming, basic input/output, control flow, and debugging. Laboratory exercises will include a diverse set of exercises, drawing from different areas in electrical engineering.

EENG 199. DIRECTED STUDY. 1-5 Credits.
Pre-requisites: permission of the instructor, department chair and college dean.

EENG 209. CIRCUIT THEORY I. 5 Credits.
Pre-requisites: PHYS 153 or permission of the instructor.
This course is intended to provide electrical engineering students with an understanding of electricity and its applications. Topics include AC/DC circuit-analysis methods such as nodal and mesh analysis, superposition, Norton Theorem, Thevenin Theorem and transient analysis.

EENG 210. CIRCUIT THEORY II. 5 Credits.
Pre-requisites: EENG 209 with a minimum grade ≥C.
This course covers circuit analysis using Laplace transform, phasors and AC analysis, AC Power, three-phase circuits, magnetically coupled circuits and the ideal transformer.

EENG 250. DIGITAL HARDWARE. 2 Credits.
Notes: a continuation of EENG 160.
Pre-requisites: EENG 160 with a minimum grade ≥C.
This course presents logic families, hardware characteristics, noise control and modern programmable logic.

EENG 260. MICROCONTROLLER SYSTEMS. 4 Credits.
Pre-requisites: CSCD 255 and EENG 160, both with a minimum grade ≥C.
This is an introductory course on microprocessor and microcontroller systems organization. It provides low-level programming principles for microcomputer based systems. The course emphasizes assembly and C language programming techniques and laboratory experiments in input/output programming, memory organization, interrupts and interfacing methods.

EENG 299. DIRECTED STUDY. 1-5 Credits.
Directed Study.

EENG 320. SIGNALS AND SYSTEMS I. 5 Credits.
Pre-requisites: EENG 163, EENG 210 or concurrent enrollment, or permission of the instructor; MATH 163 with a minimum grade ≥C.
This course is an introduction to continuous-time signal analysis. Topics include: generalized functions and the relationship to basic signals including impulses, pulses and unit step; system properties such as linearity, time-invariance and causality; and Fourier analysis.

EENG 321. SIGNALS AND SYSTEMS II. 5 Credits.
Pre-requisites: EENG 320 and MATH 163, both with a minimum grade ≥C.
Introduction to Laplace Transform, Z-transform, the Fourier Series, the Fourier Transform, the Discrete Fourier Transform (DFT), the Discrete-Time Fourier Transform (DTFT) and Sampling Theorem. Introduction to analysis of Linear Time Invariant (LTI) system using above techniques for continuous and discrete time.

EENG 330. MICROELECTRONICS I. 5 Credits.
Pre-requisites: CHEM 171, or HONS 171, and CHEM 171L; EENG 209 and MATH 163, both with a minimum grade ≥C and concurrent enrollment in EENG 210.
This course introduces the characterization, modeling, and application of semiconductor devices in the context of analog integrated circuits. Emphasis is placed on the development of models for circuit-level behavior of diodes, bipolar transistors, and MOS transistors and applies the models to the analysis and design of linear amplifiers.

EENG 331. MICROELECTRONICS II. 5 Credits.
Pre-requisites: EENG 210, EENG 330, and MATH 163, all with a minimum grade ≥C.
This course is the second in the characterization, modeling and application of semiconductor devices in the context of analog integrated circuits. The emphasis is on the metal-oxide-semiconductor (MOS) transistor. Topics include differential amplifiers, frequency response and feedback effects.

EENG 350. ENERGY SYSTEMS. 5 Credits.
Pre-requisites: EENG 210 and MATH 163, both with a minimum grade ≥C.
This course provides an introduction to the different energy sources, methods of electric energy conversion, the electric power system, transformers and electrical machines.

EENG 360. HARDWARE DESCRIPTION LANGUAGES. 5 Credits.
Pre-requisites: CSCD 255 and EENG 160, both with a minimum grade ≥C.
This course introduces methodologies and computer-aided design (CAD) tools for the design of complex electronic systems. The emphasis is on high-level description languages and their use for specifying, designing, simulating and synthesizing digital very large scale integration (VLSI) circuits in MOS (metaloxide-semiconductor) technologies. Theoretical knowledge will be complemented by hands-on use of several commercial CAD tools.

EENG 383. APPLIED STOCHASTIC PROCESSES. 4 Credits.
Pre-requisites: MATH 163 with a grade ≥C; and CSCD 255 or CSCD 240, with a grade ≥C or permission of the instructor; and must be taken concurrently with EENG 388.
This course provides an introduction to the basic concepts of stochastic processes and their application to engineering problems. Topics include analysis of continuous and discrete random signals and systems, as well as modern estimation techniques.

EENG 388. STOCHASTIC PROCESSES LAB. 1 Credit.
Pre-requisites: MATH 163 and CSCD 255, with a grade ≥C or permission of the instructor, and must be taken concurrently with EENG 383.
This laboratory course introduces basic concepts of stochastic processes and their application to engineering problems.

EENG 399. DIRECTED STUDY. 1-5 Credits.
Directed Studies.

EENG 401. ENGINEERING APPLIED ELECTROMAGNETICS. 5 Credits.
Pre-requisites: MATH 241, MATH 347; EENG 210 and EENG 320 both with a minimum grade ≥C.
This course provides students with the technical basis to analyze electromagnetic applications systems. Topics include waves and phasors, vector analysis, electrostatics, magnetostatics, Maxwell's equations for time-varying fields and plane wave propagation.

EENG 415. INTRODUCTION TO COMPUTER COMMUNICATION NETWORKS. 5 Credits.
Pre-requisites: junior standing.
Fundamentals of data communication, telephone/cellular/computer networks, layered network architecture, OSI model, data link layer functions and protocols including ARQ, network layer functions and protocols including IP, transport layer functions and protocols including TCP. Basic MATLAB programming experience is necessary for this course.

EENG 420. DIGITAL SIGNAL PROCESSING. 5 Credits.
Notes: this course meets 4 hours per week for lecture and 2 hours per week for lab.
Pre-requisites: EENG 321.
This course provides an introduction to digital signal processing. Convolution, time invariance and stability of discrete-time systems are presented. In addition, various signal processing techniques such as Z-transform, discrete Fourier transform (DFT) and fast Fourier transform (FFT) are studied. Time and frequency domain techniques for designing and applying infinite impulse response (IIR) and finite impulse response (FIR) digital filters are introduced.

EENG 425. PRINCIPLES OF DIGITAL IMAGE PROCESSING. 5 Credits.
Pre-requisites: EENG 321.
Image representation, color spaces, image filtering and enhancement, image transforms and image/video coding.

EENG 427. INTRODUCTION TO DEEP NEURAL NETWORKS. 5 Credits.
Pre-requisites: EENG 383 and EENG 388 (or MATH 380); and CSCD 255 (or CSCD 240 or any high-level programming language such as C/C++, Java, Python etc.).
This course provides an introduction to deep neural networks (DNNs) such as CNNs, RNNs, ResNets, GANs, etc. Those DNNs will be built up from a basic multi-layer perceptron. The learning algorithm using backpropagation will be introduced and built up to advanced learning algorithms such as SGD, Adam etc. In addition, several design issues in DNNs such as overfitting/underfitting, vanishing and exploding gradient problems etc. are explained in the context of optimization for DNNs.

EENG 430. CMOS DIGITAL INTEGRATED CIRCUITS DESIGN. 5 Credits.
Pre-requisites: EENG 160; EENG 331.
This course provides students with the theoretical and practical knowledge required for analyzing and designing digital integrated circuits and systems in complementary metal-oxide-semiconductor (CMOS) technology. Lab includes hands-on use of a variety of state-of-the-art computer-aided design (CAD) tools and design techniques.

EENG 435. ANALOG INTEGRATED CIRCUITS DESIGN. 5 Credits.
Pre-requisites: EENG 331.
This course provides students with the theoretical and practical knowledge required for analyzing and designing analog integrated circuits and systems in CMOS and BJT technologies. Topics include operational amplifier design, biasing and reference circuits, stability, and selected applications of analog circuits (e.g. filters, comparators, data converters, transceiver blocks).

EENG 440. DIGITAL COMMUNICATION SYSTEMS. 5 Credits.
Pre-requisites: EENG 321, EENG 383.
This course provides students with a solid background in modern digital communication systems. Random processing is applied in the realm of communication theory. Common digital modulation and demodulation techniques are presented. Other topics include bandpass transmission of binary data, coherent/noncoherent communications, intersymbol interference and equalization.

EENG 442. MOBILE COMMUNICATIONS. 5 Credits.
Pre-requisites: EENG 321 and EENG 383.
This course covers antennas and propagation, signal encoding techniques; spread spectrum, coding and error control, cellular and wireless control.

EENG 450. POWER SYSTEMS ANALYSIS. 5 Credits.
Pre-requisites: EENG 350.
The course provides students with the ability to analyze power systems from technical and economic perspectives. It includes symmetrical components, calculation of line parameters, power flow control, representation of transmission lines and power components.

EENG 452. PROTECTIVE RELAYS. 5 Credits.
Pre-requisites: EENG 450.
This course provides students with the technical basis to analyze and design protection for power systems. Topics include per unit and phasors, symmetrical components, relay input sources, protection fundamentals, system grounding principles and protection of power system components.

EENG 460. COMPUTING SYSTEMS: ORGANIZATION AND DESIGN. 5 Credits.
Pre-requisites: CSCD 255, EENG 360.
This course provides the theoretical and practical knowledge required for analyzing and designing complex computing systems. Topics include computer performance, MIPs assembly language, integer and floating point arithmetic, designing a processor, pipelining and memory hierarchies. Assembly programming and design using VHDL are offered in weekly labs.

EENG 461. EMBEDDED SYSTEMS DESIGN. 5 Credits.
Pre-requisites: EENG 260 and EENG 360, all with a grade ≥C.
This course provides students with theoretical and practical knowledge required for analyzing and designing embedded computing systems. The key challenge of embedded systems is to optimize various design metrics and assess the impact the organization and interfacing of hardware/software components have on system performance. Hands-on experience using hardware interfaced with select microcontroller development boards is offered in weekly labs.

EENG 462. REAL TIME EMBEDDED SYSTEMS. 5 Credits.
Pre-requisites: EENG 461 or permission of the instructor.
This course involves the design and development of real-time software and hardware for embedded systems with an emphasis on Real-Time Operating Systems (RTOS), Networking and Security. Communication and Timeliness can be compromised under these design environments and therefore constitute some of the design challenges. Hands-on experience using microcontroller development boards sensors and actuators, will be offered in weekly labs.

EENG 470. CONTROL SYSTEMS. 5 Credits.
Pre-requisites: EENG 321.
This course reviews basic topics such as transfer function, step response and stability conditions. Other topics include feedback systems, analysis techniques such as root-locus analysis, transient and steady-state response analyses and frequency response analysis are studied. In addition, state-space analysis techniques are explained within the context of state-space system models. Analysis and design of proportional, integral, and derivative (PID), PI and PD controllers are presented.

EENG 471. DIGITAL CONTROL SYSTEMS. 5 Credits.
Pre-requisites: EENG 470.
This course provides students with the technical basis to understand and analyze digital control systems. Topics include frequency response, modeling digital control systems, steady-state error, stability, Z-domain design and state-space models. An introduction to Lyapunov techniques is presented.

EENG 490A. SR CAPSTONE: DESIGN LAB I. 2 Credits.
Pre-requisites: EENG 210, EENG 260, EENG 320, EENG 330 and EENG 350, each with a minimum grade ≥C.
Satisfies: a university graduation requirement–senior capstone.
This course will simulate the industrial environment, where students will have to work in a team to solve a real world problem, from design to implementation. Team dynamics will be strictly monitored and each student's unique skills will be utilized in different stages of the design process. Dealing with problems typical of a team environment will result in an invaluable learning experience both in the professional and civic lives of the students.

EENG 490B. SR CAPSTONE: DESIGN LAB II. 3 Credits.
Pre-requisites: EENG 490A.
Satisfies: a university graduation requirement–senior capstone.
See course description for EENG 490A.

EENG 491. SENIOR PROJECT. 1-6 Credits.
Pre-requisites: permission of instructor.
Independent and/or group study and implementation of a design and development project. (variable time)

EENG 495. INTERNSHIP. 1-6 Credits.
Notes: graded Pass/Fail.
Pre-requisites: junior or senior status and permission of the instructor, department chair and dean.
Internship.

EENG 496. EXPERIMENTAL. 1-5 Credits.
Experimental.

EENG 498. SEMINAR. 1-6 Credits.
Seminar.

EENG 499. DIRECTED STUDY. 1-10 Credits.
Pre-requisites: permission of the instructor, department chair and college dean.
Designed for students wanting to pursue a subject beyond the scope of regular courses.

EENG 599. INDEPENDENT STUDY. 1-5 Credits.
Independent Study.