EE. ELECTRICAL ENGINEERING

EE-403. COMPUTATIONAL TECHNIQUES IN ELECTRICAL ENGINEERING
Credits: 3
Fees: $100

Application of MATLAB, LabVIEW, and PSPICE to solve problems in electrical engineering topics. Software design, implementation methodologies, software engineering, and procedural and data abstraction. Implementation methodology is based on object-oriented programming techniques using LabWINDOWS CVI (compiler). Students work on real-world design problems of increasing complexity. These will include graphical user interfaces (GUIs), event models, exception handling and multithreading. One Hour lecture and three hour lab per week Lab fee: $100.

Pre-Requisites

Graduate standing

EE-405. ADVANCED LABORATORY EXPERIENCE FOR GRADUATE STUDENTS
Credits: 3

Laboratory and related analytical experience in different disciplines within electrical engineering, including but not limited to, electrical measurements, mechatronics, digital design, electromagentics, and communications systems. Real-world design problems will be assigned. Three hour lab per week. Lab fee: $100.

Pre-Requisites

Graduate standing

EE-410. LINEAR SYSTEM THEORY
Credits: 3

Linear spaces and linear operators; input-output systems and state variables; linear dynamical equations and impulse response matrices; controllability, observability and their applications to minimal realizations; state feedback controllers and observers; multivariable systems.

EE-414. MODERN CONTROL SYSTEMS
Credits: 3

Mathematical modeling of linear and non-linear systems. Block diagram, signal flow graph, and state-space representation. Time response, stability, and steady-state error analysis. Root-locus and frequency response techniques. Controller and observer design. Optimal and robust control.

Pre-Requisites

Graduate standing

EE-415. DIGITAL CONTROL SYSTEMS DESIGN
Credits: 3

Review of design and compensation of control systems. State space analysis of continuous-time and discrete-time systems; discrete-time observations, control and feedback; digital regulators design; digital tracking systems design; controlling continuous-time systems.

Pre-Requisites

[[EE-414]]

EE-416. ROBOT VISION
Credits: 3

Image formation and image sensing; binary images; geometrical and topological properties; reflectance map; photometric stereo, shape, and shading; motion field and optical flow; extended Gaussian images; picking parts out of bin.

Pre-Requisites

First course in Robotics

EE-418. CONTROLS AND KINEMATICS IN NAVIGATION
Credits: 3

Theory of kinematics with application to terrestrial navigation using inertial instrumentation. Accelerometer, gyroscope, stable platform and inertial mechanizations. Space stable, local level and strapdown navigator configurations and error analysis. Integrated navigation using complementary and Kalman filter techniques.

Pre-Requisites

[[EE-318]], [[EE-460]]

EE-421. POWER SYSTEM ANALYSIS
Credits: 3

Review of power generation schemes. Transmission line calculations and power system representation; network solution by matrix transformations; symmetrical components; symmetrical and unsymmetrical fault analysis of power systems; load flow analysis.

Pre-Requisites

[[EE-321]]

EE-425. POWER ELECTRONICS
Credits: 3

SCR characteristics; turn-on and turn-off mechanisms; SCR connections; power and switching devices, including UJT, triac and special devices; AC power control: full-wave control, half-wave control, and phase control; line-commutated converters and inverters; chopper circuits; applications.

Pre-Requisites

[[EE-252]], [[EE-321]]

EE-432. ELECTROMAGNETIC FIELDS AND WAVES
Credits: 3

Maxwell's equations; energy and momentum in the electromagnetic field; plane, cylindrical, and spherical waves; boundary conditions; cylindrical waveguides; cavity resonators; scattering by a sphere and other geometries.

Pre-Requisites

[[EE-337]]

EE-435. MICROSTRIP CIRCUIT DESIGN
Credits: 3

A review of TEM mode transmission line theory. Static TEM parameters and design; discontinuities in microstrip and coupled microstrip lines; design examples of passive microstrip elements; narrowband and wideband microwave amplifiers.

Pre-Requisites

[[EE-335]]/EE 337

EE-436. ANTENNA THEORY AND DESIGN
Credits: 3

Electromagnetic vector potentials; Green's functions; radiating systems; image theory; reciprocity; directional arrays; linear and broadboard antennas; moment method; aperture antennas; microstrip antennas, and antenna synthesis.

Pre-Requisites

[[EE-337]]

EE-441. DIGITAL SYSTEMS DESIGN
Credits: 3

Advanced topics in digital design; combinational and sequential circuit modeling, fault modeling, digital design testing and testability, design to test principles, and basic concepts in fault tolerant design.

Pre-Requisites

[[EE-241]]

EE-442. MICROCOMPUTER OPERATION AND DESIGN
Credits: 3

Microprocessor architecture, microcomputer design, and peripheral interfacing. Microprogramming, software systems, and representative applications. Associated laboratory experiments consider topics such as bus structure, programming, data conversion, interfacing, data acquisition, and computer control. Two hour lecture and one two-hour laboratory a week. (same as [[CS-429]])
Click here for course fee.

Pre-Requisites

[[EE-345]]

EE-444. OPERATING SYSTEM PRINCIPLES
Credits: 3

Analysis of the computer operating systems including Batch, Timesharing, and Realtime systems. Topics include sequential and concurrent processes, processor and storage management, resource protection, processor multiplexing, and handling of interrupts from peripheral devices. (same as [[CS-426]])

Pre-Requisites

[[CS-227]]

EE-445. COMPUTER ORGANIZATION
Credits: 3

Number representation, digital storage devices and computational units, bus structures; execution sequences and assembly language concepts; control units with horizontal and vertical microcoding; addressing principles and sequencing; microprocessors; basic input and output devices; interrupts; survey of RISC principles including pipelined execution. (same as [[CS-445]])
Click here for course fee.

Pre-Requisites

[[EE-241]]

EE-446. COMPUTER ARCHITECTURE
Credits: 3

A study of the design, organization, and architecture of computers, ranging from the microprocessors to the latest 'supercomputers.' (same as [[CS-430]])

Pre-Requisites

[[EE-242]] or [[EE-342]]

EE-451. OPTO-ELECTRONICS
Credits: 3

Electromagnetic theory; propagation of rays; propagation of optical beams in homogeneous and guiding media; optical resonators; interaction of radiation and atomic systems; theory of laser oscillators; some specific laser systems; second-harmonic generation and parametric oscillation; electroptic modulation of lasers; optical radiation interaction of light and sound; propagation, modulation, and oscillation in optical dielectric waveguides; laser applications; fiber optics and couplers.

Pre-Requisites

[[EE-337]]

EE-460. STOCHASTIC PROCESSES IN ENGINEERING
Credits: 3

Review of probability. Random variables and random processes; functions of one and two random variables; expectations; moments and characteristic functions; correlation and power spectra; stationary and nonstationary processes, harmonic analysis of random processes.

EE-461. DIGITAL COMMUNICATIONS
Credits: 3

Sampling theory; analog pulse modulation; time-division multiplexing; baseband digital transmission; bandlimited digital PAM systems; synchronization techniques; PCM, PCM with noise, DPCM and DM; digital multiplexing; error correction and detection; linear block codes; convolutional codes; bandpass digital transmission; coherent and noncoherent binary systems; quadrature carrier and Mary systems; information theory.

Pre-Requisites

[[EE-361]], [[EE-460]]

EE-465. DIGITAL SIGNAL PROCESSING
Credits: 3

Z transforms; Fourier transforms; discrete Fourier transforms; sampling theorem; analog filter approximations; digital filter realizations and topological properties; analysis and design of recursive (IIR) filters and non-recursive (FIR) filters; fast Fourier transforms.

Pre-Requisites

[[EE-252]]

EE-471. ADVANCED SOLID STATE DEVICES
Credits: 3

Review of semiconductor fundamentals. Physics, fabrication technologies, and operational characteristics of a variety of solid-state structures including p-n junctions, bipolar transistors, thyristors, metal semiconductor contacts, JFET and MESFET, MIS and CCD, MOSFET, microwave and photonic devices including IMPATT, BARITT, TED, LED, semiconductor lasers, photodetectors, and solar cells.

Pre-Requisites

[[EE-271]]

EE-474. INTEGRATED CIRCUIT DESIGN
Credits: 3

Model calculations, transfer characteristics and use of SPICE for MOS devices and circuits; basic logical units; integrated systems fabrication including scaling, channel properties, yield statistics, design rules and choice of technology; data and control flow including clocks, registers and PLA'S; design implementation from circuit topology to patterning geometry and wafer fabrication; CAD; overview of LSI and VLSI systems; architecture and design of system controllers; system timing (SPICE); physical aspects of computational systems; ASICs memories and other logical circuits.

Pre-Requisites

[[EE-241]], [[EE-271]]

EE-481. ADVANCED MICROELECTRONICS LAB
Credits: 3

Theoretical and practical aspects of techniques utilized in the fabrication of semiconductor devices. Techniques of wet chemistry; deposition and diffusion; advanced concepts of contamination control; defect-free processing and gathering; complete characterization including junction penetration, resistivity, and oxide thickness. Switching speed, junction characteristics, leakage and gain, ion implantation, and method of fabrication. Extensive use of process simulation programs such as SUPREM.
Click here for course fee.

Pre-Requisites

[[EE-271]]

EE-482. ADVANCED COMMUNICATION AND ANTENNA LAB
Credits: 3

Characterization and measurement of microwave devices and systems; emphasis on antenna design and testing; utilization of the network analyzer and spectrum analyzer; antenna pattern measurements; communication link design; computer-aided design of active and passive microwave circuits; touchstone, optical signal generation and modulation.
Click here for course fee.

Pre-Requisites

[[EE-335]]

EE-498. TOPICS IN ELECTRICAL ENGINEERING
Credits: 3

Three creditsSelected topics in electrical engineering. These may include one or more of the following: control systems, information theory, signals and noise measurements, communication systems, navigational systems, network design and synthesis, solid state, quantum electronics, magnetic and non-linear circuits, digital and analog systems, computer systems, medical engineering, power systems and generation. May be repeated for credit.

EE-510. OPTIMAL FILTERING THEORY
Credits: 3

Review of stochastic processes; stochastic integrals and differential equations; Wiener filtering; discrete Kalman filter; applications and additional topics on discrete Kalman filtering; continuous Kalman filter; discrete smoothing and prediction; additional topics on Kalman filtering.

Pre-Requisites

[[EE-410]], [[EE-460]]

EE-514. OPTIMAL CONTROL THEORY
Credits: 3

The calculus of variations and the minimum principle; optimal control of discrete-time systems; optimal control of continuous-time systems; dynamic programming; models of dynamic systems; optimal estimation; stochastic neighboring optimal control.

Pre-Requisites

[[EE-410]]

EE-516. ROBOTICS AND ARTIFICIAL INTELLIGENCE
Credits: 3

Prospects for knowledge-based robots; robots and artificial intelligence; expert systems and knowledge-based languages; production-rule expert systems; search techniques; heuristic graph searching; AND/OR graphs; first order predicate logic; future prospects for knowledge-based robots.

Pre-Requisites

First course in Robotics

EE-521. COMPUTER AIDED ANALYSIS OF POWER SYSTEMS
Credits: 3

Bus impedance and bus admittance matrices; sparsity programming and triangular factorization. Load-flow studies; Gauss, Gauss-Seidel, Newton-Raphson methods. Approximate, fast and special-purpose load-flow studies. Optimal dispatch: equal incremental cost rule; gradient dispatch; optimal reactive power dispatch methods.

Pre-Requisites

[[EE-421]]

EE-535. MICROWAVE CIRCUITS
Credits: 3

Microwave networks; S-parameters and stability considerations; characterization of transmission line structures and discontinuities; models of microwave solid state devices; measurement techniques for modeling; design synthesis; optimization and analysis of microwave integrated circuits; numerical methods.

Pre-Requisites

[[EE-435]]

EE-541. MICROPROCESSOR-BASED SYSTEMS DESIGN
Credits: 3

Brief review of directions in microprocessor development: single chip microcomputers, Reduced Instruction Set Computers (RISCs), and Multiple Data Stream processors; hardware and software aspects of the design of microprocessor-based systems; architecture and design of multiple computer and parallel processing systems; cache memory techniques and issues; bus standards and interfacing.

Pre-Requisites

[[EE-342]]

EE-560. DETECTION AND ESTIMATION THEORY
Credits: 3

Probabilistic signal detection and parameter estimation theory. Decision criteria, performance, likelihood, Bayes and parameter estimation; random processes, detection and estimation of white and nonwhite Gaussian noise. Kalman and Wiener filters.

Pre-Requisites

[[EE-460]]

EE-561. COMPUTER COMMUNICATION NETWORKS
Credits: 3

Data/computer communication network structures; the structure and function of network protocols; data link control procedures; multiple-access protocols; wideband data transmission media; functions and characteristics of devices used in computer communications; analysis of data/computer networks.

Pre-Requisites

[[EE-461]]

EE-562. OPTICAL COMMUNICATION
Credits: 3

Structure and waveguiding fundamentals of optical fibers; signal degradation in optical fibers; optical sources and their characteristics; power launching and coupling; photodetectors; optical receiver operation; coherent and non-coherent detection; analysis and design of optical transmission links.

Pre-Requisites

[[EE-432]], [[EE-461]]

EE-565. DIGITAL IMAGE PROCESSING
Credits: 3

Scenes, images and digital pictures; linear operations on pictures; discrete picture transforms; random variables and random fields; visual perception. Sampling using array of points and orthonormal functions; quantization; Karhunen-Loeve, Fourier, Hadamard, and cosine compression; predictive block truncation, error-free compression; rate-distortion function. Enhancement: gray scale modification, sharpening and smoothing; restoration: inverse least-squares and recursive filtering, constrained deconvolution.

Pre-Requisites

[[EE-460]]

EE-568. MODERN NAVIGATION SYSTEMS
Credits: 3

Overview of electronic navigation systems: Global Positioning Systems (GPS); application and status; concept and operation; accuracy and propagation consideration; GPS receiver; signal structure, integration principles for navigation systems; Kalman filtering; differential GPS.

Pre-Requisites

[[EE-418]], [[EE-460]]

EE-571. MODERN SOLID STATE DEVICES AND DESIGN
Credits: 3

Semiconductor fundamentals at an advanced level. Silicon and GaAs, MOS devices; processing details; performance limitations; process design for given device specifications; limitations due to fabrication techniques; quantum phenomena in a variety of modern high performance devices; microwave semiconductor devices; integrated circuit design; VLSI design; computer aids for process and circuit design.

Pre-Requisites

[[EE-471]]

EE-590. PROJECT/THESIS
Credits: 1-6

One to six creditsStudents have the option to select a 6-credit or a 3-credit project to meet the degree requirement. Topics will touch on one or more of the following areas: Communications, Navigational Systems; Computers, Digital Systems; Microelectronics; Microwaves and Antennas; Power, Control Systems; and Software Engineering. Three faculty members constitute a Faculty Committee with the Project/Thesis Advisor as Chair. The project/thesis shall be presented in an open forum.

EE-598. ADVANCED TOPICS IN ELECTRICAL ENGINEERING
Credits: 3

Three creditsAdvanced topics in electrical engineering. These may include one or more of the following: control systems: navigational systems; information theory; signals and noise measurements; communication systems; network design and synthesis; solid state; quantum electronics; magnetic and non-linear circuits; digital and analog systems; computer systems; medical engineering; power systems and generation. May be repeated for credit.