ELECTRICAL & COMPUTER ENGINEERING (ECEN)

ECEN 2011 Experimental Methods I
Prerequisites: PHYS 2114; Co-requisite(s): ENSC 2613
Description: Basic electrical measurements and instrumentation techniques and devices. Use of voltmeters, ammeters, oscilloscopes, impedance bridges to study resistive, inductive, and capacitive circuit elements in steady state and transient operation. Reinforces ENSC 2613 and introduces design of instrumentation networks. Serves as introduction for non-majors. Previously offered as ECEN 3013.
Credit hours: 1
Contact hours: Lab: 2
Levels: Undergraduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 2714 Fundamentals of Electric Circuits
Prerequisites: MATH 2153 and PHYS 2114.
Description: Circuit analysis techniques including equivalent networks and mesh/node formulation of network equations; operational amplifiers; RL, RC and RLC transient and steady-state circuit analysis; energy and power; electrical measurements and instrumentation.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 3020 Supervised Research Project
Prerequisites: Consent of instructor and ECEN department head.
Description: Supervised research project for qualified students. May be repeated no more than three times for a total of three credit hours. Offered for variable credit, 1-3 credit hours, maximum of 3 credit hours.
Credit hours: 1
Contact hours: Other: 1
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 3113 Energy, Environment and Economics
Prerequisites: ECEN 3714, degree program requires admission to Professional School prior to enrollment.
Description: Topics relevant to understanding the close relationship between energy use, its impact on the environment, and overall economic implications. Green energy technologies (wind, solar, hydro) will be considered along with conventional techniques. Both conventional and non-conventional energy technologies will be discussed.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3233 Digital Logic Design
Description: Boolean algebra, optimization of logic networks. Design using SSI, and MSI, LSI components. ROM and PLA applications. Analysis and design of clock sequential logic networks. Flip-flops, counters, registers. Asynchronous circuit design and analysis. Laboratory experience in implementing combinational and sequential logic devices.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 3314 Electronic Devices and Applications
Prerequisites: ECEN 3714, degree program requires admission to Professional School prior to enrollment.
Description: Semiconductor electronic components including MOSFETs, BJTs, JFETs, and OpAmps. Emphasis on device models and use of solid state electronic devices to analyze, synthesize and design amplifiers and switching circuits. SPICE simulations are extensively utilized. Basic building blocks for analog and digital applications. Theoretical concepts and methods are demonstrated and reinforced through laboratory exercises. Course previously offered as ECEN 3313.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 3513 Signal Analysis
Prerequisites: ECEN 3714.
Description: Degree program requires admission to Professional School prior to enrollment. Deterministic signals. Fourier series and Fourier transforms. Impulse response, convolution and correlation. Sampling theorem. Analog modulation techniques.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3613 Electromagnetic Fields
Prerequisites: ENSC 2714 with a minimum grade of “C” or better, MATH 2163 and MATH 2233.
Description: Time-harmonic and transient response of transmission lines. Maxwells equations and their applications to engineering problems in electrostatics, magnetostatics, time-harmonic fields and plane wave propagation.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3623 Mathematical Foundations of Electromagnetics and Photonics
Prerequisites: ECEN 3613 and degree program requires admission to Professional School prior to enrollment.
Description: Mathematical and computational treatment of fundamental electromagnetic theory, with applications to microwave engineering, photonics and semiconductor design. Energy and power; Laplace and Poisson equations; wave equation, including reflection, refraction, and diffraction; and classical electromagnetic radiation at macroscopic and microscopic levels.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 3714 Network Analysis
Prerequisites: ECEN 2714 with a minimum grade of "C" or better and MATH 2233.
Description: Laplace transform, transfer functions, magnetically coupled circuits and two-port networks. Theoretical concepts and methods are demonstrated and reinforced through laboratory exercises. Course previously offered as ECEN 3713.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 3723 Systems I
Prerequisites: ENSC 2113 and ECEN 2714 with a minimum grade of "C" or better, and MATH 2233.
Description: Physical and mathematical modeling of electrical and mechanical dynamic systems. Transient response of first and second order systems. Laplace transform techniques for solving differential equations, transfer functions, frequency response and resonance. Course previously offered as ECEN 3413.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3903 Introduction to Semiconductor Devices
Prerequisites: PHYS 2114 or equivalent.
Description: Crystal structure, the quantum theory of solids. The physics of semiconductor materials and the projunction, with an emphasis on applications to semiconductor devices. Same course as PHYS 3313.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3913 Solid State Electronic Devices
Prerequisites: ECEN 2714 with a minimum grade of "C" or better and either PHYS 3313 or ECEN 3903. Degree program requires admission to Professional School prior to enrollment.
Description: Solid state physics basis of modern electronic devices. Introductory quantum mechanics. Energy bands in solids. Electronic properties of semiconductors. Junction diodes. Bipolar transistors. Field effect transistor.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4010 Technical Problems and Engineering Design
Prerequisites: Consent of instructor.
Description: Individual independent study projects selected in consultation with the instructor; analysis or design problems, literature searches and computer simulations may be involved. Offered for variable credit, 1-12 credit hours, maximum of 12 credit hours.
Credit hours: 1-12
Contact hours: Other: 1
Levels: Graduate, Undergraduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 4013 Design of Engineering Systems
Prerequisites: ECEN 3513, ECEN 3714, ECEN 3314, ECEN 3233 and ENSC 3213. ENGL 3323 as co-requisites. Degree program requires admission to professional school prior to enrollment.
Description: Complete design cycle for several small design projects, each including establishing objectives, synthesis, analysis, construction, testing and evaluation. Use of modern lab equipment and fabrication techniques. Development of communication skills.
Credit hours: 3
Contact hours: Lecture: 1 Lab: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 4024 Capstone Design
Prerequisites: ECEN 4013; degree program requires admission to Professional School prior to enrollment.
Description: Continuation of ECEN 4013. Student project teams design, build, test and present results for realistic projects from university and industrial sponsors. Formulation of specifications, consideration of alternative solutions, feasibility considerations, detailed system descriptions, economic factors, safety, reliability, aesthetics, ethics and social impact. Course previously offered as ECEN 4023.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 4030 Undergraduate Professional Practice
Prerequisites: Approval of ECEN department head.
Description: Experience in application of electrical engineering principles to typical problems encountered in industry. Solutions to the problems by student participation in the role of engineer or engineering intern. Offered for variable credit, 1-8 credit hours, maximum of 8 credit hours.
Credit hours: 1-8
Contact hours: Other: 1
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 4133 Power Electronics
Prerequisites: Degree program requires admission to Professional School prior to enrollment.
Description: Power electronic devices, components, and their characteristics; DC to AC conversion; fundamentals of inverters and waveshaping devices; application aspects; control aspects; characteristics and state-of-the-art of advanced power inverter and power conditioning topologies.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4153 Power System Analysis and Design
Prerequisites: Degree program requires admission to Professional School prior to enrollment.
Description: Power system component models from circuit theory. Formulation and design of the load flow model and the optimum economic generator allocation problem utilizing computer methods.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4213 Embedded Computer Systems Design
Prerequisites: ENSC 3213 and CS 1113.
Description: Degree program requires admission to Professional School prior to enrollment. Design of microprocessor-based systems through proper integration of hardware and software. Serial and parallel communications, sensor interfacing, computer control of external devices, and color graphics hardware. Design of PASCAL and assembly language modules for optimum real-time system performance.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Graduate, Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 4233 High Speed Computer Arithmetic
Prerequisites: ECEN 3233; degree program requires admission to Professional School prior to enrollment.
Description: Course covers computer arithmetic as applied to general purpose and application-specific processors. Focus is on developing high-speed arithmetic algorithms and understanding their implementation in VLSI technology at the gate level.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4243 Computer Architecture
Prerequisites: ENSC 3213 and ECEN 3233.
Description: Degree program requires admission to Professional School prior to enrollment. Functional organization and hardware design of digital computer systems with emphasis on microprocessor-based systems. CPU organization, features of microprocessors including advanced 32-bit CPU's, memory system design including cache, virtual memory, error detection and correction, I/O operations, including direct memory access and peripheral interface design.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Graduate, Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 4273 Software Engineering
Prerequisites: ENSC 3213 or CS 1113, CS 3443.
Description: Degree program requires admission to Professional School prior to enrollment. Functional organization and hardware design of digital computer systems with emphasis on microprocessor-based systems. CPU organization, features of microprocessors including advanced 32 bit CPU's memory system design including cache, virtual memory, error detection and correction, I/O operations, including direct memory access and peripheral interface design. Same course as CS 4273.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4283 Computer Networks
Prerequisites: ENSC 3213 or CS 3443.
Description: Degree program requires admission to Professional School prior to enrollment. Computer networks, distributed systems and their systematic design. Introduction to the use, structure, and architecture of computer networks. Networking experiments to describe network topology. ISO reference model. Same course as CS 4283.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4303 Digital Integrated Circuit Design
Prerequisites: ECEN 3233 and ECEN 3314; degree program requires admission to Professional School prior to enrollment.
Description: Theory of digital and electronics circuits. Digital logic families TTL, IIL, ECL, NMOS, CMOS, GaAs. Large signal models for transistors. Implementation at RAM and ROM. Circuit design for LSI and VLSI.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4313 Linear Electronics Circuit Design
Prerequisites: ECEN 3314; degree program requires admission to Professional School prior to enrollment.
Description: Class A and B small-signal, push-pull power, complementary symmetry, differential and operational amplifiers, utilizing field-effect transistors, bipolar transistors, tunnel diodes and integrated circuits. Emphasis on amplification in electronic devices, design and analysis of wide-band amplifier circuitry.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4353 Communication Electronics
Prerequisites: ECEN 3314; degree program requires admission to Professional School prior to enrollment.
Description: Design of tuned voltage and power amplifiers, oscillators and mixers, modulation and detection, and parametric amplifiers.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4413 Automatic Control Systems
Prerequisites: ECEN 3723 or MAE 3723; degree program requires admission to Professional School prior to enrollment.
Description: Properties of feedback control systems, mathematical models of basic components, state-variable models of feedback systems, time-domain analysis, stability, transform analysis, frequency domain techniques, root-locus design of single input single output systems and simple compensation techniques. Same course as MAE 4053.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4503 Random Signals and Noise
Prerequisites: ECEN 3513, ECEN 3714; degree program requires admission to Professional School prior to enrollment.
Description: Analysis of electrical systems using elementary concepts of probability, random variables and random processes. Frequency and time domain response of linear systems driven by random inputs. Statistical properties of electrical noise. Analysis and design of optimum linear systems.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4523 Communication Theory
Prerequisites: ECEN 3513 and ECEN 4503. Degree program requires admission to Professional School prior to enrollment.
Description: Noise in modulation systems. Digital data transmission. Design of optimal receivers. Introduction to information theory.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4533 Data Communications
Prerequisites: ECEN 4503 as co-requisite.
Description: Degree program requires admission to Professional School prior to enrollment. Signal detection in noise. Tradeoffs between bandwidth signal-to-noise ratio and rate of information transfer. Transmission multiplexing and error handling. Elements of computer network design. Data link protocols.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4613 Microwave Engineering
Prerequisites: ECEN 3613; degree program requires admission to Professional School prior to enrollment.
Description: Aspects of propagation, transmission, and radiation of microwave energy. Plane wave propagation; lossless and lossy media, reflection, refraction, and polarization. Transmission line theory; lumped element model, characteristic impedance, impedance matching, and transient response. Theory of waveguides and cavity resonators. Microwave network theory and S-parameters. Introduction to radiating systems.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4703 Active Filter Design
Prerequisites: ECEN 3613; degree program requires admission to Professional School prior to enrollment.
Description: Introduction to passive filters; operational amplifiers as network elements; filter specifications; design of active filters. Laboratory design projects and computer simulations.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4743 Introduction to Biomedical Engineering Modeling and Systems
Prerequisites: ECEN 3714, ECEN 4763; degree program requires admission to Professional School prior to enrollment.
Description: An overview of the field of biomedical engineering and an introduction of the modeling approaches implemented in biomedical engineering. Topics include bio-electronics, biomechanics, compartmental modeling, bio-signal processing, biomedical optics, etc. The course will demonstrate a few of major fields of activity in which biomedical engineers are engaged and modeling approaches are implemented.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4763 Introduction to Digital Signal Processing
Prerequisites: ECEN 3513; degree program requires admission to Professional School prior to enrollment.
Description: Introduction to discrete linear systems using difference equations and z-transforms. Discrete Fourier analysis. Design of digital filters. Sampling theorem. Applications of digital signal processing.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4773 Real Time Digital Signal Processing
Prerequisites: ECEN 4763 or equivalent; degree program requires admission to Professional School prior to enrollment.
Description: DSP Processor architectures and programming. A/D, D/A, polled and interrupt-driven I/O. Realtime implementation of FIR/IIR filters, the FFT, and other DSP algorithms on special purpose DSP hardware from Motorola, Texas Instruments and others. Link between DSP theory and practical implementation.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4823 Design of Optical Systems
Prerequisites: PHYS 2114; degree program requires admission to Professional School prior to enrollment.
Description: Introduction to optics through the design, construction, and characterization of optical systems. Emphasis on geometrical optics and spectroscopy. Course previously offered as ECEN 3813.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Graduate, Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 4843 Design of Lasers and Systems
Prerequisites: ECEN 3613; degree program requires admission to Professional School prior to enrollment.
Description: Introduction of the design of lasers and optical systems based on lasers including the design, construction, and characterization of lasers. Gaussian beams and optics, laser gain materials, laser cavities, advanced topics. Course previously offered as ECEN 4813.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Graduate, Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 5000 Thesis or Report
Description: A student studying for the master's degree will enroll in this course for a maximum of six credit hours. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 5030 Professional Practice
Description: Experience in application of electrical engineering principles to typical problems encountered in industry and government engineering design and development projects. Solutions to the problems require participation by the student in the role of junior engineer or engineer-intern. Problem solutions involve economics and ecological considerations as well as technology and must be adequately documented. Offered for variable credit, 1-8 credit hours, maximum of 8 credit hours.
Credit hours: 1-8
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 5060 Special Topics
Prerequisites: Consent of instructor.
Description: Engineering topics not normally included in existing courses. Repeat credit may be earned with different course subtitles assigned. Offered for variable credit, 1-6 credit hours, maximum of 30 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 5070 Directed Studies
Prerequisites: Consent of instructor.
Description: Investigation outside of the classroom of topics not normally covered in lecture courses. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 5113 Power Systems Analysis by Computer Methods
Description: Quasi-static control of power systems and analysis of power systems under abnormal operating conditions. Transient stability studies. Models formulated and solutions outlined for implementation on the computer.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5123 Engineering Systems Reliability Evaluation
Description: Techniques and concepts needed for evaluating the long-term and short-term reliability of a system. Topics include static and spinning generation capacity; transmission, composite, interconnected, and dc system reliability evaluations; and power system security. Applications to systems other than power systems included. For students with little or no background in probability or statistics.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5133 Power Electronics and Renewables
Description: Modeling and control aspects of power electronics for integrating renewable energy systems. Topics covered here will focus on power converter dynamics, indirect converter topologies, PWM technique, sliding mode control of converters, game theory based control, Maximum power point tracking, control of generators for different renewable energy systems. Simulation tools will be discussed as appropriate.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5153 Direct Energy Conversion
Description: Energy conversion techniques and applications; thermo-electrics, thermionics, fuel cells, MHD and other processes involving electrical, mechanical and thermal energies. State-of-the-art developments in direct energy conversion using selected papers from journals and other publications. Gives the student a proper perspective of the possibilities and problems associated with satisfying future energy requirements.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5163 Intro to Smart Grid
Prerequisites: ECEN 5193.
Description: Introduction to smart grid technologies and applications; advance metering infrastructures, demand response, renewable generation, electric vehicles, and cyberattacks.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5193 Power Economics and Regulation
Prerequisites: Vector calculus, familiarity with complex numbers.
Description: Natural monopoly, regulated mono-polities. Power pricing. Deregulation and the Energy Policy Act of 1992. Bulk power markets, transmission access and wheeling. Economic dispatch and system operations. Security and reliability. Environmental externalities and Clean Air Act compliance. Procurement of new capacity and integrated resource planning. Co-generators and independent power producers.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5223 Digital Systems Testing
Prerequisites: ECEN 3233.
Description: Testing of combinational and sequential circuits. Test generation techniques. Design of reliable and testable circuits and systems. Testing for LSI and VLSI.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5233 Embedded Sensor Networks
Prerequisites: Graduate standing or consent of instructor.
Description: Analysis and design of wireless networks, including the integration of sensing, computation, and wireless communication within an embedded system. Mobile sensor networks and body sensor networks. Real world application and new innovations.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5253 Digital Computer Design
Prerequisites: ECEN 4243 or graduate standing.
Description: Arithmetic algorithms and the design of the arithmetic/logic unit (ALU). Serial and parallel data processing; control and timing systems; microprogramming; memory organization alternatives; input/output interfaces. Same course as CS 5253.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5263 VLSI Digital Systems Design
Prerequisites: ECEN 4303; ECEN 5253 recommended or graduate standing.
Description: Design of very large-scale digital systems on a single chip. Review of MOS technology. Design rules imposed by fabrication techniques. Systematic structures for control and data flow; system timing; highly concurrent systems. Experimental opportunities available.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5283 Computer Vision
Description: The development of machine vision and advanced image understanding techniques for robotics, automated inspection, biomedicine. Object recognition, motion analysis, object tracking, segmentation, representation, and 3-D analysis.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5313 Solid-State Electron I
Description: An advanced study of electronic networks. Application of solid-state devices to the medium- and low-frequency regions. Integrated networks as replacements for discrete-component networks. Discrete and integrated operational amplifiers. Broad-band and tuned amplifiers.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5333 Semiconductor Devices
Prerequisites: ECEN 3314 and PHYS 3313 or equivalent.
Description: Semiconductor crystal structure and device fabrication, carrier distribution and transport, pn junction and diode, metal-semiconductor heterojunction, MOSFET, BJT and optoelectronic devices.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5353 Adv Power Electronics
Prerequisites: ECEN 4133.
Description: Characteristics of high power semiconductor devices and the application of such devices to power conditioning, inversion and wave shaping at high power levels.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5363 CMOS Analog Integrated Circuit Design
Prerequisites: ECEN 4313.
Description: Advanced study of solid state CMOS linear integrated circuits. Topics include: Op Amps, comparators, multipliers, D/A and A/D converters and Op Amp building blocks. Op Amp building blocks include, differential pairs, current mirrors, gain, output stages, and references. VLSI layout and circuit simulation using SPICE.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5373 RF Microwave Circuit Design
Prerequisites: ECEN 3314 , ECEN 4613 and ECEN 5333 or equivalent.
Description: Smith chart, single- and multi-port network, filter design, RF/microwave components and modeling, matching and biasing network, amplifier, oscillators and mixers.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5413 Optimal Control
Prerequisites: ECEN 5713 or MAE 5713.
Description: Optimal control theory for modern systems design. Specification of optimum performance indices. Dynamic programming, calculus of variations and Pontryagin's minimum principle. Iterative numerical techniques for trajectory optimization. Same course as MAE 5413.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5423 Control of Hybrid Systems
Prerequisites: ECEN 5713 Linear Systems or consent of instructor.
Description: Introduction and definitions. Modeling of hybrid systems. Analysis of hybrid systems. Stability analysis. Switched control systems. Hybrid control design. Applications in power systems, robotics, transportation and multivehicle systems.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5433 Robotics Kinematics, Dynamics and Control
Prerequisites: ECEN 4413 or MAE 4053 or consent of instructor.
Description: Kinematic and dynamic analysis of robot manipulators. Inverse kinematics, motion planning and trajectory generation. Industrial practice in robot servo control. Dynamics and control in the presence of constraints. Actuators and sensors. Force sensors and vision systems. Robotic force control and its applications in industry. Passivity-based control algorithms. Advanced control techniques for motion and force control. Same course as MAE 5433.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5463 Nonlinear System Analysis and Control
Prerequisites: ECEN 4413 or MAE 4053.
Description: Failure of superposition of effects; phase-plane analysis; limit-cycles; Lyapunov stability; hyperstability and input-output stability; controllability and observability of nonlinear systems; feedback linearization; robust nonlinear control system design. Same course as MAE 5463. Course previously offered as ECEN 5723.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5473 Digital Control Systems
Prerequisites: ECEN 4413 or MAE 4053.
Description: Input-output and state-space representation of linear discrete-time systems. Approximate methods in discrete-time representation. Stability methods. Controllability, observability, state estimation, and parameter identification. Design and analysis of feedback control system using frequency-domain and state-space methods. Introduction to optimal control. Same course as MAE 5473. Course previously offered as ECEN 6413.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5483 Advanced Mechatronics Design
Prerequisites: MAE 4733 or similar course and consent of instructor.
Description: Optimizing C programming code for microcontrollers using the assembly language instruction set. RS-232 microcontroller communication protocol. Controller Area Network (CAN) communication protocol plus hands-on CAN bus development boards, advanced topics which could include but are not limited to sensor design, real time operating systems, and advanced communication protocols. Same course as MAE 5483.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5493 Software Design for Real-Time Distributed Systems
Prerequisites: ECEN 5483 or MAE 5483 or consent of the instructor.
Description: Fundamental concepts associated with the design of software for implementation on distributed computer systems using real-time operating systems. Parallel computing in a real-time environment and control algorithm design. State-of-the-art boards including analog-to-digital and digital-to-analog equipment and newest computer-aided software engineering tools.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5513 Stochastic Systems
Prerequisites: ECEN 3513 and ECEN 4503 or STAT 4033.
Description: Theory and applications involving probability, random variables, functions of random variables, and stochastic processes, including Gaussian and Markov processes. Correlation, power spectral density, and non-stationary random processes. Response of linear systems to stochastic processes. State-space formulation and covariance analysis. Same course as MAE 5513.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5523 Estimation Theory
Prerequisites: ECEN 5513 or MAE 5513.
Description: Stochastic model development, parameter estimation and state estimation. The linear model, model order determination, least squares estimation, maximum likelihood estimation, Bayesian estimation, Gaussian random vectors, estimation in linear and Gaussian models, state estimation, the Kalman filter, prediction and smoothing. Same course as MAE 5523.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5533 Modern Communication Theory
Prerequisites: ECEN 5513.
Description: Noise as a random process, analog and digital signal detection in the presence of noise, optimum receiver design using signal space concepts and introduction to information theory. Trade-offs between bandwidth, signal-to-noise ratio and the rate of information transfer. Example system designs include earth satellite, deep space and terrestrial communication systems and computer communication networks.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5543 Data Transportation and Protection
Description: Data and its representation; finite field matrices, pseudorandom sequences; information protection; space division networks; synchronization; and channel and error control.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5553 Telecommunications Systems
Prerequisites: Graduate standing or consent of instructor.
Description: Surveys the ways and means that voice, data and video are moved long distances. Covers computer networks (Ethernet LAN's, Internet WAN's); telephone systems (PSTN, VoIP and cellular telephony); video (MPEG, H.323, and IPTV); and last mile delivery systems.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5563 Principles of Wireless Networks
Prerequisites: ECEN 4283 or CS 4283.
Description: Wireless network operation, planning, mobility management, cellular and mobile data networks based on CDMA, TDMA, GSM; IEEE 802-11 WLANS, Adhoc networks, Bluetooth, power management, wireless geolocation and indoor positioning technique. Same course as CS 5813.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5573 Wireless Communication
Description: Wireless channel characterization: large-scale and small scale fading. Techniques to combat fading; diversity techniques, coding techniques, CDMA, OFDM, MIMO. Cellular concept.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5613 Electromagnetic Theory
Prerequisites: ECEN 3613.
Description: First graduate level treatment of classical electromagnetic theory. Wave equation, potential theory, boundary conditions. Rectangular, cylindrical and spherical wave functions. Conducting and dielectric guiding structures. Scattering and radiation. Introduction to numerical techniques.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5623 Antenna Theory
Prerequisites: ECEN 3613.
Description: Fundamental antenna parameters, including directivity, efficiency, radiation resistance, and pattern. Analysis of dipole, loop, aperture, broad- band, and traveling wave antennas. Array theory. Introduction to numerical techniques used in modern antenna design.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5633 Radar Theory
Prerequisites: ECEN 3613; ECEN 4503 or ECEN 5513.
Description: Theoretical treatment of radar principles. Overview of radar systems and techniques, radar equation, integration of signals. Radar cross-section of single and multiple targets. Waveform design, resolution, ambiguities and accuracy. Range, speed and angular measurements. Detection of targets in noise. Statistical description of clutter. Signal processing techniques.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5643 Antennas and Propagation for Wireless Communications
Prerequisites: ECEN 3613, ECEN 4503.
Description: Aspects of radiowave propagation for fixed and mobile communication systems. Review of Maxwell's equations and plane wave propagation, antenna principles. Reflection, refraction, diffraction, fading and scintillation, attenuation, ducting, diversity. Propagation in a cellular environment. Satellite communications.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5683 Biomedical Optics
Description: Biomedical optics, also often termed as biophotonics, is highly interdisciplinary subject on applying light for diagnostic detection and manipulation of biological tissue. This course introduces fundamental concepts and principal technologies of biomedical optics or biophotonics to graduate students and upper-level undergraduate students. The course includes three parts: The first part discusses light-tissue interaction. The second part introduces approaches to modeling photon propagation in tissue. The third part details several representative light-based sensing and imaging technologies for probing biological tissues at different spatial, spectral, and temporal scales for either morphological or functional diagnosis. Topics of therapeutic use of light will also be discussed.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5703 Optimization Applications
Prerequisites: Graduate standing.
Description: A survey of various methods of unconstrained and constrained linear and non-linear optimization. Applications of these methodologies using hand-worked examples and available software packages. This applications oriented course is intended for engineering and science students. Same course as CHE 5703, IEM 5023 & MAE 5703.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5713 Linear Systems
Prerequisites: Graduate standing or consent of instructor.
Description: Introduction to the fundamental theory of finite-dimensional linear systems with emphasis on the state-space representation. Mathematical representations of systems; linear dynamic solutions; controllability, observability, and stability; linearization and realization theory; and state feedback and state observer. Same course as MAE 5713.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5733 Neural Networks
Prerequisites: Graduate standing.
Description: Introduction to mathematical analysis of networks and learning rules, and on the application of neural networks to certain engineering problems in image and signal processing and control systems. Same course as CHE 5733 & MAE 5733.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5753 Digital Processing of Speech Signals
Prerequisites: ECEN 4763 or 5763.
Description: Digital signal processing; speech production; digital modeling of speech; short time analysis and synthesis; the short time Fourier transform, linear predictive coding and solution of the normal equations; vocal tract spectrum calculation; speech coding; homomorphic processing; applications of speech processing. Introduction to more advanced topics as time permits.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5763 Digital Signal Processing
Description: Introduction to discrete linear systems; frequency-domain design of digital filters; quantization effects in digital filters; digital filter hardware, discrete Fourier transforms; high-speed convolution and correlation with application to digital filtering; introduction to Walsh-Fourier theory.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5773 Intelligent Systems
Prerequisites: ECEN 5733.
Description: Introduction to the state-of-the art intelligent control and system successfully deployed to industrial and defense applications. Emerging intelligent algorithms (e.g., NN, FS, GA, EP, DES); intelligent control architecture (e.g., bottom-up, top-down, seminotics); reinforcement learning and hybrid systems; and case studies and design projects. Same course as MAE 5773.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5783 Medical Imaging
Prerequisites: ECEN 3513, ECEN 4743 or consent of instructor.
Description: A comprehensive introduction to the standard medical imaging modalities used today. Topics include radiation, radiation-interaction with matter, X-ray radiography, ultrasound, computer topography, image reconstruction and analysis, MRI, nuclear medicine, and radiation therapy. The fundamental mathematics underlying each imaging modality is reviewed and the hardware needed to implement each system is examined.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5793 Digital Image Processing
Prerequisites: ECEN 4763 or ECEN 5763.
Description: Digital image processing including image acquisition and characterization, transforms, coding and compression, enhancement, restoration and segmentation. Use of modern image processing software on Sun and IBM work stations.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5803 Geometrical Optics
Prerequisites: PHYS 3213 or consent of instructor.
Description: Foundations of geometrical optics, geometrical theory of optical imaging, geometrical theory aberrations, image forming instruments. Same course as PHYS 5123.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5823 Physical Optics
Prerequisites: PHYS 3213 or consent of instructor.
Description: Multiple beam interference, diffractions, imaging, near field optical probes of matter, surface plasmons, light scattering from random media, optical coherence tomography- biomedical applications, negative materials, perfect lenses and super resolution. Same course as PHYS 5303.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5833 Fiber-Optic Communication Systems
Prerequisites: Graduate standing or consent of instructor.
Description: Five generations of fiber-optic communication systems described in detail. Technical advances and increased capability of each system. Historical framework of how technical capability at the time forced technical decisions. A systems engineering point of view, emphasizing optimization of all components of the optical fiber link.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5843 Microelectronic Fabrication
Prerequisites: ECEN 3314.
Description: Contamination control and clean-room, vacuum systems, wafer manufacturing. Photolithography and alternative lithographic techniques. Physical and chemical vapor deposition, oxidation, etching, doping, packaging, formation of semiconductor devices and circuits. A series of Fabrication lab projects is conducted starting from bare silicon wafers to fabricate Optoelectronic circuits. Additional flat fee of $120.00 applies.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5853 Ultrafast Optoelectronics
Prerequisites: Graduate standing or consent of instructor.
Description: Combining ultra fast laser pulses with electronic circuitry. Increased device performance. Optoelectronic/electrical pulses as short as 0.2 psec. High performance areas illustrating the power of advanced techniques in applications.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5923 Introduction to MEMS
Prerequisites: ECEN 5843 or consent of instructor.
Description: Fundamentals of Microsystems. Topics include: energy transduction mechanisms, energy dissipation modeling, energy methods, mechanics of small scale, fabrication process design, micromachining, electronic interface.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6000 Research
Prerequisites: Consent of major professor.
Description: Independent research for students continuing graduate study beyond the level of the MS degree. Offered for variable credit, 1-16 credit hours, maximum of 36 credit hours.
Credit hours: 1-16
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 6001 PhD Seminar Series
Prerequisites: Approval of ECEN department head.
Description: Seminar series for PhD studies and research.
Credit hours: 1
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6050 Preliminary PhD Research and Proposal
Prerequisites: Consent of adviser.
Description: Independent research and report of an advanced electrical engineering problem. Work performed serves as foundation of the oral PhD preliminary exam.
Credit hours: 3
Contact hours: Other: 3
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 6060 Advanced Special Topics
Prerequisites: Consent of instructor.
Description: Advanced engineering topics not normally included in existing courses. Repeat credit may be earned with different course subtitles assigned. Offered for variable credit, 1-6 credit hours, maximum of 30 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 6070 Advanced Directed Studies
Prerequisites: Admission into PhD program and consent of instructor.
Description: Investigation outside of the classroom of topics not normally covered in lecture courses. Offered for variable credit, 1-6 credit hours, maximum of 12 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 6123 Special Topics in Power Systems
Prerequisites: ECEN 5113.
Description: Selected relevant current topics related to power system operation and planning.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6253 Advanced Topics in Computer Architecture
Prerequisites: ECEN 5253 or CS 5253.
Description: Innovations in the architecture and organization of computers, with an emphasis on parallelism. Topics may include pipelining, multiprocessors, data flow, and reduction machines. Same course as CS 6253.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6263 Advanced VLSI Design and Applications
Prerequisites: ECEN 5223 and ECEN 5263.
Description: System timing. Designing testable integrated circuits. Specialized parallel processing architectures. Application examples.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6363 Analog VLSI for Signal Processing
Prerequisites: ECEN 4273.
Description: Continuation of ECEN 5363. Advanced theory and practice of analog VLSI design methodology. Very large scale design and implementation of signal processing solutions, including over sampled A/Ds, neural networks and filters.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6423 System Identification
Prerequisites: ECEN 5473 or ECEN 5713 or MAE 5473 or MAE 5713.
Description: Linear and nonlinear system modeling of random systems. Models of linear time-invariant systems, nonparametric methods and preliminary model development, parameter estimation methods, convergence and consistency, asymptotic distributions of parameter estimates. Nonlinear modeling. Same course as MAE 6423.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6453 Adaptive Control
Prerequisites: ECEN 5473 or ECEN 5713 or MAE 5473 or MAE 5713.
Description: Analysis and design of control techniques that modify their performance to adapt to changes in system operation. Review of systems analysis techniques, including state variable representations, linearization, discretization, covariance analysis, stability, and linear quadratic Gaussian design. On-line parameter estimation, model reference adaptive systems, self-tuning regulators, stable adaptive systems. Same course as MAE 6453. Course previously offered as ECEN 6450.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6463 Advances in NonLinear Control
Prerequisites: ECEN 5463 or MAE 5463.
Description: Introduction to vector fields and Lie algebra; controllability and observability of non-linear systems; local decompositions; input-output and state space representation of non-linear systems; feedback linearization; controlled invariance and distribution; control of Hamiltonian systems. Same course as MAE 6463.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6483 Robust Multivariate Control Systems
Prerequisites: ECEN 5713 or MAE 5713.
Description: Introduction to multivariable systems: SISO robustness vs. MIMO robustness; multivariable system poles and zeros; MIMO transfer functions; multivariable frequency response analysis; multivariable Nyquist theorem; performance specifications; stability of feedback systems; linear fractional transformations (LFT's); parameterization of all stabilizing controllers; structured singular value; algebraic ricatti equations; H2 optimal control; H-infinity controller design. Same course as MAE 6483.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6523 Information Theory
Prerequisites: ECEN 5513 or consent of instructor.
Description: Mathematical theory of information (Shannon theory) including information measure and transmission rates and capacities. Source coding theory including algebraic and error-correcting codes. Design of waiver-forms for noise immunity. Information transfer in learning systems.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6803 Photonics I: Advanced Optics
Prerequisites: ECEN 3813 or PHYS 3213 or consent of instructor.
Description: Advanced optics including spectral and time characteristics of detectors, characteristics of lasers, time, spectral and spatial parameters of laser emission, interferometric techniques, and nonlinear effects such as two-photon absorption and second and third harmonic generations. Emphasis on ultrashort laser pulses. Same course as CHEM 6803 & PHYS 6803.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6810 Photonics II: THz Photonics and THz-TD
Prerequisites: ECEN 6803.
Description: Concepts and techniques of driving electronic circuitry with ultra short laser pulses to generate and detect freely propagating pulses of THz electromagnetic radiation using several operational research systems. Same course as CHEM 6810 & PHYS 6810. Course previously offered as ECEN 6811. Offered for fixed credit, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6820 Photonics II: Spectroscopy II
Prerequisites: ECEN 6803.
Description: Operating principles and applications of laser spectroscopy of atoms, molecules, solids and complex fluids. Absorption, emission, photon correlation, coherence, time resolved Fourier transform. Raman spectroscopy and non-linear optical. Same course as CHEM 6820 & PHYS 6820. Course previously offered as ECEN 6821. Offered for fixed credit, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6823 Advanced Optical Techniques
Prerequisites: ECEN 5853.
Description: State-of-the-art optical devices and research methodologies. Investigation and discussion of contemporary developments in non-linear optical devices and laser applications. Includes both analytical and experimental techniques.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6830 Photonics II: Spectroscopy III
Prerequisites: ECEN 6803.
Description: Advanced spectroscopic instruments and methods used for investigation of semi-conductors and solid state material. Stimulated emission characterized both in wavelength and in time. Time-resolved fluorescence measurements. Multiphotonic excitations. Fast measuring techniques, including subnanosecond detectors, picosecond streak cameras, and ultra fast four-wave mixing and correlation techniques. Time-dependent photoconductivity measurements. Same course as CHEM 6830 & PHYS 6830. Course previously offered as ECEN 6831. Offered for 1 fixed credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6840 Photonics III: Microscopy I
Prerequisites: CHEM 3553 or consent of instructor.
Description: The structure and imaging of solid surfaces. Basics of scanning probe microscopy (SPM). Contact and non-contact atomic force microscopy (AFM). Scanning tunneling microscopy (STM) in air. Same course as CHEM 6840 & PHYS 6840. Course previously offered as ECEN 6841. Offered for fixed credit hours, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6843 Advanced Microelectronic Fabrication
Prerequisites: ECEN 5843.
Description: Photolithography, wet and dry etching, thermal and electron beam evaporation, photomask design using L-Edit, silicon devices processing, quartz devices processing, silicon-on-sapphire devices processing. GaAs devices processing and MEMS devices processing.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6850 Photonics III: Microscopy II
Prerequisites: CHEM 3553 or consent of instructor.
Description: Advanced techniques of scanning probe microscopy (SPM). Magnetic force microscopy, Kelvin force microscopy, scanning probe microscopy (STM) in vacuum. Characterization of materials with SPM. Nanolithography with SPM. Device manufacturing and analysis. Same course as CHEM 6850 & PHYS 6850. Course previously offered as ECEN 6851. Offered for 1 fixed credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6860 Photonics III: Microscopy III and Image Processing
Prerequisites: ECEN 5793.
Description: Digital image processing, including projects. Image acquisition and display, image enhancement, geometric operations, linear and nonlinear filtering, image restoration, edge detection, image analysis, morphology, segmentation, recognition, and coding/compression. Same course as CHEM 6860 & PHYS 6860. Offered for fixed credit hours, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6870 Photonics IV: Synthesis and Devices I
Prerequisites: ECEN 6803 and ECEN 6840.
Description: Preparation of functional nanostructures and related optical/electronic devices. Physical and chemical methods of thin film deposition. Engineering of prototypes of light emitting diodes, sensors, optical limiting coatings, lithographic patterns. Same course as CHEM 6870 & PHYS 6870. Course previously offered as ECEN 6871. Offered for 1 fixed credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6880 Photonics IV: Semiconductor Devices, Testing and Characterization
Prerequisites: ECEN 6803 and ECEN 6840.
Description: Test and characterization of semiconductor and optoelectronic devices. Hall effect, four point probe, CV and IV measurements, optical pump-probe, photoluminescence and electro-optics sampling. Same course as CHEM 6880 & PHYS 6880. Course previously offered as ECEN 6881. Offered for 1 fixed credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6890 Photonics IV: Semiconductor Synthesis and Devices III
Prerequisites: ECEN 6803.
Description: Processing, fabrication and characterization of semiconductor optoelectronic devices in class 100/10000 cleanrooms. Cleanroom operation including general procedure for material processing and device fabrication. Device processing using a variety of processing such as mask aligner, vacuum evaporators and rapid thermal annealer. Testing using optical and electrical testing apparatus such as I-V, C-V, Hall, and optical spectral measurement systems. Same course as CHEM 6890 & PHYS 6890. Course previously offered as ECEN 6891. Offered for fixed 1 credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr