

ELECTRICAL AND COMPUTER ENGINEERING (ECEN)

ECEN 800 Electronic Instrumentation

Crosslisted with: ECEN 400

Prerequisites: Senior standing in engineering.

Description: Applications of analog and digital devices to electronic instrumentation. Includes transducers, instrumentation amplifiers, mechanical and solid-state switches, data acquisition systems, phase-lock loops, and modulation techniques. Demonstrations with working circuits and systems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

ECEN 806 Power Systems Analysis

Crosslisted with: ECEN 406

Prerequisites: ECEN 338 or ECEN 838

Description: Symmetrical components and fault calculations, power system stability, generator modeling (circuit view point), voltage control system, high voltage DC transmission, and system protection.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: ECEN 957

ECEN 807 Power Systems Planning

Crosslisted with: ECEN 407

Prerequisites: ECEN 305

Description: Economic evaluation, load forecasting, generation planning, transmission planning, production simulation, power plant reliability characteristics, and generation system reliability.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

ECEN 808 Engineering Electromagnetics

Crosslisted with: ECEN 408

Prerequisites: ECEN 306.

Notes: Laboratory experiments.

Description: Applied electromagnetics: Transmission lines in digital electronics and communication. The quasistatic electric and magnetic fields: electric and magnetic circuits and electromechanical energy conversion. Guided waves: rectangular and cylindrical metallic waveguides and optical fibers. Radiation and antennas: line and aperture antennas and arrays.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

ECEN 810 Multivariate Random Processes

Crosslisted with: ECEN 410

Prerequisites: ECEN 305

Description: Probability space, random vectors, multivariate distributions, moment generating functions, conditional expectations, discrete and continuous-time random processes, random process characterization and representation, linear systems with random inputs.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: ECEN 911; ECEN 912; ECEN 915; ECEN 946

ECEN 815 Digital Image Processing

Prerequisites: ECEN 424/824 (UNO ECEN 4240/8240)

Description: Topics covering the spatial and spectral analysis of digital image processing systems, the design of multi-dimensional digital filters and systems, and advanced theories and technologies in digital image processing systems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

ECEN 816 Materials and Devices for Computer Memory, Logic, and Display

Crosslisted with: ECEN 416

Prerequisites: PHYS 212/(UNO) PHYS 2120.

Description: Survey of fundamentals and applications of devices used for memory, logic, and display. Magnetic, superconductive, semiconductive, and dielectric materials.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

ECEN 817 Semiconductor Fundamentals II

Crosslisted with: ECEN 417

Prerequisites: ECEN 421 or ECEN 821

Description: Analysis of BJT's and MOSFET's from a first principle materials viewpoint. Static and dynamic analysis and characterization. Device fabrication processes.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

ECEN 820 Plasma Processing of Semiconductors

Crosslisted with: ECEN 420

Prerequisites: Senior or graduate standing.

Description: Physics of plasmas and gas discharges developed. Includes basic collisional theory, the Boltzman equation and the concept of electron energy distributions. Results are related to specific gas discharge systems used in semiconductor processing, such as sputtering, etching, and deposition systems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

ECEN 821 Principles of Semiconductor Materials and Devices I

Crosslisted with: ECEN 421

Prerequisites: PHYS 213/(UNO) PHYS 2130.

Description: Introduction to semiconductor fundamentals, charge carrier concentration and carrier transport, energy bands, and recombination. PN junctions, static and dynamic, and special PN junction diode devices.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

ECEN 822 Introduction to Physics and Chemistry of Solids

Crosslisted with: PHYS 422, PHYS 822, ECEN 422

Prerequisites: PHYS 213 or CHEM 481/881, MATH 221/821.

Description: Introduction to structural, thermal, electrical, and magnetic properties of solids, based on concepts of atomic structure, chemical bonding in molecules, and electron states in solids. Principles underlying molecular design of materials and solid-state devices.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

ECEN 824 Digital Signal Processing

Crosslisted with: ECEN 424

Prerequisites: ECEN 355

Description: The temporal and spectral analysis of digital signals and systems, the design of digital filters and systems, and advanced systems including multi-rate digital signal processing techniques.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

Prerequisite for: ECEN 815; ECEN 926

ECEN 828 Power Electronics

Crosslisted with: ECEN 428

Prerequisites: ECEN 304 and ECEN 316

Description: Basic analysis and design of solid-state power electronic devices and converter circuitry.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: ECEN 932

ECEN 830 Wind Energy

Crosslisted with: ECEN 430

Prerequisites: Senior standing.

Description: Engineering principles of both the mechanical/aero dynamical and electrical components and systems, along with economic and environmental considerations for citing and public policy, to appropriately cover the relevant topics associated with all scales of wind energy implementations.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

ECEN 833 Microprocessor System Design

Crosslisted with: ECEN 433

Prerequisites: ECEN 310 with a grade of "C" or better; ECEN 332 with a grade of "C" or better.

Description: Discussion of different microprocessor hardware and software systems designs including; microprocessor bus interfacing, memory systems, peripheral design and interfacing, interrupts, Direct Memory Access, and other hardware related topics. Software includes system code, firmware generation, and designing device drivers. Design, build, program, and show successful operation of a microprocessor board with memory, I/O and other related peripheral systems.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Grade Pass/No Pass Option

Offered: FALL/SPR

Prerequisite for: ECEN 435, ECEN 835; ECEN 496

Course and Laboratory Fee: \$25

ECEN 835 Embedded Microcontroller Design

Crosslisted with: ECEN 435

Prerequisites: ECEN 433/833 with a grade of "C" or better; ECEN 305

Notes: The prerequisite is different from the syllabus.

Description: Microcontroller architecture: design, programming, and interfacing for embedded systems. Including advanced RISC based microcontroller architecture and design, standard asynchronous and synchronous serial communications, I2C, SPI, USB, and related board design, development, and fabrication with surface mount technology. Design, build, program and show successful operation of a single microcontroller board with a specific application.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Grade Pass/No Pass Option

Offered: FALL/SPR

Prerequisite for: ECEN 437, ECEN 837

Course and Laboratory Fee: \$25

ECEN 836 Electric Machines

Crosslisted with: ECEN 436

Prerequisites: PHYS 212/(UNO) PHYS 2120 and ECEN 216

Description: Provides a solid background in electric machine analysis, covering fundamental concepts, techniques, and methods for analysis and design. Discussion of transformers and presentation of some new systems and applications.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

Prerequisite for: ECEN 932

ECEN 837 Parallel and Distributed Processing

Crosslisted with: ECEN 437

Prerequisites: ECEN 435/835

Description: Parallel and distributed processing concepts, principles, techniques, and machines.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

ECEN 838 Integrated Systems Programming**Crosslisted with:** ECEN 438**Prerequisites:** ECEN 310 and ECEN 332

Description: Introduction to the basics of computer architectural details under the context of computer system programming. Topics include representing and manipulating information, machine level representation of programs, processor architecture and pipelining, compiling and linking, optimizing program performance from the system level, memory hierarchy, dynamic memory allocation and exceptional control flow. Linux system programming tool chain will also be introduced.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR**Prerequisite for:** ECEN 406, ECEN 806**ECEN 842 Basic Analytical Techniques in Electrical Engineering****Crosslisted with:** ECEN 442**Prerequisites:** MATH 221/(UNO) MATH 2350.

Description: Applications of partial differential equations, matrices, vector analysis, complex variables, and infinite series to problems in electrical engineering.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 844 Linear Control Systems****Crosslisted with:** ECEN 444**Prerequisites:** ECEN 304

Description: Classical (transfer function) and modern (state variable) control techniques. Both time domain and frequency domain techniques are studied. Traditional proportional, lead, lag, and PID compensators are examined, as well as state variable feedback.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 848 Decision Analysis****Crosslisted with:** ECEN 448**Prerequisites:** ECEN 305 or STAT 380/(UNO) STAT 3800

Description: Principles of engineering economy including time value of money, net present value and internal rate of return. Use of influence diagram and decision tree to structure and analyze decision situations under uncertainty including use of stochastic dominance, value of information, and utility theory. Fundamentals of two-person matrix games including Nash equilibrium.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 850 Bioinformatics****Crosslisted with:** ECEN 450**Prerequisites:** Computer programming language and ECEN 305 or MECH 321 or STAT 380/(UNO) STAT 3800 or equivalent

Description: Examination of how information is organized in biological sequences such as DNA and proteins and computational techniques which make use of this structure. Various biochemical processes that involve these sequences are studied to understand how these processes affect the structure of these sequences. In the process bioinformatics algorithms, tools, and techniques which are used to explore genomic and amino acid sequences are also introduced.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 851 Introduction to VLSI System Design****Crosslisted with:** ECEN 451**Prerequisites:** ECEN 310

Description: The concepts, principles, and methodology at all levels of digital VLSI system design and focused on gate-level VLSI implementation.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 852 Introduction to Computer-Aided Digital Design****Crosslisted with:** ECEN 452**Prerequisites:** ECEN 310

Description: The concepts, simulation techniques and methodology in computer-aided digital design at system and logic levels.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 853 Computational and Systems Biology****Crosslisted with:** ECEN 453**Prerequisites:** By permission.

Notes: Basic knowledge of probability and statistics (e.g. ECEN 305 or STAT 380) and basic programming skills are recommended. May also be taught as a distance course for the Omaha campus.

Description: Provides the required biology primer and covers functional genomics, transcriptomics, differential expression, clustering, classification, prediction, biomarker discovery, pathway analysis and network based approaches to high throughput biological data analysis. Includes the development of databases, algorithms, web-based and other tools regarding management and analysis of life science data. Areas of study include DNA, RNA, and protein sequence analysis, functional genomics and proteomics, 3D macromolecule structure prediction, and systems/network approach.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** SPRING

ECEN 854 Power Systems Operation and Control**Crosslisted with:** ECEN 454**Prerequisites:** ECEN 338**Description:** Characteristics and generating units. Control of generation, economic dispatch, transmission losses, unit commitment, generation with limited supply, hydrothermal coordination, and interchange evaluation and power pool.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 860 Labview Programming****Crosslisted with:** ECEN 460**Prerequisites:** Prior programming experience**Description:** Labview as a programming language and for applications to acquire and analyze data, to access the network, control lab instruments, and for video and sound applications.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 861 Digital Communications Media****Crosslisted with:** ECEN 461**Prerequisites:** ECEN 325 or ECEN 462**Description:** Topics related to the transport of bit streams from one geographical location to another over various physical media such as wire pairs, coaxial cable, optical fiber, and radio waves. Transmission characteristics, media interfacing, delay, distortion, noise, and error detection and correction techniques.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Offered:** FALL/SPR**Prerequisite for:** ECEN 466, ECEN 866; ECEN 479, ECEN 879; ECEN 885; ECEN 977**ECEN 862 Communication Systems****Crosslisted with:** ECEN 462**Prerequisites:** ECEN 304 and ECEN 305**Description:** Mathematical descriptions of signals in communication systems. Principles of analog modulation and demodulation. Performance analysis of analog communication systems in the presence of noise.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** CSCE 954; ECEN 911**ECEN 863 Digital Signal Processing****Crosslisted with:** ECEN 463**Prerequisites:** ECEN 304**Description:** Discrete system analysis using Z-transforms. Analysis and design of digital filters. Discrete Fourier transforms.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 915**ECEN 864 Digital Communication Systems****Crosslisted with:** ECEN 464**Prerequisites:** ECEN 462**Description:** Principals of digital transmission of information in the presence of noise. Design and analysis of baseband PAM transmission systems and various carrier systems including ASK, FSK, PSK.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 911; ECEN 912; ECEN 959**ECEN 865 Introduction to Data Compression****Crosslisted with:** ECEN 465**Prerequisites:** ECEN 305**Description:** Introduction to the concepts of Information Theory and Redundancy removal. Simulation of various data compression schemes such as Delta Modulation, Differential Pulse Code Modulation, Transform Coding and Runlength Coding.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 866 Telecommunications Engineering I****Crosslisted with:** ECEN 466**Prerequisites:** ECEN 362; ECEN 461/861 or parallel.**Description:** Standard telecommunications protocols, architecture of long distance integrated data networks, local area networks, wide area networks, radio and satellite networks. Network management, internetworking, system modeling and performance analysis.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**ECEN 867 Electromagnetic Theory and Applications****Crosslisted with:** ECEN 467**Prerequisites:** ECEN 306**Description:** Engineering application of Maxwell's equations. Fundamental Parameters of Antennas. Radiation, analysis, and synthesis of antenna arrays. Aperture Antennas.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 965**ECEN 868 Microwave Engineering****Crosslisted with:** ECEN 468**Prerequisites:** ECEN 306**Description:** Applications of active and passive devices to microwave systems. Includes impedance matching, resonators, and microwave antennas.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 965

ECEN 869 Analog Integrated Circuits**Crosslisted with:** ECEN 469**Prerequisites:** ECEN 361**Description:** Analysis and design of analog integrated circuits both bipolar and MOS. Basic circuit elements such as differential pairs, current sources, active loads, output drivers used in the design of more complex analog integrated circuits.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 913**ECEN 870 Digital and Analog VLSI Design****Crosslisted with:** ECEN 470**Prerequisites:** ECEN 316; ECEN 370 or ECEN 313**Description:** Introduction to VLSI design techniques for analog and digital circuits. Fabrication technology and device modelling. Design rules for integrated circuit layout. LSI design options with emphasis on the standard cell approach of digital and analog circuits. Lab experiments, computer simulation and layout exercises.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 871 Computer Communication Networks****Crosslisted with:** ECEN 471**Prerequisites:** ECEN 325**Description:** High-speed access control protocols, routing protocols, traffic management, and network topologies. Giga-bit Ethernet, ATM, and TCP/IP. Performance modeling and simulation techniques.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**ECEN 873 Mobile and Personal Communications****Crosslisted with:** ECEN 473**Prerequisites:** ECEN 325**Description:** Concepts on mobile and personal communications. Modulation techniques for mobile radio, equalization, diversity, channel coding, and speech coding.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**ECEN 874 Digital Systems****Crosslisted with:** ECEN 474**Prerequisites:** ECEN 370**Description:** Synthesis using state machines; design of digital systems; micro programming in small controller design; hardware description language for design and timing analysis.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 477, ECEN 877**ECEN 875 Satellite Communications****Crosslisted with:** ECEN 475**Prerequisites:** ECEN 325**Description:** The fundamental concepts of satellite communications. Orbits, launching satellites, modulation and multiplexing, multiple access, earth stations, coding, interference and special problems in satellite communications.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**ECEN 876 Wireless Communications****Crosslisted with:** ECEN 476**Prerequisites:** ECEN 325 or ECEN 462 or parallel**Description:** The fundamental concepts of wireless communications. Basic communications concepts such as multiple access and spectrum. Propagation, radio standards and internet working. Current issues in wireless communications.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Prerequisite for:** ECEN 926; ECEN 977**ECEN 877 Digital Systems Organization and Design****Crosslisted with:** ECEN 477**Prerequisites:** ECEN 474 or ECEN 874**Description:** Hardware development languages, hardware organization and realization, microprogramming, interrupt, intersystem communication, and peripheral interfacing.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 879 Optical Fiber Communications****Crosslisted with:** ECEN 479**Prerequisites:** ECEN 461/861**Description:** Fundamentals of lightwave communication in optical fiber waveguides, physical description of fiber optic systems. Properties of the optical fiber and fiber components. Electro-optic devices: light sources and modulators, detectors and amplifiers; optical transmitter and receiver systems. Fiber optic link design and specification; fiber optic networks.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Prerequisite for:** ECEN 979**ECEN 880 Introduction to Lasers and Laser Applications****Crosslisted with:** ECEN 480, PHYS 480, PHYS 880**Prerequisites:** PHYS 213/(UNO) PHYS 2130.**Description:** Physics of electronic transition production stimulated emission of radiation. Threshold conditions for laser oscillation. Types of lasers and their applications in engineering.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option

ECEN 882 Antennas and Radio Propagation for Wireless Communications**Crosslisted with:** ECEN 482**Prerequisites:** ECEN 328

Description: Fundamental theory of antennas and radio propagation for wireless communications. Basic antenna characteristics and various antennas and antenna arrays. Basic propagation mechanisms and various channel models, such as Friis free space model, Hata model, lognormal distribution, and multipath model. Includes practical antenna design for high radio frequency (RF) with modeling software tools such as Numerical Electromagnetic Code (NEC) and Advanced Design System (ADS). Design projects will be assigned as the main part of course.

Credit Hours: 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**ECEN 883 Random Processes in Engineering****Prerequisites:** STAT 380 (UNO STAT 3800)

Description: Topics related to the concept of random variables, functions of random variables and random processes.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Prerequisite for:** ECEN 926**ECEN 884 Network Security****Crosslisted with:** ECEN 484**Prerequisites:** ECEN 325

Description: Network security and cryptographic protocols. Classical encryption techniques, block ciphers and stream cyphers, public-key cryptography, authentications digital signatures, key management and distributions, network vulnerabilities, transport-level security, IP security.

Credit Hours: 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**ECEN 885 Spread Spectrum Communications****Prerequisites:** ECEN 461/861 (UNO ECEN 4610/8616)

Description: Introduction to the theory of spread spectrum communications: direct sequence, frequency and time hopping techniques. Topics include properties of pseudo-random binary sequences, low-probability-of-intercept (LPI) and anti-jamming (AJ) methods, performance of spread spectrum systems, applications of spread spectrum techniques in radio frequency and optical code-division multiple access (CDMA) systems.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 886 Applied Photonics****Crosslisted with:** ECEN 486**Prerequisites:** ECEN 306

Description: Introduction to the use of electromagnetic radiation for performing optical measurements in engineering applications. Basic electromagnetic theory and light interaction with matter are covered with corresponding laboratory experiments conducted.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 986**ECEN 888 Wireless Security****Crosslisted with:** ECEN 488**Prerequisites:** ECEN 325

Description: A comprehensive overview on the recent advances in wireless network and system security. Covers security issues and solutions in emerging wireless access networks and systems as well as multihop wireless networks.

Credit Hours: 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**ECEN 891 Special Topics in Electrical and Computer Engineering IV****Crosslisted with:** ECEN 491**Prerequisites:** Senior standing.

Description: Special topics in the emerging areas of electrical, computer, and electronics engineering which may not be covered in other courses in the electrical and computer engineering curriculum.

Credit Hours: 1-4**Min credits per semester:** 1**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**ECEN 892 Individual Study in Electrical and Computer Engineering IV****Crosslisted with:** ECEN 492**Prerequisites:** Senior standing.

Notes: Requires a ECE departmentally approved proposal.

Description: Individual study in a selected electrical, computer, or electronics engineering area under the supervision and guidance of an electrical and computer engineering faculty member.

Credit Hours: 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 893 Independent Study in Computer and Electronics Engineering****Prerequisites:** Departmentally approved proposal.

Description: Individual study at the graduate level in a selected electrical or computer engineering area under the supervision and guidance of an Electrical & Computer Engineering faculty member.

Credit Hours: 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 895 Special Topics**

Description: Special topics in the newly emerging areas of computer and electronics engineering not covered in the other courses in the electrical and computer engineering curriculum.

Credit Hours: 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option

ECEN 898 Special Topics in Electrical Engineering IV**Crosslisted with:** ECEN 498**Prerequisites:** Permission**Notes:** Offered as the need arises for electrical engineering topics for fourth-year and graduate students not covered in other courses.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 18**Grading Option:** Grade Pass/No Pass Option**ECEN 899 Masters Thesis****Prerequisites:** Admission to masters degree program and permission of major adviser.**Description:** Masters thesis work.**Credit Hours:** 1-10**Min credits per semester:** 1**Max credits per semester:** 10**Max credits per degree:** 99**Grading Option:** Graded**ECEN 911 Communication Theory****Prerequisites:** ECEN 862/(UNO) ECEN 8626, and ECEN 864/(UNO) ECEN 8646 or ECEN 810/(UNO) ECEN 8106**Description:** Applications of probability and statistics to signals and noise; correlation; sampling; shot noise; spectral analysis; Gaussian processes; filtering.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 912 Error Control Coding****Prerequisites:** ECEN 410/(UNO) ECEN 4100 or ECEN 810/(UNO) ECEN 8106; and ECEN 464/(UNO) ECEN 4640 or ECEN 864/(UNO) ECEN 8646; or permission.**Description:** Fundamentals of error correction and detection in digital communication and storage systems. Linear and algebraic block codes; Hamming, BCH and Reed-Solomon codes; algebraic decoding techniques; structure and performance of convolutional codes, turbo codes, and trellis coded modulation; MAP, Viterbi, and sequential decoding techniques.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 913 Advanced Analog and Mixed-Signal Integrated Circuits****Prerequisites:** ECEN 869/(UNO) ECEN 8696 and permission**Description:** Advanced current mirrors and op-amps. Comparators and sample/hold (S/H) circuits. Band-gap reference circuits. Trans-linear circuits and analog multipliers. Voltage controlled oscillators. Operational trans-conductance amplifiers (OTA's). Switched capacitor circuits. Data converters. Non-linearity, mismatch, and short-channel effects. Continuous time domain integrated filters. Current conveyors. Phase locked loops. Analog CAD.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 915 Adaptive Signal Processing****Prerequisites:** ECEN 410/(UNO) ECEN 4100 or ECEN 810/(UNO) ECEN 8106; and ECEN 463/(UNO) ECEN 4630 or ECEN 863/(UNO) 8636; and permission**Description:** Adaptive filtering algorithms, frequency and transform domain adaptive filters, and simulation and critical evaluation of adaptive signal processing for real world applications.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 926 Statistical Signal Processing for Wireless Communications****Prerequisites:** ECEN 424/824/(UNO) ECEN 4240/8246; ECEN 476/876/(UNO) ECEN 4760/8760; and ECEN 883/(UNO) ECEN 8830**Description:** Statistical signal processing and applications for wireless communications: the characteristics of random signals; optimum linear filters; statistical parameter estimation using maximum likelihood (ML) and minimum mean-square error (MMSE) methods; adaptive signal processing using least-mean-square (LMS) and recursive least-square (RLS) approaches; Kalman filtering; and eigenanalysis.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 932 Advanced Power Electronics and Applications****Prerequisites:** ECEN 428/(UNO) ECEN 4280 or ECEN 828/(UNO) ECEN 8286; and ECEN 426/(UNO) ECEN 4260 or ECEN 836/(UNO) ECEN 8366.**Description:** Analysis and design of power electronic circuits and their applications, including: snubber circuits, resonant converters and soft switching techniques, pulse-width modulation techniques, control of power electronic circuits, power electronics and control for electric machines and wind energy systems, flexible AC-transmission system (FACTS) devices, and high-voltage DC (HVDC) transmission.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 935 Computational Intelligence****Prerequisites:** MATH 208/(UNO) MATH 1970, MATH 221/(UNO) MATH 2350, MATH 314/(UNO) MATH 2050, and good skills using MATLAB**Description:** Computational intelligence paradigms and their applications, including: artificial neural networks, fuzzy logic systems, swarm intelligence, evolutionary computation (e.g., genetic algorithms), machine learning (e.g., supervised learning, unsupervised learning, and reinforcement learning), neurocontrol and adaptive critic designs, and applications of computational intelligence for system identification, state estimation, time series prediction, signal processing, adaptive control, optimization, diagnostics, prognostics, etc.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option

ECEN 946 Optimal Filtering, Estimation and Prediction**Prerequisites:** ECEN 810/(UNO) ECEN 8106**Description:** Techniques for optimally extracting information about the past, present, or future status of a dynamic system from noise-corrupted measurements on that system.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 957 Advanced Computer Methods in Power System Analysis****Prerequisites:** ECEN 806/(UNO) ECEN 8066**Description:** Power system matrices, sparsity techniques, network equivalents, contingency analysis, power flow optimization, state estimation, and power system restructuring examined via computer methods.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 959 Wireless Communications****Prerequisites:** ECEN 864/(UNO) ECEN 8646 and permission**Description:** Principles of wireless communications, including: description of the wireless channel characteristics; ultimate performance limits of wireless systems; performance analysis of digital modulation techniques over wireless channels; diversity techniques; adaptive modulation; multiple-antenna communications; multi-carrier modulation; and multi-user wireless communications.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 960 Solid-State Devices****Prerequisites:** ECEN 315/(UNO) ECEN 3150 or equivalent**Description:** Gallium arsenide and silicon devices. Device properties based on structure and physical properties of the materials.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 965 Passive Microwave Components****Prerequisites:** ECEN 867/(UNO) ECEN 8676 or ECEN 868/(UNO) ECEN 8686**Description:** Application of Maxwell's Equations to the analysis of waveguides, resonant cavities, filters and other passive microwave devices.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 967 Introduction to Quantum Electronics****Description:** Introduction to the quantum aspects of electron devices.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 968; ECEN 975**ECEN 968 Electron Theory of Solids I****Prerequisites:** ECEN 967/(UNO) ECEN 9670**Description:** Quantitative development of the fundamentals of the quantum-mechanical theory of electrons in solids.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 971 Seminar****Credit Hours:** 1-12**Min credits per semester:** 1**Max credits per semester:** 12**Max credits per degree:** 12**Grading Option:** Graded**ECEN 973 Introduction to Nanotechnology****Notes:** The content of the course will be updated annually based on new scientific findings.**Description:** Topics in nanotechnology as defined by the National nanotechnology Initiative, with emphasis on topics related to electrical engineering.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 975 Optical Properties of Materials****Prerequisites:** ECEN 967/(UNO) ECEN 9670 or equivalent**Description:** Quantum mechanical description of the optical properties of solids (complex refractive index and its dispersion, effects of electric and magnetic fields, temperature, stress; additional special topics as desired).**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 977 Space-time Wireless Communications****Prerequisites:** ECEN 461/861/(UNO) ECEN 4630/8636; ECEN 476/876/(UNO) ECEN 4760/8766**Description:** Theory of space-time (ST) wireless communication systems. Spatial diversity, smart antenna systems, MIMO capacity of multi-antenna fading channels, space-time signaling, space-time receivers, and interference mitigation. Overview of more advanced topics such as MIMO-OFDM. Current trends in research and in the industry.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**ECEN 979 Non-Linear Fiber Optic Systems****Prerequisites:** ECEN 479/879 (UNO ECEN 4790/8796)**Description:** Linear and non-linear propagations in optical fibers. Topics include fiber non-linearity, fundamentals of optical amplifiers, semiconductor and fiber amplifiers, soliton communications. Applications include high capacity and long distance transmissions, all-optical networks.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option

ECEN 986 Optoelectronics

Prerequisites: ECEN 886/(UNO) ECEN 8866

Description: Modern phenomena associated with optoelectronics.

Electro-optical effect such as Pockel effect, Kerr effect, and nonlinear optical phenomena. Material and devices used in modern communications, femtosecond lasers, and optical computer systems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

ECEN 991 Independent Study

Prerequisites: Permission

Description: Selected topic under the direction and guidance of a faculty member.

Credit Hours: 1-24

Min credits per semester: 1

Max credits per semester: 24

Max credits per degree: 24

Grading Option: Graded

ECEN 992 Research Other Than Thesis

Prerequisites: Permission and graduate standing.

Description: Supervised non-thesis research and independent study.

Credit Hours: 1-6

Min credits per semester: 1

Max credits per semester: 6

Max credits per degree: 6

Grading Option: Grade Pass/No Pass Option

ECEN 996 Topics in Electrical Engineering

Prerequisites: Permission

Description: Selected topics in electrical engineering.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 24

Grading Option: Graded

ECEN 998 Advanced Special Topics

Prerequisites: Permission

Description: Advanced topics in computer and electronics engineering.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

ECEN 999 Doctoral Dissertation

Prerequisites: Admission to doctoral degree program and permission of supervisory committee chair.

Description: Dissertation research.

Credit Hours: 1-24

Min credits per semester: 1

Max credits per semester: 24

Max credits per degree: 99

Grading Option: Graded