ELECTRICAL AND COMPUTER ENGINEERING (ECEN)

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 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 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: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded
Prerequisite for: ECEN 932
Course and Laboratory Fee: $30

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
Course and Laboratory Fee: $25

ECEN 835 Embedded Microcontroller Design
Crosslisted with: ECEN 435
Prerequisites: ECEN 333
Description: Study and develop a microcontroller-based embedded hardware/software system. Focus on the system's hardware and software design, peripheral interfacing, standard serial communication protocols, multi-bus systems, and related topics.
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 ecision 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 856 Real Time DSP Applications
Crosslisted with: ECEN 456
Prerequisites: ECEN 220; ECEN 463
Description: Introduction to concepts, principles, and state-of-the-art methods in creating embedded real-time digital signal processing systems.
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 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
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 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 872 Image Understanding, Perception, and Signal Processing
Crosslisted with: ECEN 472
Prerequisites: ECEN 304 or graduate standing
Description: Introduces fundamental principles and theory for computer vision, image understanding, and pattern recognition, perception, and signal processing. Specific attention given to analysis of the geometric properties and appearance of objects in images, such as region size, connectedness, topology, color, and texture.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

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

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 878 Practical Machine Learning
Crosslisted with: ECEN 478
Prerequisites: CSCE/ECEN 155E, CSCE 155A, or CSCE 155N
Description: Designed to provide a solid grasp of the methods of machine learning (ML) and how to build powerful ML models for discovering statistical regularities from both structured and unstructured data. Offers an introduction to Deep Learning for Computer Vision and Natural Language Processing.
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
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
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 Fundamentals of 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 887 Data and Network Security
Crosslisted with: CSCE 463, CSCE 863, ECEN 487
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Concepts and principles of data and network security. Focuses on practical aspects and application of crypto systems in security protocols for networks such as the Internet. Topics include: applications of cryptography and cryptosystems for digital signatures, authentication, network security protocols for wired and wireless networks, cyberattacks and countermeasures, and security in modern computing platforms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SPRING

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 Special Topics in Electrical and Computer Engineering IV
Crosslisted with: ECEN 492
Prerequisites: Senior standing
Notes: Requires an ECE departmentally approved proposal.
Description: Special topic in emerging areas of electrical and computer engineering which may not be covered in 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 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 894 Independent Study in Electrical and Computer Engineering
Description: Individual study at the graduate level in a selected area of electrical and computer engineering under the supervision and guidance of an Electrical and Computer Engineering faculty.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

ECEN 898 Research in Electrical Engineering IV
Crosslisted with: ECEN 498
Prerequisites: Permission
Description: Research in a selected area of electrical engineering under the supervision and guidance of an Electrical and Computer Engineering faculty member.
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 Sparse 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 Topics in Electrical Engineering
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 Advanced Special Topics
Prerequisites: Permission and graduate standing.
Description: Supervised non-thesis research.
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 Independent Study
Prerequisites: Permission
Description: Independent study in electrical engineering.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 24
Grading Option: Graded

ECEN 998 Research Other Than Thesis
Prerequisites: Permission
Description: Supervised non-thesis research.
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