

ELECTRICAL AND COMPUTER ENGINEERING (ECEN)

ECEN 102 Introduction to Electrical Engineering

Prerequisites: Open to first year students only or by permission.

Description: An overview of the electrical engineering field. Introduction to some basic concepts and skills needed in electrical engineering. Professionalism and ethics are addressed as well as the need for lifelong learning experiences. Information on professional careers available upon graduation.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

Course and Laboratory Fee: \$25

ECEN 103 Electrical and Computer Engineering Fundamentals

Prerequisites: MATH 106 or (UNO) MATH 1950, or parallel.

Description: Introduction to DC circuit analysis and digital logic. Ohm's and Kirchoff's laws, mesh and nodal analysis, Boolean algebra, logic gates, minimization, counters, and flip-flops. Uses of computer based resources for data analysis and report generation. Use of internet to locate and retrieve engineering resources.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Offered: FALL/SPR

Prerequisite for: ECEN 106; ECEN 123; ECEN 213; ECEN 220; ECEN 225; ECEN 370, CSCE 335

Course and Laboratory Fee: \$20

ECEN 106 Microprocessor Applications

Prerequisites: ECEN 103; CSCE 155A, 155E, 155H, 155N, 155T or (UNO) CIST 1400.

Description: Introduction to assembly language programming of microprocessors / microcontrollers, assemblers, and debugging tool utilization. Microprocessor system hardware components, control signals, and 'C' language micro-controller programming.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: ECEN 224; ECEN 332; ECEN 345

ECEN 123 Introduction to Electrical and Computer Engineering

Prerequisites: ECEN 103 or parallel; CSCE155A/CSCE 155E/(UNO) CIST 1400 or parallel. Open to first year students only.

Description: Laboratory design projects introducing some basic concepts and skills needed in electrical and computer engineering.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded

Offered: FALL/SPR

Course and Laboratory Fee: \$30

ECEN 155E Computer Science I: Systems Engineering Focus

Crosslisted with: CSCE 155E

Prerequisites: MATH 102 or a Math Placement Test score for MATH 103 or higher. Credit toward the degree may be earned in only one of: CSCE 155, CSCE 155A, CSCE 155E/ECEN 155E, CSCE 155H, CSCE 155N, or CSCE 155T.

Notes: Recommended for students interested in systems engineering, such as operating systems, mobile computing, and embedded devices.

Description: Introduction to problem solving with computers. Topics include problem solving methods, software development principles, computer programming, and computing in society

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: CIVE 201; CSCE 156, ECEN 156; CSCE 156H; CSCE 235; CSCE 235H; CSCE 311; CSCE 320; CSCE 336; CSCE 352; CSCE 802; ECEN 106; ECEN 123; ECEN 220; ECEN 224; MECH 300

Course and Laboratory Fee: \$10

ECEN 156 Computer Science II

Crosslisted with: CSCE 156

Prerequisites: A grade of "P" or "C" or better in CSCE 155A, CSCE 155E, CSCE 155H, CSCE 155N, or CSCE 155T; coreq: MATH 106.

Notes: Laboratories supplement the lecture material and give an opportunity to practice concepts.

Description: Data structures, including linked lists, stacks, queues, and trees; algorithms, including searching, sorting, and recursion; programming language topics, including object-oriented programming; pointers, references, and memory management; design and implementation of a multilayer application with SQL database.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Offered: FALL/SPR

Prerequisite for: CSCE 235; CSCE 310; CSCE 310H; CSCE 322; CSCE 322H; CSCE 378; CSCE 378H; CSCE 453H, RAIK 453H; SOFT 162

Course and Laboratory Fee: \$35

ECEN 164 Introduction to Computer Engineering

Crosslisted with: CSCE 164

Notes: Project-based introduction to the computer engineering field.

Description: Introduction to basic concepts and skills needed in computer engineering. Practical application of basic computing concepts through an introduction to programming an embedded system.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded with Option

Offered: SPRING

Prerequisite for: ECEN 220; ECEN 370, CSCE 335

ECEN 192 Special Topics in Electrical and Computer Engineering I

Notes: Requires an ECE departmentally approved proposal.

Description: Special topics in emerging areas of electrical and computer engineering which may not 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: Graded with Option

ECEN 194 Independent Study in Electrical and Computer Engineering I**Prerequisites:** Freshman standing.**Description:** Individual study in a selected area of Electrical and Computer Engineering 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:** Graded with Option**ECEN 198 Undergraduate Research in Electrical and Computer Engineering I****Prerequisites:** Permission.**Description:** Supervised undergraduate research**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ECEN 211 Elements of Electrical Engineering I****Prerequisites:** Prerequisite or parallel: MATH 107/(UNO) MATH 1960 and PHYS 211/(UNO) PHYS 2110.**Notes:** Not for electrical engineering majors.**Description:** Basic circuit analysis including direct and alternating currents and operational amplifiers. Digital signals and circuits.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** AGEN 325, BSEN 325; AREN 320; AREN 322; ECEN 231; MECH 350**ECEN 213 Electrical Circuits I****Prerequisites:** ECEN 103; ECEN 225; MATH 221/221H/821 or (UNO) MATH 2350, or parallel.**Description:** Electrical circuit theory, Kirchhoff's and Ohm's laws, circuit analysis theorems, Norton and Thevenin equivalence. The analysis of resistor circuits, with capacitors and inductors, in DC and AC steady state. Transients and variable frequency responses are studied, including computer solutions to circuit problems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** ECEN 217; ECEN 218; ECEN 222; ECEN 345**ECEN 214 Electrical Circuits II****Prerequisites:** ECEN 213; ECEN 218; (UNO) MATH 2050 or parallel.**Description:** Introduction to the analysis of electrical circuits in sinusoidal steady states. The concepts of impedance, phasors, power, frequency response, resonance, magnetic circuits, and two-port networks. Transform techniques for circuit analysis.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** ECEN 304; ECEN 338**ECEN 215 Electronics and Circuits I****Prerequisites:** Prerequisite or parallel: MATH 208/(UNO) MATH 1970.**Description:** Introduction to electrical engineering circuit theory. Kirchhoff's laws and circuit analysis theorems applied to steady state DC resistive circuits. Analysis of transient RLC and sinusoidal steady-state circuits. Modern computer methods employed.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** ECEN 216; ECEN 235; ECEN 345**ECEN 216 Electronics and Circuits II****Prerequisites:** ECEN 215 with a grade of "C" or better. Prerequisite or parallel: MATH 221/(UNO) MATH 2350 or MATH 221H.**Description:** Steady state power calculations for sinusoidal single-phase and balanced three-phase circuits. Mutual inductance. Frequency response. Introduction to fundamentals of semiconductor theory and their application to p-n junction devices. Kirchhoff's laws and circuit analysis theorems applied to steady state diode circuits. Modern computer methods employed.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** ECEN 304; ECEN 306; ECEN 316; ECEN 338**ECEN 217 Electrical Circuits III****Prerequisites:** ECEN 213**Notes:** This course is for computer engineering majors only.**Description:** Analysis of first and second order RLC circuits using differential equations and Laplace transforms. Variable frequency network performance analysis.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**ECEN 218 Electrical Circuits Laboratory****Prerequisites:** ECEN 213 or parallel.**Notes:** Lab to accompany ECEN 213**Description:** The use of laboratory tools for measurement and verification of electrical concepts. Experiments using both passive and semiconductor devices at audio frequencies. Analysis verification with computer simulation.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**Prerequisite for:** ECEN 214; ECEN 222**Course and Laboratory Fee:** \$15

ECEN 220 Introduction to Embedded Systems

Prerequisites: ECEN 155E; ECEN 103 or ECEN 164

Description: Basic hardware and software concepts of embedded microprocessor systems and interfacing with other hardware components. Simple circuits are designed and drivers to run them are written. Design and build hardware and write drivers in assembly or C programming languages.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded

Offered: FALL/SPR

Prerequisite for: CSCE 488; ECEN 307; ECEN 313; ECEN 345

Course and Laboratory Fee: \$25

ECEN 222 Electronic Circuits I

Prerequisites: ECEN 213 with a grade of "C" or better; ECEN 218

Description: Analysis and design of modern electronic circuits. Diode circuits, bipolar and field effect transistor switching and amplifier circuits, and operational amplifier circuits.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Offered: FALL/SPR

Prerequisite for: ECEN 310; ECEN 325; ECEN 347; ECEN 352; ECEN 481

Course and Laboratory Fee: \$30

ECEN 224 Introduction to Signal Processing

Prerequisites: ECEN 106; CSCE 155A, 155E, 155H, 155N, 155T or (UNO) CIST 1400; MATH 107/107H or (UNO) MATH 1960.

Description: The use of mathematical and digital computation tools key to engineering applications. Auditory and visual senses are used in the presentation and study of sinusoidal signals, sampling, frequency response and filtering theory.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

ECEN 225 Electrical and Computer Engineering Seminar

Prerequisites: ECEN 103 or parallel

Description: An overview of electrical, computer, electronics and telecommunication fields. There will be information on professional careers available upon graduation. Professionalism and ethics are addressed as well as the need for lifelong learning experiences.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Prerequisite for: ECEN 213

ECEN 230 Computer Organization

Crosslisted with: CSCE 230

Prerequisites: A grade of 'P' or 'C' or better in CSCE 235, CSCE 235H, or RAIK 184H.

Notes: Laboratories supplement the lecture material and give an opportunity to practice concepts.

Description: Introduction to organization and structure of computer systems. Boolean logic, digital arithmetic, processor organization, machine language programming, input/output, memory organization, system support software, communication, and ethics.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Offered: FALL

Prerequisite for: CSCE 336; CSCE 351, ECEN 351; CSCE 362; ECEN 370, CSCE 335

Course and Laboratory Fee: \$20

ECEN 231 Electrical Engineering Laboratory

Prerequisites: Prerequisite or parallel: ECEN 211

Description: Laboratory accompanying ECEN 211

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Prerequisite for: MECH 380

Course and Laboratory Fee: \$15

ECEN 235 Introductory Electrical Laboratory I

Prerequisites: Prerequisite or parallel: ECEN 215

Description: Laboratory accompanying ECEN 215

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Prerequisite for: ECEN 236

Course and Laboratory Fee: \$15

ECEN 236 Introductory Electrical Laboratory II

Prerequisites: ECEN 235; Prerequisite or parallel: ECEN 216

Description: Laboratory accompanying ECEN 216

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Prerequisite for: ECEN 307

Course and Laboratory Fee: \$15

ECEN 251 Unix Programming Environment

Crosslisted with: CSCE 251

Notes: Familiarity with at least one high-level programming language.

Description: Introduction to the Unix operating system. Unix file system. Unix tools and utilities. Shell programming.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Offered: FALL

Course and Laboratory Fee: \$25

ECEN 292 Special Topics in Electrical and Computer Engineering II

Prerequisites: Sophomore standing.

Notes: Requires a ECE departmentally approved proposal.

Description: Special topics 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: 1-6

Min credits per semester: 1

Max credits per semester: 6

Max credits per degree: 6

Grading Option: Graded with Option

ECEN 294 Independent Study in Electrical and Computer Engineering II

Prerequisites: Sophomore standing.

Description: Individual study in a selected area of Electrical and Computer Engineering 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: Graded with Option

ECEN 298 Undergraduate Research in Electrical and Computer Engineering II

Prerequisites: Permission.

Description: Supervised undergraduate research.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

ECEN 304 Signals and Systems I

Prerequisites: ECEN 214 or ECEN 216 with a grade of "C" or better; MATH 221 or 221H or (UNO) MATH 2350.

Description: Mathematical modeling of physical systems and signals. Representation of signals in terms of basis functions. Fourier series expansions, Fourier Transforms, Laplace and z-Transforms. Input-output relations, convolution. Transfer functions. System Stability. Poles/zeros and s- and z-plane methods. Applications.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: ECEN 481

ECEN 305 Probability Theory and Statistics for Electrical and Computer Engineers

Prerequisites: MATH 208/(UNO) MATH 1970.

Description: Random experiment model, random variables, functions of random variables, and introduction to random processes; statistics and practical data analysis.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: ECEN 325; ECEN 435; ECEN 835; ECEN 850, ECEN 450

ECEN 306 Electromagnetic Field Theory

Prerequisites: ECEN 216; PHYS 212 or (UNO) PHYS 2120; MATH 208 or (UNO) MATH 1970; MATH 221 or (UNO) 2350.

Description: Complex vectors. Maxwell's equations. Uniform plane waves. Wave reflection and transmission at interfaces. Waveguides and resonators. Transmission line principles. Antennas. Topics in waves.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: ECEN 481

ECEN 307 Electrical Engineering Laboratory I

Prerequisites: ECEN 220 or (UNO) ECEN 1060 and ECEN 236 or (UNO) ECEN 2220; prereq or parallel ECEN 370 or (UNO) ECEN 3700 or (UNO) ECEN 3130; admission to the College of Engineering.

Description: Laboratory work on circuits and systems, digital and analog electronic circuits.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded with Option

Offered: FALL/SPR

Course and Laboratory Fee: \$10

ECEN 310 Digital Design and Interfacing

Prerequisites: ECEN 222; ECEN 313 or parallel.

Notes: Lab exercises provide practical experience with design tools and the design process.

Description: Digital design from both the circuit and system perspectives. The structure and analysis of digital integrated circuits, interface signal integrity, Field Programmable Gate Array (FPGA) design and synthesis, and software simulation.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Course and Laboratory Fee: \$10

ECEN 313 Switching Circuits Theory

Prerequisites: ECEN 220

Description: Combinational circuit analysis and design. State machine analysis and design. Synchronous/clock mode circuits and asynchronous sequential circuits. Minimization, race, and hazard elimination are covered. Circuits are implemented in discrete logic and in CPLD and FPGA devices. VHDL hardware description language is used to describe circuits.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Prerequisite for: ECEN 310; ECEN 333; ECEN 481

Course and Laboratory Fee: \$10

ECEN 316 Electronics and Circuits III

Prerequisites: ECEN 216 with a grade of 'C' or better.

Description: Kirchhoff's laws and circuit analysis theorems applied to steady state transistor circuits. Frequency response of filters and amplifiers. Basic power amplifier types. Advanced operational amplifier circuits. Introduction to the fundamentals of semiconductor theory and their application to p-n junction and field devices.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: ECEN 347; ECEN 361; ECEN 481

ECEN 325 Communication and Networking

Prerequisites: ECEN 222; Pre or Co ECEN 305

Description: Communication: amplitude-, frequency/phase-modulation, sampling theorem, pulse-code modulation, OFDM, channel coding, and communication system/analysis. Networking: multiplexing, WANs, ATM, LANs, Internet/transport protocols, and data/computer communications.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Offered: SPRING

Course and Laboratory Fee: \$30

ECEN 327 Discrete Systems Laboratory

Prerequisites: ECEN 106 or ECEN 220

Description: Laboratory work on discrete systems.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded

Prerequisite for: ECEN 333

Course and Laboratory Fee: \$15

ECEN 332 Assembly Language Programming

Prerequisites: ECEN 106

Description: Architecture and assembly language programming of 8-bit and 32-bit microcontrollers. Assemblers and debugging tool utilization.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

ECEN 333 Computer Design

Prerequisites: ECEN 313 or ECEN 370 and ECEN 327

Description: Designed to present and discuss the design techniques for microprocessor-based systems. Discussion includes the design and implementation of hardware and software for a microprocessor system with memory, input/output, and support subsystems.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Offered: FALL/SPR

ECEN 338 Introduction to Power and Energy Systems

Prerequisites: ECEN 216 or ECEN 214 with a grade of "C" or better.

Description: Energy sources, environmental impacts, power systems principles, three-phase circuits, transmission lines, transformers, per unit analysis, generators, loads, and power system modeling.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: FALL/SPR

ECEN 345 Mobile Robotics I

Prerequisites: ECEN 106 or ECEN 220; ECEN 213 or ECEN 215

Description: Introduction to the primary issues spanning the field of mobile robotics, including robotics history, robot components (sensors, actuators), robot system design considerations, low-level control (feedback control) and robotics control architectures. The lab focuses on the practical implementation of autonomous robot control on a real mobile robot using behavior-based methods in the C language.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Course and Laboratory Fee: \$5

ECEN 347 Electrical Engineering Laboratory II

Prerequisites: ECEN 307/(UNO) ECEN2350; pre- or parallel ECEN 222/(UNO) ECEN 2220 or ECEN 316/(UNO) ECEN 3160

Description: Lab work on electromagnetics, fields and waves, solid state devices and control systems.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded

Prerequisite for: ECEN 481

Course and Laboratory Fee: \$10

ECEN 350 Electrical and Computer Engineering Cooperative Educational Experience

Prerequisites: Co-requisite UGEP 350/(UNO) ENGR 3500. Open to Electrical and Computer Engineering majors only. Approval of faculty sponsor prior to the Co-op is required.

Notes: International students have to complete a curricular practical training (CPT) application for the campus which issued their I-20. Students should start with ISSO at UNL if they are City Campus, or ISA at UNO if they are Scott Campus. They need to then meet with Engineering Career Services.

Description: For Cooperatives primarily technical in nature lasting 4.5 months or greater. Weekly communication and/or final report required. Must be taken during or after the semester in which the Co-op occurs.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

ECEN 351 System Resource Management**Crosslisted with:** CSCE 351**Prerequisites:** A grade of "P" or "C" or better in CSCE 230 or CSCE 231 and CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.**Description:** An introduction to management of computing resources, including CPUs, shared memory, I/O devices, address spaces, and threads of execution, with a focus on implementation.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL**Course and Laboratory Fee:** \$40**ECEN 352 Electronics Circuits II****Prerequisites:** ECEN 222/(UNO) CEEN 2220.**Description:** Operational amplifier circuit design and analysis feedback and stability. Design and analysis of large signal power amplifiers. Other integrated devices such as: regulators, comparators, Schmitt triggers, oscillators, and active filters.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Prerequisite for:** ECEN 362**Course and Laboratory Fee:** \$20**ECEN 361 Advanced Electronics and Circuits****Prerequisites:** ECEN 316**Description:** Analog and digital electronics for discrete and integrated circuits. Multistage amplifiers, frequency response, feedback amplifiers, simple filters and amplifiers, MOS and bipolar logic gates and families, A/D and D/A converters.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 362 Data and Telecommunications Transceivers****Prerequisites:** ECEN 352; ECEN 325 or parallel; and ECEN 328 or parallel.**Description:** Noise and signal distortions in communication systems, impedance matching techniques, high frequency measurement techniques, design of high frequency amplifiers and oscillators, PLL and frequency synthesizers, data synchronization and multiplexing techniques, Antennas and their arrays.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$10**ECEN 370 Digital Logic Design****Crosslisted with:** CSCE 335**Prerequisites:** ECEN 103 or CSCE 230**Description:** Combinational and sequential logic circuits. MSI chips, programmable logic devices (PAL, ROM, PLA) used to design combinational and sequential circuits. CAD tools. LSI and PLD components and their use. Hardware design experience.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 307; ECEN 327; ECEN 333; ECEN 481**ECEN 392 Special Topics in Electrical and Computer Engineering III****Prerequisites:** Permission**Notes:** Requires a ECE departmentally approved proposal.**Description:** Special topics 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:** Graded with Option**ECEN 394 Independent Study in Electrical and Computer Engineering III****Prerequisites:** Permission**Description:** Individual study in a selected area of Electrical and Computer Engineering under the supervision and guidance of 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:** Graded with Option**ECEN 395 Electrical and Computer Engineering Internship Educational Experience****Prerequisites:** Open to Electrical and Computer Engineering majors only. Approval of faculty sponsor prior to the internship is required.**Notes:** Weekly communication and/or final report is required. Must be taken during or after the semester in which internship occurs.**Description:** Provides the experience of Internship Education**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Experiential Learning:** Internship/Co-op**ECEN 398 Undergraduate Research in Electrical and Computer Engineering III****Prerequisites:** Permission.**Description:** Supervised undergraduate research.**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ECEN 399 Undergraduate Research****Prerequisites:** Electrical engineering seniors.**Description:** Research accompanied by a written report of the results.**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Experiential Learning:** Research

ECEN 399R Undergraduate Research

Notes: ECEN 399 and ECEN 399R should be taken in consecutive semesters.

Description: Independent research project executed under the guidance of a member of the faculty of the Department of Electrical Engineering which contributes to the advancement of knowledge in the field. Culminates in a written thesis or report and an oral presentation. For electrical engineering majors selecting the research option.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

ECEN 406 Power Systems Analysis

Crosslisted with: ECEN 806

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 407 Power Systems Planning

Crosslisted with: ECEN 807

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 408 Engineering Electromagnetics

Crosslisted with: ECEN 808

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 410 Multivariate Random Processes

Crosslisted with: ECEN 810

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 420 Plasma Processing of Semiconductors

Crosslisted with: ECEN 820

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 421 Principles of Semiconductor Materials and Devices I

Crosslisted with: ECEN 821

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 422 Introduction to Physics and Chemistry of Solids

Crosslisted with: PHYS 422, PHYS 822, ECEN 822

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: Graded with Option

ECEN 428 Power Electronics

Crosslisted with: ECEN 828

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 430 Wind Energy

Crosslisted with: ECEN 830

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: Graded with Option

ECEN 433 Microprocessor System Design**Crosslisted with:** ECEN 833**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:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** ECEN 435, ECEN 835; ECEN 483**Course and Laboratory Fee:** \$25**ECEN 435 Embedded Microcontroller Design****Crosslisted with:** ECEN 835**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:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** ECEN 437, ECEN 837**Course and Laboratory Fee:** \$25**ECEN 436 Electric Machines****Crosslisted with:** ECEN 836**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:** Graded with Option**Prerequisite for:** ECEN 932**ECEN 437 Parallel and Distributed Processing****Crosslisted with:** ECEN 837**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:** Graded with Option**ECEN 438 Integrated Systems Programming****Crosslisted with:** ECEN 838**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 442 Basic Analytical Techniques in Electrical Engineering****Crosslisted with:** ECEN 842**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 444 Linear Control Systems****Crosslisted with:** ECEN 844**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 448 Decision Analysis****Crosslisted with:** ECEN 848**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:** Graded with Option

ECEN 450 Bioinformatics

Crosslisted with: ECEN 850

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: Graded with Option

ECEN 451 Introduction to VLSI System Design

Crosslisted with: ECEN 851

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: Graded with Option

ECEN 452 Introduction to Computer-Aided Digital Design

Crosslisted with: ECEN 852

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: Graded with Option

ECEN 453 Computational and Systems Biology

Crosslisted with: ECEN 853

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 454 Power Systems Operation and Control

Crosslisted with: ECEN 854

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 456 Real Time DSP Applications

Crosslisted with: ECEN 856

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 460 Labview Programming

Crosslisted with: ECEN 860

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: Graded with Option

ECEN 462 Communication Systems

Crosslisted with: ECEN 862

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 463 Digital Signal Processing

Crosslisted with: ECEN 863

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 464 Digital Communication Systems**Crosslisted with:** ECEN 864**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 465 Introduction to Data Compression****Crosslisted with:** ECEN 865**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 466 Telecommunications Engineering I****Crosslisted with:** ECEN 866**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:** Graded with Option**ECEN 468 Microwave Engineering****Crosslisted with:** ECEN 868**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 469 Analog Integrated Circuits****Crosslisted with:** ECEN 869**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 470 Digital and Analog VLSI Design****Crosslisted with:** ECEN 870**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 471 Computer Communication Networks****Crosslisted with:** ECEN 871**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:** Graded with Option**ECEN 472 Image Understanding, Perception, and Signal Processing****Crosslisted with:** ECEN 872**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 473 Mobile and Personal Communications****Crosslisted with:** ECEN 873**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:** Graded with Option**ECEN 474 Digital Systems****Crosslisted with:** ECEN 874**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 475 Satellite Communications

Crosslisted with: ECEN 875

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: Graded with Option

ECEN 476 Wireless Communications

Crosslisted with: ECEN 876

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: Graded with Option

Prerequisite for: ECEN 926; ECEN 977

ECEN 478 Practical Machine Learning

Crosslisted with: ECEN 878

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 479 Optical Fiber Communications

Crosslisted with: ECEN 879

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: Graded with Option

Prerequisite for: ECEN 979

ECEN 480 Introduction to Lasers and Laser Applications

Crosslisted with: ECEN 880, 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: Graded with Option

ECEN 481 Electrical Engineering Capstone I

Prerequisites: ECEN 222 or ECEN 316; ECEN 313 or ECEN 370; ECEN 304; ECEN 306; ECEN 347; ENGL 151 (or JGEN 200)/(UNO) ENGL 1160

Notes: The first in a two semester electrical engineering capstone senior design course sequence.

Description: A substantial design project that allows application of electrical engineering skills to a multidisciplinary project. Requires project definition, planning and scheduling, effective written and oral communication of technical ideas, incorporation of realistic constraints and engineering standards, functioning effectively on a multidisciplinary team, and applying new ideas as needed to meet project goals.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

Prerequisite for: ECEN 495

Course and Laboratory Fee: \$10

ECEN 482 Antennas and Radio Propagation for Wireless Communications

Crosslisted with: ECEN 882

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: Graded with Option

ECEN 483 Computer Engineering Capstone I

Prerequisites: ECEN 433; ENGL 151 or JGEN 200 or (UNO) ENGL 1160.

Notes: The first in a two semester computer engineering capstone senior design course sequence.

Description: A substantial design project that allows application of computer engineering skills to a multidisciplinary project. Requires project definition, planning and scheduling, effective written and oral communication of technical ideas, incorporation of realistic constraints and engineering standards, functioning effectively on a multidisciplinary team, and applying new ideas as needed to meet project goals.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

Prerequisite for: ECEN 499

ECEN 484 Network Security

Crosslisted with: ECEN 884

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: Graded with Option

ECEN 486 Fundamentals of Photonics**Crosslisted with:** ECEN 886**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 487 Data and Network Security****Crosslisted with:** CSCE 463, CSCE 863, ECEN 887**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:** Graded with Option**Offered:** SPRING**ECEN 488 Wireless Security****Crosslisted with:** ECEN 888**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:** Graded with Option**ECEN 491 Special Topics in Electrical and Computer Engineering IV****Crosslisted with:** ECEN 891**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:** Graded with Option**ECEN 492 Special Topics in Electrical and Computer Engineering IV****Crosslisted with:** ECEN 892**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:** Graded with Option**ECEN 495 Electrical Engineering Capstone II****Prerequisites:** ECEN 494 or permission; admission to the College of Engineering.**Notes:** The second in a two semester capstone senior design course sequence.**Description:** A substantial design project that allows application of electrical engineering skills to a multidisciplinary project. Requires project definition, planning and scheduling, effective written and oral communication of technical ideas, incorporation of realistic constraints and engineering standards, functioning effectively on a multidisciplinary team, and applying new ideas as needed to meet project goals.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**Course and Laboratory Fee:** \$10**Experiential Learning:** Case/Project-Based Learning**ECEN 498 Research in Electrical Engineering IV****Crosslisted with:** ECEN 898**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:** Graded with Option**ECEN 499 Computer Engineering Capstone II****Prerequisites:** ECEN 496 or permission; admission to the College of Engineering.**Notes:** The second in a two semester capstone senior design course sequence.**Description:** A substantial design project that allows application of computer engineering skills to a multidisciplinary project. Requires project definition, planning and scheduling, effective written and oral communication of technical ideas, incorporation of realistic constraints and engineering standards, functioning effectively on a multidisciplinary team, and applying new ideas as needed to meet project goals.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**Course and Laboratory Fee:** \$10



ECEN 499H Honors Thesis

Prerequisites: Senior standing in electrical engineering; admission to the University Honors Program. Credit toward the degree cannot be earned in ECEN 499 and ECEN 499H.

Description: Honors thesis research project meeting the requirements of the University Honors Program. Independent research project executed under the guidance of a member of the faculty of the Department of Electrical Engineering which contributes to the advancement of knowledge in the field. Culminates in the presentation of an honors thesis to the department and college.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option