

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

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 313; ECEN 327; 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.

Notes: Credit may be earned in only one CSCE 155 course.

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: CSCE 156, ECEN 156; CSCE 156H; CSCE 235; CSCE 235H; CSCE 311; CSCE 352; ECEN 106; ECEN 123; ECEN 220; ECEN 224; ECEN 478; MECH 300

ACE: ACE 3 Math/Stat/Reasoning

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

ECEN 192 Individual Study in Computer and Electronics Engineering I

Notes: Requires a ECE departmentally approved proposal.

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

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

ECEN 194 Special Topics in Electrical and Computer Engineering I**Prerequisites:** Freshman 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 198 Special Topics in Electrical Engineering I****Prerequisites:** Permission.**Description:** Offered as the need arises to treat electrical engineering topics for first-year students not covered in other courses.**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 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 355**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:** CSCE 155E; ECEN 103 or CSCE 230**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:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR**Prerequisite for:** CSCE 488; ECEN 307; ECEN 327; 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 494**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 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**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 292 Individual Study in Electrical and Computer Engineering II****Prerequisites:** Sophomore standing.**Notes:** Requires a ECE departmentally approved proposal.**Description:** Individual study in a selected electrical, computer or electronics engineering area under the supervision and guidance of an electrical and computer engineering faculty member.**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ECEN 294 Special Topics in Electrical and Computer Engineering II****Prerequisites:** Sophomore 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 298 Special Topics in Electrical Engineering II****Prerequisites:** Permission.**Description:** Offered as the need arises to treat electrical engineering topics for second-year students not covered in other courses.**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 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 494

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 494

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 106

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. Circuits are implemented in discrete logic and in CPLD/FPGA devices.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Prerequisite for: ECEN 310; ECEN 494

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 494

ECEN 325 Communications Systems

Prerequisites: ECEN 222; Pre or Co ECEN 305

Description: Relevant communications systems; principles of transmission and reception; amplitude; frequency and phase modulation. Sampling theorem, pulse-code modulation and delta modulation.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

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

Course and Laboratory Fee: \$15

ECEN 328 Applied Fields and Lines I

Prerequisites: MATH 208/208H or (UNO) MATH 1970; MATH 221/821 or (UNO) MATH 2350.

Description: Transmission lines. Discontinuities, different termination, and matching methods. Application of vector analysis to Maxwell's equations. Uniform plane waves including reflection/transmission. S-parameters. Principles of antennas. LW, MW, SW, USW propagation.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: ECEN 329

ECEN 329 Applied Fields and Lines II**Prerequisites:** ECEN 328**Description:** Metallic wave guides with rectangular, circular, and coaxial cross section, antennas, free space, propagation in free space, applications.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**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 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 494**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 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 355 Signals and Linear Systems****Prerequisites:** ECEN 214**Description:** Continuous and discrete representations of signals. System modeling and analysis using differential and difference equations. Fourier, Laplace, and Z transforms. State description of continuous and discrete time transfer functions. The primary mathematical tools used in the analysis of continuous and discrete time systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**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 494**ECEN 392 Individual Study in Electrical and Computer Engineering III****Prerequisites:** Junior standing.**Notes:** Requires a ECE departmentally approved proposal.**Description:** Individual study in a selected electrical, computer or electronics engineering area under the supervision and guidance of an electrical and computer engineering faculty member.**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ECEN 394 Special Topics in Electrical and Computer Engineering III****Prerequisites:** Junior 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 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 Special Topics in Electrical Engineering III****Prerequisites:** Permission.**Description:** Offered as the need arises to treat electrical engineering topics for third-year students not covered in other courses.**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 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 400 Electronic Instrumentation****Crosslisted with:** ECEN 800**Prerequisites:** Senior standing in engineering**Description:** Applications of analog and digital devices to electronic instrumentation. Includes transducers, instrumentation amplifiers, mechanical and solid-state switches, data acquisition systems, phase-lock loops, and modulation techniques. Demonstrations with working circuits and systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 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 416 Materials and Devices for Computer Memory, Logic, and Display****Crosslisted with:** ECEN 816**Prerequisites:** PHYS 212/(UNO) PHYS 2120**Description:** Survey of fundamentals and applications of devices used for memory, logic, and display. Magnetic, superconductive, semiconductive, and dielectric materials.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 417 Semiconductor Fundamentals II****Crosslisted with:** ECEN 817**Prerequisites:** ECEN 421 or ECEN 821**Description:** Analysis of BJT's and MOSFET's from a first principle materials viewpoint. Static and dynamic analysis and characterization. Device fabrication processes.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 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 424 Digital Signal Processing****Crosslisted with:** ECEN 824**Prerequisites:** ECEN 355**Description:** The temporal and spectral analysis of digital signals and systems, the design of digital filters and systems, and advanced systems including multi-rate digital signal processing techniques.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** ECEN 815; ECEN 926**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:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 932

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 496**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 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 461 Digital Communications Media****Crosslisted with:** ECEN 861**Prerequisites:** ECEN 325 or ECEN 462**Description:** Topics related to the transport of bit streams from one geographical location to another over various physical media such as wire pairs, coaxial cable, optical fiber, and radio waves. Transmission characteristics, media interfacing, delay, distortion, noise, and error detection and correction techniques.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** ECEN 466, ECEN 866; ECEN 479, ECEN 879; ECEN 885; ECEN 977**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 467 Electromagnetic Theory and Applications****Crosslisted with:** ECEN 867**Prerequisites:** ECEN 306**Description:** Engineering application of Maxwell's equations. Fundamental Parameters of Antennas. Radiation, analysis, and synthesis of antenna arrays. Aperture Antennas.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ECEN 965**ECEN 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 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**Prerequisite for:** ECEN 477, ECEN 877

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 477 Digital Systems Organization and Design****Crosslisted with:** ECEN 877**Prerequisites:** ECEN 474 or ECEN 874**Description:** Hardware development languages, hardware organization and realization, microprogramming, interrupt, intersystem communication, and peripheral interfacing.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ECEN 478 Practical Machine Learning****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. Adopts the philosophy of learning concepts at the very moment that they are needed to accomplish some practical end.**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 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 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 Applied 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 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 Individual Study in Electrical and Computer Engineering IV****Crosslisted with:** ECEN 892**Prerequisites:** Senior standing**Notes:** Requires a ECE departmentally approved proposal.**Description:** Individual study in a selected electrical, computer, or electronics engineering area under the supervision and guidance of an electrical and computer engineering faculty member.**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ECEN 494 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:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded**Offered:** FALL/SPR**Prerequisite for:** ECEN 495**Course and Laboratory Fee:** \$10**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 496 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:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded**Offered:** FALL/SPR**Prerequisite for:** ECEN 499**ECEN 498 Special Topics in Electrical Engineering IV****Crosslisted with:** ECEN 898**Prerequisites:** Permission**Notes:** Offered as the need arises for electrical engineering topics for fourth-year and graduate students not covered in other courses.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 18**Grading Option:** 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**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