COMPUTER ENGINEERING

Computers and digital technology have dramatically altered many facets of life including entertainment, manufacturing, transportation, public safety and power production. Computer Engineers have many career opportunities in these areas that will only become more important and prevalent in the future. Most of the modern electronic devices and appliances available today contain advanced computer technology. Video game consoles, for example, utilize very powerful special-purpose computers that receive user input (from the joystick or controller), perform computations to control the game and display high-resolution graphics and sound in real time. Such devices require specialized digital circuits that can process massive amounts of data very efficiently. Computer engineers use their specialized knowledge to design a variety of systems that integrate how the hardware (electronic circuits and processors) interacts with the software such as C++ or Java to control the system and process inputs from the user. This type of close interaction between hardware and software is essential for many important applications, such as automotive systems, web and GPS-enabled devices, wireless communication, military applications, and medical imaging.

The Bachelor of Science Engineering in Computer Engineering at UM-Dearborn was developed to meet the increasing demand for engineers with knowledge of both hardware design and software development. The program offers a 125-hour curriculum consisting of core courses and technical electives. In addition to in-depth courses in engineering fundamentals, theory, and design principles, students get hands-on experience with the latest hardware and software, such as microprocessor and DSP-based development boards, system-on-a-chip technology, computer networks, and reconfigurable computing. In the junior year, students learn how to design and implement an instruction set and logic functions for a computer. In the senior year, students work on projects in which they design a complete real-world system, from initial specifications to final design, testing, and documentation. Students with an interest in pursuing graduate studies or wish to pursue a research and development career are encouraged to undertake directed research projects under the supervision of faculty advisors for more advanced design experiences.

A unique feature of the Computer Engineering program is the opportunity for students to work concurrently to earn a second degree in Electrical Engineering by taking an additional 16 credit hours of courses. In this case, a student can earn two Bachelor's Degrees in just 141 credit hours. Since some job listings require a computer engineering background while others require specialization in electrical engineering, a student who pursues the dual degree option is qualified for a much wider variety of engineering positions.

The Bachelor of Science in Engineering in Computer Engineering program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org (https://www.abet.org/)

Program Educational Objectives

The graduates who receive the Bachelor of Science in Engineering degree in **Computer Engineering** from the University of Michigan-Dearborn are expected to **achieve within a few years** of graduation the high professional, ethical, and societal goals demonstrated by accomplishing one or more of the objectives described below.

1. Achieve professional growth in an engineering position in regional and national industries. Growth can be evidenced by promotions and appointment in the workplace (management positions, technical specialization), entrepreneurial activities, and consulting activities.
2. Success in advanced engineering studies evidenced by enrollment in graduate courses, completion of graduate degree programs, presentations and publications at professional events, and awards or licenses associated with advanced studies.
3. Realization of impactful achievements in societal roles demonstrated by attainment of community leadership roles, mentoring activities, civic outreach service, and active roles in professional societies.

Program Outcomes

To achieve the educational objectives, the graduates of the program will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Dearborn Discovery Core

Please see the Dearborn Discovery Core (General Education) (https://umdearborn.edu/faculty-staff/academic-program-and-course-development/dearborn-discovery-core-general-education/) webpage or additional information.

Foundational Studies

Written and Oral Communication (GEWO) – 6 Credits

Upper-Level Writing Intensive (GEWI) – 3 Credits

Quantitative Thinking and Problem Solving (GEQT) – 3 Credits

Critical and Creative Thinking (GECC) – 3 Credits

Areas of Inquiry

Natural Science (GENS) – 7 Credits

- Lecture/Lab Science Course
- Additional Science Course

Social and Behavioral Analysis (GESB) – 9 Credits

Humanities and the Arts (GEHA) – 6 Credits

Intersections (GEIN) – 6 Credits

Capstone

Capstone (GECE) – 3 Credits

Major Requirements

Code	Title	Credit Hours
Basic Preparation for Engineering		
COMP 270	Tech Writing for Engineers (Also fulfills 3 credits of DDC Written and Oral Communication)	
ECON 201	Prin: Macroeconomics (ECON 201 or 202 also fulfill 3 credits of DDC Social and Behavioral Analysis)	
or ECON 202	Prin: Microeconomics	
ENT 400	Entrepreneurial Thinking&Behav (ENT 400 also fulfills 3 credits of DDC Intersections)	
ENGR 100	Introduction to Engineering and Engineering Design	3
MATH 115	Calculus I	4
MATH 116	Calculus II	4
MATH 215	Calculus III	4
MATH 228	Diff Eqns with Linear Algebra	4
CHEM 134	General Chemistry IA	4
or CHEM 144	Gen Chemistry IB	
PHYS 150	General Physics I	4
PHYS 151	General Physics II	4
ECE 276	Discrete Math in Computer Engr	4
or MATH 276	Discrete Math Meth Comptr Engr	
IMSE 317	Eng Probability and Statistics	3
Core Courses		
ECE 210	Circuits	4
ECE 270	Computer Methods in ECE I	4
ECE 273	Digital Systems	4
ECE 311	Electronic Circuits I	4
ECE 3731	Microproc and Embedded Sys	4
ECE 370	Adv Soft Techn in Comp Engr	4
ECE 375	Intro to Comp Architecture	4
ECE 471	Comp Networks/Data Comm	4
ECE 473	Embedded System Design	4
ECE 475	Comp Hardware Org/Design	4
ECE 478	Operating Systems	4
ECE 4982	Computer Engineering Des I	2
ECE 4984	Computer Engin Design II	2
Professional Electives		
Select two courses from the following list:		7-8
ECE 3171	Analog & Discrete Sig & Sys	
ECE 387	Digital Forensics I	
ECE 413	Intro to VLSI Design	
ECE 428	Cloud Computing	
ECE 433	Intr to Multimedia Technolgies	
ECE 434	Machine Learning in Engin	
ECE 435	Intro to Mobil/Smrt Dev & Tech	
ECE 438	Web Engr: Prin & Tech	
ECE 467	Digital Forensics II	
ECE 4881	Introduction to Robot Vision	
ENGR 492	Exper Honors Directed Research	
ENGR 493	Exper Hnrs Dir Dsgn	
Approved Electives		
Select 8-9 credit hours		8-9
ECE 3171	Analog & Discrete Sig & Sys	
ECE 319	Electromagnetic Compatibility	
ECE 385	Elec Materials and Devices	
ECE 387	Digital Forensics I	
ECE 414	Electronic Systems Design	
ECE 415	Power Electronics	
ECE 428	Cloud Computing	
ECE 433	Intr to Multimedia Technolgies	
ECE 434	Machine Learning in Engin	
ECE 435	Intro to Mobil/Smrt Dev & Tech	
ECE 4361	Electric Machines and Drives	
ECE 438	Web Engr: Prin & Tech	
ECE 4432	Renewable Elec Pwr Sys	
ECE 4431	Vehicular Pwr Sys & Loads	
ECE 446	Electromechanical Energy Conv	
ECE 450	Analog and Digital Comm Sys	
ECE 460	Automatic Control Systems	
ECE 467	Digital Forensics II	
ECE 480	Intro to Dig Signal Processing	
ECE 4881	Introduction to Robot Vision	
ECE 491	Directed Studies	
ECE 4951	Sys Desgn and Microcontrollers	
ENGR 350	Nanoscience and Nanotechnology	
ENGR 399	Experiential Honors Prof. Prac	
IMSE 3005	Intro to Operations Research	
IMSE 381	Industrial Robots	
IMSE 421	Eng Economy and Dec Anlys	
IMSE 4425	Human Factors and Ergonomics	
IMSE 4545	Information Systems Design	
ME 230	Thermodynamics	
ME 260	Design Stress Analyses	
ME 265	Applied Mechanics	
Professional and Approved Electives must equal minimum 16 credits		

ECE 210 Circuits 4 Credit Hours
Fundamental laws, electrical elements and sources, energy and power. DC analysis of linear circuits. Node and mesh analysis. Operational amplifiers and op-amp circuits, Thevenin and Norton theorems. Sinusoidal steady-state response and the phasor concept. Introductory concepts on complex frequency, average power in AC circuits. Transient responses. Three lecture hours per week and one three-hour laboratory per week.
Prerequisite(s): (MATH 116 or Mathematics Placement with a score of 215) and PHYS 151*
Corequisite(s): ECE 210L
Restriction(s):
Can enroll if College is Engineering and Computer Science

ECE 270 Computer Methods in ECE I 4 Credit Hours
Covers structured and object-oriented computer programming concepts in the context of the C/C++ programming language and engineering applications. Four lecture hours per week with programming assignments.
Prerequisite(s): ENGR 100 and MATH 115*
Restriction(s):
Can enroll if College is Engineering and Computer Science

ECE 273 Digital Systems 4 Credit Hours
Introduction to digital logic. Topics include numbers and coding systems; Boolean algebra with applications to logic systems; Karnaugh and Quine-McCluskey minimization; combinatorial logic design; flip-flops; sequential network design; and design of digital logic circuits. Three lecture hours per week and one three-hour laboratory per week.
Prerequisite(s): MATH 115*
Corequisite(s): ECE 273L
Restriction(s):
Can enroll if College is Engineering and Computer Science

ECE 276 Discrete Math in Computer Engr 4 Credit Hours
An introduction to fundamental concepts of discrete mathematics for computer engineering. Topics will be chosen from set theory, partially ordered sets, lattices, Boolean algebra, semi-groups, rings, graphical representation of algebraic systems, graphs, and directed graphs. Applications in various areas of computer engineering will be discussed.
Prerequisite(s): (MATH 116 or Mathematics Placement with a score of 215)

ECE 299 Internship/ Co-Op 1 Credit Hour
This is a Cooperative Education course. Students wishing to experience a work experience before graduation may elect to participate in the Cooperative Education Program (minimum of two terms). (F,W,S).
Restriction(s):
Can enroll if Class is Junior or Senior

ECE 300 Signals and Systems 4 Credit Hours
Signals and systems representation and classification. Impulse response and convolution integral. Fourier analysis of continuous time signals and systems. Laplace transforms with applications to linear system analysis. Introduction to computer software for solving problems involving signals and systems. Three lecture hours and three recitation hours per week.
Prerequisite(s): ECE 210 and (MATH 217* or MATH 227*) and MATH 216

ECE 305 Intro to Electrical Eng 4 Credit Hours
Introduction to electrical and electronic circuits, machinery, and instrumentation. Topics include Kirchoff's Laws, Thevenin and Norton theorems, sinusoidal and transient circuit analysis, numerical methods, solid state electronics, motors and generators, measuring instruments. Three lecture hours and one three-hour laboratory analysis. Not open to ECE students.
Prerequisite(s): PHYS 151 and (MATH 205 or MATH 215) and (MATH 217* or MATH 227* or MATH 228*)
Corequisite(s): ECE 305L
Restriction(s):
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is Electrical Engineering

ECE 3100 Data Science I 4 Credit Hours
This course provides an overview of the mathematical techniques and computer tools needed in the field of data science. The important types of problems addressed in the field of data science are rigorously formulated and analyzed, including regression, pattern recognition and classification, time series prediction, and clustering. Effective mathematical and computational solution methodologies are discussed, including exploratory data analysis, statistical methods, and machine learning. At the end of the course, the student will have an analytic and computational toolkit with which they can solve real problems and 'tell a story' with data. (F)
Prerequisite(s): (CIS 1501 or CIS 150 or ECE 270) and (MATH 217 or MATH 227 or MATH 228) and (STAT 325* or IMSE 317* or BENG 364*)
Restriction(s):
Can enroll if Level is Undergraduate

ECE 311 Electronic Circuits I 4 Credit Hours
Terminal characteristics and biasing of semiconductor diodes, bipolar and field-effect transistors, operational amplifiers. Rectifiers, amplifiers, and logic. Design projects. Three lecture hours and one three hour laboratory per week.
Prerequisite(s): ECE 210 and (CHEM 134 or CHEM 144) and (COMP 270 or COMP 106 or COMP 220 or COMP 280 or Composition Placement Score with a score of 40 or Composition Placement Score with a score of 107)
Restriction(s):
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ECE 314 Filter Design 3 Credit Hours
Review of filter descriptions, transfer functions, and frequency response characteristics; first and second order passive and active filters; biquad circuits; filter transformations. Butterworth, Chebyshev, and Elliptic filters; OPAMP realization of active filters; sensitivity analysis of active circuits. Three lecture hours per week.
Prerequisite(s): ECE 311 and ECE 317

ECE 316 Computer Electronics 3 Credit Hours
Design of selected electronic circuits such as signal conditioning amplifiers. Switching and digital logic circuits, using FET and BJT devices, A/D and D/A converters. Two-hour lecture and one three-hour lab per week. (YR).
Prerequisite(s): ECE 210 and ECE 273 and (COMP 270* or COMP 106* or Composition Placement Score with a score of 40 or Composition Placement Score with a score of 107 or COMP 220*)

ECE 317 Electronic Signals and Systems 4 Credit Hours
Signals and systems representation and classification. Impulse response and convolution integral. Laplace transforms with applications to linear electronic systems analysis. Fourier series analysis for analyzing harmonic distortion. Frequency response and filter design. Four lecture hours per week.
Prerequisite(s): MATH 216 and (MATH 217* or MATH 227*) and ECE 311*
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Level is Undergraduate

ECE 3171 Analog & Discrete Sig & Sys 4 Credit Hours
Signals and systems representation and classification. Impulse response and convolution integral. Laplace and Z transforms with applications to linear system analysis. Fourier series Fourier Transform and Discrete Fourier Transform, Frequency response, Filter design. Four lecture hours per week.
Prerequisite(s): (MATH 228 or MATH 216) and (MATH 217* or MATH 227*) and ECE 311*
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if College is Engineering and Computer Science

ECE 319 Electromagnetic Compatibility 4 Credit Hours
Introduction, cabling, grounding, balancing and filtering, passive components,shielding, digital circuit noise and PCB layout, radiation, ESD, regulations, demos, experiments, lab projects and guest lectures. Three Lecture hours and one three-hour laboratory per week.
Prerequisite(s): ECE 311
Restriction(s):
Can enroll if College is Engineering and Computer Science

ECE 321 Electromagnetic Fields/Waves 3 Credit Hours
Vector analysis; static electric field; steady electric currents; static magnetic fields; time-varying fields and Maxwell's equations; plane electromagnetic waves. Three lecture hours per week.
Prerequisite(s): ECE 311*

ECE 329 Intro to Computer Music 4 Credit Hours
This course will introduce students to methods and technologies of computer music. The basics of digital audio will be covered, including sampling, quantization, and compression standards. Various analysis tools will be covered, including the Fourier transform and windowing techniques. Mathematical models of physical instruments will be introduced. Various sound synthesis strategies will be introduced: wave tables, additive synthesis, subtractive synthesis, frequency modulation, and granular synthesis.
Prerequisite(s): MATH 105
Restriction(s):
Can enroll if Class is Junior or Senior

ECE 347 Applied Dynamics 4 Credit Hours
Introduction to rigid, multi-body dynamics tailored to the analysis and design of linkage-based robotic systems. Three dimensional kinematics, Eulerian angles, general motion of rigid bodies subjected to various forcing functions. Matrix methods, numerial and software-based problem solving. Project required. Four lecture hours per week.
Prerequisite(s): MATH 216 and (MATH 217 or MATH 227) or MATH 228
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 351 Bio-Sensors & Instrumentation 4 Credit Hours
The course covers measurements in biological materials using a variety of sensor technologies along with electronic instrumentation design and use. Safety and FDA requirements are also presented.
Prerequisite(s): ECE 305 and (ENGR 216 or ECE 270) and MATH 216 and BIOL 103 and BIOL 140
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if College is Engineering and Computer Science or Arts, Sciences, and Letters

ECE 3641 Robotics I 4 Credit Hours
Design, construction, and testing of field robotic systems. Focus on electronics, instrumentation, and machine elements. Particular attention to modeling dynamic systems, measuring and controlling their behavior, and making decisions about future courses of action. Examples include industrial robots, service robots, mobile robots, and medical robots. Three lecture hours and one three hour laboratory per week.
Prerequisite(s): (ECE 3731 or ECE 372) and ECE 347*
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 370 Adv Soft Techn in Comp Engr 4 Credit Hours
Advanced concepts and techniques of modular object oriented and structured programming; representative real-world computer engineering applications including data structures, search and sorting. A term project is required. Four lecture hours per week. (F,W,S).
Prerequisite(s): ECE 270 and ECE 273*
Restriction(s):
Can enroll if College is Engineering and Computer Science

ECE 371 Information Structures 3 Credit Hours
Fundamentals of computer data structures. Introduction to abstract data types. Characteristics and implementation of structured data types including arrays, stacks, queues, linked lists, generalized lists, trees, and graphs. Algorithms and applications of data structures in sorting and searching. Considerations of algorithm efficiency and complexity. Engineering applications and design. Three lecture hours per week.
Prerequisite(s): ECE 370 or ECE 274

ECE 372 Intro to Microprocessors 4 Credit Hours
Introduction to operation, interfacing, and applications of microcomputers and microprocessor-based systems. Assembly language programming, interrupts and interfacing. Three lecture hours and one three-hour laboratory per week.
Prerequisite(s): (ECE 270 and ECE 273) or CIS 310 and (COMP 270 or COMP 106 or COMP 220 or Composition Placement Score with a score of 107 or Composition Placement Score with a score of 40)

ECE 3731 Microproc and Embedded Sys 4 Credit Hours
This course is an introduction to the operation, interfacing, and applications of micro processor based systems, and real-time embedded system design. Topics include: microprocessor architecture, embedded C programming, real-time programming. Final project required. Three lecture hours and one three hour laboratory per week.
Prerequisite(s): (ECE 270 and ECE 273) or CIS 310
Corequisite(s): ECE 3731L
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 375 Intro to Comp Architecture 4 Credit Hours
Introduction to architecture of mini- and mainframe computers. CPU, memory, and I/O characteristics. Introduction to parallel architectures and hardware design languages. Case studies of popular computer systems and design considerations. A design project is required. Three lecture hours and one laboratory hour per week.
Prerequisite(s): ECE 270 and ECE 273 and (ECE 276* or MATH 276*) and (ECE 372* or ECE 3731*)
Corequisite(s): ECE 375L
Restriction(s):
Can enroll if College is Engineering and Computer Science

ECE 3801 Intro to Signals and Systems 3 Credit Hours
Spectral characterization of periodic and aperiodic signals. Continuous-time filters.Frequency response. Sampling and Fourier Analysis. Discrete time signals. Input-output relationships in discrete-time systems, including impulse response, transfer function, and frequency response. Design and analysis of digital filters - finite impulse response (FIR) and infinite impulse response (IIR). Matlab projects will be assigned. Three lecture hours per week.
Prerequisite(s): ECE 210 and MATH 216
Restriction(s):
Cannot enroll if Class is Freshman
Can enroll if Level is Undergraduate
Cannot enroll if Major is Electrical Engineering

ECE 385 Elec Materials and Devices 3 Credit Hours
Introduction to properties of conductors, semi-conductors, and insulators. Definitions of stress and strain. Description of the mechanical behavior of solids. Characterization of selected materials; circuit models for resistors, capacitors, inductors, junction and field-effect transistors, etc. Three lecture hours per week.
Prerequisite(s): ECE 311* and (CHEM 144 or CHEM 134)
Restriction(s):
Can enroll if College is Engineering and Computer Science

ECE 3851 Intro Elect Materials & Device 4 Credit Hours
Introduction to properties of conductors, semi-conductors, and insulators. Definitions of stress and strain. Description of the mechanical behavior of solids. Characterization of selected materials; circuit models for resistors, capacitors, inductors, junction and field-effect transistors, etc. Three lecture hours per week and on three-hour laboratory session.
Prerequisite(s): ECE 311* and (CHEM 134 or CHEM 144)
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 387 Digital Forensics I 4 Credit Hours
This course takes a detailed, hands-on approach to study the procedures and techniques used to identify, extract, validate, document and preserve electronic evidence. Students completing this course will be familiar with the core computer science theory and practical skills necessary to perform basic computer forensic investigations, understand the role of technology in investigating computer-based crime, and be prepared to deal with investigative bodies at a basic level.
Prerequisite(s): (ECE 270 or CIS 200) and (ECE 370* or ECE 372* or CIS 310*)
Restriction(s):
Cannot enroll if Class is Freshman
Cannot enroll if Level is Rackham or Graduate
Can enroll if College is Engineering and Computer Science

ECE 390 Selected Topics in ECE 1 to 3 Credit Hours
Special topics in ECE according to student's interest and availability of instructors and equipment.

ECE 399 Internship/Co-op 1 Credit Hour
A four-month professional work experience period of the Engineering Internship Program, integrated and alternated with the classroom terms.
Restriction(s):
Can enroll if Class is Junior or Senior

ECE 411 Electronics II 4 Credit Hours
Review of solid state devices and their physical properties, introduction to the state of art devices, design of operational amplifiers, oscillators, switching and digital circuits. A project will be required. Three lecture hours per week and one three-hour laboratory per week.
Prerequisite(s): ECE 301 and ECE 311

ECE 413 Intro to VLSI Design 3 Credit Hours
Introduction to digital systems and VLSI, CMOS fabrication, layout and CMOS integrated circuits, basic principles of MOSFET theory, CMOS logic circuits, subsystem design, Architecture design and HDL, CLSI chip design, advanced topics, laboratory consist of a series of design projects. Three lecture hours per week.
Prerequisite(s): ECE 273 and ECE 311

ECE 414 Electronic Systems Design 4 Credit Hours
Review of solid state device characteristics and circuit analysis. Design of selected electronic circuits such as operational amplifiers, power amplifiers, power supplies, oscillators, switching and digital circuits to further illustrate analysis and design of representative electronic circuits using classical and computer-aided design techniques. Four lecture/laboratory per week.
Prerequisite(s): ECE 311 and ECE 270*

ECE 415 Power Electronics 4 Credit Hours
Introduction to power electronic circuit analysis and design. Power electronic circuits, power converters, power semiconductors. Time domain analysis emphasized. A design project is required. Four lecture/laboratory hours per week.
Prerequisite(s): (ECE 317 or ECE 3171) and ECE 385

ECE 420 EMC Measurement and Testing 3 Credit Hours
Introduction to EMC measurements, RF measurement fundamentals, EM waves, radiation mechanisms, measurement and measurement systems, screened rooms, open field test sites, practical measurements, conducted emission measurements, radiated emission measurements, radiated immunity, conducted immunity and electrostatic discharge. Projects will be assigned. (YR).
Prerequisite(s): ECE 319

ECE 426 Multimedia Forensics 4 Credit Hours
The objective of this course is to introduce current state-of-the-art in digital multimedia editing, its impacts on multimedia tampering, and multimedia forensics techniques to uncover inconsistencies due to tampering. This course will cover existing digital multimedia tampering techniques such as copy-move, cut-and-paste, etc. and digital multimedia tamper detection techniques. The course will also cover covert communication methods such as steganography and covert channel detection method steganlysis. This course will cover the limitations of existing state-of-the-art in multimedia forensics. Hands-on experience will be provided in various aspects of multimedia tampering and analysis through the numerous assignments and projects. Three lecture hours per week and one three-hour laboratory per week. (F)
Prerequisite(s): (ECE 387 or CIS 387) or CIS 447 or ECE 317
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ECE 427 Digi Content Protec 4 Credit Hours
The objective of this course is to introduce current techniques information security in general and multimedia security in particular. This course will cover existing information hiding techniques such as digital watermarking, steganography, and fingerprinting. The course will also cover conventional digital content protection methods such as cryptography. This course will cover the pros and cons of conventional and non-conventional digital content protection methods and associated design issues to give the student hands-on experience in various aspects of information security and analysis through the various assignments and projects. (W)
Prerequisite(s): (ECE 387 or CIS 387) or CIS 447 or ECE 317
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ECE 428 Cloud Computing 3 Credit Hours
Cloud computing represents the emerging Internet-based services/ platforms with elastic and scalable computation powers operating at costs associated with service. Topics may include advanced web technologies (AJAX and Mashup), distributed computing models and technologies (Hadoop and MapReduce), Infrastructure-as-a-Service (IaaS), Software as a Service (SaaS), Platform-as-a-Service (PaaS), virtualization, parallelization, security/privacy, and other issues in cloud computing. This course will also explore the current challenges facing cloud computing. Course work will include homework assignments, presentations and a term project. Students cannot take both ECE 428 and ECE 528 for degree credit. Three lecture hours per week.
Prerequisite(s): ECE 270
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ECE 431 Electrical Eng Design 4 Credit Hours
The course is conducted as a guided project design course with the class divided into teams and assigned a specific design project. Periodic progress reports are submitted during the term. A final written report and an oral presentation including demonstration are required at the end of the term. Cost analysis, evaluation of design alternatives and application of engineering principles are emphasized. Two scheduled contact hours and six hours open laboratories per week.
Prerequisite(s): ECE 311 and ECE 373 and ECE 493*

ECE 432 Electrical Eng Design 6 Credit Hours
The course is conducted as a guided project design course over a two-semester period with the class divided into teams and assigned a specific design project. Periodic progress reports are submitted during the term. A final written report and an oral presentation including demonstration are required at the end of the term. Cost analysis, evaluation of design alternatives and application of engineering principles are emphasized. Two scheduled contact hours and six hours open laboratories per week.
Prerequisite(s): ECE 311 and ECE 372 and ECE 493*

ECE 433 Intr to Multimedia Technolgies 4 Credit Hours
This course will introduce students to basic terminology and methods of multimedia. Basic concepts of digital audio will be reviewed, including frequency, sampling, and popular compression schemes. Concepts of digital images will be introduced, such as resolution, color theory, and compression formats. Basic concepts of digital video and animation will be introduced. Relevant web technologies will be reviewed. Four lecture hours per week.
Prerequisite(s): ECE 311 or ECE 370
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Level is Undergraduate

ECE 434 Machine Learning in Engin 4 Credit Hours
Introduce fundamental theories and basic techniques in machine learning with an emphasis on engineering applications. Topics include learning concepts, search algorithms, neural networks, fuzzy learning, paradigms for problem solving using machine learning. (F, W).
Prerequisite(s): ECE 370
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Level is Undergraduate

ECE 435 Intro to Mobil/Smrt Dev & Tech 4 Credit Hours
This class will introduce students to the technology used in mobile/ smart devices and mobile communication networks. Various hardware and software aspects will be introduced, with particular emphasis on the constraints intrinsic to such systems. Students will get an overview of various mobile operating systems and how to develop software for mobile devices. Four lecture hours per week.
Prerequisite(s): ECE 372 or ECE 3731
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Major is Electrical Engineering, Software Engineering, Computer Engineering

ECE 436 Elec Machines & Hybrid Drives 4 Credit Hours
This is an introductory course on electric machines and drive systems and their application in EV, HEV, PHEV and FCV powertrains. The objectives are to familiarize the students with the basic concepts of electromechanical energy conversion and electric drive systems. Students are expected to be able to analyze and design electric drive systems for automotive powertrain applications. The topics covered in this course include DC machines, induction machines, permanent magnet synchronous machines, and switched reluctance motors and drives. Case studies in automotive applications such as electric and hybrid drivetrains will be discussed. Four lecture hours per week.
Prerequisite(s): ECE 311
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Major is Electrical Engineering, Software Engineering, Computer Engineering

ECE 4361 Electric Machines and Drives 4 Credit Hours
This is an introductory course on electric machines and drive systems and their application in HEV/PHEV powertrain and other industrial and residential systems. The objectives are to familiarize the students with the basic concepts of electromechanical energy conversion and electric drive systems. Students are expected to be able to analyze and design electric drive systems for automotive, industrial, and residential applications. The topics covered in this course include DC machines, induction machines, permanent magnet synchronous machines, and switched reluctant motors and drives. Case studies in automotive applications such as electric and hybrid drivetrains, industrial and residential electric variable speed drive systems, will be discussed. Students cannot take both ECE 436 and ECE 4361 for credit. Four lecture hours per week.
Prerequisite(s): ECE 311
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Major is Computer Engineering, Software Engineering, Industrial & Systems Engin, Mechanical Engineering, Computer & Information Science, Electrical Engineering

ECE 437 Intro to Automotive Cybersec 4 Credit Hours
The objective of this course is to introduce modern vehicles, in-vehicle communication networks and protocols such as CAN, LIN, and so on, threat models, diagnostics, and penetration testing. This course will cover existing in-vehicle communication protocols and associated vulnerabilities. Students are expected to learn penetration testing for automotive systems. This course will cover the limitations of existing state-of-the-art in multimedia forensics. Simulation tools, labs and projects will be used to provide hands-on learning experience in various aspects of in-vehicle communication. (W,YR).
Prerequisite(s): ECE 3731* or ECE 372*
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 438 Web Engr: Prin & Tech 4 Credit Hours
Advanced concepts and techniques of web technology, focusing on interactive applications; real-world web engineering applications including data persistence, web security, hardware/software issues and asynchronous client/server communication. A term project is required. Four lectures per week.
Prerequisite(s): ECE 311 or ECE 370
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Major is Electrical Engineering, Software Engineering, Computer Engineering

ECE 443 Intr to Electric Power Systems 3 Credit Hours
This course will introduce students to basic methods of electric power systems. Topics include AC circuits, phasors, complex power and complex impedance, transformers, per unit system, transmissions lines, power flow, economic dispatch, real and reactive power control, symmetric and unsymmetric faults, transient stability, relaying and protection. Three lecture hours per week.
Prerequisite(s): ECE 317 or ECE 3171

ECE 4431 Vehicular Pwr Sys & Loads 4 Credit Hours
This is an introductory course on power systems and load analysis with focus on automotive applications. The objectives are to familiarize the students with the basic principles and concepts of vehicular power systems and loads. Students are expected to be able to analyze and design basic vehicular power systems. The topics covered in this course include an overview of power systems, vehicular power system architecture, DC and AC power grid in vehicular systems, power system stability, reliability, reactive power control, load flow analysis, short circuit analysis, and vehicular power system protection. Four lecture hours per week.
Prerequisite(s): ECE 317 or ECE 3171
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if College is Engineering and Computer Science

ECE 4432 Renewable Elec Pwr Sys 4 Credit Hours
This course is an introduction to traditional power grids as well as renewable electric power systems. This course covers long-distance transmission of electric power with emphasis on admittance and impedance modeling of components and systems, complex power-flow studies, symmetrical and unsymmetrical fault calculations, economic operation of large-scale generation and transmission systems, an overview of emerging renewable energy technologies (e.g. wind and solar) and the impact of grid integration of renewable energy on power grids. Students cannot take both ECE 4431 and ECE 4432 for credit. Four lecture hours per week.
Prerequisite(s): ECE 3171
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Major is Computer Engineering, Software Engineering, Industrial & Systems Engin, Mechanical Engineering, Computer & Information Science, Electrical Engineering

ECE 446 Electromechanical Energy Conv 4 Credit Hours
Introduces fundamental concepts and specifications of electromechanical energy conversion: AC and DC machines drive, electric and magnetic storage and transfer, transformer, and performance analysis of AC and DC machines. The topics include principles of energy conversion, permanent magnet synchronous machines, induction machines, and DC machines. The lab projects for the course will focus on modeling, evaluation, and practice of AC and DC machine drives based on computer simulation and DSP based experiments; transient and dynamic analysis; linearization and small signal analysis of machines. Four lecture/laboratory hours per week.
Prerequisite(s): ECE 311 and (ECE 317* or ECE 3171*)

ECE 450 Analog and Digital Comm Sys 4 Credit Hours
Topics include introduction to communication systems, base band communications, sampling theorem, amplitude and frequency modulation system design, statistical analysis of error and performance, digital modulation of analogy signals, digital communication and digital modulation schemes, random processes and applications in digital communications, and noise analysis, optimal receiver. Four lecture hours per week.
Prerequisite(s): (ECE 317 or ECE 3171) and IMSE 317

ECE 451 Signal Detection 3 Credit Hours
Introduction to signal detection, parameter estimation and information extraction theory and its application to communication systems. Subject areas covered within the context of a digital environment are decision theory, detection and estimation of known and random signals in noise, adaptive recursive digital filtering, optimal linear filtering and pattern recognition. Three lecture hours.
Prerequisite(s): ECE 450

ECE 452 Probabilistic Meth/Signal Alys 3 Credit Hours
Introduction to probability, random processes, correlation functions, and spectral density. Response of linear systems to random inputs. Applications in the field of communications.
Prerequisite(s): ECE 300

ECE 454 Intr to Modern Wireless Comm 3 Credit Hours
This course provides an introduction to the fundamentals of modern wireless communication. The focus of this course will be on the (i) basic signal propagation issues and channel impairments, (ii) modulation schemes and bandwidth/power trade-offs, and (iii) overcoming channel impairment using equalizers, diversity and channel coding. Additionally case studies will examine current wireless LANs and cellular system. Three Hours of lecture per week.
Prerequisite(s): ECE 450 or ECE 471
Restriction(s):
Cannot enroll if Class is Freshman or Sophomore
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 456 Intro to Electro-optics 3 Credit Hours
Laser sources, detectors, imaging systems, optical signal processing, illumination and image acquisition, triangulation, and fiber optics. Three one-hour lecture periods.
Prerequisite(s): ECE 311 and ECE 321

ECE 460 Automatic Control Systems 4 Credit Hours
Modeling and response of dynamic systems. Transfer functions, poles and zeros and their significance to transient and steady state response of feedback systems. Analysis of stability of closed-loop systems. Steady state errors and transient performance of closed-loop systems. Design of feedback control systems by root locus techniques and by frequency domain methods. Laboratory projects include modeling, controller design, controller realization, system performance evaluation, and simulation studies. Three lecture hours and one three hour laboratory per week.
Prerequisite(s): ECE 317 or ECE 3171
Corequisite(s): ECE 460L

ECE 464 Robotics 4 Credit Hours
An overview of robotics systems and current technology. Spatial descriptions and transforms. Lagrange and Newton-Euler equations of motion. Path planning and trajectory calculations. Direct and inverse kinematics and dynamics of open articulated chains. Feedback control problems in manipulators.
Prerequisite(s): (ECE 300 or ECE 365) and ME 265

ECE 4641 Robotics II 4 Credit Hours
This is the second of a two-course sequence introducing foundational theory and applications of robotics engineering. The topics of this course include embedded computing, locomotion, localization, dead reckoning, inertial sensors and perception, navigation, multi-robotics systems, and human-robot interaction, and complex response processes. Three lecture hours and one three hour laboratory per week.
Prerequisite(s): ECE 3641 and ECE 370 and IMSE 317
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 465 Digital Control Desgn and Imp 4 Credit Hours
Discrete model of a continuous-time system. Differential equations and Z-transforms. Similarities and differences between discrete-time and continuous-time models. Translation of analog designs to digital designs. State-space methods including state feedback and observers. Hardware limitations and implementation issues. Four lecture/laboratory hours per week.
Prerequisite(s): ECE 460

ECE 467 Digital Forensics II 4 Credit Hours
This course is a continuation of Digital Forensics I and will focus on Internet Forensics. Students will examine in-depth concepts in Internet evidence collection and preservation, as well as applications of contemporary commercial forensic investigative software.
Prerequisite(s): (ECE 387 or CIS 387) and (ECE 471* or CIS 427*)
Restriction(s):
Cannot enroll if Class is Freshman
Cannot enroll if Level is Rackham or Graduate
Cannot enroll if College is Business

ECE 470 Computer Int and Data Comm 4 Credit Hours
Hardware and software techniques used in interfacing between computers and other computers or devices. Analog and digital techniques. Parallel and serial communications. Popular communication protocols. Error detection and correction. Lab project involves interfacing and communicating with a microprocessor.
Prerequisite(s): ECE 372

ECE 471 Comp Networks/Data Comm 4 Credit Hours
Hardware and software techniques used in interfacing between computers and other computers or devices. Data transmission techniques and protocols. Introduction to popular local area network protocols. Forward Error Control Techniques and Data Compression. Introduction to wireless communications with focus on major challenges and obstacles and the cellular phone infrastructure. Term projects involve developing a data link layer protocol for interfacing and communication with microprocessors. Four lecture hours per week.
Prerequisite(s): (ECE 372 or ECE 3731) and (IMSE 317 or BENG 364)

ECE 473 Embedded System Design 4 Credit Hours
This course studies the issues dealing with real-time embedded system design. Topics include: microprocessor architecture, assembly language, real-time programming, space and time limitations, relations between ANSIC Compiler output and assembly language, compiler linkers and using a system development package for C programming. (F,W,S).
Prerequisite(s): ECE 372 or ECE 3731
Corequisite(s): ECE 473L

ECE 474 Compiler Design 3 Credit Hours
Principles of language compilation. Introduction to formal languages. Lexical analysis, top-down and bottom-up parsing, code generation and optimization. Error handling and symbol table management. Run-time storage management. Programming language design. Introduction to compiler-writing tools. A software design project is required. Three lecture hours per week.
Prerequisite(s): ECE 370

ECE 475 Comp Hardware Org/Design 4 Credit Hours
Design methodology, performance analysis using probability and statistic methods, hardwired and microprogramming in CPU design, hardware design languages and memory design. Advanced concepts in computer architecture. A design project is required. Three lecture hours per week and one three-hour laboratory per week.
Prerequisite(s): ECE 375

ECE 476 Intro to Parallel Processing 3 Credit Hours
Advances in computer architecture, parallel structures, performance evaluation, memory bandwidth considerations, processing bandwidth, communication and synchronization. A design project is required. Three lecture hours per week.
Prerequisite(s): ECE 375

ECE 478 Operating Systems 4 Credit Hours
Introduction to computer operating systems. Process management, threads, CPU scheduling, memory management, process synchronization, file systems and I/O devices. Selected advanced topics, e.g., distributed systems, deadlock, I/O, job scheduling, and performance analysis using queueing models, will be introduced. Case studies of modern operating systems. A design project is required. Four lecture hours per week.
Prerequisite(s): ECE 370 and IMSE 317

ECE 479 Artificial Intelligence 3 Credit Hours
Basic concepts and methodology of artificial intelligence from a computer engineering perspective. Emphasis is placed on the knowledge representations, reasoning and algorithms for the design and implementation of intelligent systems. Introduction to an AI language and representative intelligence systems. A design project is required. Three lecture hours per week.
Prerequisite(s): ECE 370

ECE 480 Intro to Dig Signal Processing 4 Credit Hours
Fundamentals of discrete-time signals and systems. Introduction to z-transform and its applications. Design of digital filters. Characteristics of analog-to-digital and digital-to-analog converters. Fourier transform of sequences, DFT and FFT algorithms. An introduction to software tools for the simulation and design of real time-digital filters. Implementation of digital systems using digital signal processing boards. Three hours lecture and three hours laboratory experiments per week.
Prerequisite(s): (ECE 317 or ECE 3171) and (MATH 217 or MATH 227 or MATH 228)
Corequisite(s): ECE 480L
Restriction(s):
Can enroll if College is Engineering and Computer Science

ECE 488 Introduction to Machine Vision 4 Credit Hours
Applications to machine vision. Representative topics are: optics and lighting, sensor characteristics, image acquisition, image analysis, segmentation, connectivity, shape description, hardware for vision applications, software considerations, applications including automatic inspection and metrology. Open lab and project will be required.
Prerequisite(s): ECE 270
Restriction(s):
Can enroll if Class is Senior

ECE 4881 Introduction to Robot Vision 3 Credit Hours
This course introduces the theories and modern technologies in robot vision. Topics include sensors, image analysis, region and segmentation, object recognition, stereo vision, optical flow, color image, object tracking and applications. Students cannot receive credit for both ECE 4881 and ECE 588. Three lecture hours per week.
Prerequisite(s): ECE 270
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ECE 490 Selected Topics in Elec Engin 1 to 3 Credit Hours
Advanced or applied topics in electrical engineering offered according to student's interest and availability of instructors and equipment. Lecture hours, laboratory, and/or computation period to be arranged.

ECE 491 Directed Studies 1 to 4 Credit Hours
Student in consultation with a faculty advisor will prepare a proposal in sufficient detail describing a subject topic to be studied. The proposal will be subject to approval by the department. A formal written and oral evaluation of the work performed are required for successful completion. Lecture hours, laboratory, and/or computation periods to be arranged.
Restriction(s):
Can enroll if Class is Senior or Graduate

ECE 492 Directed Research 1 to 4 Credit Hours
Student, in consultation with a faculty advisor will prepare a proposal in sufficient detail describing a research problem to be studied. The proposal will be subject to approval by the department. A formal written and oral evaluation of the research performed are required for successful completion. Lecture hours, laboratory, and/or computation period to be arranged.
Restriction(s):
Can enroll if Class is Senior or Graduate

ECE 493 Design Factors in Eng 2 Credit Hours
This course is comprised of a series of lectures on the subject of design. It will promote awareness of such factors as literature review, performance specifications, design considerations, product liability, standards and ethics, professional registration codes, patents and copyrights, packaging, documentation and report preparation. Two lecture hours.
Restriction(s):
Can enroll if Class is Senior or Graduate

ECE 495 Micro Systems Design 4 Credit Hours
Course content includes discussion and laboratory experience on a number of interfacing topics (timing, serial and parallel communication, ADC/DAC, control loop) and the preparation of a major report on a design topic approved by the course instructor. Team design projects may involve either software or hardware, or both. Two lecture hours and two three-hour laboratories per week.
Prerequisite(s): ECE 373 and (ECE 311 or ECE 316)

ECE 4951 Sys Desgn and Microcontrollers 3 Credit Hours
Techniques for interfacing actuators and sensors to computers with emphasis on the use of a variety of microprocessors and a broad range of sensors. Topics include introduction to small microprocessors such as PIC16, PIC18, small systems such as oopic, basicx as well as using a PC as a controller. Control of motors and other actuators using opto-isolators and discrete electronics, use of H-bridges. Interfacing sensors that provide different encoding data, such as analog signals, digital communication using I2C protocol, handshake I/O, pulse width encoding. Interfacing to wireless communication using RF or IR. Includes laboratory experiments, individual midterm project and a final team project. Three lecture hours per week. (F,W)
Prerequisite(s): ECE 311 and (ECE 372 or ECE 3731)

ECE 498 Senior Engineering Design 3 Credit Hours
This course is conducted as a guided project design course over a two-semester period, with the class divided into teams, each assigned a specific design project. Periodic progress reports, a final written report, an oral presentation and project demonstration are required. Cost analysis, evaluation of design alternatives and application of engineering principles will be emphasized. A series of lectures on design issues will be presented in the first semester.
Prerequisite(s): (ECE 311 or ECE 316) and ECE 373

ECE 4981 Electrical Engineering Des I 2 Credit Hours
This course is conducted as a guided project design course over a two semester period, with the class divided into teams, each assigned a specific design project. Periodic progress reports, a final written report, an oral presentation and project demonstration are required. Cost analysis, societal impact, safety issues, evaluation of design alternatives and application of engineering principles will be emphasized. A series of tutorials will be presented to provide student teams with insight into important system level considerations and trade offs.
Prerequisite(s): (COMP 270 or COMP 106 or COMP 220 or COMP 280) and (ECE 317 or ECE 3171) and (ECE 372 or ECE 3731) and (ECE 414 or ECE 415 or ECE 450 or ECE 460 or ECE 480 or ECE 4951)
Restriction(s):
Can enroll if Class is Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 4982 Computer Engineering Des I 2 Credit Hours
This course is conducted as a guided project design course over a two semester period, with the class divided into teams, each assigned a specific design project. Periodic progress reports, a final written report, an oral presentation and project demonstration are required. Cost analysis, societal impact, safety issues, evaluation of design alternatives and application of engineering principles will be emphasized. A series of tutorials will be presented to provide student teams with insight into important system level considerations and trade offs.
Prerequisite(s): (COMP 270 or COMP 106 or COMP 220 or COMP 280) and (ECE 372 or ECE 3731) and ECE 375 and (ECE 471 or ECE 473 or ECE 475 or ECE 478)
Restriction(s):
Can enroll if Class is Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 4983 Electrical Engin Design II 2 Credit Hours
Second Semester ? Electrical Engineering Design This course is conducted as a guided project design course over a two semester period, with the class divided into teams, each assigned a specific design project. Periodic progress reports, a final written report, an oral presentation and project demonstration are required. Cost analysis, societal impact, safety issues, evaluation of design alternatives and application of engineering principles will be emphasized.
Prerequisite(s): ECE 4981
Restriction(s):
Cannot enroll if Class is Freshman or Sophomore or Junior
Can enroll if College is Engineering and Computer Science

ECE 4984 Computer Engin Design II 2 Credit Hours
Second Semester Computer Engineering Design This course is conducted as a guided project design course over a two semester period, with the class divided into teams, each assigned a specific design project. Periodic progress reports, a final written report, an oral presentation and project demonstration are required. Cost analysis, societal impact, safety issues, evaluation of design alternatives and application of engineering principles will be emphasized.
Prerequisite(s): ECE 4982
Restriction(s):
Cannot enroll if Class is Freshman or Sophomore or Junior
Can enroll if College is Engineering and Computer Science

ECE 4985 Electrical Engineering Design 3 Credit Hours
This course is conducted as a guided project design course over a two-semester period, with the class divided into teams, each assigned a specific design project. Periodic progress reports, a final written report, an oral presentation and project demonstration are required. Cost analysis, societal impact, safety issues, evaluation of design alternatives, and application of engineering principles will be emphasized. A series of lectures on design issues will be presented in the first semester.
Prerequisite(s): (COMP 270 or COMP 106 or COMP 220 or Composition Placement Score with a score of 40 or Composition Placement Score with a score of 107) and (ECE 317 or ECE 3171) and ECE 372 and (ECE 414 or ECE 415 or ECE 450 or ECE 460 or ECE 480 or ECE 4951)
Restriction(s):
Can enroll if Class is Senior

ECE 4986 Computer Engineering Design 3 Credit Hours
This course is conducted as a guided project design course over a two-semester period, with the class divided into teams, each assigned a specific design project. Periodic progress reports, a final written report, an oral presentation, and application of demonstration are required. Cost analysis, societal impact, safety issues, evaluation of design alternatives and application of engineering principles will be emphasized. A series of lectures on design issues will be presented in the first semester.
Prerequisite(s): (COMP 270 or Composition Placement Score with a score of 40 or Composition Placement Score with a score of 107 or COMP 106 or COMP 220) and (ECE 317 or ECE 3171) and ECE 372 and ECE 375 and (ECE 471 or ECE 473 or ECE 478 or ECE 475)
Restriction(s):
Can enroll if Class is Senior

ECE 4987 Robotics Engineering Design I 2 Credit Hours
This course is conducted as a guided project design course over a two-course sequence, with the class divided into teams, each assigned a specific design project. Periodic progress reports, a final written report, an oral presentation and project demonstration are required. Cost analysis, societal impact, safety issues, evaluation of design alternatives and application of engineering principles will be emphasized. A series of tutorials will be presented to provide student teams with insight into important system level considerations and trade offs.
Prerequisite(s): ECE 311 and ECE 3171 and (ECE 372 or ECE 3731) and ECE 3641 and (ECE 460 or ECE 4641)
Restriction(s):
Can enroll if Class is Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 4988 Robotics Engineering Design II 2 Credit Hours
Second semester Robotics Engineering Design: This course is conducted as a guided project design course over a two-course sequence, with the class divided into teams, each assigned a specific design project. Periodic progress reports, a final written report, an oral presentation and project demonstration are required. Cost analysis, societal impact, safety issues, evaluation of design alternatives and application of engineering principles will be emphasized.
Prerequisite(s): ECE 4987
Restriction(s):
Can enroll if Class is Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ECE 499 Internship/Co-op 1 Credit Hour
A four-month professional work experience period of the Engineering Internship Program, integrated and alternated with the classroom terms.
Restriction(s):
Can enroll if Class is Senior

* An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally