ELECTRICAL AND COMPUTER ENGINEERING (ECEN)

ECEN 1100 Introduction to ECE 1 Credit
Department: College of Engineering
This course introduces various topics in electrical and computer engineering. Technical topics include analog and digital systems. Technical skills include hands-on, design thinking, problem-solving, and computer-aided design. Other topics include information about electrical and computer engineering fields, ethics in engineering, curricula, and students' services, resources, and opportunities. 1-hour lab work includes signal processing with software and hardware implementations of digital and analog circuits.
Prerequisite(s)/Corequisite(s): MATH 2413

ECEN 1301 Computers and Programming I 3 Credits
Department: College of Engineering
Study of digital computer principles, program organization, algorithm development, and implementation using high-level languages, such as C/C++ and/or Python. Topics include number systems, data types, input/output, logical operations, selections, repetitions, functions, arrays, and structures.
Prerequisite(s)/Corequisite(s): MATH 2413

ECEN 3313 Signals, Systems and Transforms 3 Credits
Department: College of Engineering
High-level representation of systems in both continuous and discrete time domains; properties of systems; description of continuous and discrete signals and their properties; zero-pole representations; Laplace and Fourier-based analyses; the concept of sampling and the sampling theorem.
Prerequisite(s): ECEN 2311 and ECEN 2111 and MATH 2320

ECEN 3421 Electronics I 4 Credits
Department: College of Engineering
Topics include basic physics and operation of semiconductor electronic devices, analysis, and design of electronic circuits including diodes, BJT, MOSFET, and JFET transistors, and their applications, and operational amplifier concepts, circuits analysis, and design, and applications. 3-hour laboratory included.
Prerequisite(s): ECEN 2311 and ECEN 2111 and MATH 2415

ECEN 3431 Digital System Design I 4 Credits
Department: College of Engineering
Introduction to the engineering of digital systems. Topics include logic gates, combinational and sequential circuits, finite-state machines, pipelining, and complete computer systems. 3-hour laboratory design content.
Prerequisite(s): ECEN 1100 and ECEN 1301

ECEN 4304 Advanced Topics 3 Credits
Department: College of Engineering
Topics are selected on the basis of the needs of an adequate number of students. May be repeated for credit when topics vary. Topics include artificial neural networks, digital signal processing, advanced electromagnetics, fault tolerant design, fiber optics, advanced power systems, and VLSI (very large scale integrated circuit) design.
May be Repeated for a maximum of 12 hours

ECEN 4305 Essentials of Low Power Design Methodologies 3 Credits
Department: College of Engineering
This introductory course covers the basic design of low-power circuitry in deep submicron technologies. The course also deals with the impact of soft errors in VLSI and introduces the reliability issues of low power designs. Topics studied include leakage power, short channel effects and basic leakage mechanisms such as sub-threshold and gate leakage, leakage minimization techniques such as transistor stacking, basic interconnect design, Synopsys HSpice simulation tool introduction, soft errors in advanced computer systems, error mechanisms, error rate, basic mitigation methodologies and impact of power optimizations on chip reliability.
Prerequisite(s): ECEN 3431

ECEN 4306 Senior Project Design I 3 Credits
Department: College of Engineering
This course is based on group design projects. Students work in teams to plan and develop proposals for their selected projects. Topics include engineering professionalism, ethics, design methodology, project management, development of standards, specifications and constraints, and evaluation of alternatives. Students make oral presentation and submit written reports on their proposed projects. Each student also prepares a technical paper and a poster on a separate topic. In lieu of the published prerequisites, other courses can be required by the instructor depending on the project. This is not to exceed the maximum of 11 hours set by the published prerequisites.
Prerequisite(s): ECEN 3313 and ECEN 3421 and ECEN 4486

ECEN 4307 Senior Project Design II 3 Credits
Department: College of Engineering
In this course, students complete the design projects proposed in ECEN 4306. Students perform the design synthesis, analysis, construction, testing, and evaluation of their team projects. This course is a study of engineering fields and profession, technology/society interface, new areas of electrical and computer engineering involvement, professional development, ethics, and standards. Students make oral presentation and submit written reports on their proposed projects. Each team also prepares a poster and a demo video on their project.
Prerequisite(s): ECEN 4306

ECEN 4308 Process Instrumentation & Measurement Systems 3 Credits
Department: College of Engineering
This course provides senior-level engineering students a comprehensive knowledge to instrumentation and measurement systems used in process control systems. With an emphasis on common industrial applications, this course covers the instrumentation measurements of temperature, pressure, level, and flow, in addition to position, humidity, moisture, and typical liquid and gas measuring instruments. Scientific principles and detailed illustrations will be used to present the course content.
Prerequisite(s): ECEN 2311 and ECEN 2111 and PHYS 2426

ECEN 4315 Introduction to Robotics 3 Credits
Department: College of Engineering
Robotics is a relatively young field of modern technology that crosses traditional engineering boundaries. Understanding the complexity of robots and their applications requires knowledge of electrical engineering, mechanical engineering, systems and industrial engineering, computer science, economics and mathematics. New disciplines of engineering, such as manufacturing engineering, applications engineering and knowledge engineering have emerged to deal with the complexity of the field of robotics and factory automation. This course is concerned with fundamentals of robotics, including kinematics, dynamics, motion planning, computer vision and control. The goal is to provide a complete introduction to the most important concepts in these subjects as applied to industrial robot manipulators, mobile robots and other mechanical systems. A complete treatment of the discipline of robotics would require several courses. Nevertheless, at the present time, the majority of robot applications deals with industrial robot arms operating in structured factory environments so that a first introductory course must include a rigorous treatment of such robots.
Prerequisite(s): ECEN 3313 and ECEN 4486

ECEN 4317 PLC Programming 3 Credits
Department: College of Engineering
This course teaches electrical engineering undergraduate students the concepts, methods of analysis, and design of programmable logic controllers and systems. Topics include programmable logic controllers, ladder logic programming, and PLC operations.
Prerequisite(s): ECEN 3431
Restriction(s):
Enrollment limited to students with a class of Senior.

ECEN 4318 Introduction to VLSI CAD Tools 3 Credits
Department: College of Engineering
The course introduces some basic industry-grade computer-aided-design (CAD) tool skills used to facilitate the design, verification and analysis of VLSI. The course begins with an introduction to CMOS design and process technologies. Then it covers basics interconnect design and noise analysis. Industry tools such as Synopsys Hspice, and Microwind layout tools will be introduced and studied using simple circuits. Overview of parasitic extraction, layout verification, interconnect design and timing analysis are also given. Optical interconnect introduction is also discussed. The course also introduces Verilog Programming, a desired skill sought by industry.
Prerequisite(s): ECEN 3431

ECEN 4321 Cyber Security 3 Credits
Department: College of Engineering
This course provides an overview of cyber security. The course primarily discusses the principles and design of cryptography and network security, which serves as the basis for cybersecurity. Topics include cryptographic methods, key distribution, protocols for authenticated and confidential communications, and the practice of network security.
Prerequisite(s): ECEN 3431

ECEN 4324 CMOS Digital IC DSN 3 Credits
Department: College of Engineering
Digital Integrated Circuit Analysis and Design. Design of CMOS switch level circuits, transmission gate logic, review of standard CMOS fabrication processes, device and interconnect analysis, scaling induced challenges on performance and testing, deep submicron issues, various simulation tools.
Prerequisite(s): ECEN 3421 and ECEN 3431

ECEN 4325 Testing of Advanced VLSI Circuits 3 Credits
Department: College of Engineering
Following an introduction on the course design and analysis of digital COMS VLSI, this course covers important concepts of CMOS- based digital system design and testing. The first part of the course introduces basics on gate sizing, transmission, gate logic design, interconnect delay optimization, clock networks and power integrity challenges. The course then introduces VLSI testing issues. Students will learn how to use test sequences for stuck at faults, transistor stuck on/open faults for simple circuits and describe controllability and observability measures. The course will then study testability and pseudorandom test techniques. Introduction to alternative testing, methodologies such as IDDQ and IBMs picosecond light emission testing will also be given.
Prerequisite(s): ECEN 3431

ECEN 4336 Instrumentation & Automation Systems 3 Credits
Department: College of Engineering
Study of electronic instrumentation systems for performing engineering measurements on electrical, mechanical, and fluid systems. Design of modern computerized industrial control and automation systems. The topics covered include: architectures of instrumentation and industrial control and automation systems IAS; signal conditioning circuits; recording systems; measurement systems for: strain, force, displacement, velocity, acceleration, temperature, fluid mass/velocity, and vibration; digital-interface; PID-controls; open system buses.
Prerequisite(s): ECEN 3313
Restriction(s):
Students with a class of Freshman or Sophomore may **not** enroll.

ECEN 4366 Image Processing Fundamentals 3 Credits
Department: College of Engineering
This course introduces the fundamentals of Image Processing. Topics include discussions of basics of digital imaging, intensity transformations and spatial filtering, filtering in frequency domain, image restoration and reconstruction, color image processing, image compression, and introduction to morphological image processing.
Prerequisite(s): ECEN 3313

ECEN 4387 Computer Organization and Architecture 3 Credits
Department: College of Engineering
This course primarily discusses computer organization and architecture. Topics include advanced assembly language, microcomputer organization, computer memory system, interfacing with peripheral and I/O devices, CPU design, and microsequencer control unit design. One and a half hours of design content.
Prerequisite(s): ECEN 4486

ECEN 4486 Embedded Microprocessor Systems 4 Credits
Department: College of Engineering
In-depth introduction to assembly language programming and microcomputer architecture. Topics include an overview of the programming model, the instruction execution cycle, an in-depth overview of the architecture of the specific CPU, its registers, Assembly instructions, addressing modes, and an introduction to Inline. The course includes 3-hour lab work.
Prerequisite(s): ECEN 3431

ECEN 5301 Special Topics 3 Credits
Department: College of Engineering
An investigation into specialized study in advanced areas of engineering under guidance of a faculty member. This course may be repeated for credit when topics of investigation differ.
May be Repeated for a maximum of 12 hours
Restriction(s):
Undergraduate level students may **not** enroll.

ECEN 6355 Advanced Electric Machine and PE Drive 3 Credits
Department: College of Engineering
This course focused on the latest innovations in electric drives. The objective is to explore energy conversion, management principles, and advanced control strategies using state-of-the-art simulation tools like MATLAB/Simulink. Students will engage with real-world case studies to understand the dynamics of AC and DC drives, induction machines, and vector control's intricacies in induction and permanent magnet synchronous motors. The course also covers the design and optimization of Switched Reluctance Motor drives, emphasizing performance enhancement across various industries. By integrating hands-on simulations with theoretical learning, this course equips students with the expertise to innovate and improve electric drive technologies.
Prerequisite(s): ELEN 3441 and ELEN 4351
Restriction(s):
Undergraduate level students may **not** enroll.

ECEN 6356 Advanced Power System Monitoring and Protection 3 Credits
Department: College of Engineering
This doctoral-level course takes a project-based research approach to advanced power system monitoring and protection. Students will go beyond conventional relay theory to design, implement, and test advanced protection and monitoring schemes under realistic system conditions. Emphasis is placed on hands-on projects using simulation platforms (PSCAD, OPAL-RT, MATLAB/Simulink), synchrophasor data analytics, and cyber-physical testbeds. Projects will explore cutting-edge themes including adaptive relaying, wide-area monitoring and protection (WAMPAC), inverter-based resource protection, and cyber-resilient architectures. Each project is structured to mimic professional research practice: problem definition, model development, simulation/implementation, data analysis, and presentation in a publishable format.
Prerequisite(s): ELEN 3441 and ELEN 4351
Restriction(s):
Undergraduate level students may **not** enroll.