Elective Courses

All ECE Undergraduate Students are required to take Elective Courses. Below, you will find a list of ALL the Elective Courses offered by our department. Courses that are highlighted in Yellow are offered during the Spring Semester of 2017. Courses Offered during the Summer Semester are labeled with an asterisk (*). As always, remember to review your degree audit to ensure requirements are being met. For any questions or concerns, please contact your Academic Advisor.

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**EE Foundation Electives**

**EE Major:** Choose any 2 courses; CPE Majors have NO foundation electives

**E 304: Introduction to Nano Science and Technology, Instructor: L. Lunardi**
Fundamentals Concepts of Nano-Science and Technology including scaling, nano-scale physics, materials, mechanics, electronics, heat transfer, photonics, fluidics, and biology. Applications of nano-technology.
Prerequisite: MA 242 and PY 208 with grade of C- or higher

**ECE 305: Principles of Electromechanical Energy Conversion, Instructor: L. White**
Three-phase circuits and power flow, analysis of magnetic circuits, performance of single-phase and three-phase transformers, principles of electromechanical energy conversion, steady-state characteristics and performance of alternating current and direct current machinery.
Prerequisite: C- or better in ECE 211 or ECE 331

**ECE 308: Elements of Control Systems, Instructor: A. Rindos**
Analog system dynamics, open and closed loop control, block diagrams and signal flow graphs, input-output relationships, stability analyses using Routh-Hurwitz, root-locus and Nyquist, time and frequency domain analysis and design of analog control systems. Use of computer-aided analysis and design tools. Class project. EE, CPE, BME majors only.
Prerequisite: (ECE 220 and ECE 211) or BME 311; Co-requisite: ECE 301

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**EE Electives**

**EE Majors:** Choose 2 courses from within any one area

**Comm, Sig, Proc Sys**

*ECE 402: Communications Engineering, Instructor: J. K. Townsend (Spring and Summer)*
An overview of digital communications for wireline and wireless channels which focuses on reliable data transmission in the presence of bandwidth constraints and noise. The emphasis is on the unifying principles common to all communications systems, examples include digital telephony, compact discs, high-speed modems and satellite communications.
Prerequisite: ECE 301 and ST 371

**ECE 420: Wireless Communication Systems, Instructor: S. Alexander**
A study of applications of communication theory and signal processing to wireless systems. Topics include an introduction to information theory and coding, basics and channel models for wireless communications, and some important wireless communication techniques including spread-spectrum and OFDM. MATLAB exercises expose students to engineering considerations.
Prerequisite: ECE 402

*ECE 421: Introduction to Signal Processing, Instructor: D. Baron (Summer: S. Alexander)*
Control Sys

ECE 436: Digital Control Systems, Instructor:
Discrete systems dynamics, sampled-data systems, mathematical representations of analog/digital and digital/analog conversions, open- and closed-loop systems, input-output relationships, state-space and stability analyses, time- and frequency-domain analyses. Design and implementation of digital controllers.
Prerequisite: ECE 435

ECE 455 Industrial Robotic Systems, Instructor: F. Livingston
Techniques of computer control of industrial robots: interfacing with synchronous hardware including analog/digital and digital/analog converters, interfacing noise problems, control of electric and hydraulic actuators, kinematics and kinetics of robots, path control, force control, sensing including vision. Major design project. EE, CPE, BME, JEM majors only.
Prerequisite: ECE 435

Circ, E&M Sys

ECE 403: Electronics Engineering, Instructor: G. Bilbro
Design and analysis of CMOS integrated circuits, from single transistor stages to operational amplifiers. Feedback in operational amplifier circuits, compensation and stability. ECE majors only.
Prerequisite: ECE 301, ECE 302

ECE 422: Transmission Lines and Antennas for Wireless, Instructor:
Review of time-varying electromagnetic theory. A study of the analytical techniques and the characteristics of several useful transmission lines and antennas. Examples are coaxial lines, waveguides, microstrip, optical fibers and dipole, monopole and array antennas.
Prerequisite: ECE 403

Nano Sys

ECE 404: Introduction to Solid-State Devices, Instructor: S. Bedair
Basic principles required to understand the operation of solid-state devices. Semiconductor device equations developed from fundamental concepts. P-N junction theory developed and applied to the analysis of devices such as varactors, detectors, solar cells, bipolar transistors, field-effect transistors. Emphasis on device physics rather than circuit applications.
Prerequisite: ECE 302 or E 304

ECE 423: Introduction to Photonics and Optical Communications, Instructor:
This course investigates photonic devices at the component level and examines the generation, propagation, and detection of light in the context of optical communication systems. Topics include the design of simple optical systems and focuses on the use of lasers, fiber optics, and photodetectors. The labs include building a Michelson interferometer, preparing and coupling light to an optical fiber, characterizing LEDs and laser diodes and making a fiber optical link.
Prerequisite: ECE 403 or Permission of the Instructor

ECE 442: Integrated Circuit Technology and Fabrication, Instructor:
Semiconductor device and integrated-circuit processing and technology. Wafer specification and preparation, oxidation, diffusion, ion implantation, photolithography, design rules and measurement techniques.
Prerequisite: ECE 404

Power Sys

ECE 434: Fundamentals of Power Electronics, Instructor:
Design, analysis, modeling and control of DC-DC converters, DC-AC inverters, AC-DC rectifiers/converters, and AC-to-AC converters. Power conversion using switched high-voltage high-current semiconductors in combination with inductors and capacitors. Design of DC-DC, DC-AC, AC-DC, and AC-AC power converters as well as an introductions to design of magnetic components for use in power converters, applications to fuel cells, photovoltaics, motor drives, and uninterruptable power supplies.

Prerequisite: ECE 302 or equivalent

ECE 451: Power System Analysis, Instructor:
Long-distance transmission of electric power with emphasis on load flow, economic dispatch, fault calculations and system stability. Applications of digital computers to power-system problems. Major design project.
Prerequisite: ECE 305

ECE 452: Renewable Electric Energy Systems, Instructor: M. Baran
Principles and characteristics of renewable energy based electric power generation technologies such as photovoltaic systems, wind turbines, and fuel cells. Main system design issues. Integration of these energy sources into the power grid. Economics of distributed generation. Credit is not allowed for both ECE 452 and ECE 552.
Prerequisite: ECE 305 or ECE 331

ECE 453: Electric Motor Drives, Instructor: S. Lukic
Principles of electromechanical energy conversion; analysis, modeling, and control of electric machinery; steady state performance characteristics of direct-current, induction, synchronous and reluctance machines; scalar control of induction machines; introduction to direct- and quadrature-axis theory; dynamic models of induction and synchronous motors; vector control of induction and synchronous motors.
Prerequisite: A grade of C or better in ECE 305.

ECE 552: Renewable Electric Energy Systems, Instructor: M. Baran
Principles and characteristics of renewable energy based electric power generation technologies such as photovoltaic systems, wind turbines, and fuel cells. Main system design issues. Integration of these energy sources into the power grid. Economics of distributed generation. Credit is not allowed for both ECE 452 and ECE 552.
Prerequisite: ECE 305 or ECE 331

CPE Electives

CPE Majors: Choose any 2 Courses

Comp Arch Sys

ECE 463: Advanced Microprocessor Systems Design, Instructor: G. Byrd
Advanced topics in microprocessor systems design, including processor architectures, virtual-memory systems, multiprocessor systems, and single-chip microcomputers. Architectural examples include a variety of processors of current interest, both commercial and experimental. Major design project.
Prerequisite: ECE 406

ECE 464: ASIC Design, Instructor:
Design of digital application specific integrated circuits (ASICs) based on hardware description languages (Verilog, VHDL) and CAD tools. Emphasis on design practices and underlying algorithms. Introduction to deep sub-micron design issues like interconnections and low power and to modern applications including multi-media, wireless. Telecommunications and computing. Required design project.
Prerequisite: ECE 406, ECE 302

Embedded Sys

ECE 461: Embedded System Design, Instructor: A. Dean
Design and implementation of software for embedded computer systems. The students will learn to design systems using microcontrollers, C and assembly programming, real-time methods, computer architecture, interfacing system development and communication networks. System performance is measured in terms of power consumption,
speed and reliability. Efficient methods for project development and testing are emphasized. Credit will not be awarded for both ECE 461 and ECE 561. Restricted to CPE and EE Majors.

Prerequisite: Grade of C- or better in ECE 306.

**Networking Sys**

**ECE 407: Introduction to Computer Networking, Instructor: W. Wang**

This course focuses on engineering principles of computer communications and networking, including layering concepts, overview of protocols, architectures for local, metropolitan, and wide-area networks, routing protocols, internet operations, transport control and applications, emerging issues in computer networks. EE and CPE majors only.

Prerequisite: ECE 301

**ECE 470: Internetworking, Instructor: I. Viniotis**

Introduction, Planning and Managing networking projects, networking elements-hardware, software, protocols, applications; TCP/IP, ATM, LAN emulation. Design and implementation of networks, measuring and assuring network and application performance; metrics, tools, quality of service. Network-based applications, Network management and security.

Prerequisite: ECE 407 or CSC 401

**Software Sys**

**ECE 466: Compiler Optimization and Scheduling, Instructor:**

Provide insight into current compiler designs dealing with present and future generations of high performance processors and embedded systems. Investigate dataflow analysis and memory disambiguation, classical and parallelism enhancing optimizations, scheduling and speculative execution, and register allocation. Review of techniques used in current research compilers.

Prerequisite: ECE 306 and either ECE 309 or CSC 316

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**ECE Electives**

All ECE Majors: Choose any 2 EE, CPE or ECE Electives

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**Special Topic Courses**

**ECE 492-008: Expr Electronic, Instructor: R. Kolbas**

Laboratory-based analog electronics lab. Students will buy their own supplies and build numerous projects and circuits.

Prerequisite: Knowledge and experience from ECE 302

**ECE 492-018: Architecture of Parallel Computers, Instructor:**


Prerequisites: Knowledge and experience from ECE 406

**ECE 492-029: Radio Systems and Design, Instructor: D. Ricketts**

In this course you will learn how modern radios work, like those in your cell phone and in the wi-fi connection to your laptop. This course will cover the basics of communication theory and how physical signals relate to information. You will learn the basic building blocks of a modern radio, including digital signal processing and analog circuits and systems. This course will involve labs during class time that will allow you to get hands on experience with both communication techniques as well as radio circuit and system design. The course will culminate with group projects where you will build a fully functional 1 GHz 16 QAM radio, using off the shelf components as well as components that you design yourself.

Prerequisite: None

**ECE 492-030: Systems Biology Modeling of Plant Regulation, Instructor:**
The aim of this course is to provide an introduction to the field of systems biology with a focus on mathematical modeling, gene regulatory network and metabolic pathway reconstruction in plants. Students will learn approaches that are used to integrate biological data with mathematical, statistical, and computational approaches to gain new insights into structure and behavior of complex cellular systems.

Prerequisites: None

ECE 492-035, Instructor:
This course is an introduction to the hardware and software used for business-centric ("enterprise") computing. Examples of enterprise applications include databases and web services. Computing platforms (mainframes, clusters), networks, and storage systems will be discussed, as well as modern data centers. Hands-on projects will be included.

Prerequisites: None

ECE 492-036: Solid State Solar and Thermal Energy Harvesting, Instructor:
This course studies the fundamental and recent advances of energy harvesting from two of the most abundant sources namely solar and thermal energies. The first part of the course focuses on photovoltaic science and technology. The characteristics and design of common types of solar cells is discussed and the known approaches to increasing solar cell efficiency will be introduced. After the review of the physics of solar cells, we will discuss advanced topics and recent progresses in solar cell technology. The second part of the course goes over the basic phenomenology of the contributing terms to the thermoelectric effect, i.e., the Seebeck coefficient, the electrical conductivity, and thermal conductivity, which are analyzed through the Boltzmann transport formalism. A thorough comparison of recent experiments in nanostructures is presented. Advanced subject such as carrier scattering time approximations in relation to dimensionality and the density of states are also studied. Different approaches for further increasing efficiencies are discussed including energy filtering, quantum confinement, size effects, band structure engineering, and phonon confinement.

Prerequisite: E 304 or ECE 404

ECE 492-038: Wearable Biosensors, Instructor:
This course will explore the application of wearable electronics to monitor human biometrics. The first part of the course will introduce the sources of chemical, electrical, and mechanical bio-signals, and the sensing motifs for monitoring each bio-signal. The second part of the course will explore the design, function and limitations of wearable biosensors. Example systems will include wearable electrocardiograms, blood-glucose monitors, electronic tattoos, “smart” clothing, and body area networks. This course will provide students with a general overview of wearable biosensors and the necessary technical background to solve basic problems in engineering systems at the interface of biology and electronics.

Prerequisite: None. Junior, Senior or Graduate standing. Familiarity with basic biology, chemistry and physics (electromagnetics).

ECE 492-039: Embedded System Architectures, Instructor:
This course focuses on software and hardware architectures used for embedded systems. Good architectural choices reduce computing requirements, enabling efficient implementations on low-cost hardware. They further reduce costs by simplifying code maintenance, enhancement and testing.

Prerequisite: None

ECE 492-040: Introduction to Autonomous Systems, Instructor: M Sichitiu
Introduction to unmanned systems, including unmanned ground systems (UGS) and unmanned aerial vehicles (UAVs); the course will focus on principles and implementations common among all these systems, from hardware (e.g., sensors, actuators) to control systems and software. By the end of the course the students will be familiar with the most common implementations of such vehicles, and will work in teams to extend the capabilities of the common platform in one or more directions.

Prerequisite: None