

# ELECTRICAL & COMPUTER ENGR. (ECEG)

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## **ECEG 100. Foundations of Electrical and Computer Engineering. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:2**

Foundational concepts of electrical and computer engineering and introduction to electronic and computing system design principles. Students develop skills in simulation, testing, and programming. Students must have had or be taking MATH 201.

## **ECEG 101. Electrical and Computer Engineering Analysis. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

Introduction to concepts, voltage, current, signals, network elements, and Kirchhoff's laws. Electrical measurements, energy and information generation, storage and transmission. Introduction to logic circuits and switching theory. Not for majors in electrical and computer engineering. Students must have had or be taking MATH 202.

## **ECEG 200. Individual Development. .25-.5 Credits.**

**Offered Both Fall and Spring; Lecture hours:1; Repeatable**

A course that connects students across the department with a focus on reflection, integration of experiences, student agency, and student support. Provides time, space, and support for individual student development.

## **ECEG 201. Introduction to Electrical and Computer Engineering Design. .5 Credits.**

**Offered Either Fall or Spring; Lecture hours:3**

This introductory ECE design course covers basics of electronic design focusing particularly on fabrication, measurement, and professional communication. Students will design, fabricate, and test electronic circuits and learn standards for manufacturability and professional communication. Prerequisite: permission of the instructor.

## **ECEG 205. Electrical and Computer Engineering Fundamentals. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

Electrical measurement and physical quantities, sensors, sensor dynamics, and filters. Corequisite: MATH 202.

## **ECEG 210. Circuit Theory & Application. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

Analysis and design of simple DC and AC circuits including Thevenin equivalents, time domain and sinusoidal response, power transfer, and complex impedance. Design of practical circuits and fundamentals of system integration. Prerequisite: ECEG 100 or permission of the instructor.

## **ECEG 230. Introduction to Engineering Programming. .5 Credits.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

Introduction to algorithmic thinking and programming using Python. Topics include basic variable types, variable scope, declaring and using functions, list processing, essential control structures and data visualization. This course runs during the second half of the semester, after ECEG 241. Prerequisite: ECEG 100 or permission of the instructor.

## **ECEG 240. Digital System Design. 1 Credit.**

**Offered Both Fall and Spring; Lecture hours:3,Lab:2**

Comprehensive introduction to digital logic design. Number systems, combinational logic, synchronous sequential logic, and finite state machines. Overview of programmable logic devices and hardware description languages. Synthesis and optimization of designs from high-level and abstract definitions. Prerequisite: ECEG 100 or ECEG 101 or CSCI 206 or permission of the instructor.

## **ECEG 241. Foundations of Digital Systems. .5 Credits.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

Introduction to digital logic and foundations of computing. Topics include number representation, Boolean algebra, combinational logic, synchronous sequential logic and finite state machines. This course runs during the first half of the semester. Prerequisite: ECEG 100 or permission of the instructor.

## **ECEG 247. Embedded Systems. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:2**

Introduces basic concepts in computer architecture, microcontroller assembly language, C programming, interrupt handling and microcontroller interfacing. Multitasking and real-time operating systems are presented. Laboratory activities emphasize systematic debugging. Prerequisites: (CSCI 203 or ECEG 230) and ECEG 241 or permission of instructor.

## **ECEG 270. Signals and Systems Theory. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:2**

Introduction to the general theory of analog systems with an emphasis on linear and time-invariant systems. Topics include elementary operator theory, Fourier/Laplace analysis, linear network analysis, elementary analog filter design, and sampling interpolation. Prerequisites: ECEG 210 and MATH 202.

## **ECEG 2NT. Electrical and Computer Engineering Non-traditional Study. .25-4 Credits.**

**Offered Fall, Spring, Summer; Lecture hours:Varies**

Non-traditional study in electrical and computer engineering. Prerequisite: permission of the instructor.

**ECEG 301. Praxis of Engineering Design. .5 Credits.**

**Offered Both Fall and Spring; Lecture hours:3**

Hands-on, project-focused introduction to methods of addressing open-ended design challenges in electrical and computer engineering. Emphasis on undertaking design from a systems perspective and the use of graphical, textual, and other technical representations and models in design processes. Prerequisites: ECEG 201 and permission of the instructor.

**ECEG 305. Technology as Service to Humanity. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:2,Other:4; Repeatable**

Team-based, technology design projects in electrical and computer engineering focusing on service to the local community. Emphasis on engineering as service to humanity through project development. Completion of 200-level ECEG courses or equivalent experience required for enrollment. Prerequisites: ECEG 270 and ECEG 247.

**ECEG 308. Independent Study. .25-1 Credits.**

**Offered Either Fall or Spring; Lecture hours:Varies,Other:Varies; Repeatable**

Independent study for first-year students, sophomores, and juniors. Prerequisite: permission of the instructor.

**ECEG 310. ECE Fall Seminar. .5 Credits.**

**Offered Fall Semester Only; Lecture hours:2; Repeatable**

Seminar course focusing on the skills, knowledge, and mindsets helpful in becoming a professional engineer. The course is divided into several short modules. Each module is devoted to a different topic and is taught by a different instructor. External speakers provide context for engineering practice. Taken second year or later.

**ECEG 311. ECE Spring Seminar. .5 Credits.**

**Offered Spring Semester Only; Lecture hours:2**

Seminar course focusing on the skills, knowledge, and mindsets helpful in becoming a professional engineer. The course is divided into several short modules. Each module is devoted to a different topic and is taught by a different instructor. External speakers provide context for engineering practice. Taken second year or later.

**ECEG 341. Electrical & Computer Engineering Systems. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

This course explores the foundational concepts of electrical and computer engineering through the design and evaluation of embedded computing systems. Concepts explored will include basic electricity and circuits, digital logic, conversion of analog and digital signals, microcontroller programming and debugging, and sensor data analysis.

**ECEG 350. Electronics I. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

Introduction to semiconductor components, device physics, and modeling. Applications and practical design considerations of circuits based on operational amplifiers, diodes, voltage regulators, transistors, and CMOS logic gates. Prerequisite: ECEG 210 or permission of the instructor.

**ECEG 351. Electronics II. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:2**

Fundamentals of p-n junctions, power electronics and sensors. The course's emphasis is on the integration of electronics with sensors to design a system. Prerequisite: ECEG 350 or permission of the instructor.

**ECEG 370. Probabilistic System & Data Analysis. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

Introduction to the probabilistic description of signals, systems, and data. Topics include random variables/vectors/processes, statistical data characterization, expectations, information measures, and transformations of random data. The course includes a discussion of the foundations of detection, classification, and estimation theory. Prerequisite: ECEG 270.

**ECEG 390. Theory and Applications of Electromagnetics. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:4**

Applications of Maxwell's equations to the solution of problems involving electric and magnetic fields and transverse electromagnetic waves. Transmission line parameters, wave propagation, reflection from planar surfaces, polarization, and electromagnetic interaction with matter. Prerequisites: ECEG 210 and MATH 211.

**ECEG 3NT. Electrical and Computer Engineering Non-traditional Study. .25-4 Credits.**

**Offered Fall, Spring, Summer; Lecture hours:Varies,Other:3**

Non-traditional study in electrical and computer engineering. Prerequisite: permission of the instructor.

**ECEG 400. ECE Capstone Design I. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:4,Lab:2**

Engineering capstone design focusing on problem identification, project planning and logistics, and learning the divergent/convergent engineering design process in Electrical Computer Engineering. Year long capstone experience that concludes with ECEG 401. Prerequisite: ECEG 301 or permission of instructor.

**ECEG 401. ECE Capstone Design II. 1 Credit.****Offered Spring Semester Only; Lecture hours:3,Lab:2**

The continuation of ECEG 400 concludes the capstone sequence for electrical and computer engineering majors. Student teams develop, implement, and evaluate the value of their project for an external client. Prerequisite: ECEG 400 or permission of the instructor.

**ECEG 402. Special Topics in Electrical or Computer Engineering. 1 Credit.****Offered Either Fall or Spring; Lecture hours:3,Lab:2; Repeatable**

Current topics of interest in electrical or computer engineering. This course includes a lab section. Crosslisted as ECEG 602.

**ECEG 403. Special Topics in Electrical and Computer Engineering. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4; Repeatable**

Current topics of interest in electrical and computer engineering. This course does not include a lab section. Crosslisted as ECEG 603.

**ECEG 408. Advanced Independent Study. .25-2 Credits.****Offered Either Fall or Spring; Lecture hours:Varies,Other:Varies; Repeatable**

Advanced independent study for seniors. Prerequisite: permission of instructor.

**ECEG 411. Neural Engineering. 1 Credit.****Offered Occasionally; Lecture hours:3,Recitation:1**

Introduction to neural systems and engineering. Topics include neurophysiology, quantitative neural recording and stimulation models, neural signal acquisition and processing, clinical applications, and current field-wide challenges. Prerequisite: permission of the instructor. Crosslisted as BMEG 441 and ECEG 611.

**ECEG 430. Mobile Computing. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4**

Mobile computing ecosystem including apps, devices, wireless networks, and back-end systems. Includes at least one major project; the specific course content will vary based on projects, student interest, and current technology trends. This course typically includes a considerable amount of software development. Prerequisite: CSCI 205 or permission of instructor. Crosslisted as CSCI 340 and ECEG 630.

**ECEG 431. Computer Systems. 1 Credit.****Offered Either Fall or Spring; Lecture hours:3,Lab:2**

This course provides students the concepts, technologies, and skills needed for advanced study in computer engineering. It includes aspects of computer organization, computer architecture, operating systems, networking, and performance evaluation and the relationship between them.

Prerequisite: CSCI 206, ECEG 247, or permission of the instructor.

**ECEG 432. The Internet of Things. 1 Credit.****Offered Either Fall or Spring; Lecture hours:3**

A broad investigation into the design of internet-connected physical objects and the infrastructure that supports them. This hands-on course covers topics including embedded systems, wireless communication, internet protocols, cloud computing and security. Students will develop their own IoT system. Prerequisite: (CSCI 206 or CSCI 306) or ECEG 247. Crosslisted as CSCI 332 and ECEG 632.

**ECEG 442. Digital VLSI Circuit Design. 1 Credit.****Offered Either Fall or Spring; Lecture hours:4**

Introduction to digital integrated circuit design, from wafer fabrication through structured design techniques. Teams conceptualize, design, simulate, layout, extract, and verify small VLSI systems using appropriate CAD tools. Prerequisites: ECEG 240 and ECEG 350 or permission of the instructor. Crosslisted as ECEG 642.

**ECEG 443. Computer Architecture. 1 Credit.****Offered Either Fall or Spring; Lecture hours:3**

Explores two important topics in computer architecture today: memory hierarchy and parallelism in all its forms. Students will use a hardware description language to implement concepts including pipelining, cache and branch prediction. Prerequisite: CSCI 206 or CSCI 306 or ECEG 247 or permission of the instructor. Crosslisted as CSCI 320 and ECEG 643.

**ECEG 444. Advanced Digital Design. 1 Credit.****Offered Either Fall or Spring; Lecture hours:2,Other:2**

Design of multi-part digital systems using contemporary digital components centered around a system-on-chip with a microprocessor and FPGA. Hardware description languages, specialized FPGA elements, peripheral interfacing and protocols, high-level synthesis. Prerequisites: ECEG 240 or permission of the instructor. Crosslisted as ECEG 644.

**ECEG 461. Electrical Energy Conversion. 1 Credit.****Offered Either Fall or Spring; Lecture hours:3,Lab:2**

Three phase power circuits, transmission and distribution systems, transformer circuits, substation equipment, rotating machines, motor generator systems and introduction to renewable power systems. Prerequisite: ECEG 350 or permission of the instructor.

**ECEG 462. Renewable Energy Systems. 1 Credit.****Offered Either Fall or Spring; Lecture hours:3**

Engineering analysis of photovoltaic, wind and other renewable energy systems. Modeling of systems, resources and performance with an emphasis on grid-tied photovoltaic system optimization. Open to juniors and seniors in engineering. Crosslisted as ECEG 662.

**ECEG 470. Communication and Information Systems. 1 Credit.**

**Lecture hours:3,Other:1**

Digital and analog communication systems, elements of information theory and contributions of Claude Shannon, signal space, modulation, and case studies of modern digital communication systems. Prerequisite: ECEG 270 or permission of the instructor. Crosslisted as ECEG 670.

**ECEG 472. Digital Signals and Communications. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:2**

Introduction to digital signal processing and digital communications. Topics: sampling theorem, discrete time Fourier transform (DTFT), Fourier series, fast Fourier transform (FFT), z-transform, digital filters, applications in audio and image processing, modulation techniques for digital signals. Prerequisite: ECEG 270 or permission of instructor. Crosslisted as ECEG 672.

**ECEG 473. Digital Speech and Audio Processing. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:4**

Theory and application of digital speech and audio processing. Topics vary, but may include audio filtering, audio coding, room acoustics, digital analysis of speech and music signals, basic concepts of electronic music, and audio effects. Prerequisite: ECEG 270 or permission of the instructor. Crosslisted as ECEG 673.

**ECEG 474. Neural Signals and Systems. 1 Credit.**

**Offered Occasionally; Lecture hours:3**

Introduction to neural systems and signaling. Topics include neural physiology, models of action potential generation and synapse dynamics, neural networks and techniques of neural waveform analysis. Prerequisite: permission of the Instructor. Crosslisted as BMEG 441.

**ECEG 475. Computer Communication Networking. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:3**

An introduction to computer networking using the seven-layer Open Systems Interconnection model. Hands-on exploration of the data link, network, transport, and application layers. Prerequisite: Junior status.

**ECEG 476. Electrical Control Systems. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:3,Other:1**

Analysis of linear systems in time and Laplace transform domains, closed-loop transfer function, stability criteria, control system design with root locus, implementation with Arduino microcontrollers. Prerequisite: ECEG 270.

**ECEG 478. Machine Learning and Intelligent Systems. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:3,Other:2**

Introduction to artificial intelligence (AI) and machine learning (ML) including fundamental principles and creation of software applications. The course covers both practical applications and the theoretical underpinnings of ML and AI technologies. MATH 211 and Python coding experience recommended. Prerequisite: MATH 202 or permission of instructor. Crosslisted as ECEG 678.

**ECEG 479. Wireless Networks & Applications. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:4**

This course explores the realm of modern wireless technologies and their practical applications, familiarizing students with the ever-evolving landscape of wireless networks. It equips students with a profound understanding of wireless communication principles, protocols and network architectures, covering fundamental concepts such as radio frequency fundamentals, as well as advanced topics. Crosslisted as CSCI 368 and ECEG 679.

**ECEG 495. Advanced Topics in Engineering Mathematics. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:4**

Linear algebra and analytical computation techniques for solving ordinary and partial differential equations relevant to engineering applications. Prerequisite: permission of the instructor. Crosslisted as CEEG 495 and CHEG 495 and MECH 495 and ENGR 695.

**ECEG 497. Wireless System Design. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:3,Other:2**

Introduction to hardware aspects of wireless communication systems, including RF circuit design, transmitter and receiver architecture, antennas, and radio wave propagation. Prerequisite: ECEG 390 or concurrent enrollment or permission of the instructor. Crosslisted as ECEG 697.