ELECTRICAL AND COMPUTER ENGINEERING (ECE)

Degrees Offered: Ph.D., M.Eng., M.S.

This program is offered in Durham.

The Department of Electrical and Computer Engineering offers a doctor of philosophy (Ph.D.) degree, a master of science degree (M.S.) and a master of engineering degree (M.Eng.).

Opportunities

Advanced degrees in electrical and computer engineering open the door to a wider variety of job opportunities, particularly with regard to consulting, research and development, and positions in academia. Within the department, opportunities for formal study, research, and individual or team projects are available in the following areas: biomedical engineering; communication systems; digital signal processing; computer engineering, computer networks, digital systems, and logical synthesis; robotics and neural networks; image processing and pattern analysis; control systems; electromagnetics; pervasive computing; human-computer interaction; ocean engineering; cyber-physical security and systems; flexible and wearable electronics; bioelectronic sensors; instrumentation; Internet-of-Things; machine learning; and artificial intelligence.

Admission Requirements

An applicant should have completed a baccalaureate degree in electrical or computer engineering or have comparable training, which includes courses and laboratory experiences in mathematics and physical science as well as in topics such as network theory, digital systems, fields and waves, electronics, and electrical circuits. Students must submit current (within five years) general scores from the Graduate Record Examination (GRE). Student with BS or MS degrees from non-US university must also submit current scores from the Test of English as a Foreign Language Exam (TOEFL).

https://ceps.unh.edu/ece

Programs

- Electrical and Computer Engineering (Ph.D.)
- Electrical and Computer Engineering (M.Eng.)
- Electrical and Computer Engineering (M.S.)
- Electrical and Computer Engineering: Biomedical Engineering (M.S.)

Courses

Electrical and Computer Engineering (ECE)

ECE 812 - Advanced Digital Systems Design and Verification
Credits: 4
This course will introduce standard on-chip communication networks for digital systems, off-chip wired/wireless communication protocols and the implementation of standard I/O interfaces. This course will also teach the advanced FPGA architecture, design flow, and debugging methods, and reinforce students' prototyping skills on standalone FPGAs and cloud FPGAs. Modern digital design and optimization techniques will be presented and examined, as well. Reliability and security issues in digital system design will be emphasized in this course.
Grade Mode: Letter Grading

ECE 814 - Introduction to Digital Signal Processing
Credits: 4
Introduction to digital signal processing theory and practice, including coverage of discrete time signals and systems, frequency domain transforms and practical spectral analysis, digital filter terminology and design, and sampling and reconstruction of continuous time signals. Laboratory component providing an introduction to DSP design tools and algorithm implementation. Lab.
Grade Mode: Letter Grading

ECE 815 - Introduction to VLSI
Credits: 4
Principles of VLSI (Very Large Scale Integration) systems at the physical level. CMOS circuit and logic design, CAD tools, CMOS system case studies. Students exercise the whole development cycle of a VLSI chip: design and layout with the up-to-date commercial EDA tools. An IA (continuous grading) grade is given at the end of semester I.
Grade Mode: Letter Grading

ECE 817 - Introduction to Digital Image Processing
Credits: 4
Digital image representation; elements of digital processing systems; multidimensional sampling and quantization; image perception by humans, image transformations including the Fourier, the Walsh, and the Hough Transforms; image enhancement techniques including image smoothing, sharpening, histogram equalization, and pseudo color processing; image restoration fundamentals; image compression techniques, image segmentation and use of descriptors for image representation and classification. Lab.
Grade Mode: Letter Grading

ECE 857 - Fundamentals of Communication Systems
Credits: 4
Spectra of deterministic and random signals, baseband and bandpass digital and analog signaling techniques, transmitter and receiver architectures, performing analysis of digital and analog signaling in additive noise channels, carrier and symbol timing synchronization methods. Lab.
Grade Mode: Letter Grading

ECE 872 - Control Systems
Credits: 4
Development of advanced control system design concepts such as Nyquist analysis, lead-lag compensation; state feedback; parameter sensitivity; controllability; observability; introduction to non-linear and modern control. Includes interactive computer-aided design and real-time digital control. (Also offered as ME 872.) Lab.
Equivalent(s): ME 872
Grade Mode: Letter Grading

ECE 875 - Applications of Integrated Circuits
Credits: 4
Design and construction of linear and nonlinear electronic circuits using existing integrated circuits. Limitations and use of operational amplifiers. Laboratory course in practical applications of non-digital integrated circuit devices. Lab.
Grade Mode: Letter Grading

ECE 884 - Biomedical Instrumentation
Credits: 4
Principles of physiological and biological instrumentation design including transducers, signal conditioning, recording equipment, and patient safety. Laboratory includes the design and use of instrumentation for monitoring of electrocardiogram, electromyogram, electroencephalogram, pulse, and temperature. Current research topics, such as biotelemetry, ultrasonic diagnosis, and computer applications. Lab.
Grade Mode: Letter Grading

ECE 896 - Special Topics in Electrical or Computer Engineering
Credits: 1-4
New or specialized courses and/or independent study. Some sections may use credit/fail grading.
Grade Mode: Letter Grading

ECE 899 - Master's Thesis
Credits: 1-6
Master's Thesis.
Repeat Rule: May be repeated for a maximum of 6 credits.
Grade Mode: Graduate Credit/Fail grading

ECE 900 - Research and Development From Concept to Communication
Credits: 4
The course will introduce students to the general tools of scientific research and technical communication, including topics on: 1. how to conduct research (and development), and general tools for formulating research questions and hypotheses; 2. how to effectively communicate in writing and in oral presentations, both for proposals and for reports on completed technical work.
Grade Mode: Letter Grading

ECE 910 - Graduate Seminar
Credits: 1
Graduate seminars presented by UNH faculty, graduate students and external speakers. Topics include new research ideas and results in areas relevant to electrical and computer engineering.
Grade Mode: Graduate Credit/Fail grading

ECE 915 - Advanced Active Circuits
Credits: 3
Investigation of devices and techniques used in advanced circuit design using discrete solid-state devices and integrated circuits. Oscillators, phase-lock systems, low noise techniques, etc.
Grade Mode: Letter Grading

ECE 920 - Wireless Communication Systems
Credits: 3
Principles of wireless communication systems including analysis of radio wave propagation and modeling, large scale and small scale signal fading, cellular communication architectures, multi-access systems, advanced modulation techniques, signal diversity systems, multiple antenna communications, cognitive radio, and software defined radio.
Grade Mode: Letter Grading

ECE 924 - Ubiquitous Computing
Credits: 3
Ubiquitous computing, or ubicomp, explores embedded, interconnected computing devices that are part of everyday objects and activities. This course takes an interdisciplinary look at the ubiquitous computing through the review of recent research literature. Topics include the visions of ubicomp and some of its applications, software and hardware for ubicomp, human-computer interaction, context awareness, privacy, and security. Students undertake a ubicomp research project inspired by the literature review.
Grade Mode: Letter Grading

ECE 925 - Biosensors: Fundamentals and Applications
Credits: 3
An in-depth and quantitative view of device design and performance analysis. An overview of the current state of the art to enable continuation into advanced biosensor work and design. Topics emphasize biomedical, bioprocessing, environmental, food safety, and bio-security applications. College level general chemistry, calculus, differential equations, and linear algebra required prior to taking this course.
Grade Mode: Letter Grading

ECE 941 - Digital Signal Processing
Credits: 3
Discrete-time stochastic signals, signal modeling, parameter estimation, optimal filtering and decision making, with application to adaptive filters, echo cancellation, channel equalization and parametric spectral estimation. Requires prior coursework in discrete-time LTI systems, analysis and design of recursive and non-recursive linear digital filters, and Fournier based spectral estimation.
Grade Mode: Letter Grading

ECE 952 - Advanced Control Systems II
Credits: 3
Special topics in control theory: continuous and discrete systems; optimal control systems, including calculus of variations, maximum principle, dynamic programming, Weiner and Kalman filtering techniques, stochastic systems, and adaptive control systems.
Equivalent(s): ME 952
Grade Mode: Letter Grading

ECE 960 - Computer Architecture
Credits: 3
Advanced topics in computer organization. Parallel and pipeline processing, associative and stack computers, microprogramming, virtual memory, current topics.
Grade Mode: Letter Grading

ECE 992 - Advanced Topics
Credits: 1-4
Special course covering advanced topics in electrical and computer engineering. Refer to section description for details about the covered topics. Course may be repeated, but not in duplicate subjects.
Grade Mode: Letter Grading

ECE 998 - Independent Study
Credits: 1-3
Independent theoretical and/or experimental investigation of an electrical engineering problem under the guidance of a faculty member.
Grade Mode: Letter Grading

ECE 999 - Doctoral Research
Credits: 0
Doctoral Research.
Grade Mode: Graduate Credit/Fail grading
Special Fee: Yes

Faculty

See https://ceps.unh.edu/electrical-computer-engineering/faculty-staff-directory for faculty.