Electrical Engineering

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Graduate Program Coordinator

The Department of Electrical and Computer Engineering offers a graduate program leading to the degree Master of Science of Electrical Engineering. The goal of the program is to enhance the student's understanding of advanced concepts in core areas of modern electrical and computer engineering and to enrich the student's design and/or research skills in a specialization of his or her choice. This is done through coursework and a design project or thesis as described below.

Students work closely with the Graduate Program Coordinator in tailoring an overall program best suited to their background and interests. Course sequences, design projects, and research are available in applied electromagnetics, communication theory, control theory, digital systems and computers, microprocessor applications, signal processing, and wireless components and systems. The ECE department has excellent computer and laboratory facilities to support advanced studies in these areas.

Degree Requirements

A total of 33 semester hours is required for the degree and all students must do either a thesis (thesis option) or design project (design option). The specific requirements for each option are as follows:

Thesis Option

- EE 501 Principles of Electrical Engineering Design, 3 hours
- Thesis, 6 hours
- 18 hours of electrical engineering courses with two 6-hour specializations
- 6 hours of EE or approved technical electives

Design Option

- EE 501 Principles of Electrical Engineering Design, 3 hours
- Design Project, 3 hours
- 21 hours of electrical engineering courses with two 6-hour specializations
- 6 hours of EE or approved technical electives

In addition to the two six-hour specializations, at least six hours of the EE coursework must utilize advanced mathematical concepts. Examples of such courses are EE 530, EE 532, EE 540, EE 550, EE 631, EE 642, EE 643, and EE 651. Technical electives can be chosen from graduate courses offered by other engineering programs or by the biology, chemistry, computer science, math, or physics departments. The one-semester EE 501, Principles of Electrical Engineering Design, covers design techniques in key areas of electrical engineering. This course will be waived for students unconditionally admitted to the MSEE program. In addition, those students conditionally admitted but with considerable design experience can seek to waive EE 501 by petitioning the graduate coordinator.

All the courses used to satisfy the degree requirements for the MSEE degree must be listed in the student's Graduate Program of Study. This document must be completed and approved by the EE Graduate Program Coordinator before completion of 12 hours of coursework. The student must also complete a final degree experience, normally an oral comprehensive or colloquium.

Admission

Successful completion of an undergraduate electrical or computer engineering program is required for admission. In addition to the material described in the general admission section of this catalog, applicants to the MSEE program must also submit their scores from the GRE General Test. Undergraduate GPA, number of repeated undergraduate courses (if any), and GRE scores are the primary factors considered in admission decisions. International students must also submit material and information described in the general admission section of this catalog.

Plans of study are available for those with non-electrical engineering or non-engineering undergraduate degrees. These plans require a number of undergraduate foundation courses to be successfully completed before admission to the MSEE program. Further information can be obtained by contacting the ECE graduate program coordinator.

Course Descriptions

EE 501 Principles of Electrical Engineering Design 3 hrs.
Analog, digital, and software design experiments: use of instrumentation transistor amplifiers and switches, operational amplifiers, active and passive filters, digital logic, microcontrollers, and signal processing circuits. Use of computer-aided design and simulation tools for system analysis and design. (Cannot be used to satisfy MSEE elective.) Prerequisite: BSEE degree or consent of the department chair.

EE 530 Random Variables and Signals 3 hrs.
Correlation functions; power-density spectra; transmission of random signals through linear and non-linear systems; linear mean square estimation. Prerequisite: EE 302 or graduate standing.

EE 531 Communication Theory 3 hrs.
Optimum filtering; analogue and digital communication; detection theory. Prerequisite: EE 530.

EE 532 Information Theory 3 hrs.
Coding theory; memory and memoryless systems. Prerequisite: EE 530.

EE 533 Digital Image Processing 3 hrs.
Design of computer-based imaging systems; multidimensional filtering and quantization methods for image enhancement, restoration, and pattern recognition. Prerequisite: EE 302 or MTH 325.

EE 534 Digital Signal Processing 3 hrs.
Representation and analysis of discrete time signals and systems. Finite and infinite impulse response filter design; computer-aided-design; Fast Fourier Transform; implementation of digital filters. Prerequisites: EE 302.

EE 535 Engineering Applications of Neural Networks 3 hrs.
Provides a working knowledge of the theory, design, and engineering applications of artificial neural networks. Emphasis will be directed to low-level implementation such as embedded microcontrollers and integrated circuits. Specific architectures such as correlation matrix memory, perceptron, adaline, multilayer networks, radial-basis function networks, and Hopfield networks will be examined as well as their corresponding learning rules. Prerequisite: EE 302 or graduate standing.

EE 540 Dynamic Systems Analysis 3 hrs.
Advanced techniques for analysis of electrical, mechanical, and electromechanical systems. State function concepts are emphasized with methods for determining state equations, system stability, and control. Prerequisite: EE 302 or graduate standing.

EE 550 Electromagnetic Theory 3 hrs.
Time-varying electric and magnetic fields; Maxwell's equations; plane waves in conducting and dielectric media; transmission lines; wave guides; antennas. Prerequisite: EE 381.

EE 551 Radio Frequency Circuits and Systems 3 hrs.
Review of transmission lines, impedance matching and transformations, S-parameters, passive R.F. junctions, R.F. amplifier design, R.F. systems, and front end design. Prerequisites: EE 205, 206.

EE 555 Optical Fiber Communication 3 hrs.
EM wave propagation in silica glass and step index optical fibers, LP modes, multimode and singlemode fibers, optical transmitters and receivers, design of optical fiber communication systems meeting industry standards. Prerequisite: EE 381 or consent of instructor.

EE 561 Digital Systems: Logic Design 3 hrs.
Boolean algebra; logical design; storing and switching phenomena. Prerequisite: EE 304 or graduate standing.

EE 562 Digital Systems: Computer Structures 3 hrs.
Use of hardware programming language to design a small computer or other digital system; busing; control units; interfacing; transfer design. Prerequisite: EE 201.

EE 563 Advanced Electronics - VLSI System Design 3 hrs.
Design and implementation of very-large-scale integrated systems (VLSI). Integrated circuit devices, subsystems, and architecture. Computer-aided-design (CAD) and design testing. Prerequisites: EE 304 or graduate standing.

EE 565 Digital Systems: Microprocessor and PC Architecture 3 hrs.
Architecture of PC-compatible computers; 32-bit processor architecture and assembly language programming; standard buses. Design of peripheral cards to interface with the standard PC bus architectures. Prerequisites: EE 365 or consent of instructor.

EE 566 Digital Systems: Memory and Interfacing 3 hrs.
Design of single-board computers using 32-bit processors; processor architecture and assembly language programming. Introduction to RISC processors. Prerequisites: EE 365 or consent of instructor.

EE 567 Advanced VLSI Design 3 hrs.
Addresses the testability of integrated systems, using very large scale integration or VLSI, which includes topics on devices, circuits, and digital subsystems in CMOS technology. Includes the concept and methodology for the design for testability of digital integrated systems. Prerequisite: EE 563.

EE 568 VHDL: Digital System Design 3 hrs.
A structured guide to the modeling of the design of digital systems, using VHDL, a hardware description language. VHDL is designed to fill a number of needs in the design process. It allows description of the structure of a system, and the specification of the function using familiar programming language forms. As a result it allows the design of a system to be simulated and synthesized.

EE 575 Power Systems 3 hrs.
Analysis of electric power systems; fault studies; load flow; economic loading; stability; relaying; high voltage DC transmission; lightning and switching transients. Prerequisite: senior or graduate standing in EE. .

EE 582 Medical Imaging 3 hrs.
Introduction to the common methods and devices employed for medical imaging, including conventional x-ray imaging, x-ray computed tomography (CT), nuclear medicine (single photon planar imaging), single photon emission computed tomography (SPECT), and positron emission tomography (PET), magnetic resonance imaging (MRI), and ultra-sound imaging. The physics and design of systems, typical clinical applications, medical image processing, and tomographic reconstruction. Cross-listed as ME 582. Prerequisites: Senior standing in engineering or consent of instructor.

EE 631 Advanced Communication Theory 3 hrs.
Continuation of Electrical Engineering 531. Prerequisites: EE 531, 540.

EE 642 Advanced Control Systems 3 hrs.
Continuation of EE 540. Prerequisite: EE 540.

EE 643 Optimal Control Systems 3 hrs.
Analysis and design of multivariable control systems: stability, observability and controllability, deterministic/stochastic linear optimal regulator and observers, and multivariable stability robustness. Prerequisite: EE 540 or permission of instructor.

EE 651 Advanced Electrodynamics 3 hrs.
Continuation of EE 550. Special theory of relativity; plasma dynamics. Prerequisites: EE 540, 550.

EE 681, 682 Research 3-6 hrs. each
Graduate research on a project selected by student and advisor.

EE 691, 692 Topics in Electrical Engineering 1-3 hrs. each
Topics of special interest which may vary each time course is offered. Topic stated in current Schedule of Classes.

EE 699 Thesis 3-6 hrs.
Advanced electrical engineering research or design under the guidance of a faculty advisor. Required of students choosing thesis option. Total of 6 semester hours to be taken in one or two semesters. Prerequisites: consent of department chair; unconditional status.