

## Electrical Engineering M.S.



### Contact Information

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### Faculty

Steven P. Miller Endowed Chair and Professor Whites; Professor Batchelder; Associate Professor Tolle; Assistant Professors Montoya, Zhang, Fathelbab, and Anagnostou; Instructor Linde.

### Electrical Engineering

The mission of the electrical and computer engineering graduate program is to provide

quality student learning at an advanced level and to disseminate new knowledge in electrical engineering, while at the same time working to increase resources in support of these objectives.

The graduate program in electrical engineering consists of research and study leading to the master of science degree in electrical engineering (M.S. EE) and multidisciplinary Ph.D. degrees in materials engineering and science, nanoscience and nanoengineering, and biomedical engineering. In special cases, with the consent of the graduate committee of the electrical and computer engineering department, students may elect to do research in association with another engineering or science department.

The prospective student should have completed a baccalaureate degree in electrical engineering or computer engineering. Applicants from universities that are not accredited by the Accreditation Board for Engineering and Technology (ABET) are generally required to submit Graduate Record Exam (GRE) scores from the General Test with their application.

Depending on the student's undergraduate background, and at the discretion of the electrical and computer engineering graduate committee, graduates of other institutions may also be required to take one or more courses of preparatory undergraduate work in addition to their graduate program of study.

The M.S. EE degree is available with thesis and non-thesis tracks. The course requirements for these tracks are as follows:

#### **Thesis option**

The thesis M.S. EE degree consists of a program of graduate course work and thesis research. Candidature for the M.S. EE degree with Thesis is contingent on an aptitude to do research. A limited number of students are accepted into the M.S. EE Thesis option, on the recommendation of a major professor. The requirements for the M.S. EE Thesis degree are as follows:

1. A program of at least 30 credit hours of course work and research.

2. At least 15 credit hours of graduate course work (500 level courses and above).
3. At least 6 credit hours of thesis research. (No more than 9 credit hours of thesis research will count toward degree requirements.)
4. A satisfactory thesis based upon individual research.
5. Meeting or exceeding prescribed academic standards.
6. Passing an examination on general knowledge and successfully defending the thesis.

### **Non-Thesis option**

The non-thesis MSEE degree consists of a program of graduate course work. A project is not required and normally is not encouraged for the M.S. EE non-thesis option. The requirements for the M.S. EE non-thesis degree are as follows:

1. A program of at least 32 credit hours of course work.
2. At least 20 credit hours of graduate course work (500 level courses and above).
3. Meeting or exceeding prescribed academic standards.
4. Passing an examination on general knowledge in the field.

### **Language Requirements**

1. Students whose native language is not English are generally required to take the Test of English as a Foreign Language Test (TOEFL).
2. Graduate students with a TOEFL score below 560 are required to attend a remedial course in English.
3. Meeting or exceeding prescribed academic standards.

4. Passing an examination on general knowledge in the field.

### **Graduate Credit Taken as an Undergraduate**

Undergraduate students taking 600 level graduate courses and petitioning these courses for graduate credit should realize that application of these credits to the program of study is subject to the approval of the student's graduate committee. A student's graduate program will come under the control of the graduate committee at the time the student is accepted into the graduate program.

### **Graduate Committee and Program of Study**

The ECE Graduate Committee is the graduate committee for all M.S. EE non-thesis degree students, with the ECE Graduate Coordinator serving as the advisor. M.S. EE thesis students form a graduate committee with a major professor who has agreed to supervise the research of the student. In both cases, the student must arrange to have a faculty member external to the Department of Electrical and Computer Engineering on his or her committee.

Each student must submit a program of study to the candidate's graduate committee by the end of the first semester of study. Approval of the program of study is necessary in order to register for the second and subsequent semesters.

The student's graduate committee has the right to disallow any course proposed in the student's program of study that they feel is not appropriate for the graduate degree in electrical engineering. A student accepted into the Ph.D. program in materials engineering and science, nanoscience and nanoengineering, or biomedical engineering must have his or her program approved by the graduate committee responsible for that respective program.

### **Research Areas and Resources**

The M.S. EE degree offers emphases in three areas: communications and applied electromagnetics, control and power systems. In addition to the more discipline-specific equipment listed below, the ECE department has well-equipped laboratories of networked PCs and Sun workstations, general purpose test and measurement equipment such as high-speed

oscilloscopes, arbitrary function generators, logic analyzers, and printed circuit board prototyping machines and software.

Research activities in the communications and applied electromagnetics area include: compact antennas, electromagnetic propulsion of space sailcraft, engineered electromagnetic materials using active and passive circuit particles, and ultra-wideband and ground penetrating radar. Resources in support of this program include a number of vector network analyzers, impedance analyzers, Agilent Advanced Design System, and Microwave Studio. Additionally, the Steven P. Miller Endowed Chair in electrical engineering was recently established to support telecommunications in the ECE department.

Research activities in the embedded systems and signal processing area include: neural network and fuzzy logic chips, computationally intelligent systems, FPGA- and CPLD-based embedded system design, fault tolerant computer systems, residue and pseudo-floating point number architectures, pattern recognition, system identification, wavelet signal processing and adaptive signal processing. Resources in support of this program include logic analyzers, a variety of microcontroller and microprocessor development systems, FPGA and CPLD prototyping boards, VHDL and Verilog compilers, Analog Devices DSP development tools, Mentor Graphics Computer Aided Design Toolset, a variety of microchip fabrication equipment, and printed circuit board manufacturing equipment.

Research activities in the area of control systems include: robotics, machine control, fuzzy logic control, nonlinear and adaptive control, modeling of power systems, power systems stability, generator dynamics, fault analysis, and wind power. Additionally, a number of robotics projects are performed in association with the School of Mines Center of Excellence in Advanced Manufacturing and Production (CAMP).

### **M.S. E.E. Course Offerings**

Courses that students would take for each of the focus areas would typically include, but would not be limited to, those listed below:

### **Communication and Applied**

#### **Electromagnetics:**

EE 621	Information and Coding Theory
EE 622	Statistical Communication Systems
EE 623	Random Signals and Noise
EE 692	Topics

#### **Embedded Systems and Signal Processing:**

EE 612	High-Speed Digital Design
EE 624	Advanced Digital Signal Processing
EE 641	Digital Systems Design
EE 643	Advanced Digital Systems
EE 644	Fault Tolerant Computing
EE 647	HDL Design
EE 648	Advanced VLSI Design

#### **Control and Power Systems:**

EE 552	Robotic Control System
EE 618	Sensors and Signal Processing
EE 633	Power System Analysis I
EE 634	Power System Analysis II
EE 651	Digital Control Systems
EE 652	Nonlinear and Optimal Control Systems