MS Engineering - Electrical and Computer Engineering Emphasis

Program of Study

This program of study was effective Spring Semester 2019 – Summer Semester 2021.

The M.S. in Engineering with Electrical and Computer Engineering Emphasis requires a minimum of 33 semester hours in the Program of Study, which consists of:

► A minimum of 24 semester hours of coursework:

- 20 hours of graduate-level coursework
    - 12 hours of 8000-level courses from one or more of the ECE Emphasis Area tracks listed below.
    - 8 hours of 6000-level or higher coursework from any UGA school or college, exclusive of thesis (7300) and research (7000, 7010)
- 3 hours of Foundations for Engineering Research (ENGR 6910)
- 2 hours of Graduate Seminar (ENGR 8950)**

And either

► Thesis Option:

- A minimum of 6 hours of master's research (ENGR 7000) or project-based research (ENGR 7010). A typical student's research hours will exceed this minimum; however, at most 6 hours of 7000/7010 may be listed on the program of study.
- 3 hours of MS thesis preparation and writing (ENGR 7300)

Or

► Non-Thesis Option:

- 6 hours of additional emphasis area courses
- 3 hours of ENGR 7010 Project Research and a Master's Project Report

*** Only 1 hour of Graduate Seminar may apply on the Program of Study and is counted toward the 33 hour MS minimum. Students are free to register for the course multiple times and are encouraged to continue regular attendance of speaker series presentations even if not registered for seminar.*

Students will work with their graduate advisor to select the most appropriate set of courses to ensure breadth of understanding as well as mastery of knowledge in a specific area consistent with their interests and research. In addition to completing 12

credit hours selected from the tracks below, students may work with their graduate advisor to develop an interdisciplinary plan of study drawing from the extensive graduate course offerings at UGA.

The thesis option is provided for students wishing to receive professional training via coursework integrated with research training through the successful completion of a thesis. In the MS Thesis Option, all coursework is selected consistent with specific degree and emphasis area requirements in coordination with the Student's Faculty Advisor and approved by the student's Advisory Committee on the Program of Study. To receive the M.S. degree, each student is required to present a satisfactory research proposal approved by the student's advisory committee and the graduate coordinator and pass a final examination and defense of the research thesis.

The non-thesis option is provided for students either currently employed in professional practice or wishing to emphasize only professional training through their MS. For the MS Non-Thesis Option, all coursework is selected consistent with specific degree and emphasis area requirements and approved by the program's Graduate Director and Advisory Committee on the Program of Study. The Graduate Director serves as the student's faculty advisor. The student identifies an appropriate faculty member to serve as supervisor for their Master's Project who then works in coordination with the Graduate Director to advise the student through degree completion. The supervising faculty for the Master's Project, the Graduate Director, and Graduate Coordinator comprise the student's Advisory Committee. To receive the M.S. degree under the Non-Thesis Option, each student is required to complete a Master's Project under the supervision of a faculty member and submit a Masters Project Report for approval by the student's Advisory Committee.

Students elect their MS option at the start of their programs. In the event a student wishes to change their degree option during their program, the student must request a change in degree objective. Students successfully petitioning to change their previously elected MS option must 1) complete at least two full-time semesters in their new option before they are eligible for graduation, 2) adequately complete any prior work to which they committed or for which they were supported under assistantship in their prior option, and 3) after option change start and complete either the MS project requirement (ENGR 7010) or MS thesis research requirement (ENGR 7000/7010, 7300). Only students in the thesis option are eligible for College assistantship support.

Completion of the M.S. requirements for all programs in the College of Engineering fulfill all requirements of the University of Georgia Graduate School. No grade below C will be accepted in the program of study. To be eligible for graduation, a student must maintain a 3.0 (B) average on the graduate transcript and a 3.0 (B) average in the program of study.

Students will work with their graduate advisor to select the most appropriate set of courses to ensure breadth of understanding as well as mastery of knowledge in a specific area consistent with their professional interests. In addition to completing the required number of credit hours selected from the tracks below, students may work with their graduate advisor to develop an interdisciplinary plan of study drawing from the extensive graduate course offerings at UGA.

Emphasis Area Courses

Coursework fulfilling the ECE Emphasis Area credit hour requirement for the Ph.D in Engineering or M.S. in Engineering degree may be chosen from one or more of the areas below. Courses will be reviewed each academic year and updated as needed to reflect new areas in the field.

Track 1: Control Systems

Through this track, students can gain expertise in the analysis and design of controllers for complex, large scale systems. The need for improved safety and a cleaner environment have posed countless challenges that can only be addressed through the design and implementation of intelligent feedback controls. Numerous emerging applications for controls include cyber-physical systems (e.g., smart grids and intelligent transportation systems) and biological networks.

- ENGR 8240 - Instrumentation programming
- CSCI(ENGR) 8940 - Computational intelligence
- ENGR 8930 - Optimization Theory and Applications
- ELEE 8220- Nonlinear Control Systems

Track 2: Electronics & Photonics

Students develop an understanding of the design and analysis of systems involving electromagnetic waves from RF electronics to photonic systems for signal processing and communication and optical systems for image capture and processing. High-speed communication and signal processing at gigabit speeds requires sophisticated electro-optic systems that must be understood at both the device and the systems level. Modern optical imaging systems use a wide variety of electrical and photonic technologies to achieve everything from imaging biological systems at the nanometer scale to imaging distant galaxies.

- ELEE 8510 - Microwave Photonics
- ENGR 8570 - Topics in Advanced Microscopy
- ELEE 8530 - Advanced Optics and Photonics
- PHYS 8201 - Advanced Electromagnetic Theory I
- PHYS 8202 - Advanced Electromagnetic Theory II
- ENGR 8310 - MEMS Design
- ENGG 8840 - Advanced Image Analysis

Track 3: Cyber-physical Systems

This track develops in students an understanding of engineered systems that are built from, and depend upon, the seamless integration of computational algorithms and physical components. Advances in CPS will enable capability, adaptability, scalability, resiliency, safety, security, and usability that will far exceed the simple embedded systems of today. CPS technology will transform the way people interact with engineered systems -- just as the Internet has transformed the way people interact with information. New smart CPS will drive innovation and competition in sectors such as agriculture, energy, transportation, building design and automation, healthcare, and manufacturing.

- CSEE 8300 – Principles of Cyber-Physical Systems
- CSEE 8830 - AR/VR 3D User Interface Design
- ELEE 8240 - Instrumentation programming
- CSCI(ENGR) 8940 - Computational intelligence
- CSCI 8820 - Computer Vision and Pattern Recognition
- CSCI 8380 - Advanced Topics in Information Systems
- CSCI 8250 - Advanced Network Security Systems
- ENGG 8840 - Advanced Image Analysis

- ENGR 8990 - Optimization Theory and Applications

Selected Course Offerings

Students may want to consider the following courses in building their Programs of Study, as appropriate:

- ENGR 4210/6210 Linear Systems
- ENGR 4220/6220 Feedback Control Systems
- ENGR 4230/6230 Sensors and Transducers
- ENGR 4240 Introduction to Microcontrollers
- ENGR 4250/6250 Advanced Microcontrollers
- ENGR 4260/6260 Introduction to Nanoelectronics
- ELEE 4040 Communication Electromagnetics
- ENGR 4620/6620 Biomedical Imaging

In addition, graduate courses from other colleges that are relevant for ECE students include:

- PHYS 8101 Quantum Mechanics I
- PHYS 8102 Quantum Mechanics II
- PHYS 8201 Advanced Electromagnetic Theory I
- PHYS 8202 Advanced Electromagnetic Theory II
- CSCI 8820 Computer Vision and Pattern Recognition
- CSCI 8380 Advanced Topics in Information Systems
- CSCI 8250 Advanced Network Security Systems

This program of study is effective Spring Semester 2019. Previous program of study requirements may be found here.