MASTER OF SCIENCE IN ENGINEERING IN ELECTRICAL AND COMPUTER ENGINEERING

Electrical and Computer Engineering

Option Coordinator

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Option Description

The Rayen School of Engineering provides opportunities for post accalaureate study toward the Master of Science in Engineering. These opportunities serve the practicing engineer as well as the student who wants to pursue advanced graduate study and research. Thesis, non-thesis, management, Internship or industry Project, and Accelerated (4+1) plans are available. Areas of study include control systems, digital systems, computer engineering, RF communications, computer-aided design, device and circuit modeling, solid-state devices, sensors, power systems and energy, power electronics, electromagnetic fields, electromechanical systems, and system analysis and design. The student is encouraged to interact with the faculty and explore these opportunities.

The Master of Science in Engineering may be characterized as being both career-oriented and flexible. Program plans and options are available to accommodate the needs of nearly every engineering graduate student. Graduate students enrolled in any of the engineering graduate programs must complete:

- 30 semester hours for the thesis plan,
- 33 semester hours for the non-thesis plan,
- 33 semester hours for the management plan,
- 30 semester hours for the internship or industry project plan, or
- 30 semester hours for the Accelerated (4+1) MSE plan*.

*The accelerated 4+1 MSE plan is only available to students already in the YSU Electrical Engineering undergraduate program.

The degree requirements consist of core courses, technical courses, and project courses. The management plan also requires a series of business courses. These degree programs are designed to provide graduate students with the knowledge and skills to excel in professional careers and/or pursue a Ph.D. or doctorate degree in engineering. To obtain a list of core and technical course requirements for a particular engineering discipline, students should contact the option coordinator for the program of interest.

Program Plans

Thesis Plan

Graduate students choosing the thesis plan are required to complete 30 semester hours of graduate coursework. This generally consists of:

- six to nine semester hours of core courses,
- 15-18 semester hours of technical concentration courses, and
- six semester hours of thesis.

This plan is strongly recommended for all candidates who wish to continue their graduate studies beyond the master's degree. The thesis provides firsthand experience with experimental design, literature searches, research methodology, technical report writing, and oral presentation of results. Additionally, the thesis option can lead the graduate student to a higher level of expertise in the chosen area of specialization.

Non-thesis Plan

The non-thesis plan is designed for students who wish to enhance their knowledge and skills to succeed in careers as practicing engineers, but are unlikely to pursue a Ph.D. or doctorate degree. A total of 33 semester hours of coursework is required for this plan. In addition to 6-9 semester hours of core courses, every student enrolled in this option is required to complete 21-24 semester hours of technical courses related to their discipline, and a 3-semester-hour graduate project course. A graduate student enrolled in a graduate project course will be required to defend the results of his or her project by giving a presentation to the engineering faculty and students.

Management Plan

Students who have been in the work arena and are moving into an engineering management role may wish to choose the management plan. A total of 33 semester hours of coursework is required for this plan. This consists of:

- 6-9 semester hours of core courses,
- 6-9 semester hours of business courses,
- 12-18 semester hours of technical courses, and
- a 3-semester-hour graduate project.

INTERNSHIP or industry project PLAN

Students who would like to gain experience in industry and practice engineering in real-life. A total of 30 semester hours of coursework is required for this plan. This consists of:

- 6-9 semester hours of core courses,
- 12-15 semester hours of technical courses, and
- 6-9 semester-hour graduate-level internship courses.

A graduate student enrolled in a graduate project course will be required to defend the results of his or her project by giving a presentation to the engineering faculty and students.

Accelerated (4+1) MSE PLAN

A total of 30 semester hours of coursework is required for this plan. This consists of:

- 6-9 semester hours of core courses,
- 18-21 semester hours of technical courses, and
- 3 semester-hour graduate project or 6 semester-hour Thesis

Undergraduate students can apply for admission into the accelerated program for the MSE in Electrical and Computer Engineering after completing 78 semester hours with a GPA of 3.3 or higher. After being admitted into the program, students can take a maximum of nine semester hours of graduate coursework that can count toward both a bachelor's and master's degree. The courses chosen to count for both undergraduate and graduate coursework must be approved by the Graduate Program Coordinator upon admission into the program. An additional three hours of graduate coursework can be completed as an undergraduate and used exclusively for graduate credit.

Electrical Engineering Requirements

The basic degree requirements for each program plan are described under the general program description for the Master of Science in Engineering.

Descriptions of course requirements and available electives for each program plan in the electrical and computer engineering master's program can be obtained from the graduate option coordinator.

Within the first semester of graduate study, every graduate student must complete an option plan form signed by the student, academic advisor, and the department graduate option coordinator. The student may seek another advisor in case of interest changes. Likewise, the student-advisor relationship may be terminated at the advisor's recommendation. The graduate option coordinator is available to discuss these and other issues as appropriate.

Selected electrical engineering (ECEN) graduate courses are offered each semester based on the available teaching resources and student needs. Each graduate candidate is required to receive advice each semester from the department graduate option coordinator before registration. Based on the graduate student's academic background, work experience, and academic goals, the department graduate option coordinator may approve a student's request to substitute a graduate course not listed in the applicable program plan description.

COURSE	TITLE	S.H.
Core Courses		
MATH 6910	Advanced Engineering Mathematics 1	3
MATH 6911	Advanced Engineering Mathematics 2	3
or		
CSCI 6901	Principles of Computer Programming	
or		
CSCI 6950	Advanced Database Design and Administration	
Technical Courses		
ECEN 6901	Control Systems 1	3
ECEN 6902	Control Systems 2	3
ECEN 6903	Advanced Control Systems	3
ECEN 6911	Electromagnetic Fields 1	3
ECEN 6912	Electromagnetic Fields 2	3
ECEN 6933	Digital Systems: VHDL Design	3
ECEN 6934	Digital Systems: Computer Arithmetic	3
ECEN 6981	Electric Power System Engineering	3
ECEN 6983	Modern Power Sources	3
ECEN 6985	Electromechanical Motion Devices	3
ECEN 6986	Power Electronics Circuits and Devices	3
ECEN 6987	Power Electronics and Industrial Drives	3
ECEN 6900	Seminar (May be repeated once.)	1-3
ECEN Swing courses		
ECEN 5800	Special Topics	1-3
ECEN 5807	Advanced Digital and Analog Circuits	3
ECEN 5808	Advanced Signals and Systems	3
ECEN 5816	Theory and Fabrication of Solid-State Devices	3
ECEN 5817	Sensor Design and Application	3
ECEN 5830	Digital Signal Processing	3
ECEN 5835	Computer Architecture with VHDL	4
ECEN 5840	Electric Power Systems	4
ECEN 5850	Communications Applications	3
ECEN 5860	Fundamental of Antenna Design and Application	3
ECEN 5879	Computer-Aided Design	3
ECEN 5890	Power Electronics	4
Graduate Internship		
STEM 5890	STEM Graduate Internships	1-3

Learning Outcomes: Electrical and Computer Engineering

The graduate program offers diverse educational opportunities with its high-standard multidisciplinary curriculum and prepares its students to:Advance their mathematical knowledge and application of electrical and computer engineering;

- Obtain depth of knowledge in specific electrical engineering disciplines;
- Conduct research and develop new ideas for engineering practice;
- Understand methodologies and their applications;
- Enhance their technical writing and oral communication skills

ECEN 5807 Advanced Digital and Analog Circuits 3 s.h.
Chip circuitry for devices such as BJT, CMOS, and ECL-based digital logic chips. Switching devices such as SCRs, triacs, and timers. Switching power supplies. Power amplifiers. Applications and specifications of off-the-shelf IC devices. Computer-aided design and analysis.
Prereq.: ECEN 3772.

ECEN 5808 Advanced Signals and Systems 3 s.h.
Communication and control system modeling and simulations; signal analysis in continuous-time, discrete-time and frequency domains. Advanced communication system applications.
Prereq.: ECEN 3710 and MATH 3705.

ECEN 5816 Theory and Fabrication of Solid-State Devices 3 s.h.
An introductory study of physical theory, design, and fabrication of discrete devices and integrated circuits. Electronic properties of semiconductors such as carrier concentration, energy gap, mobility, lifetime. Techniques of fabrication such as oxidation, diffusion, alloying ion implantation, metallization, masking.
Prereq.: ECEN 3741 and ECEN 3771.

ECEN 5817 Sensor Design and Application 3 s.h.
Designs and applications for measurement and control; includes electro-chemical, -mechanical, -optical, and -thermal transducers. Signal conditioning and smart sensors.
Prereq.: ECEN 3771 or ECEN 3717.

ECEN 5830 Digital Signal Processing 3 s.h.
Discrete time signals and systems; discrete, fast, and inverse Fourier transforms. Digital filter analysis and design, digital signal processing applications. Two hours lecture, three hours laboratory.
Prereq.: ECEN 3710.

ECEN 5835 Computer Architecture with VHDL 4 s.h.
Use of hardware description languages to design computer components and systems. Arithmetic and logic units, control units, VHDL models for memories and busses, interfacing, transfer design. Survey of modern computer systems.
Prereq.: ECEN 3734.

ECEN 5840 Electric Power Systems 4 s.h.
Modeling of power system components. Power flow, faults, protection systems, and stability problems. Special projects and laboratory experiments including CAD applications for analysis, design, and simulation of power system networks. Three hours lecture, three hours laboratory per week.
Prereq. or Coreq.: ECEN 4844.

ECEN 5850 Communications Applications 3 s.h.
Applicable technologies and "real-world" communication components and systems. Design and analysis tools. Emerging technologies, "killer apps", networking, data acquisition, and convergence.
Prereq.: ECEN 3710 or ECEN 5808.

ECEN 5860 Fundamental of Antenna Design and Application 3 s.h.
Examination of dipole, loop aperture, and microstrip antennas; array theory; radiation resistance, directivity, equivalent circuits, input impedance, and basic transceiver architecture. Investigation of practical applications of antennas and arrays in communications systems, radar systems and airborne navigation systems.
Prereq.: ECEN 3742 grade of "C" or better and 21 s.h. of ECEN courses.

ECEN 5879 Computer-Aided Design 3 s.h.
The design, analysis, and modeling of linear and nonlinear networks and systems using a simulation and modeling computer program. Development and use of library models of devices, subcircuits, and subsystems.
Prereq.: ECEN 2611 and 21 s.h. of ECEN courses.

ECEN 5890 Power Electronics 4 s.h.
SCRs, rectifier circuits, commutation techniques, AC controllers, converters, and inverters. Special projects and laboratory experiments including computer applications for analysis, design, and simulation of power electronics network. Three hours lecture, three hours laboratory per week.
Prereq.: ECEN 3771 and 21 s.h. of ECEN courses.

ECEN 6900 Seminar 1-3 s.h.
Designed to examine topics in the field. May be repeated once.

ECEN 6901 Control Systems 1 3 s.h.
Fundamental concepts in linear system theory. matrix algebra, linear vector spaces, linear operators. Input-output and state-space models for continuous-time systems; canonical forms. Solutions of state space equations. Characteristics of linear systems: stability; controllability and observability. State variable feedback; introduction to state estimation.

ECEN 6902 Control Systems 2 3 s.h.
State-variable feedback techniques; design of state estimators. Design using polynomial equations. Design of digital controllers: discrete equivalents and direct methods. Introduction to implementation of digital control systems.
Prereq.: ECEN 6901.

ECEN 6903 Advanced Control Systems 3 s.h.
Introduction to nonlinear control systems: basic nonlinear phenomena, describing functions, Lyapunov stability, linearization techniques. Introduction to linear optimal quadratic control; stochastic modeling and Kalman filtering.
Prereq.: ECEN 6902.

ECEN 6911 Electromagnetic Fields 1 3 s.h.
Solution of boundary value problems in general form. Laplace, Poisson, and diffusion and wave equations in orthogonal coordinate systems.

ECEN 6912 Electromagnetic Fields 2 3 s.h.
Solution of boundary value problems in general form. Laplace, Poisson, and diffusion and wave equations in orthogonal coordinate systems.

ECEN 6933 Digital Systems: VHDL Design 3 s.h.
Local minimization, design of combinational networks; design of synchronous and asynchronous sequential machines; design of digital systems using VHD, modeling combinational and sequential networks, compilation, simulation, and synthesis of VHDL codes.

ECEN 6934 Digital Systems: Computer Arithmetic 3 s.h.
Number system representations: standard and unconventional formats. Design of two-operand and multi-operand fast adders. High-speed multiplication and division algorithms. Floating-point numbers, algorithms, and error control. Hardware algorithms for function evaluation.
Prereq.: ECEN 6933.

ECEN 6981 Electric Power System Engineering 3 s.h.
The formulation of equations to study electric power network problems, including feeders, power flow, short circuits, protection systems, and stability. The study of power system over voltages and transients caused by short circuits, switching, and lightning. The application of numerical techniques to study and design special projects using digital computations.

ECEN 6983 Modern Power Sources 3 s.h.
Analytical and descriptive study of modern power plants. Combustion and environmental problems with fossil-fueled power plants. Electromagnetic circuits and devices with emphasis on the principles of electromechanical energy conversions.
Cross-Listed: CHEN 6983 and MECH 6983.

ECEN 6985 Electromechanical Motion Devices 3 s.h.
Thermodynamics of batteries, and of electric and fuel cells. Power from nuclear isotopes. Features common to rotating electromagnetic fields. Analysis and design of electromechanical power components. Logic circuit design with I/O structure and interface.
Cross-Listed: CHEN 6985 and MECH 6985.

ECEN 6986 Power Electronics Circuits and Devices 3 s.h.
The design and analysis of power electronic circuits using solid-state switching devices. Topics include power semiconductor diodes and transistors, diode circuits and controlled rectifiers, thyristors, communication techniques, AC voltage controllers, and switching regulators, with applications.

ECEN 6987 Power Electronics and Industrial Drives 3 s.h.
The design and analysis of power electronic circuits and systems, static switches, power supplies, AC and DC drives, and protection of power electronic devices and circuits.

ECEN 6988 Nano- and Micro-Electro Mechanical Systems 3 s.h.
NEMS and MEMS fabrications, elastic system structure, membranes and plates, magnetically actuated systems, continuum theory and scaling laws. Microfluidics and nanofluidics devices.
Prereq.: Graduate standing.

ECEN 6990 Thesis 1-6 s.h.
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Admission Requirements

DEGREE PROGRAMS

Applicants must meet all of the general requirements for admission to the College of Graduate Studies. Admission to the program is selective and based on the qualifications of the applicant, the needs of the program, and the availability of funding. Applicants with lesser qualifications may be granted provisional graduate student status based on evaluation of their undergraduate records, standardized test (e.g. GRE) results, work experience, and other professional qualifications. A graduate assistantship is offered to highly qualified applicants based on the needs of the program and the availability of funding.