

ELECTRICAL AND COMPUTER ENGINEERING

The Master of Science in Engineering (MSE) - 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,
- 30 semester hours for the non-thesis/course plan,
- 30 semester hours for the management plan,
- 30 semester hours for the internship plan, or
- 30 semester hours for the 4+1 Bachelor's/Master's Program*.

*The 4+1 Bachelor's/Master's Program is only available to students already in the YSU 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 discipline-specific technical course requirements for a particular engineering discipline, students should contact the program 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 plan is strongly recommended for candidates who wish to continue their graduate studies beyond the master's degree. The thesis provides firsthand experience in experimental design, literature review, research methodology, technical report writing, and oral presentation of results. It also enables students to develop deeper expertise in their chosen area of specialization.

- 9 semester hours of Mathematics, Computer Science and Engineering Courses
- 3 semester hours of seminar course
- 6 semester hours of thesis
- 12 semester hours of discipline-specific technical courses

COURSE	TITLE	S.H.
Mathematics, Computer Science and Engineering Courses		9 s.h.
MATH 6910	Advanced Engineering Mathematics 1	
MATH 6911	Advanced Engineering Mathematics 2 or CSCI 6951 Data Science and Machine Learning	
ENGR 6920	Project Planning and Management	
Seminar Course		3 s.h.
ENGR 6900	Seminar (Course is repeated 3 times at 1 s.h. each time.)	
Master's Thesis		
ENGR 6990	Thesis	6 s.h.
Discipline-Specific Technical Courses		A minimum of 6 s.h. must be 6900 level. 12 s.h.
Electrical & Computer Engineering Courses		

Non-thesis Course Plan

The non-thesis plan is designed for students who wish to deepen their knowledge and skills for careers as practicing engineers and who do not intend to pursue doctoral study. This plan requires 30 semester hours of coursework:

- 9 semester hours of Mathematics, Computer Science and Engineering Courses
- 3 semester hours of seminar course
- 3 semester hours of graduate project
- 15 semester hours of discipline-specific technical courses

Students enrolled in the graduate project must present and defend their results in a public presentation to the engineering faculty and students.

COURSE	TITLE	S.H.
Mathematics, Computer Science and Engineering Courses		9 s.h.
MATH 6910	Advanced Engineering Mathematics 1	
MATH 6911	Advanced Engineering Mathematics 2 or CSCI 6951 Data Science and Machine Learning	
ENGR 6920	Project Planning and Management	
Seminar Course		3 s.h.
ENGR 6900	Seminar (Course is repeated 3 times at 1 s.h. each time.)	
Graduate Project		
ENGR 6992	Graduate Project	s.h.
Discipline-Specific Technical Courses		15 s.h.
Electrical & Computer Engineering Courses		

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

- 9 semester hours of Mathematics, Computer Science and Engineering Courses
- 3 semester hours seminar course
- 9 semester hours of business and engineering courses
- 9 semester hours of discipline-specific technical courses

COURSE	TITLE	S.H.
Mathematics, Computer Science and Engineering		9
		s.h.
MATH 6910	Advanced Engineering Mathematics 1	
MATH 6911	Advanced Engineering Mathematics 2 or CSCI 6951 Data Science and Machine Learning	
ENGR 6920	Project Planning and Management	
Seminar Course		3
		s.h.
ENGR 6900	Seminar (Course is repeated 3 times at 1 s.h. each time.)	
Business and Engineering Management Courses		
		9
		s.h.
ENGR 6930	Operations & Supply Chain Strategy	
Business Courses OMBA 69XX 6 s.h.		

Discipline-Specific Technical Courses ^{A minimum of 6 s.h. must be 6900 level.} 9 s.h.

Electrical & Computer Engineering Courses

Internship Plan

Students who have internship credits may wish to choose the Internship plan. A total of 30 semester hours of coursework is required for this plan. This consists of:

- 9 semester hours of core courses,
- 3 semester hours of seminar courses
- 6 semester hours of Internship courses
- 12 semester hours of technical courses

COURSE	TITLE	S.H.
Mathematics, Computer Science and Engineering		9 s.h.
MATH 6910	Advanced Engineering Mathematics 1	
MATH 6911	Advanced Engineering Mathematics 2	
	or CSCI 6951 Data Science and Machine Learning	
ENGR 6920	Project Planning and Management	
Seminar Course		3
ENGR 6900	Seminar (Course is repeated 3 times at 1 s.h. each time.)	
Internship		6 s.h.
STEM 6990	STEM Graduate Internships	
Discipline-Specific Technical Concentration Courses ^{A minimum of 6 s.h. must be 6900 level.}		9 s.h.
Electrical and Computer Engineering Courses		

4+1 Bachelor's/Master's Program Plan

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

- 9 semester hours of core courses
- 12 semester hours of technical courses
- 3 semester hours of Seminar
- 6 semester-hour graduate project or 6 semester-hour thesis

Undergraduate students can apply for admission into the 4+1 Bachelor's/Master's Program 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 Director upon admission into the program. An additional three hours of graduate coursework can be completed as an undergraduate and used exclusively for graduate credit.

Learning Outcomes:

- 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 5820 Function, Design, and Application of Medical Imaging Systems 3 s.h.

Introduction to the Physics, Instrumentation, Image Processing Methods used in common medical imaging modalities. Systems covered include X-Ray, CT, Ultrasound, MRI, nuclear medicine, and fluorescence. Primary foci will be system construction as well as image reconstruction and processing. Students will engage in limited hands-on image acquisition and code-based processing.

Prereq.: PHYS 2611 or ECEN 3741.

Prereq. or Coreq.: ECEN 3710.

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.

.

Sina Bakhtar Chavari, Ph.D., Assistant Professor
Additive manufacturing; energy-storage materials

Vamsi Borra, Ph.D., Assistant Professor
3D electronics; flexible electronics; electronic materials; reliability testing; controlled whisker growth; thin-film fabrication and characterization; and condensed matter physics-related research

Guy Gadola, Ph.D., Assistant Professor
Renewable energy systems; power grids; energy efficiency engineering

Frank Xiyang Li, Ph.D., Professor, Chair
Power electronics devices; RF engineering materials; applied magnetic materials