



Department of Electrical and Computer Engineering
College of Engineering and Applied Sciences
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Doctor of Philosophy (Ph.D.) Degree in

Electrical and Computer Engineering

(ECE)

Revised 11/21/06

Department of Electrical and Computer Engineering
College of Engineering and Applied Sciences
Western Michigan University
Kalamazoo, Michigan

The ECE Ph.D. program by the department is structured to provide an opportunity for engineering graduates to enhance their background in engineering, science, and design with graduate-level courses in electrical/computer engineering; it is designed to give students original research experience in their chosen field and to prepare them for careers in government, universities or industrial research centers. Students, based on their interests and background/preparation, and after consultation with the dissertation advisor, will concentrate their studies in one of the areas listed below to develop their doctoral dissertation topic.

Intelligent Controls:

Control systems research plays a major role in the Mid-Western industrial sector. Control methodology often involves real time computing through the so-called intelligent and automated controllers. Primary applications include motion control systems such as robotics, process controls and chemical processing. Research areas include fuzzy control and ontological control using automata theory and neural intelligent controllers in a real-time distributed computing environment; hardware accelerators for fuzzy logic re-configurable digital machines; power factor correction using semiconductor switching technology and compact high power switched mode power supplies. Real-time systems are prevalent in such diverse areas as the automotive industry, the defense industry and the medical industry. Power electronics is present in domestic appliances, automotive applications, military applications, industrial measurements control applications, and space applications.

Biomedical and Life Sciences Applications:

Areas of research interests are medical image processing and imaging systems such as computer tomography and magnetic resonance imaging. Doctoral topics may include the design, development, testing and commercialization of assistive devices that creatively exploit the wealth of electrical/electronic and computer technology currently available.

Signal Processing and Communications:

Research spans the areas of digital signal processing, image processing, computer vision and wireless communications. Research topics involve developing advanced algorithms for image processing applications and architecture for use in image/video coding and compression, track acquisition, target tracking and recognition, motion estimation from time-varying imagery, and nonlinear optimization. Other research topics include speech processing and coding and adaptive filter design; cellular mobile communications including application of new network architectures to cellular mobile communications and asynchronous transfer mode (ATM) technology for cellular systems.

Faculty areas of expertise include:

signal processing	applications	power electronics
real-time systems	biomedical electronics	analog circuit design
software engineering	computer architecture	intelligent controls
internet applications	communications	biosensors
control systems	motion controls	micro and nanofabrication
soft computing	stochastic systems	technology
fuzzy logic	neural networks	MEMS and NEMS
electromagnetics	fuzzy control systems	
advanced microprocessor	robotics	

Program Requirements

The ECE Ph.D. program consists of approved graduate course work, independent research, and dissertation preparation/defense. The main objective of a student's doctoral program will be to carry out original high quality research under the supervision of a graduate faculty in the department that will be presentable in the form of a dissertation. The dissertation must be in a form and contents acceptable to the ECE Department and the Graduate College before the student may be awarded the doctoral degree.

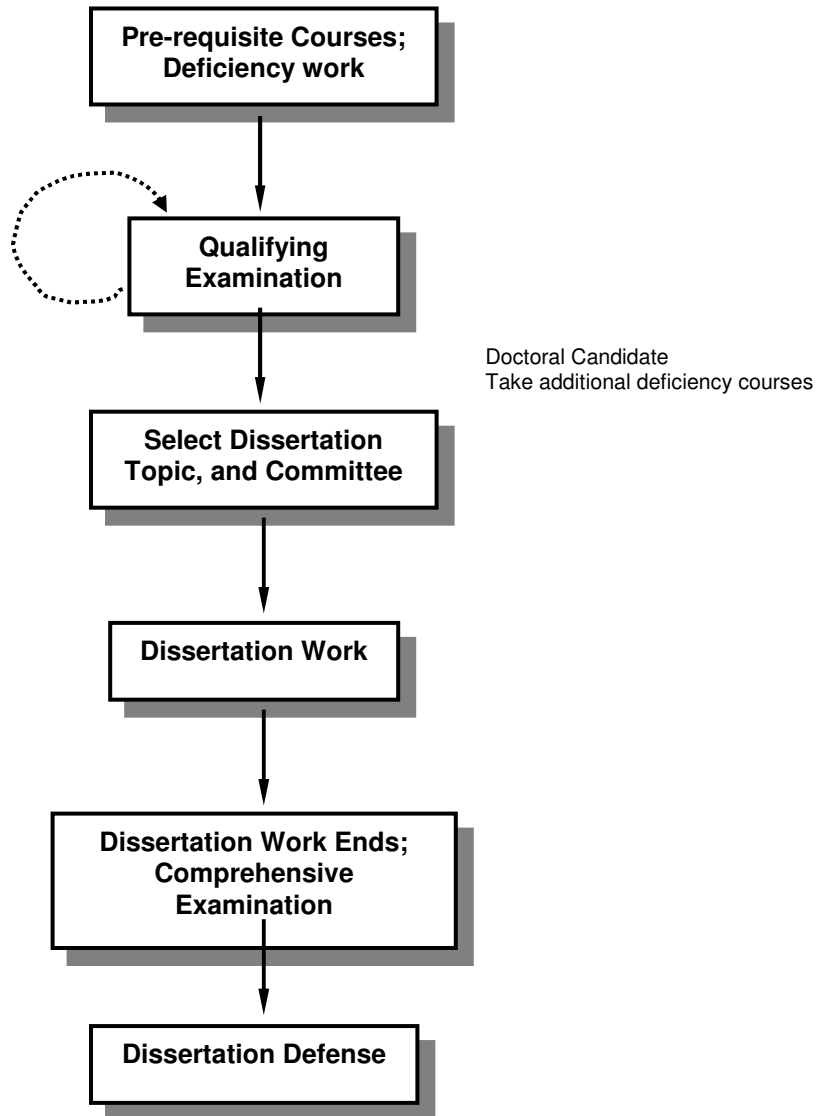
The **program requirements** consist of:

1. Minimum of 50 credit hours beyond the master's degree to include:
 - a. 15 hours of Doctoral Dissertation (ECE 7300),

- b. A maximum of 12 hours of Problems in Electrical/Computer Engineering (ECE 6970) or Independent Research (ECE 7100),
 - c. A minimum of 2 hours of ECE 7250 (Doctoral Research Seminar),
 - d. A minimum of 21 hours of graduate course work approved by the doctoral dissertation committee, at least 12 hours should be ECE courses,
2. Ph.D. Qualifying Examination to be taken within the first year of admission,
 3. Comprehensive Examination (administered by the doctoral dissertation committee), to be taken before student becomes a doctoral candidate,
 4. Graduate College Requirements,
 5. Presentation/publication requirements as specified by the doctoral dissertation committee,
 6. Research Tools: the required tools are simulation and modeling as well as statistics. Competency will be based on successful completion of ECE/ME 5800 and an approved course in statistical methods with a grade of "B" or better,
 7. A one-year residency requirement during which the student will conduct research,
 8. Final dissertation defense.

The following flowchart is a timeline of events for a student in the doctoral program:

ECE Doctoral Program Timeline



Admission Requirements

To be admitted to the Ph.D. program, a student must satisfy the following requirements:

1. MS degree in electrical or computer engineering, with a minimum 3.00 GPA.
Exceptional applicants with master's degree in other closely related quantitative fields such as engineering, mathematics, physics or computer science will be considered on a case by case basis, after completing a prescribed set of prerequisite courses,
2. Submit scores of the Graduate Record Examinations (GRE, Verbal, Analytical, Quantitative),
3. Three (3) recommendation letters from faculty familiar with the student's work,
4. A personal statement of academic goals and research written by the candidate,
5. Graduate College Requirements.

All requirements for the Ph.D. degree must be completed within seven (7) years preceding the date on which the degree is conferred.

Ph.D. Qualifying Exam

This section revised and adopted by ECE faculty 4/4/05

In order to assess a student's potential for graduate studies toward a Ph.D. degree in Electrical and Computer Engineering, the student must pass a written qualifying examination that covers the areas of electrical engineering and of computer engineering. A student that has passed the requirements of the Qualifying Exam as specified below will be considered a Ph.D. Candidate in the electrical and computer engineering doctoral program. The student must take the Qualifying Exam within twelve calendar months of the date of their acceptance letter to pursue a Ph.D. degree in Electrical and Computer Engineering. Tests will be administered on a regular basis as published by the department.

Each student must take an examination covering three areas: (1) Signals & Systems (which is common to electrical engineering and computer engineering); (2) electrical

engineering; and (3) computer engineering. Students desiring to take the exam should submit a request using the appropriate form to the Department at least three months before the exam date. The student must specify which topic they wish to test on from electrical engineering and which topic from computer engineering from the areas listed below:

Electrical Engineering

- Controls
- Electronics
- Power Engineering & Electromagnetics

Computer Engineering

- Digital Electronics & Computer Architecture
- Microprocessors & Real Time Systems
- Switching Theory & Digital Circuits

Faculty responsible for administering a specific subject area exam will evaluate and grade the performance of all students taking that exam as Pass or Fail.

A student must pass all three areas to be considered to have passed the Qualifying Exam. A student who fails to pass the examination may repeat the examination one more time – at the next available offering. If the student passes two of the examination sections, they will only be required to retake the single examination section that they failed. A student that fails two or more of the examination sections will be required to retake the entire examination.

Comprehensive Examination

The purpose of this exam, administered by the Doctoral Dissertation Committee, is to identify the student's proposed area of doctoral research.

The exam is taken near the end of the prescribed course work as specified by the dissertation committee. This exam has the following three components:

A written dissertation proposal prepared by the student and presented to the dissertation committee,

An oral presentation of the dissertation proposal,

An examination given by the dissertation committee to assess the student's preparation in the

major and related fields of study for conducting the proposed research.

Passing the comprehensive exam shall require satisfactory performance in all three components listed above.

Doctoral Dissertation Committee

This committee shall be composed of a minimum of three members of the graduate faculty, at least one of whom shall be from outside of the ECE department. The chair of the committee will be a graduate faculty member from the ECE department.

Graduate Courses

(See also the ECE department directory of classes for course offerings. Courses approved by the dissertation committee will be offered considering course staffing/enrollment.)

ECE Department Graduate Courses

ECE 5150	Introduction to Real-time Systems
ECE 5200	Power Electronics: Dynamics and Control
ECE 5210	Surface Mount Technology Design
ECE 5240	Intro to VLSI Technology
ECE 5300	Electric Power Systems
ECE5450	Introduction to Micro Electro Mechanical Systems
ECE 5510	Application Specific Integrated Circuit Design
ECE 5520	Switching and Finite Automata Theory
ECE 5530	Advanced Microcontroller Applications
ECE 5550	Advanced Digital Signal Processing
ECE 5570	Design of Reconfigurable Digital Machines
ECE 5600	Time-varying Fields
ECE 570	Digital Control Systems
ECE 580/ME 580	System Modeling and Simulation
ECE 5850/ME 5850	Mechatronics
ECE 5860/ME 5860	System Identification
ECE 5950	Topics in ECE
	<ul style="list-style-type: none">• Communication Systems• Electric Drives• State Space Control Systems• Electric Drives• Mechanical Control Robot Manipulator• Microcontroller Applications• Power Electronics• Virtual Reality Technologies
ECE 6050	Advanced Microprocessor Applications

ECE 6360/ME 6360	Applied Optics and Optical System Design
ECE 6400	Electronic Instruments I
ECE 6410	Electronic Instrumentation II
ECE 6500	Advanced Computer Architecture
ECE 6640	Digital Communications
ECE 6700	Modern Control Theory
ECE 6710	Optimal Control Systems
ECE 6720	Fuzzy Control Systems
ECE 6730	Artificial Neural Networks
ECE 6800	Design Factors for Distributed Systems
ECE 6900	Computer Engineering Seminar
ECE 6950	Advanced Topics in ECE
	<ul style="list-style-type: none"> • Medical Image Analysis and Imaging Systems • Advanced MEMS • Mobile Communications • Modeling and Simulation II • Non Linear Systems • Projects in Virtual Reality • Power systems Protection and Control • SAW Devices for Mobile Communications • Multirate signal processing
ECE 6970	Problems in ECE
ECE 7100	Independent Research
ECE 7250	Doctoral Research Seminar
ECE 7300	Doctoral Dissertation

Non-ECE Graduate Courses

To ensure adequate preparation for the graduate research subject, enrollment in courses from other programs must be approved by the dissertation faculty advisor.

Faculty

It has been said that the heart of every program is its faculty. The ECE department has a dedicated faculty who are interested in engineering education, research and professional service. Approximately one half of the present faculty has joined the department during the last five years when the university has increased its emphasis on research and scholarly activities. Here we present a brief listing of the specialization areas of the department faculty. More detailed vitae can be found on the Department Web site (www.wmich.edu/ece).

FACULTY	Areas of Specialization
Ikhlas Abdel-Qader	Multivariate Signal & Image Analysis, Pattern Recognition, Mammography, Medical Imaging Systems, Robotics Vision, Nondestructive Testing and Evaluation
Johnson Asumadu	Power Electronics, Digital Signal Systems Control Engineering (Including Fuzzy Logic) Embedded Systems
Massood Atashbar	Biosensors, Micro and nanofabrication technology, MEMS/NEMS, Nano-structured thin films, Nanocomposites, Wireless Microsystems, Analog and digital circuit design
Bradley Bazuin	Computer Architecture Wireless Communications RFID and GPS Systems
Liang Dong	Communication Systems Real-Time Systems Microelectronics

Raghvendra Gejji	Telecommunications Control Systems
John Gesink	Linear Electronics Electronic Instrumentation Biomedical Engineering
Janos Grantner	Fuzzy Logic Microprocessors Digital Systems Design
Dean Johnson	Virtual Reality Systems
Joseph Kelemen	Power Systems Power Electronics
Daniel Litynski	Photonics Optics Electromagnetics Engineering & Science Education National STEM Policy
Damon Miller	Circuits and Systems Computational Intelligence Artificial and Biological Neural Networks Simulation of Complex Systems Engineering Education
Hossein Mousavinezhad	Bio-electromagnetics Digital Signal Processing Communication Systems
Frank Severance	Mathematical Modeling Non-linear Models Control Systems, Stochastic Systems
Ralph Tanner	Robotics Mechatronics Control Systems