Department of
Electrical Engineering
and Computer Science

Department

of

Electrical Engineering and Computer Science

Graduate Student Handbook

Revision Date: March 14, 2024

Foreword

The Department of Electrical Engineering and Computer Science (EECS) at the University of Toledo offers graduate programs leading to the Master of Science in Electrical Engineering (MSEE), the Master of Science in Engineering with concentration in Computer Science and Engineering (MSE), and the Doctor of Philosophy (Ph.D.) in Engineering Science degrees with concentrations in Electrical Engineering or Computer Science and Engineering.

The current research focus of the Department faculty is in the following Tracks and Specialization Areas:

Electrical Engineering

System Sciences Track

Communications
Signals, Image Processing and Computer Vision
Controls

Physical Sciences Track

Materials, Devices, Electromagnetics and Plasma
Power

Computer Science and Engineering

Computer Engineering Track

Advanced Computing Systems

Computer Science Track

Artificial Intelligence
Cyber Security and Trust

This handbook describes the graduate programs of the Department. It also outlines several procedures for graduate students and states various departmental rules and regulations.

The information provided in this handbook is intended as a supplement to, and not a substitute for, the College of Graduate Studies (COGS) Catalog and other documents of the University of Toledo. The COGS Catalog contains general rules and regulations governing the University's graduate programs. The department web site is at the following link: https://www.utoledo.edu/engineering/electrical-engineering-computer-science/, and the COGS home page is at https://www.utoledo.edu/graduate/.

1 The policies and guidelines contained in this handbook are provided for general guidance and are subject to change by the department. Students are encouraged to consult their academic advisors and the Graduate Program Director for clarification of any issues. (Revised: March 14 2024)

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1. ACADEMIC AND RESEARCH PROGRAMS

The faculty of the EECS Department participate in several research Specialization Areas (SA). Research activities of faculty often overlap across multiple SAs, and therefore several faculty members participate in more than one of these areas. Each SA offers a set of core courses (which every student in that focus group is required to take) and another set of recommended courses. Recommended courses are to be selected by the student in consultation with their advisor in order to complete the course requirements for the degree. The graduate curriculum, to the degree possible, provides depth as well as breadth in the plan of study for all graduate students.

For a more information, please see the sections below which describe M.S. and Ph.D. degree academic requirements.

Students majoring in **Computer Science & Engineering (CSE)** may choose from the following three Specialization Areas:

- Advanced Computing Systems (ACS)
- Artificial Intelligence (AI)
- Cyber Security (CyS)

Students majoring in **Electrical Engineering (EE)** may choose from the following five Specialization Areas:

- Communications
- Signals, Image Processing and Computer Vision (SPCV)
- Controls
- Materials, Devices, Electromagnetics and Plasma (MDEP)
- Power

Not all specialization areas may be active (i.e., available to choose) during a given academic year, and therefore students joining the graduate programs should contact the EECS Graduate Program Director to learn about available active specialization areas before registering for courses and choosing a specialization.

Please note that students admitted to and pursuing EE specialization areas will receive a degree in Electrical Engineering (MS in EE) in Engineering (PhD in Engineering with specialization/concentration in EE); those pursuing CSE areas will receive a degree in Engineering (with concentration in CSE).

Changing the SA is not recommended; however, those students wishing to change their SA to another within their major only must complete a "Request for Change of Specialization Area" form, which will be available at the Department's web site.

Students wishing to change their SA to one within another major must re-apply for that major through the College of Graduate Studies (COGS).

Specialization Areas

Although the Department will make every effort to have all Specialization Areas (SA) available to newly admitted student, due to resource limitations, one or more of the SAs in a given admission cycle may not be active/available. Newly admitted students are advised to consult with the Graduate Program Director to explore available SAs prior to starting their very first semester of their degree program.

1.1 Advanced Computing Systems (ACS)

Faculty Members: Mohammed Niamat (ACS Leader), Devinder Kaur, Ahmad Javaid, Kishwar Ahmed, Samia Tasnim, Liang Cheng

Advanced Computing Systems (ACS) group focusses on research in the areas of high performance computing, innovative computer architecture, cybersecurity, cyber physical systems, machine learning/artificial intelligence, cloud computing, information systems and services, system software for parallel computing, scalable system architecture, reliable computing, field programmable gate arrays, VLSI Design, fault tolerance and reliability, and tools and methods for evaluating emerging computing architectures including novel computing technologies beyond Moore's Law.

Further research in the ACS group encompasses computing from both the programming language and the computer architecture viewpoints; computational complexity; quantum computing; design of both software and hardware; distributed systems; databases; performance modeling of computer and communication networks; adaptive scheduling, resource reservation and routing protocols; fast algorithms; cellular and high-performance computing; theoretical foundations and advanced analysis for real-time, hybrid and embedded systems.

Research may also involve applications of mathematical and computing principles from other domains to the areas mentioned above including but not limited to machine learning, computational/artificial intelligence, mathematical and economic theories such as game theory, ruin theory, and prospect theory, simulation, analytical/mathematical modeling, and analysis, pattern analysis, and data fusion.

Students specializing in the ACS area are advised to select core and recommended courses from the following list in consultation with their advisors.

Required Core Courses:

EECS 6180/8180: Biologically Inspired Computing
EECS 6660/8660: Field Programmable Gate Arrays
EECS 6640/8640: Hardware Oriented Security and Trust

Recommended Courses:

EECS 5720: Fundamentals of Cybersecurity
EECS 5750: Machine Learning
EECS 5760: Computer Security
EECS 6630/8630: Digital and VLSI System Testing

Students may also choose other EECS courses not listed above as recommended courses in consultation with their advisors. In exceptional cases, recommended courses may be taken from other departments such as Mathematics, Chemistry, Physics and Astronomy, or other College of Engineering Departments. The faculty advisor must approve such courses in advance.

Faculty Research Interests:

Dr. Mohammed Niamat's research is in the area of hardware-oriented security and trust; reconfigurable processors including field programmable gate arrays; reliable computing including testing of digital, reconfigurable, system on chip and VLSI circuits; built in self-test (BIST); fault modeling; and applications of blockchain technology and machine learning in various areas including hardware security and supply chains.

Dr. Devinder Kaur's research is in the areas of computer architecture, parallel and distributed processing, intelligent systems based on fuzzy logic, neural networks and bio-inspired algorithms.

Dr. Ahmad Javaid's research is in the areas of cybersecurity of drone networks, smartphones, wireless sensor networks, and other cyber-physical systems. He is also conducting extensive research on human-machine teams and applications of AI and machine learning to areas including but not limited to attack detection and mitigation.

Dr. Kishwar Ahmed's research is in the areas of parallel and distributed computing, cloud computing, edge computing, discrete-event simulation, hardware software co-design, interconnection network, distributed scheduling, resource management, and game theory.

Dr. Samia Tasnim's research is in the areas of Internet of Things (IoT), mobile computing, security, intelligent systems, and data mining.

Dr. Liang Cheng's research focuses on CPHS (Cyber-Physical-Human Systems) and is geared toward enabling intelligent infrastructure based on the convergence of real-time sensing, model-driven data analytics, and machine learning through inter-disciplinary projects, such as

CPS and IoT projects funded by the U.S. NSF (National Science Foundation), Department of Energy (DOE), ABB, etc.

1.2 Artificial Intelligence (AI)

Members: Devinder Kaur (AI Leader), Gursel Serpen, Samia Tasnim, Liang Cheng

Artificial intelligence aims to infuse machines with human-like intelligence, such as the ability to perceive and learn from their environments and make decisions based on this knowledge. The AI faculty conduct research in a variety of areas in AI including machine learning, data mining, fuzzy logic and reasoning, heuristic search, optimization, adaptation and automation, and probabilistic modeling and inference. Application areas include biomedical informatics, computational biology, image interpretation, computer security, social and information networks, cognitive wireless sensor networks, wearable data analytics, and many other applications to healthcare and education.

Students specializing in the AI area are advised to select core and recommended courses from the following lists in consultation with their advisors.

Required Core Courses:
EECS 5740: Artificial Intelligence
EECS 5750: Machine Learning
EECS 6180/8180: Biologically-Inspired Computing

Recommended Courses:
EECS 5120: Fuzzy Systems and Applications
EECS 5330: Image Analysis and Computer Vision
EECS 5390: Wireless and Mobile Networks
EECS 5650: Social and Information Networks
EECS 6300: Random Signals and Optimal Filters
EECS 6580/8580 Wireless Sensor Networks
EECS 6980/8980: Probabilistic Methods in Data Science
EECS 6980/8980: Pattern Recognition and Neural Networks

Students may also choose other EECS courses not listed above as recommended courses in consultation with their advisors. In exceptional cases, recommended courses may be taken from the MIME, BIOE, Physics and Mathematics departments. Such courses must be approved in advance by the faculty advisor.

Faculty Research Interests:

Dr. Devinder Kaur's research is in the areas of intelligent systems based on fuzzy logic, neural networks, bio-inspired algorithms, computer architecture, and parallel and distributed processing.

Dr. Gursel Serpen's research is in the areas of artificial intelligence and machine learning, and their applications in adaptation and automation, optimization, cyber security, bio-medical informatics, sensor networks and legal reasoning.

Dr. Liang Cheng's research focuses on CPHS (Cyber-Physical-Human Systems) and is geared toward enabling intelligent infrastructure based on the convergence of real-time sensing, model-driven data analytics, and machine learning through inter-disciplinary projects, such as AI/ML based projects funded by the U.S. Department of Transportation (DOT), Department of Energy (DOE), Ingersoll-Rand, etc.

The research in this research group has been funded by the NSF, NIH, NGA, AFOSR, the Ohio Federal Research Network, University of Toledo, and industry partners.

1.3 Cyber Security and Trust (CSAT)

Members: Ahmad Javaid (CSAT Leader), Lawrence Thomas, Mohammed Niamat, Liang Cheng

The research in CSAT involves study, development and/or testing of techniques, algorithms and systems that protect security and integrity of cyber systems (hardware or software), the information they store or process, and the users of these systems. Current areas of investigation include developing and applying new approaches to practical encryption, securing web-based computing services, security simulation, privacy technologies, cyber physical system security, malware & malicious activity detection for systems, hardware oriented security and trust including but not limited to detection of trojans, improved software engineering techniques, secure data encoding, communication protocols, communication security, secure machine learning, human factors research, penetration testing, and use of cutting edge technologies such as blockchain.

Research may also involve applications of mathematical and computing principles from other domains to the areas mentioned above including but not limited to machine learning, computational/artificial intelligence, mathematical and economic theories such as game theory, ruin theory, and prospect theory, simulation, analytical/mathematical modeling, and analysis, pattern analysis, and data fusion.

Students specializing in the CSAT area are advised to select core and recommended courses from the following list in consultation with their advisors.

<u>Required Core Courses</u>:

EECS 5720: Fundamentals of Cybersecurity
EECS 5760: Computer Security
EECS 6640/8640: Hardware Oriented Security and Trust

Recommended Courses:

EECS 5390: Wireless and Mobile Networks
EECS 5640: Inside Cryptography
EECS 5790: Network Security
EECS 6340/8340: Modern Communications I
EECS 6350/8350: Modern Communications II

Students may also choose other EECS courses not listed above as recommended courses in consultation with their advisors. In exceptional cases, recommended courses may be taken from the MIME, BIOE, Physics and Mathematics departments. Such courses must be approved in advance by the faculty advisor.

Faculty Research Interests:

Dr. Ahmad Y. Javaid's research is in the areas of cybersecurity of drone networks, smartphones, wireless sensor networks, and other cyber-physical systems. He is also conducting extensive research on cybersecurity education, human-machine teams and applications of AI and machine learning to areas including but not limited to attack detection and mitigation.

Dr. Lawrence Thomas's research is in the area of software engineering, empirical algorithmic analysis, code optimization, and computer security.

Dr. Mohammed Niamat's research is in the area of hardware-oriented security and trust; reconfigurable processors including field programmable gate arrays; reliable computing including testing of digital, reconfigurable, system on chip (SOC) and VLSI circuits; Built In Self-Test (BIST); fault modeling; and applications of blockchain technology and machine learning in various areas including hardware security and supply chain.

Dr. Liang Cheng's research focuses on CPHS (Cyber-Physical-Human Systems) and is geared toward enabling intelligent infrastructure based on the convergence of real-time sensing, model-driven data analytics, and machine learning through inter-disciplinary projects, such as cybersecurity projects funded by the U.S. Department of Energy (DOE).

1.4 Communications

Members: Junghwan Kim (Communications Leader), Ezzatollah Salari, Liang Cheng.

The research in the Communications includes a variety of topics such as mobile wireless sensor network, satellite communication, process control, real-time control, optimal control, and neural networks.

The research in communications and communications systems involves modeling, simulation and performance analysis of communication systems, mobile/satellite system architecture, and network and payload design. Work also involves on tactical communication network, digital video/audio/multimedia broadcasting, advanced channel coding using FEC codes including turbo code and LDPC codes.

Students specializing in the Communications area are advised to select core and recommended courses from the following lists in consultation with their advisors.

Required Core Courses:
EECS 5390: Wireless and Mobile Networks
EECS 6340/8340: Modern Communications I
EECS 6350/8350: Modern Communications II

Recommended Courses:
EECS 5360: Communication Systems
EECS 5370: Information Theory and Coding
EECS 5380: Digital Signal Processing
EECS 6300/8300: Random Signals and Optimal Filters

Students may also choose other EECS courses not listed above as recommended courses in consultation with their advisors. In exceptional cases, recommended courses may be taken from the MIME, BIOE, Physics and Mathematics departments. Such courses must be approved in advance by the faculty advisor.

Faculty research interests:

Dr. Junghwan Kim's research is in the areas of modeling and performance analysis of on-board processing satellite system and its architecture, anti-jamming techniques and spread spectrum system, cellular and mobile wireless network, advanced channel coding, multimedia broadcasting and physical layer (PHY)–based encryption.

Dr. Ezzatollah Salari's current research is in the areas of pattern recognition, neural networks, and machine learning involving convolutional neural network, deep learning, generative models, GANs, SVM and random forests in a variety of image processing applications.

Dr. Liang Cheng's research focuses on CPHS (Cyber-Physical-Human Systems) and is geared toward enabling intelligent infrastructure based on the convergence of real-time sensing, model-driven data analytics, and machine learning through inter-disciplinary projects, such as network system projects funded by the U.S. NSF (National Science Foundation), Defense Advanced Research Projects Agency (DARPA), etc.

1.5 Signals, Image Processing and Computer Vision (SPCV)

Members: Ezzatollah Salari (SPCV leader), Junghwan Kim, Liang Cheng

The research in the SPCV area includes a variety of topics such as mobile wireless sensor network, process control, real-time control, optimal control, pattern recognition, neural networks, machine learning, image processing and biomedical applications.

The research in pattern recognition & neural networks, machine learning and image processing mainly focuses on exploring advanced pattern recognition and machine learning techniques for a variety of image processing applications. Current focus is on the use of convolutional neural network, deep learning, generative models, GANs, SVM and random forests mainly for biomedical images. Also, a variety of advanced techniques for Image fusion, tracking of objects in a video, and data compression have been developed.

Students specializing in the SPCV area are advised to select core and recommended courses from the following lists in consultation with their advisors.

Required Core Courses:
EECS 5330: Image Analysis and Computer Vision
EECS 5380: Digital Signal Processing
EECS 6320/8320: Data Compression for Multimedia Communication

Recommended Courses:
EECS 5750: Machine Learning
EECS 6300: Random Signals and Optimal Filters
EECS 5390: Wireless and Mobile Networks
EECS 6980/8980: Pattern Recognition and Neural Networks

Students may also choose other EECS courses not listed above as recommended courses in consultation with their advisors. In exceptional cases, recommended courses may be taken from the MIME, BIOE, Physics and Mathematics departments. Such courses must be approved in advance by the faculty advisor.

Faculty Research Interests:

Dr. Ezzatollah Salari's current research is in the areas of pattern recognition, neural networks, and machine learning involving convolutional neural network, deep learning, generative models, GANs, SVM and random forests in a variety of image processing applications.

Dr. Junghwan Kim's research is in the areas of modeling and performance analysis of on-board processing satellite system and its architecture, anti-jamming techniques and spread spectrum system, cellular and mobile wireless network, advanced channel coding, multimedia broadcasting and physical layer (PHY)–based encryption.

Dr. Liang Cheng's research focuses on CPHS (Cyber-Physical-Human Systems) and is geared toward enabling intelligent infrastructure based on the convergence of real-time sensing, model-driven data analytics, and machine learning through inter-disciplinary projects, such as wireless- or image-based sensing projects funded by the U.S. NSF (National Science Foundation), Department of Transportation (DOT), etc.

1.6 Controls

Members: Richard Molyet (Controls Leader), Raghav Khanna, Liang Cheng

The research in the Controls area includes topics such as process control, real-time control, optimal control, neural networks, and machine learning. The research in control focuses on control of autonomous vehicles, smart grid systems, dc power systems, and biomedical processes.

Students specializing in the Controls area are advised to select core and recommended courses from the following lists in consultation with their advisors.

Required Core Courses:
EECS 5200: Feedback Control Systems
EECS 5260: Control Systems Design
EECS 6200/8200: Digital Control Systems

Recommended Courses:
EECS 5750: Machine Learning
EECS 6230/8230: Optimal Control Theory
EECS 6300/8300: Random Signals and Optimal Filters
EECS 6980/8980: Pattern Recognition and Neural Networks

Students may also choose other EECS courses not listed above as recommended courses in consultation with their advisors. In exceptional cases, recommended courses may be taken from the MIME, BIOE, Physics and Mathematics departments. Such courses must be approved in advance by the faculty advisor.

Faculty Research Interests:

Dr. Richard Molyet's research is in the areas of modeling and control of autonomous vehicle collision avoidance, control and performance evaluation of smart grid systems using SMES storage, control of shipboard dc power systems, and modeling and control of biomedical processes such as human kidney function.

Dr. Raghav Khanna's research is in the areas power systems, renewable energy integration, power electronics, and modeling and characterization of wide bandgap semiconductors for improved performance of next generation power electronic circuits.

Dr. Liang Cheng's research focuses on CPHS (Cyber-Physical-Human Systems) and is geared toward enabling intelligent infrastructure based on the convergence of real-time sensing, model-driven data analytics, and machine learning through inter-disciplinary projects, such as industrial control system-based projects funded by the U.S. NSF (National Science Foundation), Department of Energy (DOE), etc.

1.7 Materials, Devices, Electromagnetics and Plasma (MDEP)

Members: Daniel Georgiev (MDEP Leader), Abbas Semnani, Raghav Khanna

The research of the MDEP group focuses on a blend of electrical engineering and applied/engineering physics topics that exploit electromagnetics, photonics, plasma and semiconductor basics, as well as atomic and molecular scale phenomena in developing next generation of solid-state materials and devices, plasma-based devices and systems, and microwave and RF electronics. The research targets the growing demand for renewable/alternative energy, electrical energy conversion and storage, reconfigurable devices and systems for emerging wireless applications and communications, photovoltaics, solid-state lighting, sensors, low-power electronics, and harsh environments capable electronics.

Current and past MDEP research projects have been funded by NSF, NASA, OFRN, DOD, DOE as well as industry sources.

Students specializing in the MDEP area are advised to select core and recommended courses from the following list in consultation with their advisors.

<u>Required Core Courses:</u>
EECS 5410: Electro-Optics
EECS 5420: Microwave Electronics
EECS 6840/8840: Compound Semiconductors and Devices

<u>Recommended Courses:</u>
EECS 5330: Image Analysis and Computer Vision

EECS 5480: Power Electronics 1
EECS 6340/8340: Modern Communications I
EECS 6350/8350: Modern Communications II
EECS 6450/8450: Advanced Power Electronics
EECS 6980/8980: Plasma in Engineering and Science

Students may also choose other EECS courses not listed above as recommended courses in consultation with their advisors. In exceptional cases, recommended courses may be taken from the MIME, BIOE, Physics and Mathematics departments. Such courses must be approved in advance by the faculty advisor.

Faculty Research Interests:

Dr. Daniel Georgiev's research interests are in the areas of electronic materials and device fabrication, laser processing of materials, glassy semiconductors, magnetic materials, and device modeling.

Dr. Abbas Semnani's research interests are in the areas of low-temperature plasma and plasma metamaterials, tunable antenna arrays, reconfigurable RF electronics, applied and computational electromagnetics, high-power microwaves, inverse scattering, RF nanotechnology and plasma physics

Dr. Raghav Khanna's research interests are in the areas of modeling and characterization of wide bandgap semiconductors for improved performance of next generation power electronic circuits, and in renewable energy integration.

1.8 Power

Members: Raghav Khanna (Power Leader), Richard Molyet

Climate change effects and the resulting demand for clean energy have led to significant technological advancements in the areas of power systems, control, power electronics, and semiconductor devices. Integrated together, these disparate topics of varying levels of abstraction can lead to substantial improvements in the efficacy of renewable energy systems, the smart grid, transportation electrification systems, and electronic devices. Consequently, specific areas of interest for this focus group include power converter design and operation, semiconductor device modeling and characterization, utilization of energy storage devices for grid-related harmonic mitigation, stability analysis of the smart grid, cybersecurity of the smart grid, and advanced strategies for renewable energy integration.

Recent externally funded research projects have been sponsored by the *US Department of Defense, US Department of Energy, and NASA Jet Propulsion Laboratory* with objectives related to power electronic device modeling, converter design, and improved integration of solar technology. Even more recently, a research grant has been allocated from *Lawrence Livermore National Laboratory* related to analysis of cybersecurity threats to the smart grid.

Students specializing in Power area are advised to select core and recommended courses from the following lists in consultation with their advisors.

Required Core Courses:
EECS 5460: Power System Management
EECS 5480: Power Electronics 1
EECS 6450/8450: Advanced Power Electronics

Recommended Courses:
EECS 5200: Feedback Control Systems
EECS 5240: Power System Operation
EECS 5260: Control System Design
EECS 5410: Electro-Optics
EECS 5420: Microwave Electronics
EECS 5720: Fundamentals of Cybersecurity
EECS 6220/8220: Nonlinear Control Systems
EECS 6230/8230: Optimal Control Theory
EECS 6840/8840: Compound Semiconductors and Devices
EECS 6980/8980: Plasma in Engineering and Science

Students may also choose other EECS courses not listed above as recommended courses in consultation with their advisors. In exceptional cases, recommended courses may be taken from the MIME, BIOE, Physics and Mathematics departments. Such courses must be approved in advance by the faculty advisor.

Dr. Raghav Khanna's research is in the areas of modeling and characterization of wide bandgap semiconductors for improved performance of next generation power electronic circuits, and in renewable energy integration.

Dr. Richard Molyet's research is in the area of optimal and feedback control, as well as the use of energy storage devices for grid-related harmonic mitigation.

2. GRADUATE PROGRAM OUTCOMES

The following are the Department's Graduate Program Outcomes, approved in Spring 2020.

M.S. in Electrical Engineering

1. Apply specialized knowledge and skills gained through the MSEE program to solve complex electrical engineering problems.

2. Demonstrate competency commensurate with the master's education for one or more of the following engineering activities: design, develop, integrate, simulate, prototype, test, verify or validate a component, subsystem, system in hardware or software.

3. Demonstrate effective communication skills.

4. Demonstrate professionalism appropriate to the discipline.

M.S. in Engineering with concentration in Computer Science and Engineering

1. Apply specialized knowledge and skills gained through the MSECSE program to solve complex computer engineering or computer science problems.

2. Demonstrate competency commensurate with the master's education for one or more of the following computer engineering or computer science activities: design, develop, integrate, simulate, prototype, test, verify or validate a component, subsystem, system in hardware or software.

3. Demonstrate effective communication skills.

4. Demonstrate professionalism appropriate to the discipline.

Ph.D. in Engineering with concentration in Electrical Engineering

1. Apply advanced and specialized knowledge and skills gained through the program to solve novel and complex problems in the domain of electrical engineering.

2. Demonstrate competency commensurate with the doctoral education by making an original and substantial contribution to the body of knowledge in electrical engineering.

3. Demonstrate effective communication skills.

4. Demonstrate professional skills appropriate to the discipline.

Ph.D. in Engineering with concentration in Computer Science and Engineering

1. Apply advanced and specialized knowledge and skills gained through the program to solve novel and complex problems in the domains of computer science or computer engineering.

2. Demonstrate competency commensurate with the doctoral education by making an original and substantial contribution to the body of knowledge in computer science or computer engineering.

3. Demonstrate effective communication skills.

4. Demonstrate professional skills appropriate to the discipline.

3. REGISTRATION

Students must choose a Specialization Area in their major to identify the course to register before their first semester starts in their degree program. Course registration can be done online through the student's UT account. It is strongly recommended that course registration is done as early as possible, much before the semester begins. The Graduate Program Director (or the Specialization Area Leader) can serve as the faculty advisor of new students until a permanent advisor is chosen.

A Plan of Study (PoS) should be prepared and submitted as soon as possible but no later than the end of the first regular semester of the student's studies. Changes in the student's PoS may be requested by submitting an amended PoS form. It is the responsibility of the student to ensure that required courses in the program are taken.

3.1 FINANCIAL SUPPORT

Students with Research Assistantships (RA) or Graduate/Teaching Assistantships (GA/TA) are expected to meet certain research objectives. RAs are supported by faculty research grants and are expected to work with the respective faculty and to help meet their research goals and expectations. GAs/TAs are supported by the department and they are assigned up to twenty hours of teaching/grading duties per semester. GAs/TAs are expected to meet the goals set by the department as well as those of the faculty advisor(s) in terms of research output.

3.2 FULL-TIME STATUS

Full-time graduate students supported by the Department must register for a minimum of 9 graduate credit hours each semester including projects, independent study, research and thesis. Self-supported full-time international students must complete a minimum of 9 hours each term. Courses taken on an audit basis cannot be counted in these 9 hours.

Students with Research Assistantships (RA), Graduate Assistantships (GA), Teaching Assistantships (TA), University Fellowships (UF), Tuition Scholarships (TS) and any other financial assistance from general funds must maintain full-time status, exclusive of audit hours. If a supported student falls below the required minimum (9 credits) registration through course withdrawals during any term, he or she will be liable for the tuition for that term. Registering for credit hours in excess of the limit for a given type of financial support (e.g., 9 cr.h.) may need to be covered by the student or may result in financial penalties.

First-year students receiving financial support from the Department must register for three regular courses (a minimum of 9 hours total) per semester during each regular semester of the first year in addition to research or other credit hours to meet full-time registration

requirements. The three course/9-credit load requirement is exclusive of independent study, research, thesis, etc.

3.3 PART-TIME STATUS

To maintain an active degree program status, students are required to register for at least one credit each term. Part-time students are expected to take at least one course per term or register for thesis or dissertation work in order to complete the degree program within a reasonable time. Exceptions may be granted for such reasons as illness, maternity leave or travel requirements imposed by employers.

3.4 EXCESSIVE CREDIT HOURS

According to State of Ohio and University rules, there is a maximum number of credit hours that graduate students can earn while still being eligible for financial support from general funds. Graduate students who remain in their program for longer time than the average (or longer than their expected graduation date), and earn more credit hours that the minimum required towards their degree, should be aware of the above limit and should check with COGS.

3.5 COURSE REGISTRATION REGULATIONS

Changes in the registration can be made online through the student's account. Some courses (such as thesis/dissertation research, independent research, independent study), as well as registration/adding after the first week of the semester, require registration override/permission by the instructor for the course. Such overrides must be requested from the instructor in advance. Courses cannot be added after the 15th calendar day of the semester.

Permission to audit a course is at the discretion of the instructor of the course, who is not obligated to accept a student for audit. Audit course credits do not count towards degree requirements. Audit hours also do not count toward the maximum number of allowed credit hours (see section 2.4) for university funded financial assistance and they do not count toward full-time status. Audit credit hours do, however, require payment of tuition. No more than three courses can be taken on an audit basis.

3.6 RESEARCH COURSES

EECS 6900(M.S)/8900(Ph.D): Independent Research

Both Masters (6900) and Doctoral (8900) students may register for research hours up to the maximum allowable for each semester. Such research hours may be used to explore research topics for a thesis or dissertation. An example for a master's degree student would be EECS 6900:0XY - 3 hours, where 0XY is the identification number (or section) of the advisor. For a doctoral student an example is EECS 8900:0XY - 2 hours. Type of grade: S or U.

Note: Independent Research credit hours cannot be counted towards the minimum credit hour degree requirement (30 cr.h. for the MS degree and 60 or 90 cr.h. for the Ph.D. degree). A self-supported student working only on thesis or dissertation and using University resources must register for a minimum of 1 credit hour each term in order to have an active status in the program.

EECS 5920: M.S Projects
6 hours of the 30 required for a master's degree (project option) may be used for the project. Type of grade: S or U.

EECS 6960: Master's Graduate Research and Thesis
A total of 9 hours of the 30 required for a master's degree (thesis option) may be used for the thesis. An example for a master's degree student would be EECS 6960:0XY - 3 hours, where 0XY is the identification number (or section) of the advisor. Type of grade: S or U.

EECS 8960 (Ph.D): Dissertation
An example dissertation registration for a Ph.D. candidate would be EECS 8960:0XY - 3 hours, where 0XY is the identification number (or section) of the advisor. Type of grade: S or U.

EECS 6990(M.S)/8990 (Ph.D): Independent Study
Independent study is defined as individualized study under the direction of an EECS faculty member, and is distinct from thesis or dissertation research. A maximum of 3 credits of independent study may be counted toward the M.S. degree course work requirements; an additional 6 credits may be counted toward the doctoral degree course work requirement. This course number is not to be used for thesis/dissertation research. Type of grade: letter grade.

4. GENERAL INFORMATION

4.1 RESPONSIBILITIES OF GRADUATE STUDENTS

- Maintain a cumulative GPA of at least 3.0 with no less than C grade for any course in the Plan of Study
- Comply with all University, College, and Departmental regulations.
- Complete and submit the appropriate forms.
- Keep the EECS department office updated regarding current address, phone number, and e-mail addresses.
- Make satisfactory progress (as determined by the faculty advisor) in their research (applies to Ph.D. students and M.S. students who have chosen either the thesis or the project option)
- Perform their TA/GA duties at a satisfactory level, if supported by a TA/GA.

4.2 COMPLETION OF STUDENT RESEARCH

It is expected that the research and the resulting thesis or dissertation will be completed while the student is in full-time residence. This is especially to be expected of those students who have received support (GA, TA, RA, or TS). Departure before the final acceptance of the thesis or dissertation generally results in long delays before completion, in some cases so long that the work has been superseded by the work of others and may no longer be considered acceptable and meeting the requirements. International students must maintain full-time status and remain in residence until all requirements for the degree are met.

In those instances where unusual circumstances exist and the student wishes to complete his or her degree while no longer in residence, the student must provide adequate justification and secure written concurrence in advance by both the advisor and the Graduate Program Director. The student and the advisor must also agree on a schedule for completing the degree. Failure to do so can result in resignation of the advisor and/or the student being considered as withdrawn from the program.

4.3 GRADE REQUIREMENTS FOR GRADUATION

All regular (i.e., non-research) course work which is to be counted towards the M.S. or Ph.D. degree, must be taken for a letter grade (A, A-, B+, etc.), and cannot be taken on Pass/Fail, S/U, or audit basis. A letter grade of C- or below is not acceptable for graduate credit, although such grades are included in the computation of the grade point average (GPA). All research courses (see section 2.6) must be taken with a grade S (using only S or U type of grades) in order to be counted towards the degree. Independent study is graded with a letter grade (A, A-, B+, etc.).

In order to be awarded the master's or the doctoral degree, the student must have a GPA of at least 3.00/4.00 (B average) for all credits (course work and thesis research) in his or her program of study. Grades earned in courses which are repeated are included in the computation of the GPA.

If a grade of incomplete (IN) or progress (PR) is received, the student must remove the IN or the PR grade from the record as soon as possible. After one semester, the IN grade automatically changes to an F (failure). No student may graduate with an IN or PR on their record.

4.4 CONTINUATION AND DISMISSAL

A student may continue their studies in the EECS Department as long as reasonable progress is being made toward the degree. From an academic viewpoint, this means that the student's record in graduate course work, exclusive of thesis or dissertation research, continues to exhibit an average of B or better with an appropriate distribution of A, B, and C grades, and that IN and PR grades appear only infrequently and for a good cause.

Academic dishonesty and misconduct will be dealt with according to the current University policies. The process involves the course instructor and may require the department and the college intervention; the consequences may be as severe as expulsion of the student from the graduate program and the university.

4.5 FACILITIES AND STUDENT SERVICES

Graduate students can use their university account for academic use of computers, computer networks and access to the Internet, as well as servers or mainframe computers operated by the University Computer Center or Engineering College Computing office. In some cases, an approval by the department chair may be required. The University has an excellent central library facility (Carlson Library). Graduate students may reserve a carrel in the library, if available, for study purposes.

Keys or cards for access to departmental areas are assigned on a discretionary, as-needed basis. All keys must be returned to the Key Control Office at the end of each academic year and prior to leaving the University. A cash deposit is required by the University for each key authorized. Deposits are returned when the Key Control Office confirms that a key has been returned. In addition, grades, transcripts, and final paychecks will be withheld from individuals who have not returned keys.

Computer accessories and supplies, laser printing, copying, and similar items are the students' responsibility and will not be furnished by the department.

The Graduate Student Association (GSA) is available to assist and serve graduate students in many ways. Their offices are located in the Student Union. For a list of the services or assistance GSA has available, please contact the GSA office.

5. MASTER OF SCIENCE DEGREE REQUIREMENTS

5.1 BASIC REQUIREMENTS

The Master of Science Degree is offered with the following options.

1. Master of Science Degree with Thesis Option: A minimum of 30 credit hours of approved graduate study including 9 credit hours of Master of Science Thesis under the supervision of an EECS faculty member is required. Students are required to successfully complete the oral defense of the thesis work, submit typed copies of their thesis to the Graduate School and the department (see Section 4.6).

2. Master of Science Degree with Non-Thesis Options: The degree requirements for Master of Science with Non-Thesis option are available with the approval of the Department Chair or the Department Graduate Program Director:

a. **Master of Science Degree with Project Option:** Students are required to complete 30 credit hours of an approved graduate study including 6 hours of Master of Science Project as specified by individual department guidelines and requirements. Students are required to submit a Project Report to the department approved by a *committee consisting by the student's advisor and another faculty member*.
b. **Master of Science Degree with Coursework-only Option:** Students are required to complete a minimum of 30 credit hours of approved graduate-level course work.

All students must complete the following additional requirements:

- Take all core courses and a selection of recommended courses from their Specialization Area (see Section 1) in consultation with their advisor.
    - Apply for and receive advanced approval from the faculty advisor for recommended courses taken from other Specialization Areas.
- Submit a Plan of Study by the end of first semester and obtain its approval.
- Take a minimum of 18 hours of EECS courses (including thesis/project and independent study).
- Take at least 6 hours of EECS courses at the 6000 level excluding thesis, independent study, and (independent) research courses.
- Take the EECS 5930 Graduate Seminar course (a 1cr. hour course, which counts towards the required 30 hours for the program).
- Take the GNEN 5000 Graduate Launch course (a zero cr.h. course, offered by the College of Engineering)
- Be enrolled in a minimum of one credit hour in the semester of graduation.

- Submit at last one peer-reviewed journal manuscript (if pursuing thesis option) or one conference paper (if pursuing project option).

Note: All M.S. students in the EECS Department are encouraged to pursue a thesis option; however, students with Graduate/Teaching/Research Assistantships *are required* to choose the thesis option.

Students are encouraged to include higher-level math courses in their program, subject to approval of their advisors. Courses taken on an audit basis do not count toward the degree. Courses outside the College of Engineering require prior approval by the faculty advisor, and the EECS Graduate Program Director or the EECS Department Chair.

In order to be awarded the Master of Science degree, the student must have at least a B average (GPA of 3.0/4.0) for all graduate course credits in his or her program of study as well as for his or her entire graduate transcript.

5.2 PLAN OF STUDY

The student must, in conjunction with his/her faculty advisor, prepare a coherent Plan of Study which includes a majority of courses from the Specialization Area with which the student is associated. The Plan of Study must be approved by the faculty advisor, the EECS Graduate Program Director, the Associate Dean of Graduate Studies, and the College of Graduate Studies (COGS).

Any changes in the student's Plan of Study must be submitted as an amendment of the Plan of Study Form and approved by the EECS Graduate Program Director, the Associate Dean of Graduate Studies, and COGS.

5.3 TIME LIMIT

The M.S. degree may be pursued on a full or part-time basis. However, each student must complete all requirements for the M.S. degree no later than 6 years from the date of first graduate registration in the EECS Department, unless a petition for extension has been approved by the faculty advisor, EECS Graduate Director, and COGS.

5.4 FORMATION OF THE THESIS COMMITTEE

After the student has chosen his or her permanent advisor, a thesis committee is formed (for those students pursuing the thesis option) and approved by the EECS Graduate Program Director in consultation with the thesis advisor and the student. The *M.S. thesis committee shall be composed of a minimum of three members* (having a majority of EECS faculty), one of whom should be from the student's Specialization Area.

The thesis advisor must be a full-time member of the EECS faculty as well as a full member of the UT Graduate Faculty. Faculty of another UT department with full graduate faculty status can serve as co-advisor.

5.5 THESIS SUBMISSION, DEFENSE, AND ACCEPTANCE

A final draft of the M.S. thesis is prepared by the student when research is completed to the satisfaction of the faculty advisor. The student must follow the thesis preparation requirements by UT's COGS. The draft thesis should be submitted to the advisor for critical review and evaluation. This should be done in a timely manner, giving the advisor sufficient time to review the final draft. After the thesis advisor has reviewed the thesis draft, recommended changes, and approved the final text and form of the document, the student should submit copies to the thesis committee for evaluation. The thesis committee members should have at least one week for review of the document before the defense. All members of the thesis committee are expected to be present at the thesis defense.

The student, in consultation with the thesis advisor(s) and the committee, schedules the thesis defense. The thesis advisor will counsel the student regarding specific topics to be addressed at the defense. The defense is public, presented in an open (announced at least a week in advance of the scheduled date) presided over by the thesis advisor. The student is allowed approximately 30 minutes for a formal oral presentation. Following the oral presentation, the thesis committee, other faculty, students, and guests are allowed to ask questions concerning the student's thesis work. After the question and discussion period is concluded, all those present, other than the faculty members constituting the committee, will be excused.

The thesis committee holds a private discussion of the student's thesis and makes a final decision by a majority vote whether the student's defense has been successful. If the student does not pass the thesis defense, then the thesis committee, in consultation with the Graduate Program Director, will decide a course of action to correct deficiencies, weaknesses, or other problems.

Changes of the thesis draft that are recommended by the committee are made by the student in consultation with the faculty advisor and any concerned committee members.
After a successful defense and completion of any corrections, the committee signs a thesis approval page and forwards it to the Graduate Program Director.

The thesis must be uploaded to the Ohio Library and Information Network (OhioLINK) following a review and approval by COGS.

The student should also be aware that COGS requires final corrected copy to be submitted electronically to the ETD by a specified date, if a student is to graduate in a given term/semester.

5.6 GRADUATION

Students must formally apply for graduation in the semester they will complete their degree requirements online within the deadlines as stated on the COGS website.

There is no formal ceremony for Summer graduates. Students who will be completing their degrees in the Summer will be recognized if they apply for the Spring commencement. Otherwise, they will be recognized in the Fall commencement ceremony.

5.7 PART-TIME GRADUATE STUDIES

Admission to the program and requirements for the M.S. degree are identical to those for admission to the regular full-time program.

6. DOCTOR OF PHILOSOPHY DEGREE REQUIREMENTS

The Doctor of Philosophy (Ph.D.) degree is conferred on the basis of extended study and high scholarly attainment in the field of electrical engineering, computer engineering or computer science. The requirements for the Ph.D. degree are as follows:

- Complete a minimum of 60 semester credits beyond the M.S. degree or a minimum of 90 semester credits beyond the B.S. degree.
- Complete a minimum of 45 cr.h. of Dissertation (EECS 8960). In the case of *PhD students with an MS degree*, only 45cr.h. of Dissertation can be counted towards the Ph.D. degree. In the case of *direct-route PhD students* up to 54 cr.h. of Dissertation can be counted towards the PhD degree (i.e. a minimum of 45cr.h. and a maximum of 54cr.h.).
- For Ph.D. students with an MS degree: complete a minimum of 15 cr.h. of regular coursework of which up to 3 cr.h. can be Independent Study (EECS 8990) and the rest must be regular 7000 or 8000 level regular courses.
- For direct-route Ph.D. students: complete at least 36 semester credits of graduate-level course work beyond the B.S. degree of which up to 6cr.h. can be Independent Study (EECS 8990).
- Take all core courses and a selection of recommended courses from their Specialization Area (see Section 1) in consultation with their advisor and receive advanced approval from the faculty advisor for recommended courses taken from other Specialization Areas.
- Pursue, complete and publish a research study (a dissertation) which is demonstrated to be an original contribution to the student's field of study.
- Take the EECS 5930 Graduate Seminar course (a 1cr. hour course, which counts towards the required 30 hours for the program).
- Take the GNEN 5000 Graduate Launch course (a zero cr.h. course, offered by the College of Engineering).
- Pass the PhD Qualifying Exam (during the 3rd or 4th regular semester for PhD students with an MS degree; during the 5th regular semester for direct route PhD students; a regular semester is either the Fall or the Spring semester but not the Summer term).
- Present and defend a PhD proposal.
- Present and successfully defend the dissertation research in a public forum.
- Submit a minimum of 2 manuscripts for peer-reviewed journals or equivalent publications, which are based on the dissertation research, and have at least one of these manuscripts accepted before the dissertation defense. Equivalent publications can be conference proceedings from high-quality, highly selective conferences (evidence for this must be submitted to the Graduate Program Director) or accepted patent applications. Copies of the official letters of acknowledgments for the submitted/accepted papers should be submitted to the Graduate Program Director as part of the required paperwork.

- Direct route Ph.D. students can take 5000-level courses only during their first 4 regular semesters. However, these students must take a minimum of three regular (i.e., excluding independent study, independent research, and dissertation) 8000 level courses during these 4 semesters.
- For Ph.D. students with an M.S. degree, only 8000-level courses will be counted towards the degree requirements (except for the EECS seminar and any MATH department 7000-level, or courses from other departments, that are part of an approved Plan of Study).

  Note: In case the student and the advisor face difficulties in defining a Plan of Study due to insufficient number of required core courses (as well as recommended courses) at the 8XXX level, the required core course requirements can be modified on a case-by-case basis and with the approval of the Graduate Committee.

It is the responsibility of both the student and the faculty advisor to formulate a program of study to meet the objectives and needs of the student and to satisfy the requirements for the Ph.D. degree. The student's program/plan of study should contain both breadth of knowledge and depth of specialization *in at least one* of the areas outlined earlier. The program or plan of study must be approved by the faculty advisor, advisory committee, the Graduate Program Director, and COGS.

Note: The doctoral program is normally a full-time program throughout both course work and the dissertation. The department does not encourage part-time students in the Ph.D. program.

6.1 FORMATION OF THE ADVISORY COMMITTEE

After a student has selected their advisor, a Ph.D. advisory committee will need to be formed by the advisor in consultation with the Graduate Program Director and the student. The Ph.D. committee is composed of a minimum of five graduate faculty members, one of whom must be outside the specialization area and another one must be from outside the EECS Department. It is strongly recommended that the rest of the committee members be from the student's research track. The dissertation advisor must be a full-time member of the EECS faculty as well as a full member of the UT Graduate Faculty. The advisor chairs the committee.

All committee members must have a Graduate Faculty status that permits serving on a committee or as committee chair/co-chair. Faculty of another UT department with full graduate faculty status can serve as co-advisor.

The responsibilities of the committee include:

- Assist the student in developing a Doctoral Program Proposal.

- Review and approve the student's qualifying examination parts as well as facilitate the evaluation of the student's qualifying examination performance.
- Evaluate the student's dissertation research proposal, its presentation and defense.
- Advise and assist the student in the dissertation research.
- Evaluate the Ph.D. written dissertation.
- Participate in the decision on the approval of the final defense of the dissertation.

6.2 DOCTORAL QUALIFYING EXAMINATION

Objective: The objective of the Ph.D. Qualifying Examination (QE) is to assess the student's potential for successfully completing doctoral level studies and research in the program.

Qualifying Examination (QE) Format:

The student will be tested on *four courses*, chosen by the student advisor: two based on the core courses of the specialization area; and two based on the recommended courses. The courses will all be at the graduate level (5000 or higher level), with at least 3 courses at the 8XXX level. The examination will be in open-book and closed-notes format. If other materials (excluding student's notes) are allowed, those *need to be explicitly stated on the exam sheets and approved* by the EECS Graduate Committee as part of the examination approval process.

The examination will be given in two written parts. The first part will be in the morning and will be based on the core courses with a duration of 3 hours (90 min per course). The second part of the examination will be in the afternoon of the same day, it will be based on the two recommended courses, and will also last 3 hours (90 min per course).

The student's advisor will work with the corresponding course instructors to prepare the examination parts. The examination parts will then have to be approved by the advisory committee and the Graduate Committee.
The Graduate Program Director, with the help of the Graduate Committee, will coordinate and administer the examination.

Qualifying Examination (QE) Timing

Direct route Ph.D. students (i.e., students who do not have a master's degree and are admitted "directly" to the Ph.D. program with a bachelor's degree) must take the QE *after they complete three or four* regular semesters of PhD studies, but *no later than the end of their fifth regular semester*. Regular semesters are the Spring and the Fall semesters but not the Summer semester. Ph.D. students with a master's degree must take the QE *after they complete their second, or third semester*, but *no later than the end of their fourth semester*.

The Graduate Program Director will announce the date for the QE in advance and the examinations will be scheduled early in each regular semester (either in the second or in the third week of the semester).

A student in the Ph.D. program can take the examination up to two times and must pass it within the first 3 years after entering the Ph.D. Program. If a student fails the QE in their first attempt, a second opportunity to take it is not automatic and can be granted upon consideration and approval by the advisory committee and the Graduate Committee. If a second opportunity to take the exam is granted, the student must re-take the QE in the next offering and in the next regular semester.

Qualifying Examination (QE) Evaluation

The student's advisory committee will review the results of the QE and, based on the student's performance, will make one of the following recommendations to the Graduate Committee:

1. The student passes the QE unconditionally and proceeds onto the dissertation research phase.
2. The student fails the examination and is found lacking the potential for a doctoral study. The student will not be allowed to continue in the Ph. D. program.
3. The student fails the examination but is deemed to have the potential for doctoral work. The student is directed to retake the entire exam for a second time. This option is available only after the first QE attempt. Student must be tested on the same set of four courses which were part of the first attempt at the QE.
4. The student passes the examination with some deficiencies (conditional pass). The student is directed to complete additional work (this would typically be course work) prescribed by the advisory committee with a clear scope, deadline, and deliverables. This decision and the parameters of the additional work must be clearly communicated to the Graduate Committee. The additional work is evaluated by the advisory committee and a final recommendation of type 1, 2, or 3 above is submitted to the Graduate Committee.

Based on the recommendation of the student's advisory committee and the result of the examination, the Graduate Committee will make the final decision and the Graduate Program Director will inform the student about the outcome of their examination.

Appeals

A student may request a review of the graded Ph. D. Qualifying Examination in writing to the Graduate Program Director within two weeks of receiving the notification of evaluation results. The student should specify the reasons for the appeal. The student's advisory

committee will then review the grading and provide a recommendation to the Graduate Committee for a final decision.

6.3 ADMISSION TO DOCTORAL CANDIDACY

Doctoral students are admitted to doctoral candidacy upon passing the Ph.D. Qualifying Examination and applying for doctoral candidacy by filing the "Application for Candidacy" form available through COGS.

COGS reviews the application and formally notifies the student of admission to candidacy.

6.4 DISSERTATION PROPOSAL DEFENSE

Objective: The Ph.D. proposal defense is a review and evaluation of the student's Ph.D. research project in terms of scientific and technical merits, scope, feasibility and any other relevant criteria. The content and the style of the dissertation proposal presentation and the student's ability to communicate clearly their current work, the plan for future work, and the satisfaction of any expectations/deliverables are considered as well.

Schedule: The PhD student must present their dissertation proposal as soon as possible after passing the Ph.D. Qualifying Examination and typically within one year of it. The Ph.D. dissertation defense can be scheduled no earlier than 6 months after a successful defense of the Ph.D. proposal.

Format: A doctoral student's proposal defense consists of the following components:

- A written dissertation proposal that is prepared by the student and presented to the Advisory Committee for review and evaluation.
- An oral presentation of the dissertation proposal, which occurs at least two weeks after the written proposal is submitted to the Advisory Committee.

Passing the proposal defense shall require:

- A satisfactory written dissertation proposal, a copy of which will be placed in the student's file.
- Satisfactory performance on the oral dissertation proposal presentation.

Evaluation Criteria: The Advisory Committee will consider all of the information available to it, including an interview with the student to clarify unresolved issues, and render one of the following decisions:

1. The student passes the proposal defense and he/she is encouraged to finish all remaining requirements at the earliest possible time.

2. The student passes the defense and, except for identified deficiencies for which the Committee will prescribe a remedy, the student is encouraged to finish all remaining requirements at the earliest possible time.
3. The student fails the defense but is given permission to repeat it after certain conditions are met.
4. The student fails the defense and is asked to withdraw from the doctoral program at the end of the term.

Passing the proposal defense requires approval of at least 2/3 of the student's advisory committee.

Appeals: A student may appeal the Advisory Committee's decision. Such an appeal must be made in writing to the Graduate Program Director. The written appeal must contain explicit reasons for requesting that the review be conducted. The appeal must be filed within two weeks from the date the student is notified in writing by the Graduate Director of the Advisory Committee's decision. The Graduate Program Director will then present their case to the Graduate Committee for a final decision.

6.5 TIME LIMIT

Candidacy for the doctorate automatically terminates seven years after *beginning of study for the degree.*

6.6 DISSERTATION SUBMISSION, FINAL DEFENSE, AND ACCEPTANCE

Dissertation research is to be done while the student is in full-time residence. The PhD dissertation defense can be scheduled *no earlier than 6 months after a successful defense of the Ph.D. proposal*. The research must be completed and the dissertation must be written and successfully defended before the Ph.D. is conferred. The primary requirement for a dissertation is that it shows evidence of high scholarly attainment through original and independent research work and creation of new knowledge. The acceptability of a dissertation depends upon its quality rather than the time and credit hours spent on the research work.

When the dissertation research is completed to the satisfaction of the dissertation advisor, the student will prepare a final draft of the Ph.D. dissertation. This draft is submitted to the dissertation advisor for critical review and evaluation before scheduling a final defense of the dissertation. After receiving advisor approval, the student prepares the dissertation in final form and submits a copy of the completed dissertation to each committee member for critical evaluation at least two weeks before the defense. Information concerning the

required dissertation format, reproduction, and other regulations for preparing a dissertation is available from COGS.

Final public defense of the dissertation is required of every doctoral candidate after he or she has fulfilled all other requirements of the doctoral program. This examination is administered by the student's dissertation committee and is restricted to the content of the dissertation and closely related subject matter. The dissertation advisor is the chairperson of the committee. All members of the dissertation committee are expected to be present at the dissertation defense. The defense is presided over by the student's faculty advisor and must be publicized and posted at least two weeks before the defense date.

The dissertation defense includes an oral presentation of approximately 45 minutes. This is followed by questions and comments from members of the dissertation committee and others. At the conclusion of the question and discussion period, all attendees present other than the dissertation committee members shall be excused. The dissertation committee may ask additional questions and will make a decision regarding acceptability of the dissertation and its defense and report these findings to the candidate. At least a 3/4 majority of the committee must concur in the final decision.

Major or minor changes and additions or deletions to the dissertation may be recommended by the dissertation committee. These must be made by the student and approved by the dissertation advisor before the student can be certified as having completed requirements for the dissertation.

After successful defense and corrections have been completed, the committee will complete and sign a dissertation approval page and forward it to the Graduate Program Director. Should the student not pass the final dissertation defense, the committee, in consultation with the Graduate Program Director, will decide upon a future course of action.

The doctoral candidate must submit a minimum of two peer-reviewed journal paper manuscripts based on the dissertation research and have at least one of them accepted for publication (see the requirements at the beginning of Section 5).

The dissertation must be uploaded to the Ohio Library and Information Network (OhioLINK) following a review and approval by COGS.

6.7 GRADUATION

Students must formally apply online for graduation in the semester they will complete their degree requirements within the deadlines as stated on the COGS website.

There is no formal ceremony for Summer graduates. Students who will be completing their degrees in the Summer will be recognized if they apply for the Spring commencement. Otherwise, they will be recognized in the Fall commencement ceremony.

7. PRACTICAL TRAINING

International Ph.D. students can apply for optional (post-completion of study) practical training with the Office of International Student and Scholar Services (OISSS). To request a letter from the department, students must:

- Have a minimum GPA of 3.0.
- Have all PR and IN grades removed from their transcripts, excluding project, thesis, dissertation, and independent study.
- Have an approved and current Plan of Study on file.
- Be completing their degree requirements by the end of the semester (as confirmed by their advisor).

If the above requirements are met, students should fill out a "Request for Practical Training" form, available through OISSS, obtain the signature of their advisor and submit it to the department for further processing.