ROBOTICS, PHD

Banner Code: EC-PHD-ROB

Phone: 703-993-5389
Email: mechengr@gmu.edu
Website: https://mechanical.gmu.edu/

Admissions & Policies

Admissions

All Mason and College of Engineering and Computing admission requirements apply. Applicants must submit official transcripts, a resume, a goals statement, and two letters of recommendation. For internationally educated applicants, specific requirements are provided in the University Catalog under Admission of International Students (https://catalog.gmu.edu/admissions/international-students/). Application materials are reviewed by the Mechanical Engineering graduate committee, which makes a recommendation to the graduate committee chair.

Policies

For policies governing all graduate programs, see AP.6 Graduate Policies (https://workingcatalog.gmu.edu/policies/academic/graduate-policies/).

Reduction of Credit

Students must complete a minimum of 72 graduate credits, which may be reduced by a maximum of 30 credits from an approved and completed master's degree. Reduction of credit requires the approval of the program director and the dean or designee of the school. They determine whether the credits are eligible for reduction of credit and applicable to the degree program.

Program Requirements

In addition to the required 72 graduate credits, students enrolled in this program must demonstrate comprehensive knowledge through foundational and core coursework, further assessed via a qualifying exam, prepare and present a dissertation proposal, complete an original research project, and successfully defend their dissertation. To advance to candidacy, students must complete all foundational and core coursework, pass the qualifying exam, and defend a dissertation proposal.

Requirements

Degree Requirements

Total credits: 72

Doctoral Coursework

Foundational Courses

Due to the multidisciplinary nature of this program, the foundational coursework is intended to ensure enrolled students share a common technical basis for proceeding with core courses and research in the field of robotics. Through these courses, students demonstrate foundational knowledge in mechanical engineering, electrical and computer engineering, computer science, and cyber security engineering. Students incoming with an MS degree may count credits toward these courses if approved as described in the Reduction of Credit subsection.

Code	Title	Credits
ME 631	Advanced Dynamics of Mechanical Systems	3
ECE 521	Linear Systems and Control	3
CS 580	Introduction to Artificial Intelligence	3
CYSE 550	Cyber Security Engineering Fundamentals	3
Total Credits		**12**

Core Courses

All students in the program are required to take the following five core courses and a seminar course further developing the students knowledge in core areas of robotics as well as providing graduate level coursework in engineering education to prepare future faculty.

Code	Title	Credits
CS 685	Autonomous Robotics	3
ECE 625	Autonomous Control for Robotic Systems	3
ME 585	Human Robot Interaction	3
ME 641	Robot System Integration	3
CEC 501	Fundamentals of Computing, Engineering Technology Education	3
Total Credits		**15**

Seminar: 3 credits

Students must complete the seminar course, ME 577 Emerging AI Robotics Tech Seminar, no less than three times over the course of their doctoral degree program.

Electives

Students must take an additional 18 credits of related coursework. All elective course selections must be approved by a faculty advisor. Students may select no more than nine (9) credits of 500-level coursework. For transfer/reduction of credit courses, the equivalent levels are to be determined by approval of the program director and the dean or designee of the school.

Dissertation Research

Students must complete a minimum of 24 combined credit hours in dissertation research from the following list. Per Graduate Policy AP.6.10.6 (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-10-6), no less than 3 credits may be at the 999 level.

Code	Title	Credits
ME 990	Dissertation Topic Presentation	1
ME 998	Doctoral Dissertation Proposal	1-12
or CS 998	Doctoral Dissertation Proposal	
or ECE 998	Doctoral Dissertation Proposal	
ME 999	Doctoral Dissertation	1-12
or CS 999	Doctoral Dissertation	
or ECE 999	Doctoral Dissertation	

Qualifying Exam

Students must pass an oral qualifying examination to assess their ability to synthesize knowledge gained through foundational and core coursework. The qualifying examination also assesses student's preparedness to conduct graduate research. Students must attempt the qualifying examination after completion of the foundational and core coursework. The qualifying examination is offered twice a year prior to the fall and spring semesters. The qualifying examination is allocated four hours and graded on a pass or fail basis. Students must pass the exam within two (2) attempts, taken no less than one calendar year apart. A student who fails to pass the qualifying examination in two attempts will be subject to dismissal from the degree program.

Doctoral Supervisory Committee

The dissertation committee will be comprised of a chairperson and at least two (2) other members. The dissertation committee chairperson must be a member of George Mason University Graduate Faculty and a member of the core faculty for the proposed PhD in Robotics degree program. The second dissertation committee member must be a full-time faculty member in the College of Engineering and Computing, a member of the Graduate Faculty, and hold expertise and credentials relevant to the student's dissertation topic. The third dissertation committee member must be a member of the Graduate Faculty and hold expertise and appropriate credentials relevant to the student's field of study.

Dissertation Proposal

Near the end of the coursework, doctoral students prepare a written dissertation proposal to present to the doctoral supervisory committee. It is expected during this time the student will enroll in some combination of ME 990 Dissertation Topic Presentation, ME 998 Doctoral Dissertation Proposal, ECE 998 Doctoral Dissertation Proposal, or CS 998 Doctoral Dissertation Proposal. The proposal must be delivered to the doctoral supervisory committee at least two weeks before the presentation.

Advancement to Candidacy

After successfully completing the coursework, qualifying examination and dissertation proposal requirements, the student is formally admitted as a candidate for the PhD degree. The application for advancement to candidacy is submitted to the department on a standard form (https://registrar.gmu.edu/forms/graduate/).

Dissertation and Final Defense

With the concurrence of the dissertation supervisory committee, students proceed with the doctoral research, during which time they must be continuously enrolled in ME 999 Doctoral Dissertation, ECE 999 Doctoral Dissertation, or CS 999 Doctoral Dissertation. When the central portions of the research have been completed to the point that students are able to describe the original contributions of the dissertation effort, they submit the written dissertation to the committee. Once the committee believes the student is ready, a final public oral defense must be scheduled allowing a minimum of two weeks for the defense notification as required by the University, AP.6.10.8 (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-10-8). Please visit UDTS (https://library.gmu.edu/udts/process/) for more information on the dissertation process. The entire dissertation committee must be present at the defense, unless an exception is approved by the Department of Mechanical Engineering chairperson in advance of the defense.

With satisfactory evaluation of the oral defense of the dissertation by the committee, the student must submit to the library a final publishable dissertation that represents a definitive contribution to knowledge in Robotics. If the candidate successfully defends the dissertation, the dissertation committee recommends that the final form of the dissertation be completed and the College of Engineering and Computing faculty and the Graduate Faculty of Mason accept the candidate for the PhD degree.

If the student fails to successfully defend the dissertation, the student may request a second defense, following the same procedures as for the initial defense. There is no time limit for this request other than general time limits for the doctoral degree. If the student fails on the second attempt to defend the dissertation, the student will be terminated from the program.

Plan of Study

Plan of Study

Foundational Courses: 12 credits

The foundational coursework is intended to ensure enrolled students share a common technical basis for proceeding with core courses and research in the field of robotics.

Code	Title	Credits
ME 631	Advanced Dynamics of Mechanical Systems	3
ECE 521	Linear Systems and Control	3
CS 580	Introduction to Artificial Intelligence	3
CYSE 550	Cyber Security Engineering Fundamentals	3
Total Credits		**12**

Core Courses: 15 credits

All students in the program are required to take the following five core courses further developing the students knowledge in core areas of robotics as well as providing graduate level coursework in engineering education to prepare future faculty.

Code	Title	Credits
CS 685	Autonomous Robotics	3
ECE 625	Autonomous Control for Robotic Systems	3
ME 585	Human Robot Interaction	3
ME 641	Robot System Integration	3
CEC 501	Fundamentals of Computing, Engineering Technology Education	3
Total Credits		**15**

Electives: 18 credits

Students must take an additional 18 credits of related coursework. All elective course selections must be approved by a faculty advisor. Students may select no more than nine (9) credits of 500-level coursework. For transfer/reduction of credit courses, the equivalent levels are to be determined by the PhD advisor, subject to approval by the ME Department chair.

Seminar: 3 credits

Students must complete the seminar course, ME 577 Emerging AI Robotics Tech Seminar, no less than three times over the course of their doctoral degree program.

Dissertation Research: 24 credits

Students must complete a minimum of 24 combined credit hours in dissertation research from the following list. Per Graduate Policy AP.6.10.6 (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-10-6), no less than 3 credits may be at the 999 level.

Code	Title	Credits
ME 990	Dissertation Topic Presentation	1
ME 998	Doctoral Dissertation Proposal	1-12
or CS 998	Doctoral Dissertation Proposal	
or ECE 998	Doctoral Dissertation Proposal	
ME 999	Doctoral Dissertation	1-12
or CS 999	Doctoral Dissertation	
or ECE 999	Doctoral Dissertation	

Program Outcomes

Program Outcomes

All students will be able to:

- Design cyber-secure robotic systems.
- Describe the motions and control of robotic systems.
- Incorporate machine learning and artificial intelligence methodologies into robotic systems.
- Assimilate multidisciplinary (i.e., cyber security, electrical, and mechanical engineering) knowledge into cohesive robot system integration.
- Design systems with effective human-robot interaction.
- Conduct a comprehensive and critical literature survey of a contemporary topics in robotics.
- Write and edit a technical manuscript (i.e., dissertation) in robotics.
- Educate students in the areas of robotics at the undergraduate and graduate levels.