ROBOTICS, MASTER OF SCIENCE IN ENGINEERING

For complete and up-to-date M.S.E. information, visit https://lcsr.jhu.edu/mse. (https://lcsr.jhu.edu/mse/)

The Master of Science in Engineering in Robotics (Robotics MSE) program at Johns Hopkins University is designed to advance interdisciplinary robotics knowledge in students coming from a wide variety of engineering, scientific, and mathematical backgrounds.

Johns Hopkins University recognizes the growing need in industry for engineers with the broad multi-disciplinary training and fundamental knowledge needed to develop and deploy advanced robotics systems that function effectively in the real world.

Johns Hopkins University's broad interdisciplinary approach to robotics research makes it uniquely situated to offer such a comprehensive program. The Laboratory for Computational Sensing and Robotics (LCSR), with its reputation as one of the top robotics research sites in the world, particularly in the area of medical robotics, is pleased to offer this M.S.E. in Robotics

Academic Policies

- **Course Grade Requirement:** A course is satisfactorily completed if a grade from A+ to B# is obtained. Up to one C+, C, or C# can be counted toward the degree requirements. A grade of D or F or a second grade below B- results in probation. A second D or F, or a third grade below B- typically results in termination from the program. Any exceptions are rare and must be approved in writing by both the student's advisor and the Director of Education.
- **Transfer Courses:** Standard WSE policy and limitations on M.S.E. transfer credits apply (https://engineering.jhu.edu/graduate-studies/academic-policies-procedures-graduate/). In addition, use of each transfer course toward satisfaction of a specific Robotics M.S.E. degree requirement must be approved in writing by both the student's faculty advisor and the Robotics M.S.E. Curriculum Committee.
- **Double Counting:** Standard WSE policy and limitations on double counting apply (https://engineering.jhu.edu/graduate-studies/academic-policies-procedures-graduate/).
- **Duration:** Students must complete degree within 5 years from matriculation in the M.S.E. program. An university-approved leave of absence does not count toward this limit.
- **Graduate Research Courses:** No more than one 1-semester or 3 credits of a graduate research course (e.g., EN.620.801 Robotics MSE Graduate Research) may be counted toward one class in the course-option degree requirements.
- **WSE Engineering Management Courses:** Two (2) 1.5 credit hour courses taken for credit (i.e. a letter grade) may count towards one class of the MSE degree elective requirements if they are pre-approved in writing by the student's academic advisor.
- No more than 2 **WSE Engineering for Professionals (EP) Courses** may count toward the M.S.E. degree elective requirements. All EP courses must be approved in writing by the student's faculty advisor.
- **Residency Requirement:** Minimum residency of two full-time academic semesters at WSE (note that summer and intersession terms do not count towards this requirement).
- **Academic Ethics, Responsible Conduct of Research, Laboratory Safety**: all Robotics M.S.E. students must pass the WSE Academic Ethics course and complete at least the online Responsible Conduct of Research Course. Students conducting research may have additional in-person responsible conduct of research course requirements, as well as will be required to meet laboratory safety training requirements. For more information, please contact the academic staff in the program.

For complete and up-to-date M.S.E. information, visit https://lcsr.jhu.edu/mse/

Admission Requirements
Application Requirements for the M.S.E. in Robotics Degree

- Bachelor's degree in engineering, science, or math. (Or demonstrated knowledge or accomplishment in these fields)
- Graduate Application
- Statement of Purpose – in your short statement of purpose please take a couple of sentences to explain/answer the following:
    - Why are you interested in doing an MSE in Robotics? No need to over-think this: it is fine if it is as simple as wanting to get a job in this field!
    - What do you hope to learn during the Robotics M.S.E.?
    - What do you want to do after you graduate, and how do you see the M.S.E. degree from JHU as assisting in that goal?
- Transcript
- No Graduate Record Examination (GRE) is required.
- IELTS or TOEFL for international applicants. *Please note:* while the Robotics program accepts both the TOEFL and the IELTS tests, **we strongly prefer the IELTS.**
- Three letters of reference
- The Office of Graduate Admissions and Enrollment strongly recommends you submit a professional evaluation from one of the recommended resources (more information here (http://grad.jhu.edu/apply/international-students/)) for any academic work completed outside the USA. At this time, however, LCSR does not require the evaluation for the Robotics MSE application package.

To apply, please fill out the application and submit the required documents here (https://grad.jhu.edu/apply/apply-now/).

In making its final decisions, the Admissions Committee will consider the combination of professional knowledge, academic excellence, letters of reference, and the statement of purpose, as well as GRE, TOEFL, and IELTS scores of the applicants.

Program Requirements
M.S.E. Program Prerequisites

Please see lcsr.jhu.edu/mse/ (https://lcsr.jhu.edu/mse/) for all program prerequisites and requirements.

Math and Physics Proficiency Prerequisites

Proficiency in undergraduate mathematics and physics is expected for all M.S.E. students in the robotics program.

This includes proficiency in:

- Multivariable integral and differential calculus;
- Linear algebra;
- Ordinary differential equations;

- Physics – undergraduate calculus-based mechanics, electricity, and magnetism;
- Probability and statistics.

Proficiency will be assumed in the prerequisites for the core courses.

Computing Proficiency Prerequisites

Proficiency in computer programming is expected for all M.S.E. students in the robotics program.

This includes proficiency in:

- Basic numerical methods using existing programming environments;
- The ability to write well-structured and documented programs in a standard programming language such as C++, Java, or MATLAB.

Program Requirements

The Master of Science in Engineering in Robotics (Robotics MSE) ordinarily requires a minimum of two semesters of registration as a full-time resident graduate student.

All incoming MSE students will be assigned an MSE Academic Advisor.

To obtain departmental certification for the master's degree in Robotics, the student must complete:

- Course Requirements:
  - **Course Option:** 10 credit-bearing courses that total at least 30 credit-hours.
  - **Essay/Internship Option:** 8 credit-bearing courses that total at least 24 credit-hours and a Master's Essay or Internship Report supervised by a WSE faculty member who has been approved by the Robotics M.S.E. Curriculum Committee to serve as a faculty advisor.

At least 6 of these courses must be at the graduate level as defined by the offering department/center. All courses counted toward the MSE degree requirements must be at the 400-level or above. Any dual listed courses (e.g. listed at both the 600 and 400-level) must be taken at the 600-level. All courses counting towards the foundation, track, or elective requirements must be for a letter grade (e.g. no pass/fail). Any exceptions must be approved in writing by the student's academic advisor and the Robotics Education Director. Non-credit and one-credit courses such as the weekly seminar courses offered by Robotics may not count toward this course requirement.

A combined student (i.e. graduated with an undergraduate degree from JHU) who took required courses at the 400-level during their undergraduate course work, the classes can count as fulfilling the requirement. Students will still need to fulfill the requirement of at least six (6) 600-level courses or above to complete the degree.

- **Foundation Course Requirements:** Two core courses and a weekly seminar course.
- **Track Course Requirement:** Four courses fulfilling one of the following track requirements (see website for track course listings):
  - Medical Robotics and Computer Integrated Surgical Systems (has special track requirements, please see website)
  - Perception and Cognitive Systems
  - Automation Science and Engineering
  - Control and Dynamical Systems
  - BioRobotics
  - General Robotics

Courses counted toward the track requirement may not be used to satisfy the elective requirement.

- **Elective Course Requirement:** Four courses, or two courses and an MSE Essay or Internship Report, fulfilling the elective requirement. Courses may be any engineering or quantitative (designated E or Q in the course catalogue) course, subject to the degree requirement limitations, as approved by the student's MSE academic advisor. Courses counted toward the elective requirement may not be used to satisfy the track requirements.
- **Academic Ethics:** online tutorial required for all incoming MSE students (EN.500.603 Graduate Academic Ethics)
- **AS.360.625 Responsible Conduct of Research (online):** Online tutorial required for all incoming MSE students.
- **AS.360.625 Responsible Conduct of Research (in-person)**: may be required for certain research projects. More information: (http://eng.jhu.edu/wse/page/conduct-of-research-training (http://eng.jhu.edu/wse/page/conduct-of-research-training/)).
- **EN.500.601 Research Laboratory Safety** : required for all incoming MSE students.
- **Title IX Training:** Students are auto-enrolled in their first semester.
- **Opioid Training:** Students are auto-enrolled in their first semester.

Learning Outcomes

Program Goals

- To provide students with multi-disciplinary engineering education and training that will enable them to develop and deploy innovative advanced robotics systems that function effectively in real-world applications.
- To develop students' ability to relate individual technical and design elements to the functioning of complete engineered robotic systems.
- To develop students' ability to work effectively within and to lead multi-disciplinary teams.
- To provide students with a basis for life-long learning and professional growth.