

# *Mechanical Engineering with Concentration in Mechatronics, MSME*

While pursuing a Master of Science in Mechanical Engineering (<https://mie.northeastern.edu/academics/graduate-studies/ms-mece/>), students may choose mechatronics as a concentration. The term mechatronics is a combination of the words mechanics and electronics. Mechatronics is a multidisciplinary approach to product design and development, merging the principles of electrical, mechanical, computer, material, chemical, and industrial engineering. The mechatronics and systems research cluster in the MIE department is concerned with systems that are typically composed of traditional mechanical and electrical components but are rendered “intelligent” by the incorporation of sensors, actuators, and computer control systems. Our primary focus in mechatronics and systems is on intelligent and integrated systems and machines along with their practical applications ranging from manufacturing systems and robotic platforms to biological systems. Our research and teaching together are designed to prepare students to understand and exploit mechatronics to enable their future engineering innovations.

## **General Degree Requirements**

To be eligible for admission to any of the MS degree programs, a prospective student must hold a Bachelor of Science degree in engineering, science, mathematics, or an equivalent field. Students in all master's degree programs must complete a minimum of 32 semester hours of approved coursework (exclusive of any preparatory courses) with a minimum grade-point average (GPA) of 3.000. Students can complete a master's degree by pursuing any of one of the three tracks: coursework option, project option, and thesis option. Specific degree requirements for each of these tracks can be found under the Program Requirements tab. Students may pursue any program either on a full-time or part-time basis; however, certain restrictions may apply.

## **Academic and Research Advisors**

All non-thesis students are advised by the faculty advisor designated for their respective concentration or program. Students willing to pursue the thesis option must first find a research advisor within their first year of study. The research advisor will guide the students' thesis work, and thesis reader(s) may be assigned at the discretion of their research advisor. The research advisor must be a full-time or jointly appointed faculty. If the research advisor is outside the MIE department, before the thesis option can be approved, a faculty member with 51 percent or more appointments in the MIE department must be chosen as co-advisor, and a petition must be filed and approved by the co-advisor and the MIE Graduate Affairs Committee. Thesis option students are advised by the faculty advisor of their concentration before they select their research advisor(s). The research advisor and co-advisor must serve as thesis readers.

## **Plan of Study and Course Selection**

It is recommended that all new students attend orientation sessions held by the MIE department and the Graduate School of Engineering to acquaint themselves with the coursework requirements and research activities of the department as well as with the general policies, procedures, and expectations.

In order to receive proper guidance with their coursework needs, all MS students are strongly encouraged to complete and submit a fully signed Plan of Study (PS) to the department before enrolling in second-semester courses. This form not only helps the students manage their coursework but it also helps the department to plan for requested course offerings. The PS form may be modified at any time as the students progress in their degree programs.

Students pursuing study or research under the guidance of a faculty member can choose project option by taking Master's Project (ME 7945). An MS project must be petitioned to the MIE Graduate Affairs Committee and approved by both the faculty member (instructor for Master's Project) and the student's academic advisor. The petition must clearly state the reason for taking the project course; a brief description of the goals; as well as the expected outcomes, deliverables, and grading scheme.

## **Options for MS Students (coursework only, project, or thesis)**

Students accepted into any of the MS programs in the MIE department can choose one of the three options: coursework only, project, or thesis. Please see the Program Requirements tab on the top menu of this page for more information. MS students who want to pursue project or thesis options must find, within the first year of their study, a faculty member or a research advisor who will be willing to direct and supervise a mutually agreed research project or MS thesis. Moreover, students who receive financial support from the university in the form of a research, teaching, or tuition assistantship must complete the thesis option (12 semester hours).

Students who complete the thesis option must make a presentation of their thesis before approval by the department. The MS thesis presentation shall be publicly advertised at least one week in advance and all faculty members and students may attend and participate. If deemed appropriate by the research advisor, other faculty members may be invited to serve as thesis readers to provide technical opinions and judge the quality of the thesis and presentation.

## **Change of Program/Concentration**

Students enrolled in any of the MIE department programs or concentrations may change their current program or concentration no sooner than the beginning of their second full-time semester of study. In order for the program or concentration change request to be considered by the MIE Graduate Affairs Committee, the student must not be in the first semester of their current program, must have a 3.300 GPA, and have completed at least 8 semester hours of required course work in their sought program at Northeastern.

## Graduate Certificate Options

Students enrolled in a master's degree have the opportunity to also pursue one of the many engineering graduate certificate options in addition to or in combination with the MS degree. Students should consult their faculty advisor regarding these options (<https://catalog.northeastern.edu/graduate/engineering/graduate-certificate-programs/>).

### GORDON INSTITUTE OF ENGINEERING LEADERSHIP

#### *Master's Degree in Mechanical Engineering with a Concentration in Mechatronics with Graduate Certificate in Engineering Leadership*

Students may complete a Master of Science in Mechanical Engineering with a Concentration in Mechatronics in addition to earning a Graduate Certificate in Engineering Leadership (<https://catalog.northeastern.edu/graduate/engineering/multidisciplinary/engineering-leadership-graduate-certificate/>). Students must apply and be admitted to the Gordon Engineering Leadership Program in order to pursue this option. The program requires fulfillment of the 16-semester-hour curriculum required to earn the Graduate Certificate in Engineering Leadership, which includes an industry-based challenge project with multiple mentors. The integrated 36-semester-hour degree and certificate will require 20 hours of advisor-approved mechatronics technical courses.

### GALANTE ENGINEERING BUSINESS

#### *Master's Degree in Mechanical Engineering with a Concentration In Mechatronics with Graduate Certificate in Engineering Business*

Students may complete a Master of Science in Mechanical Engineering with a Concentration in Mechatronics in addition to earning a Graduate Certificate in Engineering Business. Students must apply and be admitted to both the Mechatronics concentration and the Galante Engineering Business Program in order to pursue this option. The Engineering Business program requires the applicant to have earned or be in a program to earn a Bachelor of Science in Engineering from Northeastern University. The integrated 32-semester-hour degree and certificate will require 16 semester hours of core courses from the mechatronics concentration and 16 semester hours from a specific set of applicable elective graduate level mechanical engineering courses. Students should consult the program directors of the Mechatronics concentration and the Engineering Business program prior to selecting courses. The course work, along with participation in cocurricular professional development elements, earn the Graduate Certificate in Engineering Business.

## Program Requirements

- Concentrations and course offerings may vary by campus and/or by program modality. Please consult with your advisor or admissions coach for the course availability each term at your campus or within your program modality.
- Certain options within the program may be *required* at certain campuses or for certain program modalities. Please consult with your advisor or admissions coach for requirements at your campus or for your program modality.

Complete all courses and requirements listed below unless otherwise indicated.

## Core Requirements

Code	Title	Hours
<b>Mathematics Competency</b>		
Complete 4 semester hours from the following:		4
ME 6200	Mathematical Methods for Mechanical Engineers 1	
or IE 6200	Engineering Probability and Statistics	
<b>Mechanics Competency</b>		
Complete 4 semester hours from the following:		4
ME 5250	Robot Mechanics and Control	
ME 5650	Advanced Mechanics of Materials	
ME 5655	Dynamics and Mechanical Vibration	
ME 5657	Finite Element Method 1	
<b>Mechatronics Concentration</b>		
ME 5245	Mechatronic Systems	4
ME 5659	Control Systems Engineering <sup>1</sup>	4
<b>Electrical Competency</b>		
Complete 4 semester hours from the following:		4
EECE 5610	Digital Control Systems	
EECE 5666	Digital Signal Processing	
EECE 5680 and EECE 5681	Electric Drives and Lab for EECE 5680	

EECE 5684 and EECE 5685	Power Electronics and Lab for EECE 5684
ME 6260	Introduction to Microelectromechanical Systems (MEMS)

## Options

Complete one of the following options:

### COURSEWORK OPTION

Code	Title	Hours
	Complete 12 semester hours from the course list.	12

### PROJECT OPTION

Code	Title	Hours
ME 7945	Master's Project <sup>2</sup>	4
	Complete 8 semester hours from the course list.	8

### THESIS OPTION <sup>3</sup>

Code	Title	Hours
ME 7945	Master's Project <sup>2</sup>	4
ME 7990	Thesis <sup>2</sup>	4
	Complete 4 semester hours from the course list.	4

In addition to completing the thesis course, students must successfully complete the thesis submission process, including securing Committee and Graduate School of Engineering signatures and submission of an electronic copy of their MS Thesis to ProQuest.

## Course List

Code	Title	Hours
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Any course in the following list will serve as an elective course, provided the student satisfies prerequisites and program requirements. Students can take electives outside this list with prior approval from the faculty advisor:

BIOE 5250	Regulatory and Quality Aspects of Medical Device Design
BIOE 5810	Design of Biomedical Instrumentation
CIVE 5373	Transportation Systems: Analysis and Planning
CIVE 5699	Special Topics in Civil Engineering (Vibration-Based Structural Health Monitoring)
CS 5335	Robotic Science and Systems
CS 5340	Computer/Human Interaction
CS 7150	Deep Learning
EECE 5115	Dynamical Systems in Biological Engineering
EECE 5550	Mobile Robotics
EECE 5552	Assistive Robotics
EECE 5554	Robotics Sensing and Navigation
EECE 5576	Wireless Communication Systems
EECE 5606	Micro- and Nanofabrication
EECE 5644	Introduction to Machine Learning and Pattern Recognition
EECE 7242	Integrated Circuits for Mixed Signals and Data Communication
IE 5617	Lean Concepts and Applications
IE 5640	Data Mining for Engineering Applications
IE 6600	Computation and Visualization for Analytics
IE 6700	Data Management for Analytics
IE 7275	Data Mining in Engineering
IE 7300	Statistical Learning for Engineering
IE 7315	Human Factors Engineering
IE 7615	Neural Networks and Deep Learning
ME 5240	Computer Aided Design and Manufacturing
ME 5250	Robot Mechanics and Control
ME 5665	Musculoskeletal Biomechanics
ME 5976	Directed Study
ME 6250	Wearable Robotics

ME 7247 Advanced Control Engineering

Or any other ME or MATL course

Or other advisor-approved courses

### **Program Credit/GPA Requirements**

32 total semester hours required

Minimum 3.000 GPA required

- <sup>1</sup> PlusOne students who have already successfully completed System Analysis and Control (ME 4555) may substitute Robot Mechanics and Control (ME 5250) for Control Systems Engineering (ME 5659). In such cases a different course must be taken to satisfy the Mechanics competency.
- <sup>2</sup> It is the student's responsibility to identify a project/thesis advisor before registering for this course.
- <sup>3</sup> Thesis option is required for all students who receive financial support from the university in the form of a research, teaching, or tuition assistantship.