



**Michigan  
Technological  
University**

Graduate Handbook  
Master of Science in Mechatronics

*Michigan Technological University*

Published April 2023

Aleksandr Sergeyevev, Program Director, [avsergue@mtu.edu](mailto:avsergue@mtu.edu)

Kay Oliver, Graduate Assistant, [koliver@mtu.edu](mailto:koliver@mtu.edu)

# **Table of Contents**

[Table of Contents](#)

[Introduction](#)

[Program Requirements](#)

[Area A: Autonomous Robotic Platforms](#)

[Area B: Sensors and Actuators](#)

[Area C: Controls of Industrial Systems](#)

[Area D: Cyber Security of Industrial Processes](#)

[Course descriptions](#)

[Grade Standards](#)

[Co-op Classes](#)

[Credit Transfer](#)

[Credit requirements](#)

[Degree Options](#)

[Thesis Option \(Plan A\)](#)

[Oral Presentation Scheduling](#)

[Report Option \(Plan B\)](#)

[Oral Presentation Scheduling](#)

[Coursework Option \(Plan D\)](#)

[Policies and Procedures](#)

[Admission Requirements](#)

[Choosing an Advisor](#)

[Change of Advisor](#)

[Professional Development](#)

[Career Counseling](#)

[Individual Development Plan](#)

[Additional Requirements](#)

[Forms and Deadlines](#)

[Table 1: Approved Elective Courses](#)

[Abbreviations](#)

## Introduction

The purpose of this handbook is to provide students pursuing the MS in Mechatronics at Michigan Tech with an overview of the rules governing this program. Students should also familiarize themselves with the degree requirements set forth by the Graduate School. The requirements set by the Graduate School supersede any policies contained in this handbook. The Graduate School requirements are given at

<https://www.mtu.edu/gradschool/policies-procedures/requirements/>.

Note that the rules and procedures contained in this handbook are subject to change. Please see the Director of the Mechatronics Graduate Programs for updates.

## Program Requirements

All students must satisfy core and area requirements.

The core requirement is satisfied by successful completion of the four courses listed below.

- EET 5144 – Real Time Robotics (4 credits) [f]
- EET 5373 – Advanced Programmable Logic Controllers (4 credits) [sp]
- MET 4377 – Applied Fluid Power (3 credits) [sp]
- MET 5400 – Holistic Safety (1 credit) [sp]

Students complete the track requirement by completing at least one course from each program area. The available areas and their course options are given below.

### Area A: Autonomous Robotic Platforms

- EE 5531 – Introduction to Robotics (3) [f, sp]
- MEEM 5705 – Robotics & Mechatronics (4) [f,sp]
- EET 5147 – Industrial Robotics Vision System and Adv. Tech Pendant Prog (4) [sp,su]
- MET 5800 – Dynamics & Kinematics of Robotics Platforms (3) [sp]
- EET 4707 – Autonomous Systems (3) [f,sp]

### Area B: Sensors and Actuators

- EE 4252 – Digital Signal Processing and Applications (3) [sp]
- MEEM 5700 – Dynamic Measurement/Signal Analysis (4) [f,su]
- EET 4253 - Data Acquisition and Signal Processing (3) [f]
- MET 4378: Advanced Hydraulics: Electro-hydraulic Components and Systems (3) [f]
- MET 5802 – Vibrations of Mechanical Systems (3) [f]

### Area C: Controls of Industrial Systems

- EE 4262 - Digital and Nonlinear Control (3) [sp]
- EE/MEEM 5750 – Model-Based Embedded Control System Design (3) [f]
- MEEM 4775 – Analysis & Design of Feedback Control Systems (4) [f]
- EET 5311 – Control Systems (4) [f,su]

- MET 5801 – Controls of Dynamic Systems (3) [f]

### **Area D: Cyber Security of Industrial Processes**

- EE 4723 – Network Security (3) [sp]
- EE 5455/MEEM 5300 – Cybersecurity of Industrial Control Systems (3) [f]
- MEEM 5315 – Cyber Security of Automotive Systems 1 (3) [sp]
- SAT 3812 – Cyber Security 1 (3) [f,sp,su]

Equivalent courses taken to fulfill the requirements for an undergraduate degree may be used to fulfill the core and area requirements; however, the credits may not be counted toward the MS degree.

Remaining credits can be fulfilled from the list above or from the qualified elective courses shown in [Table 1](#).

### **Course descriptions**

Graduate Classes (5000+)

[https://www.banweb.mtu.edu/pls/owa/stu\\_ctg\\_utils.p\\_online\\_all\\_courses\\_gr](https://www.banweb.mtu.edu/pls/owa/stu_ctg_utils.p_online_all_courses_gr)

Undergraduate Classes (1000 - 4999)

<https://www.mtu.edu/catalog/courses/>

### **Grade Standards**

One grade of BC may be applied toward the degree. All other courses must be completed with a grade of B or better.

### **Co-op Classes**

Co-op refers to the opportunity to work at an internship and earn credit for the experience. Up to four co-op credits can be used as elective credits in the Mechatronics degree. All co-op offers need to be approved by the Graduate Program Director. The co-op program is managed by Career Services, Co-op Office.

<https://www.mtu.edu/career/students/jobs-intern/coop-intern/forms/>

### **Credit Transfer**

A maximum of six course credits taken as a student at other colleges or universities may be accepted for credit towards the MS in Mechatronics at Michigan Tech. A transferred course cannot have been applied toward any other degree (at Michigan Tech or elsewhere) except under the policies for Michigan Tech's accelerated MS program. If these credits were taken before enrollment at Michigan Tech, a request for transfer credit should be made during the student's first semester on campus.

Transfer credits must be

- approved by a faculty member who teaches an equivalent course at Michigan Tech and by the graduate director, or by the graduate committee and by the student's advisory committee,
- within 10 years of the student's first semester at Tech; and
- completed with a grade of B or better.

## **Credit requirements**

Students must earn a total of thirty (30) credits to complete the MS degree. Students may choose from the elective courses given in table 1 and available special courses such as: EET 5990, EET 5999, EE 5991, EE 5992, EE 5994, MET 5990, MET 5999, MEEM 5988 and MEEM 5989.

EET 5991, EE 5990 and MEEM 5999 are only available to students completing the degree under the thesis or report options. The Graduate Program Director may allow other classes to apply to the Mechatronics degree with prior approval.

## **Degree Options**

Students may select from among three options for completion of the MS degree: the thesis option (Plan A), the report option (Plan B) and the coursework option (Plan D). All three options require 30 credits. The options are described in detail below.

All students enter the university with a coursework degree option designated. Students wishing to remain in that option do not need to make any changes. Students wishing to pursue the report or thesis option must complete the [Advisor and Committee Recommendation Form](#). This form requires the signature of an advisor and must be emailed to the Graduate School.

### **Thesis Option (Plan A)**

Under the thesis option, six to nine of the 30 hours of credit required for graduation must be in one of the research courses: EET 5991, EE 5990, and MEEM 5999.

In addition to the coursework, a student following the thesis option is expected to:

1. Prepare a written plan describing the thesis research.
2. Defend the research plan in an oral seminar presentation or meet with the advisory committee to discuss the research plan. The student and her/his advisor will determine whether the plan is to be presented in a department-wide seminar or will be presented to faculty members individually.
3. Prepare a final thesis.
4. Defend the thesis in an oral seminar presentation.

Oral defenses (research plan and thesis defense) must be announced to the College of Computing faculty and graduate students at least two weeks prior to the defense. The written plan and thesis must also be distributed two weeks in advance of the oral defense. A defense may be canceled if these requirements are not met. Section [4.1](#) describes the expected process for scheduling an oral presentation.

The department recommends the following timetable for the milestones along the way to a thesis masters.

- Find a thesis advisor during the first, or no later than the second, semester in the program.
- Present a thesis plan during the second or third semester in residence (not counting summers).
- Provide a defensible thesis to the entire committee no later than two weeks prior to the thesis defense. Make the thesis available to the College of Computing faculty and graduate students.
- Defend the thesis in a public forum. This includes two question and answer sessions: the first consists of both students and faculty; the second being closed to the general audience

consists of faculty only.

### **Oral Presentation Scheduling**

To schedule an oral presentation:

1. Reserve a room through the site:

<https://www.mtu.edu/registrar/students/room-schedule/>.

2. Create a Google Calendar invitation including the presentation location, an abstract and a link or copy of the report, proposal, thesis, or dissertation. Send the invitation to the Graduate Assistant. Note that the Graduate Assistant should be able to invite others.
3. The Graduate Assistant will distribute the invitation to the College of Computing faculty and graduate students.

### **Report Option (Plan B)**

Under the project option, three to six of the 30 hours of credit required for graduation must be in one of the research courses: EET 5990, EE 5991 and MEEM 5999. In addition to completing the required coursework, the student is expected to:

1. Prepare a written project plan which describes any background necessary for completion of the project and a project plan.
2. Present the project plan to the advisory committee.
3. Prepare a final report at the conclusion of the project.
4. Defend the project report in a public oral seminar presentation.

The final oral defense must be announced to the College of Computing faculty and graduate students at least two weeks prior to the defense. The written report must also be distributed two weeks in advance of the oral defense. A defense may be canceled if these requirements are not met.

The department recommends the following timetable for the milestones along the way to a report masters.

- Find a major advisor during the first two semesters in the program.
- Present a project plan to the advisory committee during the 3rd term in residence (not counting summers).
- Provide a “defendable” project report to the entire committee no later than two weeks prior to the oral defense.
- Defend the report in a public forum. This includes two question and answer sessions: the first consists of both students and faculty; the second being closed to the general audience consists of faculty only.

### **Oral Presentation Scheduling**

Following are the steps for scheduling an oral presentation.

1. Reserve a room through the site:

<https://www.mtu.edu/registrar/students/room-schedule/>.

2. Create a Google Calendar invitation including the presentation location, an abstract and a link or copy of the report, proposal, thesis, or dissertation. Send the invitation to the Graduate Assistant. Note that the Graduate Assistant should be able to invite others.
3. The Graduate Assistant will distribute the invitation to the College of Computing faculty and graduate students.

### **Coursework Option (Plan D)**

The coursework option requires 30 hours of graded course work. None of the 30 hours of credit required for graduation may be in EET 5991, EE 5990 and MEEM 5999.

A student in the coursework option may take up to three credits of EET 5990, EE 5991, EE 5992, EE 5994, MET 5990, MEEM 5990.

The graduate assistant is available for course planning and other advising functions.

## **Policies and Procedures**

### **Admission Requirements**

Applicants should have a BS in electrical engineering, electrical engineering technology, mechanical engineering, mechanical engineering technology or a related field. Exceptions may be made for well-qualified applicants from other disciplines.

A TOEFL score of at least 79 (IBT) or 6.5 (IELTS) is required for international applicants whose native language is not English. Successful applicants typically have an undergraduate GPA of 3.2 or better on a 4.0 point scale.

### **Choosing an Advisor**

Students pursuing a thesis or report degree option will have an advisor that has a tenured/tenure-track appointment in the Department of Applied Computing, the Department of Electrical and Computer Engineering, or the Department of Mechanical Engineering Mechanics. Students will be advised by the Mechatronics Graduate Program Director until they choose an advisor. Coursework option students may retain the Graduate Program Director as their advisor through graduation.

Students in the thesis and report options will have an advisory committee consisting of the student's advisor and at least two additional members. At least one member of the advisory committee must have a tenured/tenure-track appointment at Michigan Technological University.

All advisory committee members must be members of Michigan Tech's Graduate Faculty. The advisory committee members will be selected by the advisor in consultation with the student. An advisor should be chosen during the first year of residence.

### **Change of Advisor**

Report and thesis students may change advisors if their research interests diverge or if difficulties arise in the relationship. Students interested in initiating the process to change their graduate advisor, should consider all the options listed on the Graduate School's website for how to address difficulties in the student-advisor relationship. In certain other situations a change of advisor may also be considered.

<https://www.mtu.edu/gradschool/resources-for/students/academic/succeeding/>

Once you have decided to change your graduate advisor, you must follow the steps listed below.

1. Meet with your graduate program director to initiate the process to change advisor. If meeting with the graduate program director is not feasible or appropriate, meet with the department chair.
2. Discuss the following with the graduate program director (or Chair) and, if appropriate, the current advisor:
  - a. Whether additional resources within or outside the department (such as the Ombuds) could help resolve the situation.
  - b. The impact of the change of advisor on your time to complete the degree.
  - c. Your current and future funding.
  - d. Research already conducted. Whether this will be incorporated into the dissertation, thesis, or report, and if so, how.
  - e. Impact on immigration status (if any). Consult International Programs and Services (IPS), if necessary.
  - f. Record the agreement from the discussions in writing, including indications of agreement from all affected faculty advisors, and provide copies to the student, the graduate program director, and all affected faculty advisors.
3. File an updated Advisor and Committee Recommendation Form for approval by the Graduate School  
<https://www.mtu.edu/gradschool/documents/policies-procedures/forms/advisor-committee.pdf>
4. If the student and the graduate program director are unable to reach agreement on the advisor change, contact the assistant dean of the Graduate School to determine additional steps to resolve the situation.

## **Professional Development**

Success in graduate school and in a career depends on factors outside of coursework. The following link identifies a range of resources available to help students succeed in graduate school and beyond.

<https://www.mtu.edu/gradschool/resources-for/students/professional/>.

## **Career Counseling**

Career Services (<https://www.mtu.edu/career/>) is available to help craft and review resumes, prepare you for interviewing and provide career coaching services.

In addition to the resources identified above, it can be helpful to get advice on professional development specific to a career area. Students are encouraged to contact a faculty advisor in their chosen area to help with coursework selection and career advice.

## **Individual Development Plan**

An Individual Development Plan encourages a student to reflect on career goals and how best to use the resources and time available during graduate study to meet those goals. Students pursuing the Report and Thesis options are especially encouraged to complete an Individual Development Plan.



Many IDP forms are available online. Michigan Tech has created the form linked here

<https://www.google.com/url?q=https://www.mtu.edu/gradschool/resources-for/students/professional/documents/mtu-gs-idp.docx&sa=D&source=docs&ust=1678123521736097&usq=AOvVaw03OMZX6DkBCO4zPdeXhptE>

for this purpose. Students are encouraged to use any form they find useful. More information on IDPs is available from the graduate school at:

<https://www.mtu.edu/gradschool/resources-for/students/professional/idp/>

## **Additional Requirements**

### **Forms and Deadlines**

Forms and Deadlines for the Graduate School are available at:

<https://www.mtu.edu/gradschool/policies-procedures/forms-deadlines/>

Personalized requirements for each student are maintained at

<https://mymichigantech.mtu.edu>.

Students are responsible for keeping track of form requirements and ensuring the required forms are submitted on time.

## Table 1: Approved Elective Courses

EET 3131 – Sensors and Instrumentation [sp] (3)	MEEM 5255 – Adv. Pwrtrain Instrumntation [sp] (3)
EET 3373 – Intro to PLC [f] (3)	MEEM 5655 – Intro to Lean Manufac'ting [sp] (3)
EET 4141 – Microcontroller Interfacing [f] (4)	MEEM5680 – Optimization 1 [f, sp] (3)
EET 4707 – Autonomous Systems [f, sp] (3)	MEEM 5695 – Additive Manufacturing [sp] (3)
EET 5311 – Control Systems [f] (4)	MEEM 5700 – Dyn. Meas./Signal Analysis [f] (4)
EET 4501 - Applied Machine Learning [sp] (3)	MEEM 5705 – Robotics & Mechatronics [f,sp] (4)
EE 3160 – Signals and Systems [f, sp, su] (3)	MEEM 5811 – Automotive Systems [f] (3)
EE 3261 – Control Systems [f,sp] (3)	MEEM 5812 – Automotive Ctrl Systems [sp] (3)
EE 3280 – Robotic Operating Sys [sp] (3)	MEEM 5990 – Special Topics
EE 4253 – Real Time Signal Processing [sp] (3)	MEEM 6320 – CyberSec of Auto Systems 2 [f] (3)
EE 4262 – Digital & Non-linear Control [sp] (3)	MET 5378 – Adv. Hydraulics [f] (3)
EE 4272 – Computer Networks [f,sp,su] (3)	MET 5800 – Dyn & Kin of Robotic Platfrms [sp] (3)
EE 4295 – Intro to Propulsion for HEV [f] (3)	MET 5801 – Ctrlrs of Dynamics Systems [f] (3)
EE 4723 – Network Security [sp] (3)	MET 5802 – Vibrations of Mech. Systems [f] (3)
EE 5275 - Energy Storage Sys [sp] (3)	SAT 4812 – Cyber Security 2 [sp] (3)
EE 5365 - In Vehicle Comm Networks [f, su] (3)	MFGE 5200 - Industry 4.0
EE 5455 – CyberSec of Industrial Ctrl Sys (3)	CS 4461 – Computer Networks [f, sp] (3)
EE 5532 – Sensing & Proc. for Robotics [sp] (3)	UN 5000 – Co-op Work Experience (first semester)
EE 5715 Linear Systems Theory & Design (3)	UN 5002 – Co-op Work Experience (2nd semester)
MEEM 3750 – Dynamic Systems [f, sp, su] (4)	

## **Abbreviations**

[f] - Fall semester; late August to early December

[sp] - spring semester; early January to early May

[su] - Summer semester; early May to early August

(x) - numbers appearing in parentheses indicate credit level for a course