



COLLEGE OF ENGINEERING  
**ELECTRICAL & COMPUTER ENGINEERING**  
UNIVERSITY OF MICHIGAN

# **MEng PROGRAM MANUAL**

**Effective for students starting  
Fall 2023 or later**

**EECS BUILDING  
1301 Beal Ave  
Ann Arbor, MI 48109-2122**  
[www.eecs.umich.edu/eecs/graduate](http://www.eecs.umich.edu/eecs/graduate)

## Table of Contents

<b>1. INTRODUCTION</b> .....	<b>3</b>
MEng Degree Areas .....	3
<b>2. ADMISSION</b> .....	<b>4</b>
<b>3. GENERAL ACADEMIC POLICIES</b> .....	<b>4</b>
English Proficiency.....	4
Enrollment Status.....	4
Grades and GPA Requirement.....	5
Honor Code .....	5
Petition for Waiver or Modification of Policy or Requirement .....	5
Course Equivalency.....	6
Graduation.....	6
Converting from MEng to MS.....	6
Academic Information for International Students.....	6
Curricular Practical Training (CPT) for F-1 Students .....	6
Optional Practical Training (OPT) for F-1 Students.....	7
Reduced Course Load (RCL) for F-1 Students .....	7
<b>4. MASTER'S DEGREE REQUIREMENTS</b> .....	<b>7</b>
Program Components Elaboration .....	8
Core requirement.....	8
Non-core/Electives.....	8
Communications and e-ship skills.....	8
Internships .....	8
<b>5. Specific program requirements and policies</b> .....	<b>9</b>
All Concentrations .....	9
Data Science and Machine Learning Concentration (DS/ML) .....	9
Core requirement ( $\geq 9$ credits) .....	9
Accepted non-core courses .....	10
Project/Design/Lab requirement ( $\geq 4$ credits):.....	10
Examples of course choices and pathways to completion are as follows (numbers in parentheses denote credit hour counts):.....	10
Autonomous Systems (AS).....	11
Core requirement ( $\geq 9$ credits): .....	11
Accepted non-core courses .....	12
Project/Design/Lab requirement ( $\geq 4$ credits).....	12
Examples of course choices and pathways to completion are as follows:.....	12
<b>6. STUDENT HANDBOOKS and INTERNET RESOURCES</b> .....	<b>14</b>

## 1. INTRODUCTION

The Electrical and Computer Engineering Master of Engineering (MEng) Graduate Program Manual provides information on the requirements for the Master of Engineering degree. The MEng program, which is distinct from the ECE [Master of Science \(MS\) program](#), is specially designed for students who plan to enter industry after graduation and who have already decided their specialty. The program is highly structured, emphasizes rigorous theory, practical training, engineering projects, industrial skills, communications, project management, leadership, and entrepreneurial training. The curriculum is aligned with emerging application areas of high workforce demand.

The MEng program is part of the Electrical and Computer Engineering Graduate Program, which is one of two graduate programs comprising the Electrical Engineering and Computer Science Department (EECS) at the University of Michigan. Each of the two programs, Computer Science Engineering and Electrical and Computer Engineering have their own areas of research and courses. Students enrolled in Electrical and Computer Engineering are primarily interested in the area of Electrical Engineering, Systems Science, and Computer Engineering.

### MEng Degree Areas

The MEng program is currently offered in three areas:

- Data Science and Machine Learning
- Autonomous Systems
- Microelectronics and Integrated Circuits

The program in **Data Science and Machine Learning** focuses on the use of data science and machine learning in modern engineering projects and systems for sensing, control, inference, planning, and decision making. Students will learn to understand the engineering challenges and the skills needed to use data in solving the problem; obtain process data in large-scale complex engineering systems, and apply the resulting analytics to solve the problem.

The program in **Autonomous Systems** focuses on the design and engineering aspects of autonomous systems and operations. Students will gain knowledge in sensors, sensing, signal processing, and control, and apply that knowledge to the broad family of autonomous systems that includes robots, autonomous driving, and any engineering system that can be made to operate independently.

The program in **Microelectronics and Integrated Circuits** prepares students for a career in the semiconductor industry. Students will gain knowledge in integrated circuit design (digital, analog, microwave), semiconductor manufacturing, device physics and design principles (electronic, optoelectronic, sensing, organic, quantum), and microelectromechanical systems. The curriculum emphasizes rigorous foundational knowledge, state-of-the-art applications, hands-on projects, teamwork, communication, and entrepreneurship skills.

## **2. ADMISSION**

Admission to the MEng is through the College of Engineering. Please click here for additional information regarding applying:

<https://ece.engin.umich.edu/academics/graduate-programs/prospective-grad-students/apply-for-grad/apply-for-meng/>

It is the responsibility of the applicant to make sure the ECE MEng Program receives the completed application form by the specified deadlines.

Students desiring admission to the MEng program should have earned a bachelor's degree in engineering, mathematics, or physical sciences. Admission to the MEng programs requires a completed application, transcripts of all previous academic records, three letters of recommendation, GRE scores, academic statement of purpose, and personal statement.

Students who enter and complete the program will earn a Master of Engineering in ECE degree.

Current UM graduate students in other programs may be eligible to earn a dual degree in the ECE MEng program. Adding an additional ECE Master's degree requires a completed "Add a Degree" application, a letter of recommendation from research advisor, UM transcript, and Master's degree plan of study. Please visit the ECE Graduate Program Office or website for additional information.

## **3. GENERAL ACADEMIC POLICIES**

Courses dropped after the 3rd week of the registration period will receive a "W" on transcript.

After the eighth week of a full term (fourth week of a half term), courses may be dropped or changed to Visit/Audit status only under exceptional circumstances and with the approval of the course instructor, advisor, and the ECE Associate Chair of Graduate Affairs.

You cannot remove courses from your transcript.

Term-specific deadline dates are sent via email each term by the ECE Graduate Program Office and ECE website.

### **English Proficiency**

Based on English language proficiency test scores (such as the TOEFL), some students will be encouraged to take specific academic writing or speaking courses offered by the English Language Institute (ELI) to support their studies. The ELI courses are typically 1 to 3 credits, and will help students gain capability and confidence in English. These courses will not count toward the degree or GPA.

### **Enrollment Status**

Regarding courses:

Full-time enrollment is 8 credit hours.

For GSI/GSRA, full time enrollment is 6 credit hours.

ELI courses count towards enrollment status.

Visit/Audit of a class does not count towards enrollment status.

Regarding tuition:

For 1-8 credits, a student's account is charged an amount for each credit hour.

For 9+ credits, a student's account is charged a single amount for all credits.

**Grades and GPA Requirement**

All grades are on the College of Engineering scale:

A+	4.0	B+	3.3	C+	2.3	D+	1.3
A	4.0	B	3.0	C	2.0	D	1.0
A-	3.7	B-	2.7	C-	1.7	D-	0.7

Course grade must be B- or better for the credit hours to be counted toward any degree requirement.

The grade point average (GPA) must be at least 3.0, based on a 4.0 scale. A cumulative GPA below a 3.0 will cause the Graduate School to place a notation of "unsatisfactory academic standing" on the student's academic record.

A student with unsatisfactory academic standing will not be granted a degree, and may change programs and transfer credits only with permission of the admitting program.

**Honor Code**

All engineering programs at the University of Michigan follow the College of Engineering Honor Code outlining certain standards of ethical conduct. The Honor Council investigates reported violations of the Honor Code. Read more about the policy here: <http://elc.engin.umich.edu/wp-content/uploads/sites/19/2019/03/Honor-Code-Pamphlet-2018.pdf>

**Petition for Waiver or Modification of Policy or Requirement**

A student may request special permission to adjust the departmental degree requirements or guidelines for a specific reason or circumstances. It is recommended that the student seek the advice of their academic/research advisor before submitting the petition.

A student petitioning for waiver or modification of policy or requirement must complete the Petition Request Form. The student's academic/research advisor must approve this request, and then it is submitted to the ECE Graduate Academic Affairs Committee for final approval.

Link to ECE Petition form: <https://ece.engin.umich.edu/wp-content/uploads/sites/4/2019/08/ECE-Petition-Form.pdf>

## **Course Equivalency**

If a student has taken a course elsewhere that is “substantially equivalent” to an EECS course, it may not be necessary to retake the course. The student should consult with their academic and/or research advisor at the earliest opportunity to determine whether or not equivalency is appropriate.

For course equivalency approval, additional supporting documentation is required such as syllabus, course description, homework, etc.

Link to Course Equivalency Request form:

<https://ece.engin.umich.edu/wp-content/uploads/sites/4/2019/08/ECE-Equivalency-Request.pdf>

## **Transferring Credits**

Students may be able to transfer internal ECE credits, subject to approval, if the course is the same course required by the MEng program.

## **Graduation**

Graduation for the MEng program is not automatic. A student who has completed the degree requirements must submit a completed plan of study, receive advisor and ECE Graduate Program Coordinator approval, and apply for graduation via the Wolverine Access System.

The last day to apply for graduation for the current semester is the last day of classes (not the final exam period).

## **Converting from MEng to MS**

Students admitted to the MEng program may decide to apply to the Master of Science or doctoral programs. Students who do switch can count up to 12 credits of technical courses (including lab/design) toward the MS or PHD degree, to the ECE MS/PhD program requirement and Rackham Graduate School's residency/candidacy policies.

MEng students applying to the MS or PhD would need to complete a full application after one semester of study in the MEng Program and are not guaranteed admissions to the MS or PhD program.

## **Academic Information for International Students**

### **Curricular Practical Training (CPT) for F-1 Students**

The intent of CPT is for students to engage in practical job experience that directly relates to their academic program of study. Students must choose their internships carefully with the understanding that any job that is NOT specifically related to the applicant's major area of study, will likely result in the denial of the CPT request.

Students who want to enroll in CPT should go to the ECE Graduate Program Office or website for the CPT instruction form and complete all necessary paperwork.

Credit for CPT (ENGR 998) may not be counted toward any degree requirements.

#### Optional Practical Training (OPT) for F-1 Students

OPT is defined in the Federal Regulations as temporary employment directly related to a student's field of study. During OPT, a student remains in F-1 status. The end result of the OPT request process is an Employment Authorization Document (EAD) issued by United States Citizenship and Immigrations Services (USCIS).

Processing OPT applications typically requires 60 to 90 days.

Some STEM students may be eligible for a 17-month extension of OPT.

#### Reduced Course Load (RCL) for F-1 Students

International students who drop below fulltime status, or who need fewer than 8 credits to complete their program requirements, may apply for RCL through the International Center.

Students who want/need an RCL should complete a Graduation plan of study where they will be able to request the RCL and/or OPT letters.

Please note that students are eligible for RCL only if they have not yet completed their degree requirements. Due to Federal regulations, students must apply for their degree in the semester in which they complete their degree requirements. If a student wants to remain in the country after completing their requirements, they must apply for OPT. For further information: <http://internationalcenter.umich.edu>

## 4. MASTER'S DEGREE REQUIREMENTS

The ECE MEng degree program is a 26-credit program with the following components:

1. At least 12 credits in technical courses, of which at least 9 are from a set of core courses for a selected MEng concentration; the rest from a set of approved non-core courses.
2. At least 4 credits in project and design courses in the same concentration.
3. At least 4 and up to 6 credits in ENTR courses; these are in the areas of entrepreneurship, leadership, communication and project management. This requirement may be waived by the MEng program coordinator or the cognizant faculty, in cases such as continuing education and other warranted circumstances.
4. An optional summer internship, which can count up to 3 credits, corresponding to a 12-week full-time internship.

For MEng students who plan to graduate in 2 semesters, they will need to plan carefully with the ECE Graduate Office as courses are not offered every semester.

Example combinations of these toward program requirement include:

- (i) 18 technical (12 in core, 6 in non-core), 4 in project, 4 in ENTR
- (ii) 18 technical (9 in core, 9 in non-core), 4 in project, 4 in ENTR
- (iii) 15 technical (9 in core, 6 in non-core), 8 in project, 4 in ENTR
- (iv) 12 technical (9 in core, 3 in non-core), 8 in project, 6 in ENTR
- (v) 15 technical (9 in core, 7 in non-core), 4 in project, 4 ENTR, and 3 in internship
- (vi) 15 technical (all in core), 4 in project, 4 ENTR, and 3 in internship

## Program Components Elaboration

Core requirement (at least 12 and up to 22 credits total)

The core requirement consists of the core courses in the selected concentration and the design/project courses in the same concentration. These courses will deliver the technical/engineering foundations for the student, with a significant emphasis on hands-on and project experience, all in the concentration area.

Non-core/Electives (up to 9 credits total)

These constitute the flexible component of the program. Approved non-core courses include any “M” course on the ECE Graduate Course List: <https://ece.engin.umich.edu/academics/course-information/graduate-course-list/> – these are courses that count toward fulfilling a major requirement in one of our existing MS major areas, provided they are not simultaneously listed as a core/lab requirement for a concentration. A course not listed as “M” by the ECE Graduate Manual may count as an accepted non-core course with pre-approval from the MEng program coordinator.

Communications and e-ship skills

These have become an increasingly important part of any professional training program and reflect our belief that communications, innovation, leadership and management skills are complementary and even critical to a student’s technical training.

Internships

Practical training is recognized as a potentially very critical and beneficial part of a professional degree program and is thus accepted as an option. It is not required, as we do not guarantee such opportunities for all students, particularly international students. To qualify for credit, the student must register in the amount of credits of EECS 699 approved by the advisor. In addition, a report from the student summarizing the internship along with proper documentation from the employer needs to be submitted. An international student is also required to return for the fall term following the summer internship to obtain this credit. The EECS 699 credits may be registered in the fall term following the internship, allowing for the internship credits to be calculated in the fall term’s tuition, with over 9 credits being the same tuition rate. For guidance and questions on registering for EECS 699 please contact the Graduate Program Office.

An MEng student will not receive credit for courses outside the above requirements without pre-approval from the program coordinator.

## 5. SPECIFIC PROGRAM REQUIREMENTS AND POLICIES

### All Concentrations

The following set of entrepreneurship (ENTR) courses are common to all concentrations, along with the semester in which they are offered and the number of credits they carry.

Communications and e-ship (4-6 credits):

- ENTR 407 (Entrepreneurship Hour, 1)
- ENTR 408 (Patent law, 1)
- ENTR 520 (Tech-inspired business models, 3)
- ENTR 530 (Innovation & IP strategy, 3)
- ENTR 550 (Interpersonal skills, 3)
- ENTR 560 (Project mgmt & consulting, 3)
- EECS 406 (High-tech entrepreneurship, 4)

Relevant EECS 598 (Special Topics) courses may be allowed to satisfy any of the requirements noted below per program coordinator's approval.

All course requirements must be letter-graded (A, B, etc.) and may not be marked as satisfactory/unsatisfactory except for the optional requirements and ENTR 407.

### Data Science and Machine Learning Concentration (DS/ML)

For the DS/ML concentration, the list of accepted courses in each category is as follows.

Core requirement ( $\geq 9$  credits)

- EECS 501 (Probability and Random Processes, 4)
- EECS 504 (Foundations of CV, 3)
- EECS 551 (Matrix Methods in SIPML, 4)
- EECS 542 (Advanced Topics in Computer Vision, 3)
- EECS 553\*<sup>1</sup> (Machine Learning ECE, 3),
- EECS 556\* (Image Processing, 3)
- EECS 559\* (Optimization methods in SIPML, 3)
- EECS 564 (Estimation, Filtering, and Detection, 3)

## Accepted non-core courses

An “M” course on the [ECE Course List](#)– these are courses that count toward fulfilling a major requirement in one of our existing MS major areas. A course not listed as “M” by the ECE Graduate Manual may count as an accepted non-core course with pre-approval from the MEng program coordinator.

## Project/Design/Lab requirement (>=4 credits):

The objective is to have the student develop a portfolio of machine learning projects. The student should create a project using knowledge acquired in their DS/ML courses to showcase their DS/ML proficiencies in the various technical areas to potential employers. Many courses have project components - it is up to the student to decide on a project that best showcases their existing strengths while allowing them to develop new competencies based on a self-assessment of their existing skillset relative to skillset required for their desired post-graduation position(s) in industry or academia.

- Python for Everybody Specialization (5-course sequence on Coursera, available to take at multiple times during the year - taught by C. Severance at SI, 2)  
Other acceptable project-based course(s) include:
- EECS 553\*<sup>1</sup> (Machine Learning, 3)
- EECS 556\* (Image Processing, 3)
- EECS 559\* (Optimization methods in SIPML, 3)
- EECS 599 (Independent or directed study, credits determined in consultation with advisor depending on number of hours committed to study per week)
- Any other EECS 500+ level special topics course with a project component - ask the instructor whether a project is a component of the course
- Directed study or independent research involving DS/ML with a non-ECE UM faculty member - the advisor will have to submit a letter indicating the nature of the project work, the number of credits and how the project helps to showcase existing and acquired new DS/ML skills

\* EECS 553, EECS 556, and EECS 559 may be used to satisfy either the core course requirement or project requirement but not both.

<sup>1</sup> We recommend that EECS 553 be taken after EECS 551

Examples of course choices and pathways to completion are as follows (numbers in parentheses denote credit hour counts):

Example 1: all courses, no internship; 4-credit ENTR; 23-credit core

- Fall: 501 (4), 504 (3), 551 (4), ENTR 407 (1) – 12 total
- Winter: Two of (559, 542, 556) (6), 553 (3) as Project course with Python (2), ENTR 550 (3) – 14 total

Example 2: all courses, no internship; 4-credit ENTR; 16-credit core; 7-credit minor

- Fall: 501 (4), 551 (4), a 1st course in VLSI (3), ENTR 550 (3) – 14 total
- Winter: 553(3) or 542 (3), 559 (3) as Project course with Python (2), a 2nd course in VLSI (4), ENTR 407 (1) – 13 total

Example 3: mix; 4-credit ENTR; 19-credit core; 3-credit internship\*

- Fall: 501 (4), 504 (3), 551 (4), ENTR 407 (1)– 12 total
- Winter: 553 (3) or 542 (3), 559 (3) or directed study 599 (3) as Project course with Python (2), ENTR 550 (3) – 11 total
- SS: qualified internship: EECS 699 (3)

\* *International students on F1/J1 visas are required to be enrolled in courses on campus during their last term of study.*

Example 4: mix (for international students); 4-credit ENTR;  $\geq$ 16-credit core; 3-credit intern

- Fall: 501 or 504 (3), 551 (4), ENTR 407 (1) – 8 total
- Winter: 553 (3), 559 (3) as Project course with Python (2) – 8 total
- SS: qualified internship: EECS 699 (3)
- Fall: another approved ECE course (3) or directed study/research (3), ENTR 550 (3) – 6 total

## **Autonomous Systems (AS)**

For the AS concentration, the list of accepted courses in each category is as follows.

Core requirement ( $\geq$ 9 credits):

- EECS 453 (Principles of Machine Learning, 4)
- EECS 460 (Control Sys Analysis & Design, 4)
- EECS 501 (Probability & Random Processes, 4)
- EECS 504 (Foundations of CV, 3)
- EECS 542 (Vision Processing, 3)
- EECS 551 (Mathematical Methods for SP, 4)
- EECS 556 (Image Processing, 3)
- EECS 560 (Linear Systems Theory, 4)
- EECS 567 (Intro to Robotics, 3)
- EECS 568 (Mobile Robotics, 4)
- EECS 561 (Design of Digital Control Systems, 3)
- EECS 562 (Nonlinear Sys Control, 3)
- EECS 563 (Hybrid Control, 3)
- EECS 564 (Estimation, Filtering, and Detection, 3)
- EECS 565 (Linear Feedback Control Systems, 3)

### Accepted non-core courses

An “M” course on the [ECE Course List](#)– these are courses that count toward fulfilling a major requirement in one of our existing MS major areas. A course not listed as “M” by the ECE Graduate Manual may count as an accepted non-core course with pre-approval from the MEng program coordinator.

### Project/Design/Lab requirement ( $\geq 4$ credits)

- EECS 452 (DSP Design Lab, 4)
- EECS 461 (Embedded Control Systems, 4)
- EECS 464 (Hands-on Robotics, 4)

Examples of course choices and pathways to completion are as follows:

Example 1: all courses, no internship; 4-credit ENTR; 22-credit core

- Fall: 560 (4), 542 (3), 453 (4), ENTR 407(1) – 12 total
- Winter: 565 (or 562/563) (3), two of (461, 452, 464) (8), ENTR 550 (3) – 14 total

Example 2: all courses, no intern; 4-credit ENTR; 23-credit core

- Fall: 501 (4), 460 (4), 453 (4), ENTR 407 (1) – 13 total
- Winter: 556 or 564 (3), two of (461, 452, 464) (8), ENTR 550 (3) – 14 total

Example 3: mix; 4-credit ENTR;  $\geq 15$ -credit core; 3-credit intern

- Fall: 560 (4), 453 (4), ENTR 407 (1) – 9 total
- Winter: 565 (3), one of (461, 452, 464) (4), ENTR 550 (3) – 10 total
- SS: qualified internship EECS 699 (3)
- Fall: another ECE course (4)

## Microelectronics and Integrated Circuits (MI)

For the MI concentration, the list of accepted courses in each category is as follows.

### Core requirement ( $\geq 9$ credits)

- EECS 414 (Introduction to MEMS, 4)
- EECS 418 (Power Electronics, 4)
- EECS 421 (Properties of Transistors, 4)
- EECS 429 (Semiconductor Optoelectronic Devices, 4)
- EECS 506 (Design of Power Electronics, 3)
- \*EECS 511 (Integrated Analog/Digital Interface Circuits, 4)

- EECS 514 (Advanced MEMS Devices and Technologies, 4)
- EECS 515 (Integrated Microsystems, 4)
- EECS 517 (Physical Processes in Plasma, 3)
- EECS 520 (Solid State Physics, 4)
- EECS 521 (Solid State Devices, 3)
- \*EECS 522 (Analog Integrated Circuits, 4)
- EECS 523 (Digital Integrated Technology, 4)
- EECS 524 (Organic Electronics, 3)
- EECS 525 (Advanced Solid State Microwave Circuits, 3)
- EECS 528 (Principles of Microelectronics Process Technology, 3)
- EECS 529 (Semiconductor Lasers and LEDs, 3)
- EECS 540 (Applied Quantum Mechanics I, 3)
- EECS 620 (Electronic and Optical Properties of Semiconductors, 4)
- \*EECS 627 (VLSI Design II, 4)

The following can satisfy the core requirement when they are offered.

- EECS 509 (BioMEMS, 3)
- EECS 510 (RF MEMS, 4)
- EECS 512 (Amorphous and Microcrystalline Semiconductor Thin Film Devices, 3)
- EECS 513 (Flat Panel Displays, 3)

Accepted non-core courses

An “M” course on the ECE Course List – these are courses that count toward fulfilling a major requirement in one of our existing MS major areas. A course not listed as “M” by the ECE Graduate Manual may count as an accepted non-core course with pre-approval from the MEng program coordinator.

Project/Design/Lab requirement ( $\geq 4$  credits):

- EECS 411 (Microwave Circuits I, 4)
- EECS 413 (Monolithic Amplifier Circuits, 4)
- EECS 423 (Solid-State Device Laboratory, 4)
- EECS 425 (Integrated Microsystems Laboratory, 4)
- EECS 427 (VLSI Design I, 4)

\* EECS 511, 522, 627 can also be used to satisfy the project/design/lab requirement. However, the same course cannot be used to satisfy both the core and project requirements.

## 6. STUDENT HANDBOOKS AND INTERNET RESOURCES

The Michigan Engineering College Bulletin is among the numerous UM publication available online. The Michigan Engineering College Bulletin gives details about the graduate degree requirements imposed by the College, and should be consulted by all graduate students. All EECS course descriptions are available in the bulletin as well. The bulletin can be accessed at: <https://bulletin.engin.umich.edu>

College of Engineering: <http://www.engin.umich.edu/college/>

UM Wolverine Access: <https://wolverineaccess.umich.edu/>

UM Registrar: <http://ro.umich.edu>

Student Financial Services: <http://www.finance.umich.edu/finops/student/>

CoE Honor Code: <http://ecas.engin.umich.edu/honor-council/honor-code/>

Student Rights and Responsibilities:

<https://oscr.umich.edu/article/statement-student-rights-and-responsibilities>