

ENGINEERING, MS: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

The Master of Science in Engineering program is a flexible program designed to meet the needs of a wide variety of students. The program can be a stepping-stone on the way to further studies and the pursuit of advanced research, such as can be obtained by pursuing the PhD. Or the program can provide a pathway to professional advancement through greater technical knowledge and intellectual maturity. The student, with the help and approval of a major advisor, can choose from a wide range of courses from throughout the College of Engineering and Applied Science (CEAS), and where appropriate, from other schools and colleges.

Students entering the Master of Science in Engineering program must choose an area of concentration, from among the numerous choices offered. It is possible to complete the MS in Engineering without a concentration, but almost all students do complete one. The MS in Engineering program currently offers the following areas of concentration:

- Artificial Intelligence and Machine Learning
- Biomedical Engineering
- Civil Engineering
- Electrical and Computer Engineering
- Energy Engineering
- Engineering Management (admission to this concentration is suspended)
- Engineering Mechanics
- Industrial and Systems Engineering
- Manufacturing Engineering
- Materials Engineering
- Mechanical Engineering
- Occupational Biomechanics/Ergonomics

Artificial Intelligence and Machine Learning Concentration

A one-of-a-kind program combining Artificial Intelligence skills with engineering, available even without an engineering or computer science bachelor's degree. Engineers and computer scientists entering the advanced technical workforce are witnessing rapid change in expectations of fluency in the fundamentals of Artificial Intelligence (AI) and Machine Learning (ML), and their application across virtually every discipline and industry.

Get ahead of this technological revolution with UWM's Artificial Intelligence and Machine Learning Master's, our newest concentration, welcoming full- and part-time students from many different STEM-related backgrounds. Innovators, including Microsoft Chairman and CEO Satya Nadella ('80, MS CS), have chosen UWM for their technology-related graduate studies.

Admission Requirements

Application Deadlines

Application deadlines vary by program, please review the application deadline chart (<http://uwm.edu/graduateschool/program-deadlines/>) for

specific programs. Other important dates and deadlines can be found by using the One Stop calendars (<https://uwm.edu/onestop/dates-and-deadlines/>).

Admission

An applicant must meet Graduate School requirements (<http://uwm.edu/graduateschool/admission/>) plus the following College requirements to be considered for admission to the program:

1. Undergraduate degree in engineering, technology, mathematics, natural science, or a closely related major which includes foundational coursework in these fields.
2. Brief reason statement explaining reasons for graduate study, specific interests, and background.

Applicants may be admitted with specific course deficiencies. The student is expected to satisfy deficiency requirements within three enrolled semesters. No course credits earned in making up deficiencies may be counted as program credits required for the degree.

AI Statement

Use of AI resources by students to complete homework or exams is prohibited except in situations and courses in which the instructor deems it necessary and clearly states so in the syllabus or by email.

Credits and Courses

Minimum degree requirements are 30 credits for the thesis option and 31 credits for the non-thesis option as outlined below. Of the courses offered in the College only those numbered 400 and above may be taken for graduate credit for this degree. Independent study courses (699 and 999) may be included in the minimum course credit requirements provided approval of a program of study including them has been obtained prior to registration in such courses. Typically, no more than three credits of independent study are allowed in the MS Program. Guidelines on acceptable independent study courses are available in the CEAS Graduate Programs Office. A student may not use courses that formed part of the requirements of a baccalaureate degree for subsequent graduate credit, except when those courses were part of the CEAS Integrated BS/MS program.

Thesis and Non-Thesis Options

Students will be required to choose either the Thesis or Non-Thesis option in their program of study. If the student chooses the Non-Thesis option, then as permitted by the student's department, the student must also choose between two methods of final evaluation: the Capstone Option and the Comprehensive Examination Option.

After 12 credits of coursework are completed, changes from Thesis to Non-Thesis option will not be allowed, except under exceptional circumstances to be considered on a case-by-case basis. Students may always change from a Non-Thesis to a Thesis option. Departments and faculty may make pursuing the Thesis option a requirement (or preference) of employment for TAs, RAs, and PAs.

Thesis Option

All students are encouraged to undertake the thesis option. The degree requires the following:

Code	Title	Credits
Select a minimum of 12 credits in an approved technical program of studies		12
Select 9 credits of approved electives		9
EAS 701	Effective Academic Writing	1
EAS 702	Preparing Future Engineering Faculty & Professionals	2
Select 6 credits of thesis		6
Total Credits		30

At least 12 credits, not including thesis or the CEAS Graduate Seminar Course, must be in courses of 700 level or higher. At least 12 credits, including thesis, must be earned at UWM. The thesis may be written in absentia provided prior permission has been obtained from the major professor and the Associate Dean for Academic Affairs in the College of Engineering & Applied Science. Students in the thesis option must pass a final comprehensive examination, administered by the Master's Program Committee, partially in defense of the thesis.

Non-Thesis Capstone Option

Code	Title	Credits
Select a minimum of 18 credits in an approved technical program of studies		18
Select 9 credits of approved electives		9
EAS 701	Effective Academic Writing	1
Select 3 credits of a capstone project, using a 3 credit course that allows flexible independent study (either the Independent Study course or a specific capstone course)		3
Total Credits		31

In addition to the requirements listed in the table above, at least 15 credits must be of 700 level or above.

For the capstone project, the student must submit a written proposal and receive approval from the advisor. The capstone project should be designed with the intent of leading to creative work based on the student's background, and should be the equivalent of 3 credits of work to be completed over a single semester. Upon completion of the capstone, the student must submit a written report and give an oral presentation of the project to the Master's Program Committee for approval.

Non-Thesis Comprehensive Examination Option

Code	Title	Credits
Select a minimum of 21 credits in an approved technical program of studies		21
Select 9 credits of approved electives		9
EAS 701	Effective Academic Writing	1
Total Credits		31

In addition to the requirements listed in the table above, at least 15 credits must be of 700 level or above.

Mastery of the courses taken in the program of study may be demonstrated by one of the following:

1. The student submits a dossier of work, and passes an oral examination given by the Master's Program Committee; or

2. The student passes a written master's comprehensive examination when it is offered by the department.

Departments allowing a written examination option will offer such exams at least once per semester, and will announce the date of the exam at least 60 days prior to the exam. The department also must provide a written description of the topics covered on the exam, including text books and chapters.

Artificial Intelligence and Machine Learning Concentration

A minimum of 15 credits of qualifying courses selected from the following list are required. In addition, a student must earn 15 graduate credits at the level of 700 & above, plus a CEAS course in technical writing (e.g., EAS 701 & EAS 702).

Qualifying Courses

Code	Title	Credits
Required Courses		
COMPSCI 557G or COMPSCI 715	Introduction to Database Systems Programming for Machine Learning	3
COMPSCI/ELECENG 711 or COMPSCI 411G	Introduction to Machine Learning Machine Learning and Applications	3
Electives¹		9
<i>Application Electives</i>		
COMPSCI/ELECENG 712	Image Processing	
COMPSCI 722	Artificial Intelligence Planning Techniques	
COMPSCI 723 or COMPSCI 423G	Natural Language Processing Introduction to Natural Language Processing	
COMPSCI 744 or COMPSCI 444G	Text Retrieval and Its Applications in Biomedicine Introduction to Text Retrieval and Its Applications in Biomedicine	
ELECENG 574G	Intermediate Control Systems	
ELECENG 810	Foundations for Advanced Machine Learning and Signal Processing	
ELECENG/COMPSCI 811	Advanced Machine Learning	
ELECENG 816	Optimal Control Theory	
MECHENG 476G	Introduction to Robotics	
IND ENG 717	Operations Research in Engineering Management	
<i>Generic Electives</i>		
COMPSCI 425G	Introduction to Data Mining	
COMPSCI/ELECENG 710	Artificial Intelligence	
ELECENG 420G	Random Signals and Systems	
ELECENG 474G	Introduction to Control Systems	
IND ENG 716	Engineering Statistical Analysis	
IND ENG 590/890	Topics in Industrial and Systems Engineering: (Introduction to Connected Systems)	

IND ENG 590/890	Topics in Industrial and Systems Engineering: (Engineering Data Analytics)	
Total Credits		15

¹ Students must enroll in 3 elective courses. At least 2 must be selected from the Applications Electives section, and at least 2 must be at the 700 level or above.

Thesis and Non-Thesis Options

Incoming students will be asked to pick a nominal home department or an existing focus area in CEAS which will also assign a faculty advisor. Students must also select either the Thesis or Non-Thesis option in their program of study. If the student chooses the Non-Thesis option, then as permitted by the student's home department, the student must also choose between two methods of final evaluation: the Capstone Option and the Comprehensive Examination Option. After 12 credits of coursework are completed, changes from a Thesis to a Non-Thesis option will not be allowed, except under exceptional circumstances to be considered on a case-by-case basis. Students may always change from a Non-Thesis to a Thesis option. Departments and faculty bodies may make pursuing the Thesis option a requirement (or preference) for employment as TAs, RAs, and PAs.

Thesis Option

All students are encouraged to undertake the thesis option. The MS-Eng degree with thesis requires the following:

Code	Title	Credits
		Credits
	Select a total of 15 credits from the required and electives course list from the graduate concentration in AI & ML	15
	Select 9 additional credits of 700+ courses from the CEAS catalog	9
EAS 701	Effective Academic Writing	1
EAS 702	Preparing Future Engineering Faculty & Professionals	2
	Select 4 credits of thesis	4
Total Credits		31

At least 12 of these credits, not including thesis or the CEAS Graduate Seminar Course, must be in courses of 700-level equivalent, or higher. At least 12 credits, including thesis, must be earned at UWM. The thesis may be written in-absentia provided prior permission has been obtained from the major professor/faculty advisor and the Associate Dean for Academic Affairs in the College of Engineering & Applied Science. Students in the thesis option must pass a final comprehensive examination, administered by the Master's Program Committee, partially in defense of the thesis.

Non-Thesis Capstone Option

Code	Title	Credits
		Credits
	Select a total of 15 credits from the required and electives course list from the graduate concentration in AI & ML	15
	Select 12 additional credits of 700+ courses from the CEAS catalog	12
EAS 701	Effective Academic Writing	1

Select 3 credits of a capstone project, using a 3-credit course that allows flexible independent study (either the Independent Study course or a specific capstone course)	3
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Total Credits	31
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In addition to the requirements listed in the table above, at least 15 credits must be of 700 level or above.

For the capstone project, the student must submit a written proposal and receive approval from the advisor. The capstone project should be designed with the intent of leading to creative work based on the student's background, and should be the equivalent of 3 credits of work to be completed over a single semester. Upon completion of the capstone, the student must submit a written report and give an oral presentation of the project to the Master's Program Committee for approval.

Non-Thesis Comprehensive Examination Option

Code	Title	Credits
		Credits
	Select a total of 15 credits from the required and electives course list from the graduate concentration in AI & ML	15
	Select 15 credits of approved 700 level (equivalent or above) electives	15
EAS 701	Effective Academic Writing	1
Total Credits		31

In addition to the requirements listed in the table above, at least 15 credits must be of 700-level equivalent or above.

For the non-thesis comprehensive examination option, mastery of the courses taken in the program of study may be demonstrated by one of the following:

1. The student submits a dossier of work, and passes an oral examination given by the Master's Program Committee; or
2. The student passes a written master's comprehensive examination when it is offered by the department.

Departments offering a written examination option will offer such exams at least once per semester, and will announce the date of the exam at least 60 days prior to the exam. The department also must provide a written description of the topics covered on the exam, including textbooks and chapters.

Additional Requirements

Major Professor as Advisor

The Graduate School requires that the student have a major professor to advise, supervise, and approve the Program of Study before registering for courses. The College will assign the incoming student to an initial advisor at the time of admission. A student may change advisors with the consent of the new advisor, approval by the Associate Dean for Academic Affairs, and upon notification of the student's current advisor.

Program of Study

During the first semester the student, in consultation with the major professor, develops a program of study, obtains the consent of the advisor and submits it to the CEAS Graduate Programs Office for approval by the Associate Dean. To make subsequent changes, the student must follow the same process. Graduation requires successful completion of courses from an approved program of study. Students

are recommended to obtain approval for an amended program of study before taking a course not on the current program of study.

Master's Program Committee

The Master's Program Committee is proposed by the major professor in consultation with the student. The Committee must include at least three graduate faculty, not all of whom are in the same department.

Time Limit

The student must complete all degree requirements within five years of initial enrollment.