

M.S. IN MECHANICAL ENGINEERING

<https://www.mae.coe.miami.edu/>

Overview

General requirements for the M.S. degree are listed under the Engineering heading of this section and in the general information of this Bulletin.

Admission Requirements

Students applying for acceptance to degree status must comply with the general requirements of the Graduate School. General requirements for the M.S. degree are listed under the Engineering heading of this section and in the general information of this Bulletin

Curriculum Requirements

- One academic year, or equivalent, spent in full time graduate study will be the minimum time necessary for a student to fulfill the requirements for the degree of Master of Science in Mechanical Engineering.
- The student is required to complete only graduate-level courses, 600-level or 700-level, to fulfill the course requirement.
- Both a 30 credit hour thesis option and a 30 credit hour non-thesis option are available.
 - M.S. with Thesis Option:** The student is required to complete 24 credits of course work and 6 credits of thesis in their chosen area of specialization. The thesis involves research-type work completed under the supervision or guidance of a faculty advisor. At the completion of the thesis, the student is required to write a thesis and make an acceptable oral presentation of the thesis before a committee of three faculty members that includes the faculty thesis advisor as the Chair of the committee. The faculty advisor is required to be from the Department of Mechanical and Aerospace Engineering.
 - M.S. with Non-Thesis Option:** The student is required to complete 27 credits of course work and 3 credits of an independent project in an area of his/her interest under the supervision of a faculty advisor. The faculty advisor is required to be from the Department of Mechanical and Aerospace Engineering. After completing the project, the student is required to submit a project report to the faculty advisor and also make an oral presentation of the project before two faculty members, including the faculty advisor. The student will receive a grade for the project. The independent project credits do not count toward the required minimum of two 700-level courses to be completed as part of the total expected credits of coursework required in their chosen option.
 - M.S. with Management Option:** This is a Non-Thesis Option in which a student completes 15 credits from Mechanical and Aerospace Engineering courses and 12 credits from the general area of Management, and 3 project-based credits. The independent project credits do not count toward the required minimum of two 700-level courses to be completed as part of the total expected credits of coursework required in their chosen option. The courses in Management area can be taken either from the School of Business, if available, or from the Department of Industrial Engineering. The student will select the courses in consultation with his/her faculty advisor. The faculty advisor is required to be from the Department of Mechanical and Aerospace Engineering. An undergraduate degree in engineering is required.
- Students can also concentrate their studies in **Additive Manufacturing**, providing students hands-on training in methods to design, analyze, and fabricate complex structures using state-of-art additive manufacturing printing facilities. This area of study is designed for students who want to further their career by enhancing their analytical and practical skills, critical thinking and problem solving strategies. Special areas of study include: Advanced material science and mechanics of materials, Computer Aided Design (CAD) for novel structural design and Finite Element Methods (FEM) for structural optimization and stress analysis, and Algorithm design for the additive manufacturing process.
- Students can also concentrate their studies in **Aerospace Engineering**, providing students advanced theoretical and hands-on training in aerospace structural design and analysis, aerodynamics, computational fluid dynamics (CFD), and propulsion. This area of study is designed for students who want to further their career by enhancing their analytical and practical skills, critical thinking and problem solving strategies. Special areas of study include: Advanced fluid dynamics and CFD, design and optimization of aerospace structures and design, advanced experimental fluid mechanics, Computer Aided Design (CAD) for novel structural design and Finite Element Methods (FEM) for structural optimization and stress analysis for aerospace engineering applications.

M.S. in Mechanical Engineering (Thesis and Non-Thesis Options)

Code	Title	Credit Hours
MAE Electives		
At least two 700-level MAE courses ^{1,3}		6
Other MAE Electives ^{2,3}		18
Thesis or Non-Thesis Option		6
MAE 810	Master's Thesis	
MAE 751	Master's Project (and additional MAE Elective)	
Total Credit Hours		30

¹ If no 700-level courses are available in the chosen area of interest of the student during their stay in the M.S. program, the requirement of 700-level course(s) can be waived with the recommendation of their faculty advisor.

2 M.S. in Mechanical Engineering

2 Any M.S. student can take a maximum of two 600-level or 700-level courses from other Engineering Department(s) or other Departments such as Mathematics and Computer Science with the approval of his/her faculty advisor. The student is expected to state his reasons for taking the outside departmental course and get his/her faculty advisor's approval before registering for the course(s). The only exception is that a course from Industrial Engineering Department needs to be a course that involves lectures for the entire duration of the semester instead of those that are conducted over weekends for only 4-to-6 weeks of the semester.

3 A maximum of only one course is allowed among 600-level or 700-level courses of the MAE Department that are designated as "Special Topics" or "Special Problems" that do not have scheduled lecture classes for the entire duration of the semester.

M.S. in Mechanical Engineering: Management Option (30 Credits)

Code	Title	Credit Hours
MAE Electives		
At least two 700-level MAE courses		6
Other MAE Electives		9
General Management Electives		
These may be taken from the Miami Herbert Business School or Department of Industrial Engineering		12
Selected in consultation with faculty advisor ¹		
Non-Thesis Option		
MAE 751	Master's Project (and additional MAE Elective)	3
Total Credit Hours		30

¹ The faculty advisor is required to be from the Department of Mechanical and Aerospace Engineering. An undergraduate degree in engineering is required.

MS in Mechanical Engineering: Additive Manufacturing Concentration (30 Credits)

Code	Title	Credit Hours
Core Courses		
MAE 601	Methods of Engineering Analysis	3
MAE 631	Scientific and Engineering Foundations of Additive Manufacturing	3
Electives		
Students in the Non-Thesis Option will complete 21 credits in electives. Students in the Thesis Option will complete 18 credits of electives.		
Core Electives		
At least 2 electives must be selected from the following:		
MAE 632	Additive Manufacturing of Engineering Materials (Core Elective)	
MAE 733	Additive Manufacturing Lab (Core Elective)	
MAE 762	CAD and FEM for Stress Analysis of 3D Printed Structures (Core Elective)	
MAE 616	Introduction to Composite Materials (Core Elective)	
Other MAE Electives		
MAE 602	Vibrations	
MAE 607	Advanced Mechanics of Solids	
MAE 608	Intermediate Heat Transfer	
MAE 612	Intermediate Fluid Mechanics	
MAE 706	Experimental Methods in Fluid Mechanics	
MAE 705	Machine Learning Based Finite Element Methods	
MAE 713	Transport Phenomena	
MAE 740	Continuum Mechanics	
MAE 690	Special Topics	
Non-Thesis or Thesis Option		3-6
Non-Thesis Option (3 credits)		
MAE 751	Master's Project	
Thesis Option (6 credits)		

MAE 810	Master's Thesis	
Total Credit Hours		30

MS in Mechanical Engineering: Aerospace Engineering Concentration (Thesis Option, 30 Credits)

Code	Title	Credit Hours
Core Courses		
MAE 601	Methods of Engineering Analysis	3
MAE 604	Orbital Mechanics	3
Select 6 MAE Electives (At least 2 Core Electives, 6-Credits)		18
MAE 607	Advanced Mechanics of Solids (Core Elective)	
MAE 609	Turbomachinery Aero-thermodynamics (Core Elective)	
MAE 612	Intermediate Fluid Mechanics (Core Elective)	
MAE 616	Introduction to Composite Materials (Core Elective)	
MAE 714	Computational Fluid Dynamics (Core Elective)	
MAE 602	Vibrations	
MAE 608	Intermediate Heat Transfer	
MAE 631	Scientific and Engineering Foundations of Additive Manufacturing	
MAE 632	Additive Manufacturing of Engineering Materials	
MAE 705	Machine Learning Based Finite Element Methods	
MAE 706	Experimental Methods in Fluid Mechanics	
MAE 740	Continuum Mechanics	
MAE 690	Special Topics	
Thesis Option		
MAE 810	Master's Thesis	6
Total Credit Hours		30

MS in Mechanical Engineering: Aerospace Engineering Concentration (Non-Thesis Option, 30 Credits)

Code	Title	Credit Hours
Core Courses		
MAE 601	Methods of Engineering Analysis	3
MAE 604	Orbital Mechanics	3
Select 7 MAE Electives (At least 2 Core Electives, 6-Credits)		21
MAE 607	Advanced Mechanics of Solids (Core Elective)	
MAE 609	Turbomachinery Aero-thermodynamics (Core Elective)	
MAE 612	Intermediate Fluid Mechanics (Core Elective)	
MAE 616	Introduction to Composite Materials (Core Elective)	
MAE 714	Computational Fluid Dynamics (Core Elective)	
MAE 602	Vibrations	
MAE 608	Intermediate Heat Transfer	
MAE 631	Scientific and Engineering Foundations of Additive Manufacturing	
MAE 632	Additive Manufacturing of Engineering Materials	
MAE 705	Machine Learning Based Finite Element Methods	
MAE 706	Experimental Methods in Fluid Mechanics	
MAE 740	Continuum Mechanics	
MAE 690	Special Topics	
Non-Thesis Option		
MAE 751	Master's Project	3
Total Credit Hours		30

Sample Plans of Study

M.S. in Mechanical Engineering (Thesis Option)

Year One		Credit Hours
Fall		
MAE 601	Methods of Engineering Analysis	3
MAE Fall Elective 1		3
MAE Fall Elective 2		3
MAE Fall Elective 3		3
Credit Hours		12
Spring		
MAE Spring Elective 4		3
MAE Spring Elective 5		3
MAE Spring Elective 6		3
Credit Hours		9
Year Two		
Fall		
MAE Fall Elective 7		3
MAE 810	Master's Thesis	6
Credit Hours		9
Total Credit Hours		30

M.S. in Mechanical Engineering (Non-Thesis Option)

Year One		Credit Hours
Fall		
MAE 601	Methods of Engineering Analysis	3
MAE Fall Elective 1		3
MAE Fall Elective 2		3
MAE Fall Elective 3		3
Credit Hours		12
Spring		
MAE Spring Elective 4		3
MAE Spring Elective 5		3
MAE Spring Elective 6		3
Credit Hours		9
Year Two		
Fall		
MAE Fall elective 7		3
MAE Fall elective 8		3
MAE 751	Master's Project	3
Credit Hours		9
Total Credit Hours		30

M.S. in Mechanical Engineering (Management Option)

Year One		Credit Hours
Fall		
MAE 601	Methods of Engineering Analysis	3
MAE Fall Elective 1		3
IEN Fall Elective 1		3
IEN Fall Elective 2		3
Credit Hours		12

Spring		
MAE Spring Elective 2		3
IEN Spring Elective 3		3
IEN Spring Elective 4		3
	Credit Hours	9
Year Two		
Fall		
MAE Fall Elective 3		3
IEN Fall Elective 5		3
MAE 751	Master's Project	3
	Credit Hours	9
	Total Credit Hours	30

M.S. in Mechanical Engineering: Additive Manufacturing Concentration (Thesis Option)

Year One		
Fall		Credit Hours
MAE 601	Methods of Engineering Analysis	3
MAE 631	Scientific and Engineering Foundations of Additive Manufacturing	3
MAE General Elective 1		3
MAE General Elective 2		3
	Credit Hours	12
Spring		
MAE Core Elective 1		3
MAE Core Elective 2		3
MAE General Elective 3		3
	Credit Hours	9
Year Two		
Fall		
MAE General Elective 4		3
MAE 810	Master's Thesis	6
	Credit Hours	9
	Total Credit Hours	30

M.S. in Mechanical Engineering: Additive Manufacturing Concentration (Non-Thesis Option)

Year One		
Fall		Credit Hours
MAE 601	Methods of Engineering Analysis	3
MAE 631	Scientific and Engineering Foundations of Additive Manufacturing	3
MAE General Elective 2		3
MAE General Elective 1		3
	Credit Hours	12
Spring		
MAE Core Elective 1		3
MAE Core Elective 2		3
MAE General Elective 3		3
	Credit Hours	9
Year Two		
Fall		
MAE General Elective 4		3
MAE General Elective 5		3

MAE 751	Master's Project	3
Credit Hours		9
Total Credit Hours		30

MS in Mechanical Engineering: Aerospace Engineering (Thesis option)

Year One		
Fall		Credit Hours
MAE 601	Methods of Engineering Analysis	3
MAE Core Elective 1		3
MAE General Elective 1		3
MAE General Elective 2		3
Credit Hours		12
Spring		
MAE 604	Orbital Mechanics	3
MAE Core Elective 2		3
MAE General Elective 3		3
Credit Hours		9
Year Two		
Fall		
MAE General Elective 4		3
MAE 810	Master's Thesis	6
Credit Hours		9
Total Credit Hours		30

MS in Mechanical Engineering: Aerospace Engineering (Non-Thesis option)

Year One		
Fall		Credit Hours
MAE 601	Methods of Engineering Analysis	3
MAE Core Elective 1		3
MAE General Elective 1		3
MAE General Elective 2		3
Credit Hours		12
Spring		
MAE 604	Orbital Mechanics	3
MAE Core Elective 2		3
MAE General Elective 3		3
Credit Hours		9
Year Two		
Fall		
MAE General Elective 4		3
MAE General Elective 5		3
MAE 751	Master's Project	3
Credit Hours		9
Total Credit Hours		30

Mission

The mission of the graduate program is to prepare students to become knowledgeable and skilled engineers and researchers with an understanding of the ethical and other professional aspects of mechanical engineering.

Goals

The goal of the MS program in Mechanical Engineering is to prepare students for successful careers in the industry, academia, or government, or for further study in doctoral or other engineering-related programs. The educational objective of the program is to graduate engineers with advanced skills and knowledge in mechanical engineering and to train, motivate and inspire our graduates to become leaders in their fields.

Student Learning Outcomes

- Students will demonstrate competence in the theoretical and practical knowledge of mechanical engineering.
- Students will demonstrate the ability to effectively communicate the results of their scientific research in writing and in oral presentations.
- Students will demonstrate the ability to think critically in learning and/or research.