

# GENERAL INFORMATION AND GUIDELINES FOR Master of Science in Mechanical Engineering (MSME)

## OBJECTIVE

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

## DEGREE OVERVIEW

The MS degree program in Mechanical Engineering is designed for students who desire advanced training in fundamental and applied areas of mechanical engineering for their career development in research institutions and industry companies. Students can focus on a variety of specific disciplines, including solid mechanics, advanced materials, aerospace and automotive engineering, fluid-mechanics and thermo-fluids, propulsion, clean and renewable energy, biomechanics, robotics, and dynamic systems and control.

## M.S. OPTIONS AND CONCENTRATIONS

### MSME OPTIONS:

The degree requires either completion of a research **thesis (thesis option)** or a MS level **project (non-thesis option)**. The choice lies with our students and depends upon their career goals and interests. Alternatively, our graduates can use their education as a springboard to other professional degrees like law, medicine, corporate management, and PhD programs.

**(a) M.S. with thesis option:** The student is required to complete 24 credits of course work and 6 credits of thesis in his/her chosen area of specialization. The thesis involves research-type of 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.

**(b) M.S. with non-thesis option:** A 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. After completing the project, the student is expected to submit a project report to the faculty advisor and make an oral presentation of the project before two faculty members, including the faculty advisor. The student will receive a grade for the project.

For both options, the student must take and pass the following required courses/electives:

### 1) Two required courses

- MAE 601 -- Methods of Engineering Analysis (3 credits)
- MAE 751 – MS Project Design (3 credits -- for non-thesis option)
- MAE 810 – MS thesis and defense (6 credits – for thesis option)

### 2) Three out of the following six required electives

- MAE 603 – Internal Combustion Engines
- MAE 604 – Orbital Mechanics
- MAE 607 – Advanced Mechanics of Solids
- MAE 608 – Intermediate Heat Transfer
- MAE 612 – Intermediate Fluid Mechanics
- MAE 631 – Scientific and Engineering Foundations of additive manufacturing

A full list of all graduate courses can be found in **Appendix A**.

## **MSME WITH CONCENTRATIONS:**

### **1. MSME with Additive Manufacturing Concentration (MSME-AM)**

Students that choose this concentration can be in either the thesis or non-thesis option. The credit requirements are the same as those options, except that students must complete four required graduate courses in Additive Manufacturing listed below:

- MAE 631 – Scientific and Engineering Foundations of additive manufacturing (3)
- MAE 632 – Additive Manufacturing of Engineering Materials (3)
- MAE 733 – Additive Manufacturing Lab (3)
- MAE 762 – CAD and FEM for Stress Analysis of 3D Printed Structures (3)

### **2. 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 15 credits from the general area of Management. The courses in Management area can be taken either from the School of Business, if available, or from the Department of Industrial Systems and Engineering (ISE). The student will select the courses in consultation with his/her faculty advisor. The faculty advisor of the MS project is expected to be from the Department of Mechanical and Aerospace Engineering.

### **3. 5-year B.S./M.S. Dual-Degree program (for UM CoE students only):**

The five-year BS/MS program leads to both the B.S. degree and the M.S. degree in Mechanical Engineering in five years. The program is intended for exceptional MAE students who are admitted to the graduate program in their junior year.

- Interested students apply to this program before their junior academic year ends.
- Students applying for this program must have a grade point average of at least 3.0.
- More detailed information of this dual degree program can be found in **Appendix B**.

## **GRADUATION REQUIREMENTS**

All MSME students need to meet the following requirements before they can be cleared for graduation with the MS degree. It's imperative that students/advisors study and take these requirements seriously to ensure student's successful graduation.

### **General Course/Credit Requirements**

1. Passing of the requirement courses (MAE 601 & MAE 751/810) and three (3) of the six (6) required electives (MAE 603, 604, 607, 608, 612, 631)
2. All courses must be graduate-level courses, i.e., 600-level or above.
3. A maximum of two graduate courses from other Engineering Department(s) or from other School/College such as Department of Mathematics and Computer Science are allowed only if approved by of his/her faculty advisor. The student is expected to state his/her reasons for taking such courses and to get his/her faculty advisor's approval before registering for the course(s).

4. A maximum of one course is allowed among 600-level or 700-level courses designated as “Special Topics” or “Special Problems” in the MAE Department that do not have regularly scheduled lectures throughout the entire duration of the semester.
5. As per Graduate School Policy, an average GPA of 3.00 and above is required for a graduate degree, and no “D” credit may be counted toward the degree. All work leading to the graduate degree and taken as a graduate student will be counted in computing the quality point average, including courses graded “D”.

### **MS Thesis Requirements:**

**Thesis Committee:** MS students choose to do the thesis option (register to MAE 810, 6 credits) need to, in consultation with his/her thesis advisor, form a thesis committee. The committee should consist of at least three graduate faculty members. The thesis advisor and at least one another committee member should be from MAE department. The other member(s) may be from outside the MAE department.

**Thesis Content and Format:** The MS thesis is a detailed report of the scientific research activities and outcomes. While there are no uniform rules about how to write the technical part of the thesis (it is up to the review and agreement of the thesis committee). The university of Miami does require official format the MS thesis. The format templates of the MSME and MSOE thesis can be found:

<https://www.grad.miami.edu/electronic-thesis-and-dissertation/formatting-the-etd/index.html>

### **Deadlines for thesis submission and defense:**

The student needs to present and defend his/her thesis to the thesis committee. For each semester, the Graduate School sets the deadlines for MS thesis submission and defense -- it is critical to follow these deadlines to ensure a timely graduation. The deadlines can be found at: <https://www.grad.miami.edu/electronic-thesis-and-dissertation/defense-and-submission-deadlines/index.html>.

More information about the thesis submission and required forms can be found at: <https://www.grad.miami.edu/electronic-thesis-and-dissertation/index.html>.

### **MS Project Requirements:**

**Project Committee:** MS students choose to do the MS project option (register to MAE 751, 3 credits) need to, in consultation with his/her thesis advisor, form a MS project committee. The committee should consist of at least two graduate faculty members. The project advisor must be from MAE department. The other member(s) may be from outside the MAE department.

**Project Report:** The MS project report is a detailed report of the project activities and outcomes. The final project report should be completed and submitted to committee members at least a week before the presentation date. There is no uniform requirement for the project final report – it is up to the review and agreement of the project committee. The thesis advisor should archive the final report – no need to submit it to MAE department or to the University system.

**Deadlines for project presentation and report submission:** The deadline for presentation and report submission is in general the last day of each semester, which can be found from the university academic calendar:

<https://registrar.miami.edu/dates-and-deadlines/academic-calendars/index.html>

**Additional Resources/Requirements from the UM Graduate School:**

The UM Graduate School also has its policies that apply to all MS students across the university, and a graduate school policy overwrites an MAE requirement in case of conflict or ambiguity.

All MSME students are encouraged to consult with the Graduate Student Handbook provided by the UM Graduate School, which can be downloaded from the link below:

[https://www.grad.miami.edu/assets/pdf/2021-2022-graduate-student-handbook\\_final.pdf](https://www.grad.miami.edu/assets/pdf/2021-2022-graduate-student-handbook_final.pdf)

For more information about the Graduate School requirements, including the general information of graduate education, electronic thesis and dissertation requirements, submission and defense deadlines, please go to: <https://www.grad.miami.edu/>

## Appendix A: MAE Graduate Course List

Course ID	Course Title	Credits, semester	Required/Elective
<b>Required courses for all Options</b>			
MAE 601*	Methods of Engineering Analysis	3 F	Required for all MS
MAE 751*	Master's Project	3 SF	Required for all MS non-thesis option
MAE 810*	Master's Thesis	6, SF	Required for MS with thesis option
<b>Required Electives: select 3 courses (9 credits) from courses below</b>			
MAE 603*	Internal Combustion Engines	3 F	Required elective
MAE 604*	Orbital Mechanics	3 S	Required elective
MAE 607*	Advanced Mechanics of Solids	3 S	Required elective
MAE 608*	Intermediate Heat Transfer	3 S	Required elective
MAE 612*	Intermediate Fluid Mechanics	3 F	Required elective
MAE 631*	Scientific and Engineering Foundations of additive manufacturing	3 F	Required for MS-AM Required elective for other
<b>Regular Electives</b>			
MAE 602	Mechanical Vibrations	3 F	Elective
MAE 605	Design for Manufacturability	3 A	Elective
MAE 609	Turbomachinery Aerothermodynamics	3 S	Elective
MAE 614	Advanced Internal Combustion Engines Experimental Studies	3 S	Elective
MAE 616	Introduction to Composite Materials	3 A	Elective
MAE 621	Exhaust Emission Control	3 A	Elective
MAE 628	Fuel Cells	3 S	Elective
MAE 632	Additive Manufacturing of Engineering Materials	3 S	Required for MS-AM Elective for other
MAE 639	Heating, Ventilating and Air Conditioning System Design	3 A	Elective
MAE 640	Energy Conversion	3 A	Elective
MAE 651	Special Problems	1-3 SF	Elective
MAE 652	Special Problems	1-3 SF	Elective
MAE 690	Special Topics – with subtitle1	1-4, SF	Elective
MAE 691	Special Topics – with subtitle2	1-4, SF	Elective
MAE 692	Special Topics – with subtitle3	1-4, SF	Elective
MAE 699	Cooperative Education	1 SF	Elective
MAE 701	Advanced Heat Transfer--Conduction and Radiation	3 S	Elective
MAE 702	Advanced Heat Transfer--Convection	3 S	Elective
MAE 705	Finite Element Methods in Mechanical and Aerospace Engineering	3 S	Elective
MAE 706	Experimental Methods in Fluid Mechanics	3 A	Elective
MAE 713	Transport Phenomena	3 A	Elective

MAE 714	Computational Fluid Dynamics	3 S	Elective
MAE 730	Mechanical Systems Optimization	3, S	Elective
MAE 733	Additive Manufacturing Lab	3, S	Required for MS-AM Elective for all other
MAE 740	Continuum Mechanics	3, S	Elective
MAE 762	CAD and FEM for Stress Analysis of 3D Printed Structures	3, S	Required for MS-AM Elective for all other
MAE 780	Graduate Colloquium.	1, SF	Elective
MAE 791	Professional Communications Skills for Engineering Grad Students	0, SF	Elective
MAE 792	Special Problems.	1-3, SF	Elective
MAE 798	Advanced Topics – with subtitle	1-4, SF	Elective

## **Appendix B: Curriculum Requirements for MAE 5-year BS/MS Program**

### **FRESHMAN YEAR (30 credits)**

#### **Fall:**

MAE 111: Introduction to Engineering I (3)  
ENG 105: English Composition I (3)  
MTH 151: Analytic Geometry and Calculus I (5)  
PHY 221: University Physics I (3)

#### **Spring:**

MAE 112: Introduction to Engineering II (2)  
CAE 210: Mechanics of Solids I (3)  
ENG 107: Writing about Science (3)  
MTH 162: Calculus II (4)  
PHY 222: University Physics II (3)  
PHY 224: University Physics II Lab (1)

### **SOPHOMORE YEAR (32 credits)**

#### **Fall:**

MAE 207: Mechanics of Solids II (3)  
IEN 311: Applied Probability and Statistics (3)  
MTH 211: Calculus III (3)  
PHY 223: University Physics III (3)  
PHY 225: University Physics III Lab (1)  
PS Cognate Elective 1 (3)

#### **Spring:**

MAE 202: Dynamics (3)  
MAE 241: Measurements Lab (3)  
CHM 151: Chemistry for Engineers I (3)  
CHM153: Chemistry lab for engineers (1)  
ECE 205: Principles of Electrical Engineering--I (3)  
HA Cognate Elective 1 (3)

### **JUNIOR YEAR (32 credits)**

#### **Fall:**

MAE 302: Mechanical Behavior of Materials (3)  
MAE 303: Thermodynamics I (3)  
MAE 309: Fluid Mechanics (3)  
MAE 341: Design of Mechanical Systems Elements (3)  
MTH 311: Ordinary Differential Equations (3)

#### **Spring:**

MAE 301: Engineering Materials Science (3)  
MAE 310: Heat Transfer (3)  
MAE 342: Design of Mechanical Systems (3)  
MAE 351: Mechanics Laboratory (2)  
MAE 362: Computer analysis of mechanical and aerospace engineering problems (3)  
MAE 440: Introduction to Capstone Design (3)

### **SENIOR YEAR (32 credits) – see Note 1 below\***

**Fall:**

MAE 404: Experimental Engineering Laboratory (2)  
MAE 412: Mechanical Engineering Systems and Controls (3)  
MAE 441: Design of Fluid and Thermal Systems (3)  
MAE 442: Capstone Design I (1)  
MAE 600: Level Technical Elective (3)\*<sup>1</sup>  
MAE 6xx: Optional graduate course 1 (3)\*<sup>2</sup>  
HA Cognate Elective 2 (3)

**Spring:**

MAE 415: Automatic Control (3)  
MAE 600 Level Graduate course (3)\*<sup>1</sup>  
MAE 443: Capstone Design II (2)  
MAE 6yy: Optional graduate course 2 (3)\*<sup>2</sup>  
PS Cognate Elective 2 (3)  
PS Cognate Elective 3 (3)  
HA Cognate Elective 3 (3)

**FIFTH YEAR ( 24 credits)**

**Fall (must take at least 9 credits to qualify as fulltime student status)**

MAE 601: Engineering Analysis (3)  
Required MAE elective 1 (3)  
600/700 Level Technical Elective (3)  
600/700 Level Technical Elective (3)

**Spring (must take at least 9 credits to qualify as fulltime student status)**

Required MAE elective 2 (3)  
Required MAE elective 3 (3)  
600/700 Level Elective (3)  
MAE 751: MS project (3), **OR**, MAE 810: MS thesis (6)

\*1,2: Upon request and approval, a 5yr BSMS student can take up to two 600+ level courses per semester in his/her senior undergraduate year. Up to two 600 level courses taken in undergraduate senior year can be counted as graduate credits, as well as undergraduate technical elective credits

\*2: An undergraduate senior must take at least 12 undergraduate course credits before they consider taking graduate courses.

Upon admission into the 5yr BSMS program, the student needs to complete the “Undergraduates to Take Graduate Course” form, which can be downloaded from (attached below):

<https://www.grad.miami.edu/assets/pdf/application-for-undergraduates-to-take-a-graduate-course-revised-sep-2020-am.pdf>

The student is responsible for completing and signing the form, and getting it signed by 1) the department Chair (Dr. Qingda Yang, [qdyang@miami.edu](mailto:qdyang@miami.edu)), 2) the CoE undergraduate Dean (Dr. Ram, [ram@miami.edu](mailto:ram@miami.edu)), and then 3) sending it to Graduate School Representative (Dr. Alexander Mas, [amas@miami.edu](mailto:amas@miami.edu)) for further processing.





# Application for Undergraduates to Take a Graduate Course

University of Miami undergraduates within 30 credits of meeting the requirements for the Baccalaureate Degree may take and receive credit for graduate courses while completing the requirements for the Baccalaureate Degree. Approval for graduate coursework requires that the student has a minimum 3.000 cumulative GPA. Admission to take graduate courses does not automatically admit the student to a graduate degree program at the University of Miami. No more than 6 graduate credits may be taken in one semester, and no more than a total of 12 graduate credits may be taken as an undergraduate. The student should be enrolled in at least 12 undergraduate credits each semester to avoid eligibility issues for some aid programs. The graduate credits earned may NOT be used to meet undergraduate graduation requirements or be used to meet the 120 credit hour requirement at the University of Miami.

This form must be accompanied by a completed drop/add or course request form and be signed in the following order:

1. Department Chair
2. Undergraduate Dean
3. Graduate School
4. 'Canes Central

Undergraduate students who request to take graduate coursework must register and be processed centrally at 'Canes Central.

\_\_\_\_\_  
Print Name (First, Last) Signature Date

\_\_\_\_\_  
Student C-Number Student Empl ID Student Phone Number Student E-mail

Number of Credits Completed (UM + Transfer) \_\_\_\_\_ UM Cumulative GPA \_\_\_\_\_

Please specify which course(s) in which you wish to enroll.

Department	Course Number	No. of Credits
_____	_____	_____
_____	_____	_____
_____	_____	_____
Proposed Term for Enrollment ( <i>semester/year</i> )	Session	
_____	_____	

Please sign if this student has been approved for the above registration.

**Department Chair**  
\_\_\_\_\_  
Print Name Signature Date \_\_\_\_\_

**Undergraduate Dean**  
\_\_\_\_\_  
Print Name Signature Date \_\_\_\_\_

**Graduate School Representative**  
\_\_\_\_\_  
Print Name Signature Date \_\_\_\_\_

I understand the financial implication of this course registration.

\_\_\_\_\_  
'Canes Central (print name) Date Student (print name) Date

\_\_\_\_\_  
'Canes Central (signature) Date Student (signature) Date