

MMAE Guide to Graduate Studies

Illinois Institute of Technology

March 23, 2023

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Chapter 1

Introduction

This guide serves as a supplement to the [IIT Graduate Bulletin¹](#) and the [MMAE Department's web site](#) for faculty and students of the Mechanical, Materials and Aerospace Engineering (MMAE) Department. Students should refer to [Graduate College forms](#) and [Graduate College deadlines](#), and see the [Graduate Student Handbook](#) for general policies. For information on co-terminal bachelors and masters degree programs and accelerated masters programs (AMPs), see the [AMP website](#). Faculty should refer to [Graduate College forms for faculty](#). These resources should be consulted for degree requirements; Graduate College deadlines, forms, and procedures; course descriptions; etc. It is the student's responsibility, with guidance from his/her adviser, to be sure that all procedures are followed and deadlines met. For your reference, this guide addresses issues specific to the MMAE Department and is available on the [MMAE departmental web site](#).

Contacts:

Department Chair: Prof. Lou Cattafesta
Associate Chair for Graduate Studies: Prof. Ankit Srivastava

The Chairman of the Department, in consultation with the faculty, appoints faculty members to serve on the Graduate Studies Committee (GSC), who oversee the graduate programs within the department and can make recommendations to the full departmental faculty, who have final jurisdiction over the programs. The Graduate Studies Committee (GSC) is a sub-committee of the Departmental Faculty and handles the of the graduate programs.

1.1 MMAE Graduate Programs

The MMAE Department offers graduate programs in Mechanical and Aerospace Engineering (MAE), Materials Science and Engineering (MSE), and Manufacturing Engineering (MFG). The degrees that the department offers are summarized below.

Mechanical and Aerospace Engineering (MAE)

- ^ Master of Science in Mechanical and Aerospace Engineering
- ^ Master of Mechanical and Aerospace Engineering
- ^ Doctor of Philosophy in Mechanical and Aerospace Engineering

Materials Science and Engineering (MSE)

- ^ Master of Science in Materials Science and Engineering
- ^ Master of Materials Science and Engineering
- ^ Doctor of Philosophy in Materials Science and Engineering

Manufacturing Engineering (MFG)

- ^ Master of Science in Manufacturing Engineering
- ^ Master of Manufacturing Engineering

The master of science degrees include course-only or thesis options. For information on co-terminal bachelors and masters degree programs and accelerated masters programs (AMPs), see the [AMP website](#). For additional interdisciplinary degrees offered by the Armour College of Engineering see [Armour College of Engineering Graduate Programs](#).

1.2 Advising Procedures

All new graduate students are assigned an advisor at the time of admission who will assist in the selection of courses. MS with thesis and PhD students are encouraged to find a permanent research advisor as soon as possible. All graduate students are advised to update their mailing addresses, email addresses, and/or telephone numbers on myIIT so that IIT has accurate contact information.

Students registering for either of the following research and thesis credit hours require an online registration override from their research adviser prior to registering:

- ^ MMAE 591 Research and Thesis for MS Degree
- ^ MMAE 691 Research and Thesis for PhD Degree

Students registering for either of the following project credit hours require an online registration override from the corresponding instructor prior to registering:

- ^ MMAE 594 Project for Masters of Engineering Degree
- ^ MMAE 597 Special Topics

1.3 Financial Assistance Policy

The Mechanical, Materials, and Aerospace Engineering Department has a limited number of teaching assistantships (TA) available to graduate students in the department who show high potential for success in the programs and have the necessary teaching skills. Applications are sought near the end of each semester for the following term. The Department Chair, in consultation with the Chair of the Graduate Studies Committee, awards these assistantships to the most qualified students for a certain period of time during their degree programs. In order to make these awards to as many deserving students as possible, teaching assistantships are awarded for a maximum number of semesters as follows:

- ^ MS with thesis students: 2 semesters
- ^ PhD students: 4 semesters

Master of engineering and non-thesis master of science students are not eligible for teaching assistantships. The availability of these assistantships is dependent upon funding and the needs of the department. Students are encouraged to pursue a research assistantship (RA) as early as possible in their program. RA positions are available to full-time Master of Science with thesis and Doctor of Philosophy degree students and are awarded by individual faculty members.

1.4 MMAE Seminar

Registration in the departmental seminar course, MMAE 593, is required for all graduate students enrolled in a degree with a thesis requirement. This includes all PhD students and Master of Science students pursuing the thesis option. The seminar is a no fee, no credit class, but registration and attendance is mandatory. The seminar is a pass/fail class and will be graded on attendance. A student will receive a passing grade if he/she attends a minimum of 80 percent of the seminars offered in that semester. For degree completion, students must pass

Chapter 2

Master of Science (MS) and Master of Engineering (MEng)

2.1 Overview

Students with bachelors degrees in mechanical engineering, materials science and engineering, aerospace engineering, or other related fields are eligible to apply for masters degrees in the MMAE Department. Once admitted, the student's advisor will help the student formulate a program of study that includes 30 credit hours for the Master of Engineering (MEng) degrees or 32 credit hours for the Master of Science (MS) degrees. The Master of Engineering degrees are course-only programs that may include an optional project. The Master of Science degrees have a course-only option as well as one that includes research and a thesis. See the [IIT Graduate Bulletin](#) for specific course requirements for the masters degrees available in the MMAE Department.

2.1.1 Mechanical and Aerospace Engineering (MAE)

All MAE students are expected to demonstrate proficiency in engineering analysis, normally accomplished by taking one or two courses, and one of the five major areas within mechanical and aerospace engineering. The five major areas of study are fluid dynamics; thermal sciences; solids and structures; design and manufacturing; and dynamics and control. Master of science students are required to take the core course for their chosen major area and a set of electives. Master of engineering students are required to take an engineering analysis course, one course that emphasizes numerical methods, the core course in their major area, and electives, which may include core courses from other areas. The core courses corresponding to the five major areas are:

- ^ Fluid Dynamics: MMAE 510 Fundamentals of Fluid Mechanics
- ^ Thermal Sciences: MMAE 525 Fundamentals of Heat Transfer
- ^ Solids and Structures: MMAE 530 Advanced Mechanics of Solids
- ^

semester that articulates the necessary steps and corresponding deadlines for completion of the degree. Note that students must be registered for a minimum of one credit hour in the semester in which they graduate, including the summer semester.

2.2.2 MS with Thesis Students

MS with thesis students should submit [Form G300](#) prior to the final oral examination to schedule the exam. The examination committee consists of at least

Chapter 3

3.2.1 MAE Exam

The PhD qualifying exam for MAE students is administered by the MMAE PhD Qualifying Exam Committee. Students are required to take the exam dur-

First Attempt: Take all three subject areas (Engineering Analysis, major area, second area)

- ^ Pass 0 of 3 subject areas Retake oral exam in 3 failed subject areas at the next opportunity.
- ^ Pass 1 of 3 subject areas Retake oral exam in 2 failed subject areas at the next opportunity.
- ^ Pass 2 of 3 subject areas Retake oral exam in 1 failed subject areas at the next opportunity.
- ^ Pass 3 of 3 subject areas Pass PhD Qualifying Examination.

Second Attempt: Let n equal the number of failed subject areas in the first attempt

- ^ Pass less than n subject areas Failed PhD Qualifying Examination
- ^ Pass n of n subject areas Pass PhD Qualifying Examination.

3.2.2 MSE Exam

The PhD qualifying examination for MSE students consists of an oral exam administered by a committee of MSE faculty. The level of the exam will assess basic materials science and engineering concepts at the undergraduate level. A written research exam is also required where students submit a critical review of a published paper or research topic. Students are required to take the exam within their first three semesters of study in the PhD program.

3.3 PhD Advisory Committee

The purpose of the Thesis Advisory Committee is to assist the student in the satisfactory and timely progression of the thesis research and to evaluate the comprehensive and final oral examinations. The committee is nominated by the student in consultation with his or her adviser using [Form G301A](#) in preparation for the Comprehensive Exam. Upon approval by the Department Chair, Form G301A is submitted to the Graduate College.

The MAE student's PhD Advisory Committee must consist of at least four full-time IIT (tenured or tenure track) faculty members as follows:

- ^ the student's adviser, who acts as committee chair
- ^ one representative from the student's major area
- ^

semester that articulates the necessary steps and corresponding deadlines for completion of the degree. Note that students must be registered for a minimum of one credit hour in the semester in which they graduate, including the summer semester.

PhD students should submit [Form G301B](#) prior to the final oral examination, i.e. the PhD defense, to schedule the exam. At least one week prior to the final oral defense, the student distributes copies of the thesis draft to the thesis committee members. His/her adviser then emails all MMAE faculty members announcing the place and time of the examination. The email should include an abstract of the thesis. It is the student's responsibility to ensure that the email is sent on time. Failure to do so may result in rescheduling of the examination.

The PhD final oral defense is conducted by the student's PhD Advisory Committee but shall be open to the public without restriction. However, the student's PhD Advisory Committee appointed to conduct the examination may continue the defense and deliberate the candidate's performance and prepare its report in private. The results of the Defense Examination are reported to the Graduate College on Form G309 by the student's adviser in the presence of all members of the PhD Advisory Committee and should be returned to the Graduate College within 72 hours after the final oral exam. Form G309 will be provided to the advisor by the Graduate College. The student is responsible for obtaining approval from all committee members of the final thesis on [Form G501, Final Thesis Approval](#).

Chapter 4

4.2 Courses Listed by Major Area

The MMAE graduate programs have six different areas of study: Fluid Dynamics, Thermal Sciences, Solids and Structures, Design and Manufacturing, Dynamics and Control, and Materials Science and Engineering. In this section, the core and non-core courses in each major area are listed in tabular form. The core course(s) in each area of study is marked in red italics.

4.2.1 Fluid Dynamics

MMAE 510	Fundamentals of Fluid Mechanics
MMAE 511	Compressible Flows
MMAE 512	Viscous Flows
MMAE 513	Turbulent Flows
MMAE 514	Stability of Viscous Flows
MMAE 515	Engineering Acoustics
MMAE 516	Advanced Experimental Methods in Fluids
MMAE 517	Computational Fluid Mechanics
MMAE 518	Spectral Methods in Computational Fluid Mechanics

Other relevant courses

4.2.2 Thermal Sciences

MMAE 433	Design of Thermal Systems
MMAE 520	Advanced Thermodynamics
MMAE 522	Nuclear, Fossil-Fuel, and Sustainable Energy Systems
MMAE 523	Fundamentals of Power Generation
MMAE 524	Fundamentals of Combustion
MMAE 525	Fundamentals of Heat Transfer
MMAE 526	Heat Transfer: Conduction
MMAE 527	Heat Transfer: Convection and Radiation

Other relevant courses

MMAE 509	Introduction to Continuum Mechanics
MMAE 508	Perturbation Methods
MMAE 510	Fundamentals of Fluid Mechanics
MMAE 512	Viscous Flows
MMAE 513	Turbulent Flows
MMAE 514	Stability of Viscous Flows

4.2.3 Solids and Structures

MMAE 451	Finite Element Methods in Engineering
MMAE 529	Theory of Plasticity
<i>MMAE 530</i>	<i>Advanced Mechanics of Solids</i>
MMAE 531	Theory of Elasticity
MMAE 532	Advanced Finite Element Methods
MMAE 533	Fatigue and Fracture Mechanics
MMAE 535	Wave Propagation
MMAE 536	Experimental Solid Mechanics

Other relevant courses

MMAE 509	Introduction to Continuum Mechanics
MMAE 508	Perturbation Methods
MMAE 570	Computational Methods in Materials Processing
MMAE 578	Fiber Composites
CHE 580	Biomaterials

4.2.4 Dynamics and Control

MMAE 539 Robotic Motion Planning

MMAE 540 Robotics

MMAE 541

4.2.6 Materials Science and Engineering

MMAE 468	Introduction to Ceramic Materials
MMAE 470	Introduction to Polymer Science
MMAE 472	Advance Aerospace Materials
MMAE 520	Advanced Thermodynamics
MMAE 554	Electrical, Magnetic and Optical Properties of Materials
MMAE 561	Solidification and Crystal Growth
MMAE 562	Design of Modern Alloys
MMAE 563	Advanced Mechanical Metallurgy
MMAE 564	Dislocation and Strength Mechanisms
MMAE 565	Materials Laboratory
MMAE 566	Problems in High Temperature Materials
MMAE 567	Fracture Mechanisms
MMAE 568	Diffusion
MMAE 569	Advanced Physical Metallurgy
MMAE 570	Computational Methods in Materials Science and Engineering
MMAE 572	Crystallography and Crystal Defect
MMAE 576	Materials and Process Selection
MMAE 578	Fiber Composites
MMAE 579	Advanced Materials Processing

Other relevant courses

MMAE 451	Finite Element Methods in Engineering
MMAE 525	Fundamentals of Heat Transfer
MMAE 530	Advanced Mechanics of Solids
MMAE 532	Advanced Finite Element Methods
MMAE 533	Fatigue and Fracture Mechanics
CHE 580	Biomaterials
