

# MECHANICAL ENGINEERING, MS

While pursuing a Master of Science in Mechanical Engineering (MSME), the student will take graduate-level courses and may conduct research with a faculty advisor and observe how these studies will lead to key engineering innovations and societal impacts in the field of mechanical engineering. Equipped with complementary and state-of-the-art computational and experimental facilities, the Mechanical Engineering Department has active research programs in the following three disciplinary groups; Dynamic Systems & Control (DSC), ThermoFluids Science (TFS), and Materials Processing & Manufacturing (MPM). Faculty teach graduate-level courses and conduct research in cross-disciplinary thrust areas that include: automotive systems, robotics and human systems, automation and mechatronic systems, energy and building efficiency, internal combustion engines, manufacturing systems, additive manufacturing, and materials processing and modeling. Graduate courses in these areas, in addition to the general core graduate courses, provide the foundation for earning an MSME degree.

In addition to offering a thesis and non-thesis master's degree for the traditional on-campus student, the non-thesis master's degree is available as a distance degree. This distance option is available to students residing within the United States or serving abroad at a U.S. military installation. For more information on the online Master of Science in Mechanical Engineering, see the departmental program web page as well as the specific UA Online Degree Program. We are confident that distance education students have a great opportunity to obtain their degrees with minimal travel or job disruption.

Students and faculty in the Department of Mechanical Engineering have access to state-of-the-art computational facilities and capabilities. On-campus assets include numerous commercially available computational modeling software packages. In addition, high performance computing capabilities are accessible through The University of Alabama's Office of Information Technology.

Qualified students in the Mechanical Engineering undergraduate program at The University of Alabama are eligible for early admission into the MSME program through the Accelerated Master's Program (AMP). This program allows students to double-count up to 9 hours of graduate credit toward their undergraduate degree.

## Admissions

The following is in addition to the minimum Graduate School admission requirements. To be considered for regular admission to the Main Campus (MA) or Distance Learning (DL) MSME program, prospective applicants should have:

- A Bachelor's degree in mechanical engineering or related field (see below).
- A current Resume.
- A concise Statement of Purpose. This short document should describe the reasons for pursuing an advanced degree as well as possible research interests. Those interested in funding support should consult the Funding for Students tab above.
- Three letters from recommenders (waived for University of Alabama graduates). These recommenders may be previous faculty or supervisors.
- A residence within the borders of the US or serving on a US military installation (DL applicants only).

- If you are a non-native English speaker, you may be required to submit an English language score report. Please see the admission section link below for details.

Note that there are specific admissions requirements for UA undergraduates interested in the Accelerated Master's Program as well as graduates interested in the Dual MSME/MBA Program. See the appropriate section of this catalog for additional information.

## Non-BSME Applicants

Applicants who hold a Bachelor of Science degree in a discipline other than Mechanical Engineering may apply to a graduate degree program in Mechanical Engineering. However, there is a basic level of undergraduate understanding that applicants are expected to have upon entering the program. The following prerequisite undergraduate courses (or acceptable equivalents) are expected for entering students. These courses do NOT count toward the graduate degree:

- Mathematics: Calculus (usually 12 semester credit hours) and Ordinary Differential Equations
- Chemistry: General Chemistry (usually 4 semester credit hours)
- Physics: Calculus-Based Physics (usually 8 semester credit hours)
- Mechanical Engineering, depending on your emphasis area (see below) in graduate school

<b>DSC: Dynamic Systems &amp; Control emphasis</b>		<b>Hours</b>
AEM 250	Mechanics Of Materials I	3
ME 350	Static Machine Components	3
ME 372	Dynamic Systems	3

or

<b>TFS: ThermoFluids Science emphasis</b>		<b>Hours</b>
ME 215	Thermodynamics I	3
AEM 311	Fluid Mechanics	3
ME 309	Heat Transfer	3

or

<b>MPM: Materials Processing &amp; Manufacturing emphasis</b>		<b>Hours</b>
AEM 250	Mechanics Of Materials I	3
ME 350	Static Machine Components	3
ME 372	Dynamic Systems	3

The engineering courses listed above may have prerequisite courses as listed in the undergraduate catalog. Students with Bachelor of Science degrees in physical sciences are likely to have the background needed to start directly in the listed Mechanical Engineering courses. Depending on the number of courses needed from the list above, it may be possible to take one or more of these courses simultaneously with graduate-level coursework. Applicants are encouraged to consult with faculty in the area of study emphasis to inquire about any modifications to the above list that they feel may be appropriate. Recall that undergraduate courses (400-level and below) cannot count toward a graduate degree in Mechanical Engineering.

See the Admission Criteria section of this catalog for more information.

## Application Deadlines

**There are no formal deadlines for graduate applications to the Department of Mechanical Engineering.** Once an application is

complete, the internal review process typically only takes a few weeks. **International applicants** should consider the time required to obtain any necessary visa documents.

## Curricular Requirements

### MSME Curriculum Overview

The MSME program is offered with both a thesis option (Plan I) as well as a non-thesis option (Plan II). Designation of the selected program is not required or expected at the time of application. All MSME students on teaching or research assistantships in the department are expected to pursue the thesis degree option (see Funding for Students tab). Unless prior arrangements are made with an advising faculty member, Distance Learning (DL) students are expected to pursue the non-thesis option, which includes a comprehensive examination.

### MSME Curriculum Requirements

All MSME students must complete the 30-hour curriculum requirement through the following three areas:

#### 1. MSME Core Area Course Requirements

Hours

The first two courses are chosen based on the student's area of study interest. That is, select one of the following Major Core Areas and then complete at least two courses from that list.

##### Dynamic Systems and Control (DSC) Core

ME 556	Mechatronics	3
ME 562	Intermediate Dynamics	3
ME 575	Control Systems Analysis	3
ME 577	Advanced Linear Control	3

##### Materials Processing and Manufacturing (MPM) Core

ME 538	Modeling of Deformation 1	3
ME 540	Failure of Engr Materials	3
ME 544	Forming Processes	3
MTE 583	Adv Structure Of Metal	3

##### ThermoFluids Science (TFS) Core

ME 509	Intermed Heat Transfer	3
ME 511	Cmp Heat Transfer & Fluid Flow	3
ME 560	Thermal Fluid Meas. & Analysis	3
ME 605	Classical Thermodynamics	3
AEM 500	Intermediate Fluid Mechanics	3

#### 2. MSME Mathematics Core Requirements

Hours

The second two courses are selected to satisfy the mathematics area core requirement. That is, complete at least two courses from the following list. Note that other courses may be petitioned as fulfilling the math requirement upon permission of the student's faculty advisor.

ME 501	Mech Engr Analysis I	3
GES 500	Engineering Statistics	3
GES 551	Matrix And Vector Analysis	3
GES 554	Partial Diff Equations	3
ST 560	Statistical Methods	3

#### 3. MSME Research and/or Elective Course Requirements

Hours

The final courses and/or research hours will depend on the MSME plan being pursued. One of the following is required:

ME 599	Thesis Research ( Plan I, Thesis Option)	6
ME 598	Non-Thesis Research (Plan II, Comprehensive Exam Option)	3

with the remaining hours coming from a selection of the following:

ME 500-level, and/or

ME 600-level, and/or

AEM 500-level, and/or

CHE 500-level, and/or

CE 500-level, and/or

CS 500-level, and/or

ECE 500-level

GES 500-level, and/or

MTE 500-level, and/or

Note that no more than 50% of these hours may be from outside Mechanical Engineering (ME) without advisor approval. Courses not contained by the parameters of this list must have advisor approval.

A student's curriculum will be developed and approved by the student's graduate advisory committee made up of faculty in the TFS Mechanical Engineering Departmental Disciplinary Group (DDG) to ensure a cohesive plan.

Each student in this concentration must take 6 hours of basic TFS courses (not taken in MSME core) and 6 hours of Elective TFS courses (see below for the course list).

#### Energy Systems Concentration

Hours

##### Required Core Courses

Select 2 courses not taken in TFS Core	6
ME 509	Intermed Heat Transfer
ME 511	Cmp Heat Transfer & Fluid Flow
ME 560	Thermal Fluid Meas. & Analysis
ME 605	Classical Thermodynamics
AEM 500	Intermediate Fluid Mechanics

##### Required elective courses

Must take at least 2 courses form the following:	6
ME 506	Found Thermal Power Gen
ME 514	Principles of Combustion I
ME 516	Fnd Energy Conserv & Mgt
ME 526	Internal Combustion Engines
ME 607	Conduction Heat Transfer
ME 618	Princ Of Combustion II (Combustion Engineering)
ME 591	Special Problems (Combustion Engineering)
ME 691	Special Problems (Advanced Thermodynamics OR Convection OR Advanced Gas Turbines)

**Total Hours**

**12**

#### Other Coursework: Thesis or Non-Thesis Plans (6 hours)

The non-thesis plan is intended primarily for (1) students employed full-time in government or industry, (2) doctoral students pursuing research in the energy area seeking to establish a foundational coursework experience, and (3) self-supported on-campus or UA Online students. Thesis research credits may not be used to satisfy the hour requirements for this degree.

- Six hours of Research (Plan I) or elective courses (Plan II)
  - a. Thesis (Plan I) – six hours of ME 599  
ME 599ME 599ME 599 Thesis Research Hours. Plan I students

must conduct research, prepare a thesis document, and present and defend it to their committee.

- b. Non-Thesis (Plan II) – One graduate level elective course (as approved by the advisor). and ME 598 Non-Thesis Research. Plan II students must pass a comprehensive exam, typically taken during the final semester of study, and as part of the ME 598 course. Refer to the Comprehensive Exam section below.

## Transfer Credit

For information on transfer credit, refer to the UA graduate catalog or click on the highlighted text. Note that new students should not apply for transfer credit until after they have started their first set of courses at UA.

## Accelerated Master's Program

Current Mechanical Engineering (ME) and Aerospace Engineering and Mechanics (AEM) undergraduate students at The University of Alabama with a sufficiently high GPA and the required number of undergraduate course credit hours are eligible to apply for the Accelerated Master's Program (AMP). For additional information on Accelerated Master's Program, please refer to UA graduate catalog or click on the highlighted text. AMP is also available to distance students currently enrolled in our undergraduate program as well as students in the dual MSME/MBA Program.

## Dual MSME/MBA Program

Students may be simultaneously enrolled in the MSME and MBA Programs at The University of Alabama (including STEM path to MBA).

This dual program provides an overall reduced course credit hour requirement for both degrees through the double-counting of various courses. Both degrees must be earned at the same time to take advantage of this program. Students interested in the Dual MSME/MBA Program must apply to each degree program separately and the two applications are reviewed for admission separately by each respective program. Please contact the Mechanical Engineering Department for more information on the Dual MSME/MBA Program.

## Plan I - Thesis Requirements

The Master of Science in Mechanical Engineering (MSME) degree Thesis-Option (Plan I) is obtained by successfully completing the following requirements:

- Complete 24 hours of graduate-level course work (500-level and above) approved by the committee, where:
  - 12 semester course hours are in the major area, with six hours taken from the approved major core area (see above list). Major area courses are ME and ME cross-listed courses. Three hours of approved coursework in a closely allied area may be used with additional hours requiring advisor approval.
  - 6 hours are in the mathematics core area (see above list).
  - Any transfer credit request is submitted electronically after classes start and within the first year.
- Pass 6 hours of ME 599 Thesis Research (does not impact GPA),
- Complete and present a thesis (see additional information in the section below), and
- Submit a course portfolio to the MSME Committee and have the committee chair provide the forms evaluating that portfolio to the ME Graduate Program Director. This information is not submitted to the graduate school.

## Plan II - Non-Thesis Requirements

The Master of Science in Mechanical Engineering (MSME) degree Non-Thesis Option (Plan II) is obtained by successfully completing the following requirements:

- Complete 30 hours of graduate-level course work (500-level and above) approved by the committee, where:
  - 18 semester course hours are in the major area, with six hours being selected from the approved major core area (see list above). Major area courses are ME and ME cross-listed courses. Three hours of approved coursework in a closely allied area may be used with additional hours requiring advisor approval.
  - 6 hours are in the mathematics core area (see list above).
  - 3 hours of ME 598 Non-Thesis Research as part of the comprehensive exam process (see below).
  - Any transfer credit request is submitted electronically after classes start and within the first year.
  - This program differs slightly for students in the dual MSME/MBA program. A chart outlining this program is available upon request.
- Pass a comprehensive exam (see below), and
- Submit a course portfolio to the MSME Committee and have the committee chair provide the forms evaluating that portfolio to the ME Graduate Program Director. This information is not submitted to the graduate school.

## Comprehensive Exams

Students pursuing the MSME Plan II option will enroll in 3 hours of a section of ME 598:Non-Thesis Research under a faculty member, who will serve as the "major professor / research advisor" for the student's culminating experience. Students pursuing the MSME Plan II degree will have the following options to satisfy the requirement of a culminating experience/comprehensive exam:

- **Option 1:** Complete a **capstone project** and receive faculty advisor approval for the associated written report. This project is an in-depth study of a topic that must be approved by the student's research advisor, an ME faculty member the student selects based on mutual research interests. While the project is not as comprehensive as a thesis, it must integrate knowledge and concepts from more than one of the program courses. Students are required to submit a written report drafted in accordance with the UA thesis/dissertation format guidelines found here: <https://graduate.ua.edu/current-students/thesis-and-dissertations/>. The approved written report for the culminating experience must be submitted to the research advisor, providing sufficient time to evaluate and potentially require edits prior to the comprehensive exam deadline for the term of graduation. Students must also submit a graduate course portfolio as part of this process (see below).
- **Option 2:** Complete an **Internship or practicum** and receive faculty advisor approval for the written report detailing how the student used/continues to use knowledge gained from the MSME core courses in their internship/practicum experience. The written report will need to be drafted in accordance with the UA thesis/dissertation format guidelines found here: <https://graduate.ua.edu/current-students/thesis-and-dissertations/>. The approved written report for the culminating experience must be submitted to the research advisor, providing sufficient time to evaluate and potentially require edits prior to the comprehensive exam deadline for the term of

graduation. Students must also submit a graduate course portfolio as part of this process (see below).

- **Option 3:** Pass the **PhD qualifying examination** in accordance with the ME Department policies outlined here: <https://catalog.ua.edu/graduate/engineering/mechanical/phd/#requirements> Students must also submit a graduate course portfolio as part of this process (see below).

All students regardless of whether they choose Option 1, Option 2 or Option 3 **must** submit a **graduate course portfolio**, which is a short presentation summarizing the learning outcomes from 3 to 5 graduate-level courses. The research advisor can provide information on satisfying this requirement.

## Thesis Process Requirements

Students in the MSME thesis program (Plan I) must describe their completed research in a thesis document that is presented to the committee. To accomplish this, students must:

- Complete the electronic thesis committee formation form,
- Submit the completed thesis to the thesis committee two weeks prior to the presentation,
- Present the research described in the thesis to the thesis committee, which satisfies UA's comprehensive exam requirement, and
- Upload the revised (if necessary) final approved thesis and the *required electronic forms* to the graduate school web site prior to the deadline for the intended semester of graduation (see below).
- Students are also expected to submit a course portfolio for evaluation per the requirements stated above.

Note that students are expected to give thesis presentations, proposal presentations, exam presentations, and dissertation defenses in person with the full committee in attendance. In the case of time conflicts, students are furthermore expected to reschedule a presentation to minimize the need for virtual participation. In the event it is not possible for all members to attend in person even with rescheduling, a presentation may occur with the student and at least a majority of the committee participating in person and the remainder of the committee participating virtually in accordance with The University's policy on virtual participation. Under extenuating circumstances, when the student and a majority of the committee cannot attend in person, the thesis committee chair may petition the Graduate Program Coordinator or the Department Head for an exception by providing details as to why rescheduling the event will not enable one of the two acceptable formats to be used.

## Time Limits for Degree Completion

For information on time limits for degree completion, refer to the UA graduate catalog or click on the highlighted text.

## Academic Misconduct

The Mechanical Engineering Department expects all students to adhere to The University's policy on academic conduct. Please refer to the UA graduate catalog or click on the highlighted text for more information.

## Withdrawals and Leave of Absence

The ME department adheres to The University's policies on withdrawals and leaves of absence.

## Academic Grievances

For information on academic grievances, refer to the UA graduate catalog or click on the highlighted text.

## Grades and Academic Standing

The ME department expects all graduate students to remain in good academic standing. Graduate school policies on grades and academic standing can be accessed in the UA graduate catalog page or by clicking on the highlighted text.

## Graduate School Deadlines

Important information regarding deadlines for graduation, including thesis submission and comprehensive exam deadlines can be found on the UA graduate catalog page or by clicking on the highlighted text.

## Application for Graduation

Information regarding the application for graduation can be found on the UA graduate catalog page or by clicking on the highlighted text. Students are expected to apply for graduation prior to the deadlines posted by the graduate school for the respective term of graduation.

Note that funding is not provided at the department level nor is funding considered during the admissions process. Funding is requested (GTA) or granted (GRA) by **individual** faculty members within the department. If you are an unconditionally admitted full-time main campus (MA) MSME graduate student interested in seeking some form of financial assistance through a fellowship or graduate assistantship, please read this page carefully. Applicants contacting the graduate coordinator or department head with a request for funding will be redirected to this page.

Assistantships and fellowships generally include a monthly stipend, tuition, and health insurance. Because the financial assistance application process is **separate** from the admissions process, applicants are encouraged to learn about different funding options and **how to pursue funding**. Due to the nature of these opportunities, only main campus (MA) students completing an MSME thesis are eligible for assistantships and fellowships. Note that offers of funding can only be made to applicants that have been admitted to the program.

Furthermore, **applicants should not contact the Graduate Program Director or the ME Department Head with a specific request for funding.**

Additional information on funding and academic requirements for maintaining funding can be found in the Financial Assistance section of the Graduate Catalog.

**Graduate Research Assistantships** (GRAs) are awarded by individual professors with funded research. Applicants should communicate directly with a faculty member in the applicant's area of study interest concerning the availability of GRA positions and a potential match. Visit the department website for additional information about research areas.

Funding is not considered during the admission process. Furthermore, requests for funding are not handled by the Graduate Program Director.

While the Graduate Program Director is happy to answer questions regarding the process of seeking a GRA, please do not contact the Graduate Program Director or Department Head with a direct request for a GRA.

The ME Department also offers **Graduate Teaching Assistantships** (GTAs) for students assisting faculty members with undergraduate courses and laboratories. There are a very limited number of GTA positions each semester and those are typically reserved for current PhD students, though there may be exceptions. A university-wide requirement for all GTAs is that they should either have English as their native language or have successfully completed an English language proficiency course and passed an English language proficiency exam administered by UA's English Language Institute. The English language proficiency exam and course process typically require at least one semester. To obtain GTA funding, it is necessary to work with a faculty member to inquire

about the possibility of obtaining a teaching assistantship. While GTA awards are determined by the ME Department Head, applicants should not contact the Department Head or the Graduate Program Director requesting a GTA. **All requests for GTAs must come from a faculty member interested in recruiting the student/applicant.**

MSME students supported by assistantships are expected to follow the Plan I Thesis Option, as described in the Graduate Catalog.

Half-time assistants must register for at least six credit hours of graduate credit during the semester. In addition, assistants are expected to perform 20 hours of work per week as part of their position. Accepting an assistantship implies an obligation on the part of the student. Students supported by an assistantship are expected to fulfill their roles as students, meeting all academic requirements, as well as carrying out teaching and/or research assignments. Students who do not maintain good academic standing, as defined in the UA Graduate School, are not eligible for assistantships. Assistantships may also be terminated for unsatisfactory performance of the assigned research and/or teaching duties or for not maintaining satisfactory academic performance.

Domestic students may be eligible for student loans and other financial aid and should visit the UA Financial Aid Office website to learn more about these options.

Additional support is available in the form of **fellowships**, available from The University and other funding agencies. Applicants are encouraged to visit the Graduate School and Mechanical Engineering websites to learn more about these opportunities, application requirements, and deadlines.

Some professional societies also offer assistance to new graduate students. Qualified applicants are encouraged to learn more about fellowships like the NSF Graduate Research Fellowship, the DoD SMART Scholarship, the Alabama Space Grant Consortium Fellowship, and UA's Graduate Council, National Alumni Association, and McNair Fellowships.

Note that most of these have early application deadlines and some require interaction with and support from a nominating faculty member.

For example, **nominations for the UA Graduate Council Fellowship must come from an ME faculty member interested in recruiting the applicant.**

While the Graduate Program Director can answer questions about the fellowship and faculty-based nomination process, please do not contact the Graduate Program Director or the Department Head specifically asking to be nominated.

Additional information on funding and academic requirements for maintaining funding can be found in the Financial Assistance section of the Graduate Catalog.