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. For more information online Master of Science in Mechanical Engineering, see UA Online Degree Programs. We are confident that distance education students will 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

In addition to the minimum Graduate School admission requirements, to be considered for regular admission to the Main Campus (MA) or Distance Learning (DL) program should have:

- A Bachelor’s degree in mechanical engineering or related field (see below)
- A combined verbal and quantitative GRE requirement of 300 or greater (see below for exceptions). The GRE score is waived for graduates of ABET-Accredited engineering programs. Applicants with five or more years of field-related work experience may contact the ME Graduate Program Director to inquire about a GRE waiver request. There is no minimum score on the writing section of the GRE for admission to the MSME Program
- A current resume
- A concise statement of purpose describing graduate study interests
- Three letters from recommenders (waived for University of Alabama graduates)
- A residence within the borders of the US or serving on a US military installation (DL applicants only)
- A TOEFL score of of at least 92 or an IELTS score of at least 7.0 for non-native English speakers who are required to submit an English Language test score (see admissions criteria link below)

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 for a graduate degree in Mechanical Engineering. However, there is a basic level of undergraduate understanding that students are expected to have upon entering the program in order to be successful. The following prerequisite undergraduate courses or acceptable equivalents, which do not count toward the graduate degree, are expected for entering students:

- 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

DSC: Dynamic Systems & Control emphasis

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEM 250</td>
<td>Mechanics Of Materials I</td>
<td>3</td>
</tr>
<tr>
<td>ME 350</td>
<td>Static Machine Components</td>
<td>3</td>
</tr>
<tr>
<td>ME 372</td>
<td>Dynamic Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

or

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 215</td>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>AEM 311</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ME 309</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
</tbody>
</table>

TFS: ThermoFluids Science emphasis

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 309</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
</tbody>
</table>

MPM: Materials Processing & Manufacturing emphasis

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEM 250</td>
<td>Mechanics Of Materials I</td>
<td>3</td>
</tr>
<tr>
<td>ME 350</td>
<td>Static Machine Components</td>
<td>3</td>
</tr>
<tr>
<td>ME 372</td>
<td>Dynamic Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

The engineering courses listed above may have prerequisite courses as listed in the 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 is appropriate. Recall that undergraduate courses (400-level and below) cannot count toward a graduate degree in Mechanical Engineering.

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 couple of weeks. International applicants should consider the time required to obtain any necessary travel documents. Only after the student has been accepted and The University has provided the appropriate paperwork can an applicant apply for appropriate travel documents. This process can
take between two and six months, depending on the country of origin. Students must complete this process and arrive on campus prior to the first day of class. All of these steps should be considered by international students when planning to apply.

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

### Curricular Requirements

#### MSME Curriculum Overview

The MSME program is offered with both a thesis option as well as a non-thesis option. Designation of the selected program is not required at the time of application. All MSME students on teaching or research assistantships in the department are expected to pursue this thesis degree option.

#### MSME Curriculum Requirements

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

1. **MSME Core Area Course Requirements**
   
   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
   - ME 562: Intermediate Dynamics
   - ME 575: Control Systems Analysis
   - ME 577: Advanced Linear Control

   **Materials Processing and Manufacturing (MOM) Core**
   - ME 540: Failure of Engr Materials
   - ME 542: Multiscale Material Design
   - ME 546: Atomistic Mod of Materials
   - ME 591: Special Problems

   **ThermoFluids Science (TFS) Core**
   - ME 509: Interm. Heat Transfer
   - ME 511: Cmp Heat Transfer & Fluid Flow
   - ME 560: Thermal Fluid Meas. & Analysis
   - ME 605: Classical Thermodynamics
   - AEM 500: Intermediate Fluid Mechanics

2. **MSME Mathematics Core Requirements**
   
   The second two courses are selected to satisfy the mathematics area core requirement. That is, complete at least two courses from the following list.

   - ME 501: Mech Engr Analysis I
   - ME 591: Special Problems (Linear algebra for engineering computations)
   - GES 500: Engineering Statistics
   - GES 551: Matrix And Vector Analysis
   - GES 554: Partial Diff Equations
   - ST 560: Statistical Methods

3. **MSME Research and/or Elective Course Requirements**
   
   The final courses and/or research hours will depend on the MSME plan being pursued. Options include:

   - ME 599: Thesis Research (Up to 6 hours)
   - ME 500-level, and/or
   - ME 600-level, and/or

   - MTE 500-level, and/or
   - AEM 500-level, and/or
   - CS 500-level, and/or
   - CHE 500-level, and/or
   - GES 500-level, and/or
   - ECE 500-level

   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.

#### Transfer Credit

For information on transfer credit, refer to the UA graduate catalog or click on the highlighted text.

#### Accelerated Master’s Program

Current Mechanical Engineering (ME) and Aerospace Engineering and Mechanics (AEM) undergraduate students at The University of Alabama with a 3.3 or higher GPA and 90 or more hours of undergraduate course credit are eligible to apply for the Accelerated Master’s Program (AMP). AMP allows currently enrolled undergraduate students to simultaneously count up to 9 hours of graduate coursework toward both the undergraduate and graduate degrees. **The GRE test requirements are automatically waived for AMP applicants.** For additional information on Accelerated Master’s Program, pls. 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 1 - 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 hours are in the major area, with six hours taken from the approved major core area. 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.
  - Any transfer credit request is submitted electronically 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
Students in the MSME thesis (Plan I) program 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 MSME Committee two weeks prior to the presentation,
- Present the research described in the thesis to the MSME 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).

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 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 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. Pls. refer to 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.

**Scholastic Requirements**

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

**Application for Graduation**

Information regarding the application for graduation can be found in UA graduate catalog page or by clicking on the highlighted text.

**Faculty**

**Professors**

- Jalili, Nader, Department Head
- Agrawal, Ajay K.
- Balasubramanian, Bharat
- Krishnan, Sundar Rajan
- Shen, Xiangrong
- Shepard Jr., W. Steve
- Srinivasan, Kalyan Kumar
Associate professors
Amini, Shahriar (Sean)
Ashford, Marcus D.
Bittle, Joshua A.
Fonseca, Daniel J.
Khandelwal, Bhupendra
Mahmoodi, S. Nima
Momeni, Kasra
Puzinauskas, Paulius V.
Todd, Beth Ann
Volkov, Alexey N.
Williams, Keith A.
Yoon, Hwan-Sik

Assistant professors
Carpenter, Joseph
Cousin, Christian A.
Davami, Keivan
Kasemer, Matthew
Kim, Hyun Jin
Martelli, Dario
Pakniyat, Ali
Patiballa, Sree Kalyan
Samadi, Forooza
Shah, Krishna
Vikas, Vishesh

Instructors
Hill, Lawrence
Koutahzadeh, Negin
Scott, Radley

Adjunct professor
Daniewicz, Steve

Adjunct assistant professor
Rasoulzadeh, Mojdeh

Professor emeritus
Woodbury, Keith A.