

MECHANICAL ENGINEERING, PH.D.

While pursuing a Doctor of Philosophy (PhD) degree in mechanical engineering, the student will take graduate-level courses and 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 research 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 a PhD degree in mechanical engineering. Additionally, the student demonstrates mastery of the selected study area through the qualifying exam, the proposal of a research topic, and the defense of a research-based dissertation.

In addition to the traditional on-campus degree offering, our PhD program is also offered via the distance option. The distance option is available to students residing within the United States or serving abroad at a U.S. military installation, with performance expectations being identical to those of the on-campus program. For more information on the online PhD in Mechanical Engineering, see the departmental web page as well as the 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. Applicants interested in the distance option are encouraged to contact faculty members in the area of research interest to inquire about the formulation of a research project suitable for completion via distance as well as any on-campus visits that individual faculty may require.

Students and faculty in the Department of Mechanical Engineering have access to state-of-the-art computational facilities and experimental 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. The department also has many state-of-the-art experimental facilities available for daily use by graduate students.

Qualified students in the Mechanical Engineering undergraduate program at The University of Alabama are eligible for early admission into the PhD program through the Accelerated Masters 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) PhD program, prospective applicants should have:

- A Master's degree in Mechanical Engineering or closely-related field.
- A current Resume.
- A concise Statement of Purpose describing interests in an advanced degree and possible graduate study interests. Applicants interested

in funding are encouraged to elaborate on their research interests and carefully read the information provided under the Funding for Students tab above.

- Three letters from recommenders (waived for UA graduates). Recommenders can be previous faculty or supervisors.
- A TOEFL score 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).
- A residence within the borders of the US or serving on a US military installation (DL applicants only).

For applicants that do not have an earned MS degree, **direct-admission** to the PhD program is available to applicants with:

- A Bachelor's degree in Mechanical Engineering or closely related field (see below).
- Transcripts showing a grade point average of at least 3.3 on a 4.0 scale.
- A combined verbal and quantitative GRE requirement of 300 or greater. The GRE score requirement will be waived for all applicants with degree(s) from an ABET-Accredited engineering program. There is no minimum score on the writing section of the GRE for admission to the PhD Program. Applicants with a BSME and five or more years of post-BS field-related work experience may inquire about a GRE waiver request by contacting the ME Graduate Program Director **after** the application and detailed resume are submitted.
- A current Resume.
- A concise Statement of Purpose describing interests in an advanced degree and possible graduate study interests. Applicants interested in funding are encouraged to elaborate on their research interests and carefully read the information provided under the Funding for Students tab above.
- Three letters from recommenders (waived for UA graduates).
- A TOEFL score 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).
- A residence within the borders of the US or serving on a US military installation (DL applicants only).

Note that direct-admit PhD students must also apply for the MSME program separately if they plan to earn an MSME *en route* while pursuing the PhD.

Current MSME students at UA with a grade point average of at least 3.5 on 4.0 scale and 9 or more graduate credit hours may also apply for admission to the PhD program with the recommendation of his or her faculty advisor. This option is available to BSME-degreed students that are not eligible for direct admission to the PhD Program (undergraduate GPA below 3.3) or to MSME students that later decide they would rather focus on pursuing a PhD degree.

Note that there are specific admissions requirement for UA undergraduates interested in the Accelerated Master's Program (PhD option). See the appropriate section below 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 ME.

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 and do **not** count toward any 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 in graduate school

DSC: Dynamic Systems & Control emphasis		Hours
AEM 250	Mechanics Of Materials I (TFS: ThermoFluids Science emphasis)	3
ME 350	Static Machine Components	3
ME 372	Dynamic Systems	3

or

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

or

MPM: Materials Processing & Manufacturing emphasis		Hours
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 University 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 or below) cannot count toward a graduate degree in ME.

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

Application Deadlines

There are no formal deadlines for graduate applications. 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

PhD Curriculum Overview

The PhD in Mechanical Engineering is obtained by successfully completing the following requirements beyond the BS degree (60 hours total and the MSME can be used to satisfy some of these requirements):

- Complete 42 semester hours of approved course work and submit the committee-approved electronic Plan of Study form to the graduate school (may be revised if necessary), where:
 - 21 semester hours are in a major area, of which 9 hours may be in approved closely related supporting fields.
 - 9 semester hours are in any minor technical area.

- 3 semesters hours are graduate-level Mechanical Engineering seminar courses.
- No more than 21 semester hours of course work are transferred. This transfer credit may come from a previously earned Master's degree. Note that 30 hours of the PhD program may count toward an *en route* MSME degree (Plan II, non-thesis).
- Any transfer credit request is submitted electronically only after classes start and within the first year.
- Complete the electronic dissertation committee (*i.e.* PhD Committee) formation form.
- Pass a Qualifying Examination (see below).
- Submit the Admission to Candidacy form electronically via the PhD Committee chair.
- Present a Research Proposal at least nine months prior to completing the dissertation (see below).
- Submit a proposal/qualifying exam PhD assessment to the PhD Committee (see below).
- Pass 18 semester hours of ME 699 Dissertation Research (does not impact GPA). Note that there is a continuous registration requirement for ME 699 Dissertation Research. Students may not start taking ME 699 Dissertation Research until after being Admitted to Candidacy and are ready to enroll every fall and spring (and summer for graduation that term) in these hours.
- Present, defend, and upload the final dissertation (see below) along with the required electronic forms (ETD Form) to the Graduate School web site prior to the deadline for graduation in the desired semester (see below).
- Submit a final PhD assessment to the PhD Committee (see below).

PhD Curriculum Requirements

All PhD students in Mechanical Engineering must complete the 60-hour curriculum requirement through the following five areas, with specific course selection being approved by the faculty advisor via the Plan of Study and no more than 50% of these courses being from outside Mechanical Engineering (ME) without faculty advisor approval:

PhD Curriculum Requirements	Hours
1. Major Core Area	21
ME 500-level, and/or	
ME 600-level, and/or	
AEM 500-level, and/or	
CE 500-level, and/or	
CHE 500-level, and/or	
CS 500-level, and/or	
ECE 500-level and/or	
GES 500-level, and/or	
MTE 500-level.	
Note that other courses require advisor approval.	
2. Minor Technical Area	9
ME 500-level, and/or	
ME 600-level, and/or	
AEM 500-level, and/or	
CE 500-level, and/or	
CHE 500-level, and/or	
CS 500-level, and//or	
ECE 500-level, and/or	
GES 500-level, and/or	

MTE 500-level.

Note that other courses require advisor approval.

3. Graduate Seminar 3

ME 695 Graduate Seminar

ME 696 Graduate Seminar

ME 697 Graduate Seminar

4. Elective Area 9

ME 500-level, and/or

ME 600-level, and/or

AEM 500-level, and/or

CE 500-level, and/or

CHE 500-level, and/or

CS 500-level, and/or

ECE 500-level, and/or

GES 500-level, and/or

MTE 500-level.

Note that other courses require advisor approval.

5. Dissertation Research 18

ME 699 Dissertation Research

Total Hours 60

Transfer Credit

For information on transfer credit, refer to the UA graduate catalog. Note that new students cannot apply for transfer credit prior to starting their initial set of courses at UA.

Accelerated Master's Program – PhD Direct Admit

Current Mechanical Engineering (ME) 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 PhD direct-admit program via the Accelerated Master's Program (AMP). AMP allows undergraduate students to earn admission to the PhD program and 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. Additional information for AMP can be found from the Graduate School Accelerated Master's Program catalog page.

Doctoral Plan of Study Requirement

Students are expected to submit a committee-approved Plan of Study to the graduate school prior to completing the Qualifying Exam or the Dissertation Proposal. This Plan of Study should be updated and resubmitted if the planned coursework changes. Consult with the PhD Committee Chair on submitting this electronic form. Note that any transfer credit must be approved prior to submitting the Plan of Study.

Qualifying Exam Requirements

The specific format of the qualifying exam, which is based on graduate coursework, is at the discretion of the PhD Dissertation Committee. This exam may only be taken twice. While this requirement may be satisfied as part of the proposal oral presentation, note that the proposal must be completed at least nine months prior to completing the Dissertation.

Furthermore, students must complete the Qualifying Exam prior to being Admitted to Candidacy and starting ME 699 Dissertation Research hours. These factors should be considered when consulting with the PhD Committee regarding the specific exam format and timing. Upon

completion of the Qualifying Exam, the PhD Committee Chair should initiate the electronic Admission to Candidacy form, which requires an approved Plan of Study (see above).

Upon completion of the qualifying exam, the student also submits a course portfolio to the PhD Dissertation Committee and has the committee chair provide the forms evaluating that portfolio to the ME Graduate Program Director. This evaluation typically occurs when the proposal is presented. This portfolio paperwork is not submitted to the graduate school.

Admission to Candidacy Requirements

PhD students are Admitted to Candidacy upon successful completion of the Qualifying Exam (see above). The Admission to Candidacy form is submitted electronically by the PhD Dissertation Committee Chair. Again, this form also requires an approved Plan of Study.

Continuous Enrollment Policy

The University of Alabama has a continuous enrollment policy. Please refer to the UA graduate catalog page on this or click on the highlighted text.

Dissertation Requirements

To successfully complete the PhD Dissertation, students must:

- Complete the electronic dissertation committee (*i.e.* PhD Dissertation Committee) formation form.
- Provide a written proposal to the PhD Committee describing the research to be undertaken to complete the dissertation. The specific format is at the discretion of the faculty advisor and PhD Committee. Generally, this document contains the literature review, research objectives, research already completed, and an outline of the research to be undertaken to complete the dissertation. This document should be provided two weeks prior to the oral presentation.
- Complete an oral presentation and examination defending the dissertation proposal. See policies on virtual participation below.
- Provide a written dissertation to the committee two weeks prior to the defense.
- Present and defend the dissertation to the PhD Dissertation Committee (may not be in the same term as the proposal). See policies on virtual participation below. Note that the graduate school has requirements for publicizing this event.
- Upload the revised (if necessary) final approved dissertation in one of the approved formats and the required electronic forms (*e.g.* ETD Form initiated by the PhD Committee Chair) to the Graduate School web site prior to the deadline for graduation in the desired semester (see below).
- Submit the final PhD assessment to the PhD Dissertation Committee and have the committee chair provide the forms for that assessment to the ME Graduate Program Director. This evaluation typically occurs when the Dissertation is defended. This information is not submitted to the graduate school.

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 Requirements

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

Student Progress Requirement

Students are expected to maintain satisfactory academic progress each semester. Students that do not remain in good academic standing and/or fail to complete ME 699 Dissertation Research in a satisfactory manner may be suspended from the program.

Academic Misconduct Information

The Mechanical Engineering Department expects all students to adhere to The University's policy on academic conduct.

Withdrawals and Leave of Absence Information

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

Academic Grievances Information

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

Grades and Academic Standing

The ME department expects all graduate students to remain in good academic standing. Please refer to Graduate School policies on grades and academic standing.

Graduate School Deadlines Information

For important information regarding deadlines for graduation, including dissertation submission, see Graduate School website.

Application for Graduation Information

Information regarding the application for graduation can be found on the UA graduate catalog page or click on the highlighted text. Students are expected to submit the appropriate paperwork prior to the posted deadlines.

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) PhD 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 a PhD Dissertation 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 web site for additional information about research areas and communicate directly with those faculty in your area of interest. 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 funding, please do not contact the Graduate Program Director or the 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. 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 directly 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.

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.

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.