

Graduate Student Handbook

Department of Mechanical Engineering
The University of Alabama

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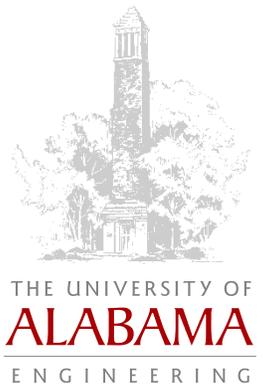


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I. INTRODUCTION

Welcome to the graduate program in Mechanical Engineering (ME) at The University of Alabama. You have embarked on an exciting journey. Advanced engineering study is intellectually stimulating and will prove to be a great asset in your career.

We have prepared this handbook to help you navigate through program and degree requirements and to supply you with additional information that we have found will help you be successful in your studies.

In addition to this handbook, useful information may be found on the follow web sites:

- UA Graduate School (<http://graduate.ua.edu/>),
- Department of Mechanical Engineering (<http://me.eng.ua.edu/>), and
- UA Graduate Catalog (<https://catalog.ua.edu/graduate/>)

Note that the purpose of the Graduate Handbook is to give you a brief outline of various procedures and requirements needed to attain a graduate degree; however, the Graduate School and Mechanical Engineering Department sites are the definitive resources for graduate procedures and policies. Note that in all cases, information on the UA Graduate School web site (<http://graduate.ua.edu/>) and policies in the graduate school catalog (<https://catalog.ua.edu/graduate/>) take precedent over the information provided in this document.

When questions arise, you should first consult your major advisor. Your advisor is your primary advocate. The Mechanical Engineering Graduate Program Director will be happy to help with any questions that your advisor cannot answer.

II. ADMISSION REQUIREMENTS

MSME (On campus and Distance): For unconditional admission to the MSME Program, a prospective graduate student should have:

- a Bachelor's degree in mechanical engineering or related field (Appendix A lists requirements for those with non-ME degrees),
- a grade point average of at least 3.0 on a 4.0 scale, and
- a combined verbal and quantitative GRE requirement of 300 or greater.

There is no minimum score on the writing section of the GRE for admission to the MSME Program. A short Statement of Purpose describing possible research/study interests and a Resume are also required. External applicants should submit three letters

of recommendation. Applicants with 5 or more years of field-related work experience may contact the ME Graduate Program Director to inquire about a GRE waiver request.

All international applicants must submit TOEFL scores of 580 (229 computerized test, 92 ibt) or higher.

Accelerated Masters 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 Masters Program (AMP). AMP allows undergraduate students to simultaneously count up to 9 hours of graduate coursework toward both the undergraduate and graduate degrees. The **GRE admissions test and recommendation letters requirements are automatically waived for AMP applicants**. AMP is also available to distance students currently enrolled in our undergraduate program.

PhD: For admission to the PhD Program, a prospective graduate student should have:

- a Master's degree in Mechanical Engineering,
- a grade point average of at least 3.0 on a 4.0 scale

or

- a Bachelor's degree in Mechanical Engineering (see Appendix A for non-ME degree requirements),
- a grade point average of at least 3.3 on a 4.0 scale, and
- a combined verbal and quantitative GRE requirement of 300 or greater.

There is no minimum score on the writing section of the GRE for admission to the PhD Program. The GRE requirement is automatically waived for those applicants holding an MSME degree. BSME applicants with 5 or more years of field-related work experience may contact the ME Graduate Program Director to inquire about a GRE waiver request. A short Statement of Purpose describing possible research/study interests and a Resume are required for each application. External applicants should also submit three letters of recommendation.

All international applicants must submit TOEFL scores of 580 (229 computerized test, 92 ibt) or higher.

Current MSME students 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 major advisor.

Accelerated Masters Program – PhD Option

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 PhD program as part of the Accelerated Masters Program (AMP). AMP allows undergraduate students to simultaneously count up to 9 hours of graduate coursework toward both the undergraduate and graduate degrees. The **GRE admissions test and recommendation letters requirements are automatically waived for AMP applicants**. AMP is also available to distance students currently enrolled in our undergraduate program.

III. DEADLINES

There are no formal deadlines for graduate applications. Once an application is complete, the internal review process typically only takes a few days. However, **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 then apply with their country of origin for these travel documents. Some countries take between two and six months, depending on the country of origin, to then provide the appropriate travel documents. 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.

IV. GENERAL INFORMATION

A. [The University of Alabama](#)

The University of Alabama was established in 1831. The University has an outstanding academic reputation and consistently ranks in the top 50 public comprehensive universities by *US News and World Report*. The current enrollment is over 38,000 students with approximately 5,000 of those in graduate programs and around 6,000 students enrolled in an engineering degree program. The approximately 2000-acre campus surrounds a large main quadrangle with broad lawns, majestic trees, and shaded walkways. In addition to the nationally renowned athletic programs, the University and the Tuscaloosa community offer a wide range of cultural activities in theater, art, music, and other creative opportunities. The Tuscaloosa community offers a myriad of recreation and entertainment options with numerous parks, golf courses, galleries, museums, and an active night life with renowned sports bars, restaurants, and night clubs. The Black Warrior River and nearby Lake Tuscaloosa also provide opportunities for water recreation.

B. [The Department of Mechanical Engineering](#)

Approximately 1,700 undergraduates and over 100 graduate students are enrolled in mechanical engineering at The University of Alabama. Currently, there are 30 mechanical engineering faculty members. The department has active research programs in Dynamic Systems & Control (DSC), ThermoFluids Science (TFS), and Materials Processing & Manufacturing (MPM). Faculty teach graduate-level courses and conduct research in 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 Master of Science (MSME) or Doctoral (PhD) degree in mechanical engineering. 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 through Bama By Distance. Individual faculty members and their research and teaching interests are listed on the ME website, <http://me.eng.ua.edu/people/>.

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 through the College of Engineering server. In addition, high performance computing capabilities are accessible through the University of Alabama's Office of Information Technology (OIT). Additional information regarding the resources available from the OIT may be found at <http://oit.ua.edu/>. High performance computing facilities are also available to UA students and faculty through the Alabama Supercomputer Authority (ASA). Information regarding ASA resources and capabilities may be found at: <http://www.asc.edu/supercomputing/index.shtml>

C. [Assistantships, Financial Aid, and Fellowships](#)

Many unconditionally admitted full-time graduate students seek and receive some form of financial assistance in the form of a graduate assistantship. Assistantships generally include a monthly stipend, tuition, and health insurance.

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. See Appendix C for information on faculty research areas.

The ME Department offers Graduate Teaching Assistantships (GTAs) for students assisting faculty members with undergraduate courses and laboratories. GTA awards are

determined by the ME Department Head. 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 (<http://www.eli.ua.edu/>). The English language proficiency exam and course process typically required at least one semester. There are a very limited number of GTA positions each semester.

MSME students supported by assistantships are expected to follow the Plan I Thesis Option, as described in the Graduate Catalog (<https://catalog.ua.edu/graduate/>).

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.

Domestic students may be eligible for student loans and other financial aid and should visit the UA Financial Aid Office website (<http://financialaid.ua.edu/>) 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 apply for fellowships like the NSF Graduate Research Fellowship, the DoD SMART Fellowship, the Alabama Space Grant Consortium Fellowship, and UA's Graduate Council Fellowship. Note that most of these have early application deadlines and some require interaction with a nominating faculty member.

D. Graduate Courses

Graduate courses are those with numbers in the 500-level and 600-level. 500-level courses are intermediate-level courses and are often associated with MSME-level work. 600-level courses are advanced-level courses and are often associated with PhD-level work. However, both MSME and PhD plans of study can contain both 500- and 600-level courses. Graduate courses are listed in the Graduate Catalog (<https://catalog.ua.edu/graduate/engineering/mechanical/>).

Courses taken for graduate credit generally cannot be repeated. This includes audited courses. Required courses can be repeated for credit if the student makes a D or F grade with the recommendation of the Department Head and the Dean of the Graduate School.

Note that 400-level courses are generally not acceptable for graduate degree requirements. However, there are strict exceptions to this rule as described in Section F below.

Undergraduate students enrolled in the Accelerated Masters Program may double count a limited number of graduate course hours as undergraduate electives. More information about his program is available on the Graduate School web site.

E. Academic Misconduct

It is important that students have a clear understanding of what level of group activity is allowable for each assignment. Students should be careful to cite references properly whenever the literature, web, or any work of others is used. Penalties for academic misconduct can range from a grade of zero on the particular assignment to expulsion from the University.

The UA Undergraduate Catalog makes the following statement on academic misconduct.

“Academic misconduct includes all acts of dishonesty in any academic or related matter and any knowing or intentional help, attempt to help, or conspiracy to help, another student commit an act of academic dishonesty. Academic dishonesty includes, but is not limited to, the following acts, when performed in any type of academic or academically related matter, exercise, or activity:

- **Cheating**: using or attempting to use unauthorized materials, information, study aids, or computer-related information
- **Plagiarism**: representing the words, data, works, ideas, computer programs or output, or anything not generated in an authorized fashion, as one's own
- **Fabrication**: presenting as genuine any invented or falsified citation or material
- **Misrepresentation**: falsifying, altering, or misstating the contents of documents or other materials related to academic matters, including schedules, prerequisites, and transcripts”

F. Grades and Academic Standing

Grades in graduate courses are assigned on the A, B, C, D, F system. Plus and minus grades are not used for graduate courses. A weighted grade point average (GPA) is computed using 4 points for A's, 3 for B's, 2 for C's, 1 for D's and 0 for F's. In order to be in good academic standing and to graduate, a student must maintain at least a B average (GPA \geq 3.0). Graduate students with 12 or more credit hours and a GPA $<$ 3.0 will be placed on academic warning and may not hold a graduate assistantship. To remain in the program, students on academic warning must raise their GPA to 3.0 or better by the end of the semester following being placed on academic warning.

Seventy-five Percent Rule (taken verbatim from the [Graduate Catalog](#)):

“At least 75 percent of the hours taken must have been completed with grades of ‘A’ or ‘B’ at The University of Alabama. In applying this 75 percent rule, a maximum of 6 hours of thesis research may be counted, if appropriate.”

400-Level Courses:

While 400-level courses may be applied toward a master's degree, see Section 4.9 of the Graduate Catalog for some very important considerations that should be noted. For example, approval for such coursework must be obtained before the course is taken and it will only count if a graduate course on the same topic is not available. Students are expected to do additional work as well. Note 400-Level Courses may not be accepted for a doctoral degree except when taken as part of the master's degree. It is very rare that a 400-level course will count toward a graduate degree. Consult with your advisor or graduate program director prior to pursuing this option.

G. Office Space

The location of graduate student office space is coordinated through the ME Department. Graduate student offices are located in the South Engineering Research Center, the North Engineering Research Center, and in Hardaway Hall. Graduate students with questions regarding student office space should contact their faculty advisor.

Cooking and sleeping in offices and laboratories is forbidden. As students often share offices with other students, neatness and respect for others' property should be observed.

H. Email and Departmental Mailboxes

Each University of Alabama student will be assigned an account on the University of Alabama web portal “mybama.” This portal includes an email address “yourid@crimson.ua.edu.” This crimson e-mail account is the official communication

channel between you, The University, and the ME Department. You should check your “mybama” account every day for official announcements, summons, and classroom communications. The student will be held responsible for official communications sent to this email account. You can forward this email to another email account; however, spam filters often delete incoming mail from public email providers such as yahoo.com, hotmail.com, etc. It is, therefore, strongly recommended that you use your “mybama” e-mail.

Some on-campus graduate students will be assigned a mailbox. This mailbox is also an official channel of communication. It is important to check this mailbox regularly for announcements, summons, and other official communications. The departmental Office Associate will help with the assignment of a mailbox.

I. Assessment of the Department’s Graduate Program

The University's primary accreditation agency, the Southern Association of Colleges and Schools (SACS), has program self-assessment requirements that are to be reported annually. Consequently, the ME department has implemented an annual graduate programs assessment plan. For this assessment, each student prepares a Course Portfolio to present to their committee. This Course Portfolio is a PowerPoint® presentation summarizing the learning outcomes in 3-4 graduate courses taken during the program. Each slide summarizes one course with a “List of Topics” covered as well as a list of “Application of Topics,” indicating that the student has a mastery of the course material. MS students provide this portfolio during the thesis defense or as part of the comprehensive exam, and PhD students present it during the qualifying exam/proposal presentation. A sample course portfolio and the forms for this assessment are provided in Appendix D. Note that **it is the student’s responsibility to ensure the assessment and forms are completed prior to graduation.** Generally, the final forms needed for graduation will not be signed until these assessment forms are submitted.

J. Seminar

The ME department holds a seminar series each regular academic term. In addition to student presentations, outside speakers distinguished in some area of engineering are invited to make seminar presentations. Graduate students are expected to attend these seminars. There is a one-hour course that students may take to obtain course credit for this seminar series each semester.

V. REQUIREMENTS FOR THE MSME DEGREE

A. Degree Requirements

The Master of Science in Mechanical Engineering (MSME) degree may be obtained through either of two plans. Students may also enroll in the Dual MSME/MBA Degree Program, which includes a slightly reduced number of hours for both degrees.

MSME – Thesis Option (Plan 1): 30 Credit Hours

- The thesis option is the standard master’s degree for mechanical engineering. Graduates complete 24 hours of graduate course work (500-level and above), at least six hours of ME 599, and a thesis. All students on teaching or research assistantships in the department are expected to pursue this degree option.
- A student’s curriculum and thesis must be approved by the student’s graduate advisory committee. The student must pass a final comprehensive examination, which is typically a presentation and defense of the thesis. In addition, the student must satisfy all University requirements defined in the current edition of The University of Alabama Graduate Catalog (<https://catalog.ua.edu/graduate/>).
- A minimum of 12 semester course hours in the major area at or above the 500 level is required. Major area courses are ME and ME cross-listed courses. Three hours of approved coursework in a closely allied area may be used as a major area course, with additional hours requiring advisor approval and notification of the graduate registrar.
- A minimum of 6 hours of mathematics is required. Note that some engineering courses may satisfy this requirement as described in Appendix B.
- A minimum of 6 hours of ME 599 thesis research hours and an approved thesis are required.
- The student must provide a course portfolio to the thesis committee per Section IV.I above. The Graduate Assessment Forms given in Appendix D must be completed by the student’s thesis committee and submitted to the department.

MSME – Non-Thesis Option (Plan II): 30 Credit Hours (On-Campus and Distance):

- The non-thesis option is intended primarily for students who are employed full-time in government or industry as well as those completing the program through Bama By Distance. Graduates complete 30 hours of graduate course work and pass a comprehensive exam. Credit for ME 599 may not be used to satisfy hour requirements for this degree or The University's 75% rule.
- A student's curriculum must be approved by the student's graduate advisory committee.
- A minimum of 18 semester hours in the major area at or above the 500 level is required. Major area courses are ME and ME cross-listed courses. Six hours of approved coursework in a closely allied area may be used as a major area course, with additional hours requiring advisor approval and notification of the graduate registrar.
- A minimum of 6 hours of mathematics is required. Appendix B provides a listing of suggested mathematics courses, including some engineering courses that satisfy the math requirement.
- The student must pass a comprehensive exam, typically taken during the final semester of study.
- The student must provide a course portfolio to the advisory committee per Section IV.I above. The Graduate Assessment Forms given in Appendix D must be completed by the student's advisory committee and submitted to the department.

Grades below a "C" are counted in the scholastic averages but do not carry credit toward a degree. The grades of at least 75% of all courses must be A or B.

Dual MSME/MBA 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.

B. Committees

Every MSME candidate (Plan I or II) is responsible for working with their advisor to select a faculty committee to oversee the candidate's progress toward earning the MSME degree.

The MSME Plan I candidate's committee will consist of two members of the department's faculty plus one faculty member from outside the department. The MSME Plan I committee will work with the advisor to approve the candidate's plan of study, evaluate the candidate's thesis and thesis defense, assess the Course Portfolio, and help the candidate with any problems that may arise in the course of obtaining the MSME degree.

The MSME Plan II candidate's committee will consist of three department faculty who have each taught the candidate at least one graduate course. The MSME Plan II candidate's committee is responsible for administering a comprehensive exam, as described in section D, and assessing the Course Portfolio.

C. Transfer Credit

With your committee's approval, you may transfer up to one half of your required semester hour credits (12 hours for MSME Plan I and 15 hours for MSME Plan II) from another regionally accredited University. Forms for transfer of credit can be obtained from the UA Graduate School:

<https://graduate.ua.edu/current-students/forms-students/>

The Mechanical Engineering Department and the Dean of the Graduate School must approve any transfer credit. It is recommended that you discuss potential transfer courses with your major advisor and the ME Graduate Program Coordinator before you apply to The University of Alabama. Only grades of B or better will transfer. In addition, you must have an overall GPA of at least 3.0 on a 4.0 scale at the institution from which the credit will be transferred. Note that the graduate school has very strict deadlines regarding the transfer of credit that differ from graduation application deadlines. These deadlines are posted on the graduate school web site.

D. Comprehensive Examination

A final comprehensive examination is required of all Master's candidates. The content of this exam depends on the candidate's degree program. Note that all MSME students must also complete a Course Portfolio for assessment as described above in Section IV.I and in Appendix D.

Plan I Master's candidates submit a thesis of their research work to the committee members and defend their thesis work in a formal presentation. The assessment forms are also completed at this presentation.

Plan II Master's candidates can satisfy the comprehensive exam via one of the following:

- Pass an oral and/or written examination based on course content in the major (and minor) field. The format of the Plan II candidate's exam is determined by the committee.
- Pass a formal defense of a journal paper in which the student is an author. The student must meet with the committee to defend their portion of the work described in the paper. The specific format of this exam is at the discretion of the committee.
- Pass a Dissertation Research Proposal as described in Section VI.F below. This option is intended for Direct Admit PhD students desiring to obtain a Master's Degree after completing 30 hours of appropriate coursework.
- Other options are also available per the discretion of the student's advisory committee. Such options should be discussed with each member of the committee.

The assessment forms are completed at the time of the examination. Note that the examination must be passed and the results filed with the Graduate School on the Master's Examination Form no later than the deadline posted by the graduate school:

<https://graduate.ua.edu/current-students/student-deadlines/>

E. Thesis

The thesis is a formal research document and must be prepared following the Graduate School's thesis and electronic submission guidelines (<http://services.graduate.ua.edu/etd/>). Your thesis will be reviewed by your thesis advisor and your committee. Once they are satisfied with the thesis, you and your thesis advisor will schedule your Comprehensive Exam/Thesis Defense. After successfully defending your thesis, you may have final corrections and revisions to your thesis before the committee gives their final approval. Such conditions should be considered in scheduling the presentation/defense relative to the graduate school submission deadlines.

F. Necessary Paperwork & Deadlines

A series of forms, obtainable from the Graduate School website, must be filed with the ME department and the Graduate School prior to the deadlines posted by the graduate school. These forms may be found at:

<https://graduate.ua.edu/current-students/forms-students/>

UA Graduate School deadlines may be found at:

<https://graduate.ua.edu/current-students/student-deadlines/>

Note that the deadline for degree applications is early during the semester in which you plan to graduate. Please refer to the aforementioned web site for the UA Graduate School deadlines. It is a good idea to have the Application for Degree form complete at the beginning of the semester in which you plan to graduate. While the administrative staff in the ME Department may be consulted for assistance regarding these forms, **it is the responsibility of each student to complete and submit his/her forms in a timely manner.** Failure to submit this paperwork in an appropriate manner may result in a delay of graduation.

G. Time Limits

All requirements for the MSME degree must be completed during the six years prior to the date that the degree is awarded.

VI. REQUIREMENTS FOR THE PhD DEGREE

A. Degree Requirements

The doctorate requires 48 credit hours of coursework past the Bachelor's degree, a comprehensive qualifying exam, and a dissertation. Students with a Master's degree will receive credit for 24 hours of course work. The dissertation must sufficiently document original research that makes a significant contribution to the profession. Note that additional requirements may be stipulated by the UA Graduate School.

Requirements:

- A minimum of 48 semester hours of approved course work that satisfy all other course requirements for the degree. Up to 24 semester hours of course work earned for the Master's degree may be incorporated within or transferred into the total Ph.D. course work requirement.
- A minimum of 24 semester hours of approved course work in mechanical engineering, of which 9 hours may be in approved closely related supporting fields.
- A minimum of 12 semester hours in any minor technical area must be included in the student's program of study.
- Qualifying examination covering graduate course work must be passed.
- The student must provide a course portfolio to the dissertation committee as outlined in Section IV.I above. The Graduate Assessment Forms given in Appendix D must be completed by the student's committee at the proposal and submitted to the department.

- A minimum of 24 semester hours of dissertation research (ME 699) and an approved dissertation. **Note that once ME 699 hours are started, there is a continuous registration requirement as described in the graduate catalog.**
- A dissertation reviewed and approved by the committee members. The candidate will defend a dissertation in a formal manner for this committee.
- The Graduate Assessment Forms given in Appendix D must be completed by the student's committee at the defense and submitted to the department.

Grades below a "C" are counted in the scholastic averages but do not carry credit toward a degree. The grades of at least 75% of all courses must be A or B. The courses counted to arrive at this percentage can include 6 hours of ME 699.

B. Committees

Every PhD candidate is responsible for working with his/her advisor to select a committee of five or more members. The candidate's committee will consist of the advisor plus at least three members of the department's faculty plus at least one faculty member from outside the department. The committee will work with the advisor to approve the candidate's plan of study, to evaluate the candidate's dissertation and plan the dissertation defense, as well as to help the candidate with any problems that may arise in the course of obtaining the PhD degree. Committee appointment and other forms can be found here: <https://graduate.ua.edu/current-students/forms-students/>.

C. Transfer Credit

With your committee's approval, you may transfer up to one half of your required semester course hour credits (24 hours) from another regionally accredited university. Specific courses may only be transferred if they were earned within six years of being admitted to the PhD program. Forms for transfer of credit can be obtained from the UA Graduate School web site. The Mechanical Engineering Department and the Dean of the Graduate School must approve any transfer credit. It is recommended that you discuss potential transfer courses with your major advisor and the ME graduate coordinator before you apply to the University of Alabama. Only grades of B or better will transfer. In addition, you must have an overall GPA of at least 3.0/4.0 at the institution from which the credit will be transferred.

For applicants holding an MS degree not earned during the previous six years, the student must demonstrate field-relevant employment in order to earn the 24 hours of transfer credit for that MS degree. Additional information is available in the Graduate School Catalog (http://services.graduate.ua.edu/catalog/14800.html#transfercredit_phd). Note that the graduate school has very strict deadlines regarding the transfer of credit that differ from graduation application deadlines. These deadlines are posted on the graduate school web site.

D. Plan of Study

Soon after admission to the PhD program, you should work with your advisor and committee to complete the Outline of Doctoral Program for the PhD. Consult the graduate course schedule for help with choosing the coursework that will be listed in this 3-year plan of study. Courses listed in the plan of study may be modified during your course of study with the approval of your advisor. **It is the student's responsibility to keep the graduate school informed of revisions to the Plan of Study, as this document is used to audit the student's courses prior to graduation.**

E. Residence Requirements

In addition to completing a minimum of 50% of the graduate coursework at The University of Alabama (UA), all of the dissertation research hours (699) must be earned while attending UA. Note that 599 hours are not the same as 699 and these hours generally cannot be converted. Note also that once ME 699 courses are started, students must continuously register for a minimum of 3 hours of ME 699 each semester until graduating. There are a few exceptions for the final semester, depending on when the dissertation defense is completed. See the Graduate Catalog for additional information.

F. Dissertation Research Proposal

The Ph.D. degree is a research degree whose defining elements are the dissertation research and dissertation. A formal written dissertation research proposal is an important part of the Comprehensive Qualifying Examination discussed in section G.

G. Comprehensive Qualifying Examination

A comprehensive qualifying examination is required of all students enrolled in the doctoral program for earning PhD candidacy. This examination is given after approximately two full years of graduate study are completed. The examination consists of the following:

- A written dissertation proposal that describes the research objective and research already completed as well as an outline of the research to be undertaken to complete the dissertation. The specific format is at the discretion of the faculty advisor and dissertation committee.
- A course portfolio, as described in Section IV.I, that is assessed by the committee using the forms provided in Appendix D.
- An oral examination defending the dissertation proposal.
- In addition, an examination, oral or written, based on graduate coursework can be assigned at the discretion of the graduate committee. In many cases, however, the proposal oral presentation satisfies this requirement.

The comprehensive qualifying examination should be completed at least nine months before the degree is to be awarded. If the student's qualifying examination results are deemed unacceptable by the student's committee, the student may arrange to retake the exam a maximum of one more time. Note also that the proposal/qualifying exam and dissertation defense cannot occur within the same semester. See the Graduate Catalog for additional information.

H. Candidacy and Continuous Registration

A student who has successfully completed the qualifying examinations and has had a dissertation research proposal approved will be admitted to *candidacy* for the doctoral degree. Students admitted to candidacy are expected to pursue completion of the dissertation without interruption by enrolling each semester following admission to candidacy for at least three hours of dissertation research (ME 699). **Since there is a continuous registration requirement as described in the graduate catalog, students should not start taking ME 699 until they are ready to take at least 3 hours every semester until graduation.**

I. Dissertation and Final Examination

The dissertation research and dissertation are the defining elements of the PhD degree. The dissertation must demonstrate independent, original scholarship within the mechanical engineering field.

The dissertation is a formal research document and must be prepared following the Graduate Schools guidelines (<http://services.graduate.ua.edu/etd/>). Your dissertation will be reviewed by your advisor and your dissertation committee. Your advisor will help in scheduling your Final Exam/Dissertation Defense. Note that the assessment forms provided in Appendix D are also completed at the final dissertation defense. After a successful defense, you may still have final dissertation corrections and revisions required by the committee. Such conditions should be considered in scheduling the presentation/defense relative to the graduate school submission deadlines.

The article-style dissertation can be used as an alternate to the traditional dissertation format. This format is beneficial for publication of the dissertation research. Additional information concerning the article-style dissertation may be found at the site listed above.

J. Necessary Paper Work & Deadlines

A series of forms, obtainable from the Graduate School website, must be filed with the ME department and the Graduate School prior to graduation. These forms may be found at:

<https://graduate.ua.edu/current-students/forms-students/>

UA Graduate School deadlines may be found at:

<https://graduate.ua.edu/current-students/student-deadlines/>

While the administrative staff in the ME Department may be consulted for assistance regarding these forms, **it is the responsibility of each student to complete and submit his/her forms in a timely manner.** Failure to submit this paperwork in an appropriate manner may result in a delay of graduation.

K. Time Limits

All requirements for the Ph.D. degree must be completed during the nine years immediately prior the date that the degree is awarded.

APPENDICES

A. Undergraduate Course Requirements for Non-ME Graduates

Applicants who hold a Bachelor of Science degree in a discipline other than Mechanical Engineering are encouraged to consider a graduate degree in ME. The following prerequisite undergraduate courses or acceptable equivalents are required

1. Mathematics: Calculus (usually 12 semester credit hours) and Ordinary Differential Equations
2. Chemistry: General Chemistry (usually 4 semester credit hours)
3. Physics: Calculus-Based Physics (usually 8 semester credit hours)
4. Mechanical Engineering, depending on your emphasis area in graduate school
 - a. Thermal-Fluids Emphasis:
ME 215 (3 hours) Thermodynamics
AEM 311 (3 hours) Fluid Mechanics
ME 309 (3 hours) Heat Transfer
 - or
 - b. Mechanical Systems Emphasis
AEM 250 (3 hours) Mechanics of Materials I
ME 350 (3 hours) Static Machine Components
ME 372 (3 hours) Dynamic Systems

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 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 coursework.

B. Guide for Math Courses for Master's Students

The following list is composed for your guidance. Courses listed here are pre-approved to satisfy the 6 hours of mathematics requirement for the Mechanical Engineering Master's programs. Other courses may be approved on an individual basis by the student's graduate committee.

Engineering: The following engineering courses are pre-approved to fulfill the ME Master's math requirement.

ME 501 Mechanical Engineering Analysis I. (3-0) Three hours. Prerequisites: ME 309, ME 349, and ME 372. Analysis of mechanical engineering systems; presentations and application of advanced analysis techniques for continuous and discrete dynamic systems.

ME 530 Fuzzy Set Theory and its Applications. (3-0) Three hours.

Prerequisites: GES 255 or ME 349 or Instructor Consent. The course covers the basic concepts in fuzzy set theory, fuzzy logic, and approximate reasoning. Relation between fuzzy set theory, probability theory, and possibility theory is also discussed. Applications of fuzzy set theory in engineering systems through the use of Matlab's *Fuzzy Toolbox* are outlined.

GES 500 Engineering Statistics. (3-0) Three hours. Prerequisite: MATH 126.

Not open to students who have earned credit for GES 255 or GES 400; not available for M.S.I.E. or M.S.C.S. degree credit. Probability and basic statistical concepts. Discrete and continuous distributions; the central limit theorem; sampling distributions; point and interval estimation; hypothesis testing; regression and correlation analysis; analysis of variance.

GES 501 Operations Research. (3-0) Three hours. Prerequisite: MATH 126.

Corequisite: GES 255, GES 400, or GES 500. Not open to students who have earned credit for IE 363; not available for M.S.I.E. degree credit. Model construction, linear programming, network models, dynamic models, stochastic models, queueing theory, and decision theory.

GES 551 Matrix and Vector Analysis. (3-0) Three hours. Prerequisite: MATH 253 or permission of the instructor. This course provides a graduate level overview of linear algebra and vector analysis. Topics covered include; linear simultaneous equations, eigenvalues and eigenvectors, matrix functions, computer techniques, and transformations, vector calculus, the Laplacian, and integral theorems such as the theorems of Green and Stokes.

GES 554 Partial Differential Equations. (3-0) Three hours. This course examines the solution of partial differential equations by focusing on three specific equations: (1) the heat equation, (2) the wave equation, and (3) Laplace's equation. Topics covered include: Fourier transforms, Sturm-Louisville problems, classification of partial differential equations, Bessel functions, and numerical methods for solving partial differential equations.

GES 658 Applied Numerical Methods. (3-0) Three hours. Prerequisites: GES 451 and MATH 238. Condensed coverage of numerical methods essential in engineering: interpolation, integration, root calculation, matrix algebra, eigenvalue problems, matrix differential equations, two-point boundary value problems, least square approximation, Fast Fourier Transforms, and optimization methods. Emphasis is on applications with extensive FORTRAN programming.

Mathematics: Any 500- or 600- level course taught by the mathematics department (MATH prefix) will satisfy the ME Master's math requirement. The following courses are the ones that an ME would usually find of interest.

MATH 500 Mathematical Methods of Physics I. Three hours. Prerequisite: MATH 238. Vector calculus, tensors and matrices, functions of a complex variable, and special functions.

MATH 501 Mathematical Methods of Physics II. Three hours. Prerequisite: MATH 500. Special functions, Fourier series and integral transforms, Green's functions, and group theory.

MATH 510 Numerical Linear Algebra. Three hours. Prerequisites: MATH 237 (or MATH 257) or equivalent. Direct solution of linear algebraic systems, analysis of errors in numerical methods for solutions of linear systems, linear least-squares problems, orthogonal and unitary transformations, eigenvalues and eigenvectors, and singular value decomposition.

MATH 511 Numerical Analysis I. Three hours. Prerequisites: MATH 237, MATH 238 or MATH 257, and CS 226; or equivalent. Numerical methods for solving nonlinear equations; iterative methods for solving linear systems of equations; approximations and interpolations; numerical differentiation and integration; and numerical methods for solving initial-value problems for ordinary differential equations.

MATH 512 Numerical Analysis II. Three hours. Prerequisite: MATH 411, MATH 511, or equivalent. Continuation of MATH 511 with emphasis on numerical methods for solving partial differential equations. Also covers least-squares problems, Rayleigh-Ritz method, and numerical methods for boundary-value problems.

MATH 520 Linear Optimization. Three hours. Prerequisite: MATH 237. Topics include formulation of linear programs, simplex methods and duality, sensitivity analysis, transportation and networks, and various geometric concepts.

C. Departmental Disciplinary Groups and Research Thrust Areas

 Mechanical Engineering					
Departmental Disciplinary Groups (DDG)					
Dynamic Systems & Control (DSC)		ThermoFluids Science (TFS)		Materials Processing & Manufacturing (MPM)	
Bharat Balasubramanian	●▲▲	Ajay Agrawal (Chair)	■▲	Paul Allison	●▲
Christian Cousin	■▲	Marcus Ashford	▲■	Steve Danlewicz	▲
Nader Jalli	■▲●	Josh Bittle	■▲	Kelvan Davami	●■
Nima Mahmoodi	▲■	Sundar Krishnan	▲	Matthew Kasemer	▲
Dario Martell	■	David MacPhee	●	Daniel Fonseca	●▲
Xiangrong Shen (Chair)	■▲	Zheng O'Neil	●	Brian Jordan (Chair)	●■▲
Steve Shepard	■▲	Paul Puzhauskas	■▲	Beth Todd	▲
Vishesh Vikas	■▲	Kalyan Srinivasan	■▲	Alexey Volkov	▲■■
Xuefeng Wang	■▲	Keith Woodbury	●		
Keith Williams	▲●	Jay Uddl	●■		
Hwan-Sik Yoon	●▲				
Research Thrust Areas					
● Automotive Systems		● Energy and Building Efficiency		● Manufacturing Systems	
■ Robotics and Human Systems		■ Combustion		■ Additive Manufacturing	
▲ Automation and Mechatronic Systems		▲ Internal Combustion Engines		▲ Materials Processing & Modeling	

09/13/2019

D. Portfolio Sample and Graduate Assessment Forms with Instructions

For this assessment, each student prepares a Course Portfolio to present to their committee. This Course Portfolio is a PowerPoint® presentation summarizing the learning outcomes in 3-4 graduate courses taken during the program. The following pages contain a couple of course portfolio slide samples as well as instructions and electronically fillable forms that are used as part of the program assessment. The forms must be completed by the entire advisory committee and submitted by the committee chair after each of the following events:

- MSME Comprehensive Exam or MSME Thesis Presentation/Defense
- PhD Qualifying Exam and Proposal
- PhD Dissertation Defense

ME 518: Combustion 1

Main topics covered:

- Role and application of combustion in academia, industry and government work
- Review of basic chemistry, physics, mathematics, and thermodynamics required for combustion analysis.
- Analysis of chemical equations, including: mass/energy conservation, fuel heating values, adiabatic flame temperature calculations, application of the second law of thermodynamics and Gibb's free energy.
- Discussion of role of fluid dynamics in relation to chemical kinetics for combustion applications.
- Introduction and analysis of transport properties relating to fluid dynamics in combustion.
- Comparison and analysis of diffusion vs. premixed flames, including discussion of flame structures and applications of different flame types.
- Chemical kinetics analysis including laminar flame speed, flammability limits, detonation vs. deflagration, elemental vs global reactions, reaction rates, introduction to reaction mechanisms.
- Discussion of principles and application approaches to auto-ignition, flame blow-off, flashback, flame stabilization and pollutant formation.
- Analysis of liquid fuel atomization and droplet evaporation.

Application of topics:

- These combustion basics are essential knowledge for combustion related research or analysis. Application of chemical kinetics can lead to understanding of phenomenon observed during experimentation, leading to more educated analysis.
- These topics form a baseline for more advanced combustion related analysis, both computationally and experimentally.

ME 591: Advanced Vibrations

Main Topics covered:

- Review of Discrete system vibrations for SDOF and MDOF systems
- Derivation of equations of motion by Energy Methods: Lagrange, Hamilton
- Vibrations of strings and bars
- Derivation of equations of motion for Timoshenko and Euler-Bernoulli beams
- Approximate methods for determining mode shapes and natural frequencies
- Numerical Methods and the Galerkin Method
- Vibration of membranes, plates, and shells

Application of Topics:

- This course provided a thorough understanding of the physics governing the vibration of continuous systems
 - For my research, this course was helpful in understanding how multiple vibration modes combine in structures and understand wave propagation in structures
 - The project in this class modeled a micro-cantilever double beam system. This helped me understand the physics of a complex vibrating system.
-

Instructions for Graduate Assessment

Graduate assessment is performed using the following two forms:

- (a) Graduate Outcome Assessment Form, and**
- (b) Graduate Outcome Summary Form.**

A common set of forms is used for both MS and PhD students. Assessment is conducted by each graduate student committee member including the committee chair. *The committee chair is responsible for submitting these forms to the ME office **within 2 working days** of the exam.*

- MS students are assessed only once (at thesis defense or comprehensive exam).
- PhD students are assessed twice (at qualifying exam and PhD dissertation defense).

Graduate Outcome Assessment Form:

Assess the coursework outcomes for each student based on course portfolio provided by the student. Course portfolio is a power point presentation summarizing learning outcomes in 3-4 graduate courses that the student has taken during the program. For PhD students, the course portfolio is assessed once only, at the time of the qualifying exam.

In addition, assess the research outcomes based on MS thesis or PhD qualifying/dissertation defense.

Each committee member must complete this form at the time of the exam.

Graduate Outcome Summary Form:

The graduate student's committee chair must complete this summary form. It provides summary of assessment by all committee members. In addition, this form includes information on conference and journal publications. The Graduate Outcome Assessment Form from each Committee member must be attached to this summary form.

- For PhD dissertation defense, the portfolio scores section is not used and should be left blank.

Submission Instructions:

The committee chair is responsible for returning this package to the ME office within **2 working days** of the exam. Electronic forms should be saved into a single file with the convention StudentLastname_StudentFirstName.pdf in the UA+Box folder: **...\Box Sync\ME Department Upload Folder\Graduate Assessment Forms**

Version: 10/21/2019

Mechanical Engineering: Graduate Outcome Assessment Form to be completed by each committee member.

Student Name: _____

Date: _____

Student CWID #: _____

Select: PhD Dissertation Defense PhD Qualifying Exam MSME Thesis MS Comprehensive

Evaluator's Name: _____ **Select one:** Committee Member Advisor/Chair

Based on your knowledge of this student's work through coursework portfolio, the exam document and presentation, and other sources, please rate this student from excellent to poor regarding the Mechanical Engineering graduate outcomes.

Course Portfolio questionnaire (leave this section blank if this is dissertation defense)	Excellent		Satisfactory		Poor
	5	4	3	2	1
Q1. Demonstrates proficiency in their chosen area of specialization.	Score =				
Q2. Possesses the ability to think critically as well as to analyze and synthesize data.	Score =				

If this is a Thesis Defense or Comprehensive Exam , please answer the following questionnaire	
Q1. Demonstrates competency beyond the B.S. level in either the mechanical systems or thermal systems sub-disciplines.	Score =
Q2. Can solve problems in areas related to mechanical engineering using advanced concepts and techniques.	Score =
Q3. Possesses the ability to examine novel problems and/or situations in areas related to mechanical engineering and research/formulate solutions to these problems and/or situations.	Score =

If this is a Dissertation Defense or Qualifying exam , please answer the following questionnaire	
Q1. Demonstrates proficiency in their chosen area of specialization.	Score =
Q2. Possesses the ability to think critically as well as to analyze and synthesize data.	Score =
Q3. Can apply the knowledge gained during the course of his or her studies to solve novel problems / situations	Score =
Q4. Can perform independent, state-of-the-art research in the mechanical engineering field	Score =

Mechanical Engineering: Graduate Outcome Summary Form

to be completed by Committee Chair

Student Name: _____ Exam type: _____
 PhD Defense PhD Qualifying
 Date of the Exam: _____ MSME Thesis MSME Comprehensive
 Advisor/Chair(s) Name (s): _____
 Enter year for correct graduation semester: Fall _____ Spring _____ Summer _____

In the table below, summarize scores for questions in the Graduate Outcome Assessment Form completed by each committee member including the committee chair. Attach all assessment forms to this summary form.

Name of the Committee Member	Portfolio scores		Thesis /Comp. Exam Qual. Exam/Dissertation			
	Q1	Q2	Q1	Q2	Q3	Q4

In the table below, provide publication details in each category and attach a copy of the first page and citation details for all papers authored or co-authored by the student.

	Refereed Journal	Refereed Conference	Conference	Other
Number published				
Number accepted				
Number submitted				

I certify that the above information is correct, and that (a) the Graduate Outcome Assessment Form from each committee member including the committee chair, and (b) publication pages are attached.

Committee chair signature _____ Date: _____