Mechanical Engineering Program

Policies and Procedures

For M.S. and Ph.D. Degrees in Mechanical Engineering

At the University of California, Merced

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1. Introduction

Mechanical Engineering is a multidisciplinary field that includes the traditional areas of solid and fluid mechanics and the transport phenomena associated with processes related to design, fabrication, and analysis of mechanical devices and systems. Today, Mechanical Engineers develop applications in biomedical, space, energy, materials, computational sciences, and many other fields. The Mechanical Engineering (ME) Graduate Group at UC Merced offers a multidisciplinary research and training program for M.S. and Ph.D.-seeking students who want to be at the forefront of new methods of solving mechanical problems at various length and time scales. Research projects are available on topics ranging from fundamental mathematical methods to advanced applications, and coursework will provide a background in the latest techniques in analytical, computational, and experimental methods in Mechanical Engineering.

2. Program

The graduate emphasis in Mechanical Engineering is dedicated to the education of a new generation of mechanicists and researchers of areas related to mechanical engineering who aim to master the fundamentals of the mechanical sciences -- which include disciplines such as continuum mechanics, fluid mechanics, heat and mass transfer, energy conversion, etc. -- while being exposed to the forefront of research techniques, methodologies and equipment to solve problems that are relevant to modern society (green energy, mechanical modeling and synthesis, robotics and mechatronics, control systems, etc.).

2.1 Admissions Procedures and Requirements

All persons seeking admission to graduate standing must submit a formal application for admission. We encourage applicants to utilize the on-line application to streamline the process. Applications are reviewed by the Admissions Committee, which makes recommendations on admission to Graduate Studies; the Dean of Graduate Studies makes final decisions on admission.

2.1.1 Application Deadlines for Admission

The deadline for receipt of applications is January 15. Normally applications will be accepted for Fall semester only; enrollment in other semesters will be considered on an individual basis, with applications due no later than seven months prior to the beginning of the semester when the student would like to begin graduate studies. Applicants are encouraged to contact individual faculty members to discuss their research interests before applying for graduate study.

2.1.2 Materials to be Submitted

* The complete official application form;
* The application fee;
* All official university/college/junior college transcripts;
* An official Graduate Record Exam (GRE) score report. Only the general tests are required;

* Three letters of recommendation from instructors or supervisors who can comment on the applicant's scholarly ability and promise as a researcher;
* Official score reports from the Test of English as a Foreign Language (TOEFL) or the International English Language Testing Service (IELTS) examination if the applicant's native language or language of instruction is other than English;
* Current curriculum vitae.

Applicants are encouraged to contact individual faculty members to discuss their research interests before submitting a full application.

2.1.3 Admission Criteria

The minimum requirement for graduate admission to UCM is a bachelor's degree with an undergraduate grade point average no lower than 3.0 on a 4.0 scale. This minimum will be waived only under circumstances where the applicant has demonstrated strong academic skills subsequent to their undergraduate studies. Performance on the GRE, accomplishments in undergraduate research, and letters of recommendation are also important determinants of an applicant's potential for success in graduate education and will be evaluated by the admissions committee. Foreign students from non-English speaking countries are required to attain a minimum score of 550 on the TOEFL exam (paper version) or 80 (internet based testing, IBT) **or** a score of at least 7 on the IELTS. Academically qualified students may also be required to complete a telephone or in-person interview with one or more of the ME faculty members. Finally, the match of the candidate's skills and interests to ME research programs will be considered. For this reason applicants are encouraged to contact participating faculty before applying. As a guideline, ME graduate students should have adequate background in Mechanical Sciences, which typically involve higher division classes in Fluid Mechanics, Solid Mechanics, and adequate Mathematics background (Linear Algebra, Differential Equations, Numerical Methods, etc.). A graduate student in ME can be granted conditional admission pending remedial classes.

2.2 General Requirements for Advanced Degrees

2.2.1 Residency

In accordance with SR 682 and 686, the minimum residency requirement for any advanced degree is two semesters. The minimum residency requirement for the Ph.D. degree is four semesters. Before advancement to candidacy Ph.D. students must be registered in regular University courses as a full-time student for at least two semesters. M.S. students must be registered as a full- time student for at least one semester before advancement to candidacy. M.S. students must be in residency for at least one semester after advancement to candidacy before conferral of the degree. For the purposes of determining residency, only the Fall and Spring semester will be counted; however, the summer semester may be counted in evaluating students on academic probation. Residency is established by satisfactory completion of at least 12 units of graduate coursework (including research) per term. Ordinarily, a graduate student shall not receive credit for more than 12 units of graduate courses in any semester. The ME graduate group only accepts full time students. Exceptions will only be granted for students in

the non-thesis Master's Degree program (Section 2.3.1) with the permission of the graduate group Chair, in consultation with the ME Executive Committee.

2.2.2 Scholarship

Graduate students must remain in good academic standing to be awarded an academic graduate degree. A student whose cumulative graduate grade-point average falls below the minimum required, or who is judged not to be making satisfactory progress toward the degree by his or her graduate advisor or faculty committee, will be placed on academic probation. The student will then be allowed a maximum of one semester to make up the deficiencies and be returned to good academic standing (beyond the semester they go on probation). Graduate students who fail to make satisfactory academic progress must be officially disqualified from the university in writing by UCM's Graduate Dean after consultation with the student's Graduate Group faculty. However, in those cases where the student and the Graduate Group mutually agree that the student will terminate their status as a graduate student (e.g., a decision to end graduate study with a Master's Degree or a decision to withdraw from graduate study for other reasons), then the Graduate Group and/or student may independently notify the other of this mutual agreement.

Upon recommendation of academic disqualification, the student's academic record is reviewed carefully by the Graduate Dean in consultation with the student's faculty graduate advisor. Unless there are indications of procedural error or other substantive mitigating factors to explain the student's unsatisfactory record, the Graduate Dean will notify the student of the impending action in writing, and will provide a reasonable opportunity for the student to alert the Graduate Dean as to erroneous information or academic records, to submit other relevant information or comments in writing, or to request a second review of their academic performance. Guidelines for due process requirements and student appeals are described in the UC Merced Graduate Advisor's Handbook.

Specific scholarship requirements are as follows:

1. Only courses in the 100 and 200 series in which the student receives grades of "A", "B", or "S" may be counted in satisfaction of the requirements for advanced degrees. A course in which a student receives a "C" or "D" or lower cannot be used to satisfy the unit requirement for the degree but will count in determining the grade point average.

2. Candidates must maintain an average of at least three grade points per unit in all courses taken during their residence as graduate students at the University of California. Students must maintain an average grade point of 3.0 for advancement to candidacy and conferral of the degree.

3. Courses graded "S/U" will not be counted in determining grade point averages.

4. Students must make satisfactory progress on their programs of study as determined by their graduate research advisor.

2.2.3 Faculty Committees for Advanced Degrees in ME

All students in the ME graduate group must have a graduate research advisor. The student's graduate research advisor (see section 2.4.2), normally in consultation with the student, the graduate group and other faculty, recommends appointment of faculty members to advise on and supervise the student's dissertation research, serve on examination committees, and review and pass upon the merits of the doctoral dissertation. Final approval of the membership on these committees rests with the Dean of Graduate Studies.

Ph.D. degree committees in the ME group typically consist of four members and M.S. degree committees typically consist of three members, although additional committee members are permitted if warranted by the student's research project. One member of the committee is the student's graduate research advisor and the two or more others are UC Merced faculty members in the group (one of whom is appointed as Committee Chair). Under some circumstances one of the committee members can be a UC Merced faculty member from outside the group or a regular or adjunct faculty member from any UC campus or an individual from outside the University of California who has special expertise and qualifications. In this case, the graduate research advisor should submit a brief statement indicating the appointee's affiliation and title and how the prospective appointee has special expertise or qualifications that are not represented on the campus. In addition to the justification letter from the graduate advisor, a curriculum vita and a letter from the proposed appointee indicating a willingness to serve must be submitted to the Chair of the ME graduate group for review and subsequent approval by the Executive Committee. No outside member participation is required for either the M.S. or Ph.D. program committees. However, participation of an external (fourth) member in the Ph.D. defense committee is strongly encouraged.

All members of the committee must be in attendance for the Ph.D. dissertation defense. If a committee member's absence from campus for an extended period of time makes scheduling of examinations unreasonably difficult, the student may request that the committee be reconstituted. Reconstitution of the committee may also be justified by a substantial change in the student's thesis topic or may be required by the departure of a committee member from the university. When membership changes must be made, the graduate advisor in consultation with the student should recommend a new committee member, giving the reason for the change. The change must be reviewed and approved by the Executive Committee.

2.3 Master's Degree

Students may be admitted to the graduate program in ME to work toward a Master's Degree. The recipient of an M.S. degree is understood to possess knowledge of a broad field of learning that extends well beyond that attained at the undergraduate level, but is not necessarily expected to have made a significant original contribution to knowledge in that field. Students may switch from one degree objective to another with the consent of their faculty advisor.

Note: Graduate courses include those offered by ME and those offered by other SOE graduate programs if approved by the faculty advisor.

2.3.1 Requirements

The ME group has established the following requirements for the M.S. degree. Each M.S. student must have a faculty advisor responsible for designing and approving a plan of study detailing all classes to be taken. Two different tracks are recognized:

PLAN I (thesis option)

- Complete at least two semesters of full-time academic residence at UC Merced;
- Complete at least 20 units of letter graded graduate course work;
- Maintain a cumulative GPA of at least 3.0;
- Complete at least 8 units of research in addition to the letter graded course requirement;
- Register for and obtain a Satisfactory (S) grade in one semester of the ME Seminar Course
- Prepare a written thesis describing relevant research in the field that is read and accepted by a committee (see section 2.2.3);
- Defend the M.S. thesis via oral presentation attended and approved by the committee

PLAN II (non-thesis option)

- Complete at least two semesters of full-time academic residence at UC Merced;
- Complete at least 28 units of letter graded graduate course work. No research effort is required in this plan.
- Maintain a cumulative GPA of at least 3.0;
- Register for and obtain a Satisfactory (S) grade in one semester of the ME Seminar Course
- Pass an oral comprehensive examination administered by the faculty committee.

Students may switch from one M.S. plan to another with their faculty advisor's consent.

M.S. Comprehensive Examination (PLAN II)

The M.S. comprehensive examination is a 2-hour oral test and covers the materials of the same topics as the Ph.D. preliminary examination. This is for PLAN II (non-thesis option) only. The test will be given by three members of the ME faculty who will jointly determine the outcome. Possible outcomes are

- Pass- A student has passed when the Comprehensive Examination Committee unanimously votes that the student passed the entire examination with scholarship that is at least acceptable. The committee must report to the Graduate Council via the Vice Provost and Dean of Graduate Education within 30 days. If agreed unanimously by the committee the student may be allowed to make minor modifications prior to submitting the results of the examination.

- Fail- A student has failed when the Comprehensive Examination Committee votes unanimously that the student failed the entire examination. The second examination may have a format different from the first, but the substance should remain the same. A student whose performance on the second attempt is also unsatisfactory, or who does not undertake a second examination within a reasonable period of time, is

subject to academic disqualification. A third examination may be given only with the approval of the Graduate Group committee and the Vice Provost and Dean of Graduate Education.

- Partial Pass- A student has partially passed when the Comprehensive Examination Committee votes unanimously that the student passed some components but failed others. In this instance, the following apply:

    - The student has the option of taking a second examination as detailed above on the components failed; and
    - The chair of the committee must write a letter to the student, with a copy to the Graduate Division, conveying the information about the student's performance (pass, fail, or partial pass) on each of the components covered during the examination.

2.4 Doctoral Degree

The Doctor of Philosophy degree is granted to students who demonstrate a thorough knowledge of a broad field of learning and have given evidence of distinguished accomplishment in that field. The degree also signifies that the recipient has critical ability and powers of imaginative synthesis as demonstrated by a doctoral dissertation containing an original contribution to knowledge in his or her chosen field of study.

2.4.1 Requirements

The Mechanical Engineering (ME) graduate group has established the following requirements for the Ph.D. degree.

Post M.S.
Students entering the program with an M.S. degree must:

- Complete at least four semesters of full-time academic residence at UC Merced;
- Complete at least 12 units of letter graded graduate course work (see section 2.4.3).
- Maintain a cumulative GPA of at least 3.0;
- Register for and obtain a Satisfactory (S) grade in two semesters of the ME Seminar Course
- Serve as a Teaching Assistant (TA) for at least one semester;
- Pass a written preliminary exam to show mastery of fundamental mechanical engineering topics (see section 2.4.4);
- Present a written dissertation proposal and pass an oral qualifying examination in which the proposed research is presented to the dissertation committee (see section 2.4.6);
- Present one open technical seminar or a presentation at a professional conference
- Present and successfully defend a doctoral dissertation containing an original contribution to knowledge in the field (see section 2.4.7).

M.S. and Ph.D.

Students whose degree objective is a Ph.D. but who wish to also receive an M.S. from UC Merced must complete all requirements for an M.S. degree either Plan I or II (see section 2.3.1) in addition to the requirements for the Post M.S. degree described above.

Direct Ph.D.

Students who directly enter the Ph.D. program with bachelor's degree and do not intend to pursue an M.S. degree en route to the Ph.D. must:

- Complete at least six semesters of full-time academic residence at UC Merced;
- Complete at least 32 units of letter graded graduate course work (see section 2.4.3).
- Maintain a cumulative GPA of at least 3.0;
- Register for and obtain a Satisfactory (S) grade in two semesters of the ME Seminar Course
- Serve as a Teaching Assistant for at least one semester;
- Pass a written preliminary exam to show mastery of fundamental mechanical engineering topics (see section 2.4.4);
- Present a written dissertation proposal and pass a an oral qualifying examination in which the proposed research is presented to the dissertation committee (see section 2.4.5);
- Present one open technical seminar or a presentation at a professional conference
- Present and successfully defend a doctoral dissertation containing an original contribution to knowledge in the field (see section 2.4.7).

2.4.2 Selection of Graduate Research Advisor

The heart of the ME Ph.D. program is the completion of a piece of original scientific research leading to the preparation and defense of a Ph.D. thesis. To this end, each student should discuss research interests and possible Ph.D. projects with all faculty in the group as early as possible, and select a graduate research advisor early during the first year of study. Selection of a graduate research advisor must be approved by the graduate group and must occur before the student's faculty committee can be constituted. The student and the graduate research advisor together will develop a research topic, and research will normally occupy a majority of the student's time after the first year of residence. Interdisciplinary projects are highly encouraged, as are research collaborations with faculty or senior scientists outside UC Merced. However, the graduate research advisor must be a member of the ME group. Students will be assigned an initial advisor when they first enroll, unless the student has already chosen an advisor.

2.4.3 Coursework Requirements

No courses are uniformly required for all ME graduate students. They are *expected* to take courses in fundamental mechanical engineering concepts to ensure that the student is prepared to take the qualifying examination and *required* to take graduate courses in their chosen research area.

2.4.4. Ph.D. Preliminary Examination

All students in the ME Ph.D. program are required to pass a written preliminary examination before beginning to prepare for the research proposal and qualifying examination. Students are encouraged to take the examination at the end of their first year of study, but are required to take it within the first two years of graduate student unless they successfully petition the graduate group chair. The preliminary examination will be offered and administered by the ME Graduate Group during the spring break each spring semester. A student wanting to take the exam must sign up for it with the ME Graduate Group no later than 4 weeks before the final day of classes of the semester before the exams will be taken.

The preliminary examination will cover undergraduate core material from three out of six ME focus areas:

1. Thermodynamics
2. Fluid Mechanics
3. Heat Transfer
4. Dynamics,
5. Controls
6. Solid Mechanics

The candidate may choose freely, which three focus areas he/she wants to include in the preliminary examination.

The examination will consist of open-ended questions (minimum of two questions in each of the three chosen focus areas) to be posed and graded by a committee of ME faculty members familiar with the field. The format will be a 6-hour examination.

The examination will be followed by a ME Group faculty meeting, evaluating the performance of the candidate, and promptly thereafter the results of the examination will be submitted to Graduate Studies. Possible outcomes for each of exam taken one of the focus areas are Pass or Fail. Based on these results, a committee of ME faculty members will discuss a student's overall exam performance and make a determination of one of the possible outcomes:

- Pass- A student has passed when the Preliminary Examination Committee unanimously votes that the student passed the entire examination with scholarship that is at least acceptable. The committee must report to the Graduate Council via the Vice Provost and Dean of Graduate Education within 30 days. If agreed unanimously by the committee the student may be allowed to make minor modifications prior to submitting the results of the examination.

- Fail - A student has failed when the Preliminary Examination Committee votes unanimously that the student failed the entire examination. This can occur if the overall performance on the exam is such that the committee does not judge that a retake would reflect better performance. Or, an outcome of Fail applies for a student whose performance on a second attempt of an exam is unsatisfactory, or who does not undertake a second examination within one year of the initial attempts. In either case, the student is subject to academic disqualification. A third examination may be given

only with the approval of the Graduate Group committee and the Vice Provost and Dean of Graduate Education.

- Partial Pass- A student has partially passed when the Comprehensive Examination Committee votes unanimously that the student passed some components but failed others. In this instance, the following apply:
    - The student has the option of taking a second examination, consisting only of the focus areas that were not passed the first time; the second examination may have a format different from the first, but the substance should remain the same.
    - The chair of the committee must write a letter to the student, with a copy to the Graduate Division, conveying the information about the student's performance (pass, fail, or partial pass) on each of the components covered during the examination.

The ME Graduate Group should include in their evaluations of the student such factors as relevant portions of the previous academic record, performance on the examination, and an overall evaluation of the student's performance and potential for scholarly research as indicated during the examination. Once a majority decision has been reached, the ME Graduate Group chair shall inform the student of its decision in one of the forms listed above.

2.4.5 Research Proposal and Ph.D. Qualifying Examination

After a student has completed all coursework and passed the ME Preliminary Examination, they are ready to prepare for the research proposal and qualifying examination. Before the qualifying examination, the student will provide to the degree committee a written dissertation proposal that describes his or her research topic, summarizes progress to date, and outlines what he or she proposes to do, why it is relevant, and what will be learned. The dissertation committee will receive this document no later than 2 weeks before the scheduled qualifying examination, which will include two parts: presentation of the proposal related to thesis research, and a structured oral examination. The student must be registered the semester of the exam.

2.4.6 Advancement to Candidacy

Upon successful completion of the Research Proposal and Ph.D. Qualifying Examination the student will fill out and submit an application for advancement to candidacy. After the application is signed by the graduate research advisor and graduate group chair, the student pays a candidacy fee and submits the form to Graduate Studies. Upon advancement to candidacy for the degree, the faculty committee is then charged to guide the student in research and in the preparation of the dissertation.

2.4.7 Dissertation and Defense

The Ph.D. dissertation must be creative and independent work that can stand the test of peer review. The expectation is that the material will serve as the basis for publication(s) in a peer-

reviewed journal. The work must be the student's, and it must be original and defensible. The student is encouraged to discuss with members of the faculty committee both the substance and the preparation of the dissertation well in advance of the planned defense date. Detailed instructions on the form of the dissertation and abstract may be obtained from the Graduate Studies office.

The student must provide a copy of the dissertation to each member of the faculty committee and allow each committee member at least four weeks to read and comment on it. If one or more committee members believe that there are significant errors or shortcomings in the dissertation or that the scope or nature of the work is not adequate, the student must address these shortcomings before scheduling a defense. Once the committee members are in agreement that the dissertation is ready to be defended (although minor errors or matters of controversy may still exist), the final examination date may be scheduled by the student in consultation with the committee. The date must be reported to the Dean of Graduate Studies, and one copy of the dissertation filed, no later than three weeks before the proposed date of the final examination.

The Ph.D. final examination consists of an open seminar on the dissertation work followed by a closed examination by the faculty committee. During the examination, the student is expected to explain the significance of the dissertation research, justify the methods employed, and defend the conclusions reached. At the conclusion of the examination, the committee shall vote on whether both the written dissertation and the student's performance on the exam are of satisfactory quality to earn a University of California Ph.D. degree. A simple majority is required for a pass. Members of the committee may vote to make passing the exam contingent on corrections and/or revisions to the dissertation. In this case, the committee will select one member, normally the graduate research advisor, who will be responsible for approving the final version of the dissertation that is submitted to Graduate Studies. All members of the degree committee must sign the final dissertation.

2.5 Time to Degree and Annual Evaluation of Progress

The ME Graduate Group places a nominal time limit of two years from entrance to completion of the M.S. and five years for completion of the Ph.D. Extensions beyond these limits can be permitted by the Executive Committee.

In order to ensure satisfactory progress toward the degree, each student must meet with his or her faculty advisor for an annual review of progress at a mutually agreeable time prior to the first day of each Fall semester. This review will include analysis of the student's progress toward the degree during the past year and development of a timetable for completion of the remaining requirements. The outcome of the annual review will be documented and will become part of the student's record. In addition to annual reviews with the advisor, students are encouraged to obtain regular feedback from their committee members. Thesis committees are an important resource for providing feedback on progress toward a degree, and review meetings with some or all of the committee members are recommended.

Should the committee conclude that the student is not making satisfactory progress toward the degree, the student may be placed on academic probation as described under “Scholarship” above (Section 2.2.2)