

Colorado State University

**Department of
Mechanical Engineering**

***GUIDELINES
FOR
GRADUATE STUDY
IN
MECHANICAL ENGINEERING***

2009-2010

Rev. 08.20.09

Introduction

Graduate study in mechanical engineering at Colorado State University (CSU) is intended to bring together faculty members and graduate students in a community of scholars having a common interest in advanced professional study and creative work. The program seeks to cultivate the spirit of intellectual independence and provide the opportunity for extending the boundaries of the mechanical engineering profession. The main areas of emphasis are Energy Conversion; Bioengineering; Laser Applications, Materials and Plasmas; Motorsport Engineering and Industrial Systems.

Advisers

An initial academic adviser is automatically assigned to every student who enters the graduate program. This adviser supervises the course work that the student takes until the student sets up a graduate committee with a formal adviser. It is appropriate for the academic adviser and the student to set forth a course work plan for the student that covers the entire range of the student's degree. This should be discussed before the first semester of work is begun. This plan should be considered as tentative and is meant to provide direction and guidance for the student.

The initial academic advisers are:

Academic Advisers

Prof. David Alciatore
Prof. Thomas Bradley
Prof. Prasad Dasi
Prof. William Duff
Prof. Patrick Fitzhorn
Prof. Douglas Hittle
Prof. Susan James
Prof. Allan Kirkpatrick
Prof. Mani Manivannan
Prof. Anthony Marchese
Prof. Daniel Olsen
Prof. Ketul Popat
Prof. Christian Puttlitz
Prof. Xianghong Qian
Prof. Donald Radford
Prof. Hiroshi Sakurai
Prof. W.S. Sampath
Prof. Steven Schaeffer
Prof. Wade Troxell
Prof. Paul Wilbur
Prof. John Williams
Prof. Bryan Willson
Prof. Azer Yalin

Area

Mechatronics
Complex Transportation and Sustainable Energy Systems
Fluid Dynamics, Biomedical Engineering
Solar Water Purification and Industrial Engineering
Motorsports, Vehicle Dynamics
HVAC Control Theory
Biomedical Engineering – Biomaterials/Biomechanics
Computational Fluid Dynamics
Advanced Materials in Solar Cells and Lithium Batteries
Engines – Combustion and Pollutant Formation
Engines and Energy Conversion
Micro/Nano Technology in Orthopaedic Materials
Biomedical Engineering
Biomedical Engineering
Composite Materials, Motorsports
Geometric Modeling and Computational Fluid Dynamics
Photovoltaic Cell Manufacturing
Rapid/Flexible Tooling, Casting
Intelligent Control of Networked Distributed Resources
Broad Beam Ion Sources
Plasmas and Ion Thrusters
Engines - Optical Combustion Diagnostics
Laser Diagnostics and Atmospheric Plasmas

The Graduate Committee

To guide and supervise a student's progress in graduate studies, a graduate committee must be selected before the end of the student's **second** semester of study. This committee is composed of your adviser (Mechanical Engineering Professor) and other CSU professors. The committee will conduct preliminary (Ph.D.) and final (M.S. and Ph.D.) examinations, make regular evaluations of the student's progress, and conduct the thesis or dissertation defense.

- For **Master's of Engineering (M.E. Plan C)** an adviser is required, but no thesis or committee.
- For **Master's of Science (M.S. Plan A)** the committee must include an adviser, another mechanical engineering professor and a professor from outside the mechanical engineering department.
- For **Doctoral** students, the committee must include an adviser, two other mechanical engineering professors, and a professor from outside the mechanical engineering department.

Committee meetings should be held periodically to review a student's progress. It is the student's responsibility to arrange a time and a place for all committee meetings. Rooms may be reserved through the department administrative assistant.

Program of Study

Due to varying backgrounds and interests, specific courses for a program are chosen by the student and his/her graduate committee. Students without an undergraduate degree in mechanical engineering will follow the guidelines for non-BSME students. Depending on their academic background, these students may be admitted as second bachelor's students. At present, there are no specific course requirement for the M.S. or Ph.D. degrees. Submitting the program of study on the **GS6 Form** at the earliest possible date is advantageous to all concerned, especially the student and the committee members. The student, the student's adviser and co-adviser (if applicable) must sign the program of study. Students will confirm the outside committee member's willingness to participate prior to submitting the program of study. Programs need not be regarded as final in every respect, however, any changes made in the course selection will require adviser approval on the **GS25 Form**, which is the application for graduation that is generally submitted the semester before the student plans to graduate. Committee member changes will be made on the **GS9A Form** and also must be approved by the adviser and the committee members who are added or removed.

Thesis and dissertation work requires students to become involved in the research activities of the faculty for problems that are of a very challenging and stimulating nature. In addition, the student will have the opportunity to learn more about a particular problem than is learned in the classroom setting. Graduate students will typically register for three formal courses each term, so that four terms will usually be required to complete the Master's Degree, and a subsequent eight terms will usually be required to complete the Doctor of Philosophy Degree. Students are encouraged to write journal and conference articles during their research. These articles may be appropriately incorporated as chapters in theses and dissertations.

The minimum full-time course load for graduate students is nine (9) credits per semester. In cases where a graduate student is not registering for classes but is continuing his/her research, registration in the program must be kept current by registering for **Continuous Registration (CR)** through RamWeb. **Students must register for CR the semester they plan to graduate**, regardless of whether they have completed the degree requirements. **Students who fail to register for CR will not be allowed to graduate that semester.** If this occurs, students must reapply for graduation, apply for readmission, and pay a \$150 fee.

Courses to be applied towards the requirements for the Master's and Doctoral degrees, including any transfer credits from other institutions, must have been completed within the ten (10) years immediately preceding the date of completion of the final CSU degree. All transfer classes are submitted with the program of study on the **GS6 Form**. Eligibility requirements apply. The Graduate School will notify the student by email when the GS6 Form has been approved, meaning that the recommended committee is satisfactory, the transfer of credits is completed, and the program of study is acceptable.

Requirements for the Master of Science Degree

Plan A - Thesis

- Minimum of 30 semester credits of graduate work in approved course of study
- Minimum of 24 semester credits earned at CSU (21 while in graduate program)
- Minimum of 18 semester credits earned at CSU in 500 level (and above) regular courses (does not include thesis, independent study or supervised teaching credits)
- Thesis credits (a minimum of 6 and a maximum of 12 credits)
- Final thesis defense

Thesis: A properly typed, acceptable thesis must be submitted to the student's committee **at least one week** before the final examination. The candidate must submit to the Graduate School two unbound copies (on non-acid bond paper) of the thesis by the specified dates. Exact dates are available each semester from the Graduate School web page. The student must also submit one electronic copy in .pdf format to the mechanical engineering graduate program coordinator to be stored by the department. Guidance for preparation of the thesis may be found in the "Thesis Manual" found on the Graduate School web page.

Final Thesis Defense: The student and the committee determine the specific format of the thesis defense. The defense is given at the end of the Master's Degree program. The Master's defense is most often an oral presentation that is similar to the Ph.D. preliminary examination, but is reduced in scope, is oral only and the questions are oriented more towards applications. The defense is open to all members of the mechanical engineering faculty and the student population. It is the student's responsibility to notify the graduate program coordinator of the time and place of the defense. The coordinator will announce the defense to the faculty and graduate students.

The mechanical engineering graduate program coordinator will provide the adviser with the student file and the **GS24 Form** to take to the final examination. The form is also available online or in the mechanical engineering department office. The committee members will sign the form at the end of the examination.

The student is required to provide the graduate program coordinator with a copy of the completed and signed GS24 Form and to file the signed original with the Graduate School within 2 days following the examination.

Requirements for the Master of Engineering Degree

Plan C - Regular Coursework (no thesis)

- 30 credits of regular coursework (no thesis, independent study or supervised teaching credits)
- Minimum of 21 semester credits earned while in the graduate program at CSU
- Minimum of 24 credits of courses that are 500-level and above
- Minimum of 15 credits of mechanical engineering courses (must have prefix MECH)
- Adviser required but no graduate committee required

Please note that "mechanical engineering" is a specialization of the College of Engineering Plan C degree and is therefore only printed on the transcript and not on the diploma.

Requirements for the Doctor of Philosophy Degree

- Minimum of 72 semester credits of graduate work in approved course of study (42 credits beyond the master's degree)
- Minimum of 32 semester credits in the graduate program after admission to CSU
- 10 credits earned after the Master's degree may be accepted for transfer credit with approval from the adviser, the department, and the Graduate School
- 21 credits beyond the master's degree must be earned in courses numbered 500 and above. 12 credits must be in regular courses (**in addition to** courses applied to the master's degree and **not including** dissertation, independent study or teaching credits). For students enrolled in a continuous master's/Ph.D. program, all courses taken during the master's program may be applied to the doctoral degree even if the total master's degree credits exceed 30. For students who do not submit a master's degree in partial fulfillment of the requirements for the Ph.D., at least 62 credits must be earned at CSU and at least 37 credits beyond the bachelor's degree must be earned in courses numbered 500 or above.
- Written Diagnostic Examination
- Ph.D. Preliminary Examination
- Ph.D. Dissertation Defense (Final Examination)
- Dissertation credits (a maximum of 30 credits of the 42 required beyond the master's degree)
- Dissertation

The above coursework outlines the minimum requirements. Additional coursework may be required by a particular program and/or a student's committee. The dissertation is a major effort in which the doctoral candidate undertakes a program of work, which will result in a significant contribution to the major field of one's own interest. In general, such a program will involve consideration of a challenging problem utilizing analytical, experimental, and/or design techniques. The objective, on the one hand, may be to determine and explain the behavior of a simple system, or on the other, to bring into logical order the techniques of a field which has suffered random growth. The results of the dissertation will be new analytical knowledge, design knowledge, experimental knowledge, or a combination of these. Whatever its nature, the dissertation topic must provide an opportunity for the candidate to make an original contribution to the field.

Ph.D. Written Diagnostic Exam

Purpose: To test the candidate's graduate level understanding of undergraduate topics in mechanical engineering and to determine the candidate's "breadth" of knowledge. The candidate must pass in two topical areas as listed below. Based on the results of the exam, the student may be required to take additional courses to strengthen their Mechanical Engineering background.

Scheduling: The exam must be attempted during the student's first two semesters in the program. Students entering the Ph.D. program directly from a Bachelor's degree will be allowed to take the exam during their third semester. Students may only attempt the diagnostic exam twice. In the event the diagnostic exam is failed, at the discretion of the department, it may be attempted again the next time the exam is offered. Student must submit the "Intent to Take Written Diagnostic Exam" form by mid-September to take the exam in the fall semester, and by mid-February to take the exam in the spring semester. The two topical areas shall be specified on the form. The "Intent" form, instructions and requirements are online under the "Resources" tab at http://www.engr.colostate.edu/me/pages/grad_about.html.

Students are required to demonstrate competency in two of the following topical areas:

- 1) Energy & Thermal Sciences
- 2) Mathematics
- 3) Mechanics of Solid Bodies & Materials
- 4) Moving Systems

Ph.D. Preliminary Examination

Purpose: The purpose of the preliminary examination is to determine the candidate's background knowledge in the proposed dissertation area and to determine the adequacy of the current research plan. Upon successful completion of the exam, the committee and student have an outline of the research plan and expectations for the student's dissertation.

Scheduling: Students are expected to take this exam after an extensive literature review in the area and collection of preliminary data. At the time of the exam, the student must have already selected a major professor and a graduate committee, and must have been working with the major professor on the definition of the research leading to the dissertation. The student has a maximum of two opportunities to pass the exam. The preliminary exam must be completed at least one calendar year prior to the final dissertation defense. It is advised that the student complete the preliminary exam within a year after successfully completing the diagnostic exam.

Procedure: The student must provide a written research proposal to each member of the committee and the graduate program coordinator at least two weeks prior to the exam date. This written research proposal must include a detailed survey of the supporting literature. Any Mechanical Engineering faculty member can request a copy of the proposal before the examination. The student must also provide the graduate program coordinator with the scheduled date, time and location of the exam two weeks prior to the exam date. The graduate program coordinator is responsible for announcing the exam to faculty, staff and graduate students.

The written research proposal must include a detailed survey of the supporting literature. The exam will consist of the student's presentation of the research proposal, questions by the committee to further assess the preparedness of the student to continue, followed by analysis of the proposal by the student's committee with recommendations for changes in the plan. The student and adviser will prepare a rough outline of the changes to the research plan suggested by the committee in the preliminary exam that will be added to the student's file. The student's adviser will be responsible for bringing the student's folder to the exam.

Results: By completing and signing the **GS16 Form**, the committee shall:

1. Pass: recommend the student advance to Ph.D. candidacy and accept the research plan as agreed to by the committee during the exam
2. Fail: Recommend that the student take the preliminary examination again, if the student's research plan or background knowledge is unacceptable but the committee feels that the potential exists for satisfactory performance
3. Terminate: Recommend the student be terminated from the Ph.D. program

Within 2 days following the examination, the student is required to submit the Report of Preliminary Examination (GS16 Form) to the Graduate School.

Ph.D. Dissertation Defense

Purpose: The purpose of the dissertation defense is to allow faculty members and the public to examine critically and comment on the dissertation work and its significance and contribution to the literature.

Scheduling: Upon completion of the research, the candidate must furnish to each committee member a preliminary copy of the dissertation at least two weeks before the scheduled date of the Ph.D. dissertation defense (final examination). After careful study and possible conferences with the candidate and other committee members, each member will make a recommendation as to the scheduling of the final defense. Upon majority approval of the committee, the candidate may schedule the dissertation defense. It is the student's responsibility to notify the mechanical engineering faculty of the date and location of the dissertation defense.

Common courtesy to both the candidate and committee dictates that the committee be given two weeks to reach a decision on the acceptability of a student's dissertation. In the event that the candidate does not receive approval to schedule the public defense, the committee must make further suggestions to the candidate.

Procedure: Final examinations are open to the public and are conducted in a formal and professional manner. The student's faculty adviser is responsible for bringing the student's file with necessary forms to the defense. To begin the presentation, the candidate is introduced by the adviser. The candidate then presents the findings of the doctoral research to the committee and to the public. After the presentation, questions are invited from all present.

Results: Upon completion of the public question and answer period, the committee members and other members of the mechanical engineering faculty who are present at the defense will go into closed session. The committee members will decide whether to accept or reject the dissertation. If the dissertation is accepted, the committee members will sign the **GS24 Form**. If the dissertation is rejected, the committee members will make appropriate recommendations to the student, who must complete the required revisions. Another dissertation defense may or may not be scheduled, based on the decision of the committee.

Quality of Work

Any student not making satisfactory progress as determined by his or her graduate committee, or whose cumulative grade point average is less than B (3.0), shall be automatically placed on academic probation. Newly admitted students will not be placed on probation until after completion of 12 credits or two semesters, whichever comes first.

A student's individual graduate committee or the department graduate committee may recommend immediate dismissal upon finding that the student is making unsatisfactory progress toward the degree and that satisfactory progress cannot reasonably be anticipated. Such a recommendation must be documented in writing with substantive justification for this action in lieu of probation. It must be referred to the department head for approval and the dean of the Graduate School for final action. The student may appeal such an immediate dismissal through the existing Graduate School grievance procedure. Otherwise, the student must improve his or her cumulative grade point average to at least 3.0 in the semester following probation or face immediate dismissal and/or make satisfactory progress as determined by the student's graduate committee.

In special studies, departmental seminars, and research, students must earn an S, or average B or better. Averages in the category of formal course work and in the category of research, special studies and seminars are determined independently. Additionally, the Department of Mechanical Engineering may choose to place the student on probation for falling below a 3.0 average, in either area, in any single semester.

To be eligible for graduation, a student must maintain at least a B average (3.0 GPA) in formal course work and satisfactory grades in research, special studies and seminars included in the program of study. Supervised teaching credits do not count towards the number of credits needed for graduation. Work graded D, F, and U will not be accepted toward degree requirements. Grades of I (incomplete) must be replaced with appropriate letter grades within twelve months or the credits involved will not be accepted toward degree requirements.