MAE Graduate Student Handbook

General Procedures and Guidelines

Clarkson University
Department of
Mechanical and Aerospace Engineering

Fall 2022
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INTRODUCTION
This handbook contains the degree requirements for graduate programs in the Mechanical and Aerospace Engineering (MAE) Department at Clarkson University.

It is the responsibility of the degree candidate, working in conjunction with his/her faculty advisor, to choose a plan of study, including coursework and thesis/project work that will lead to the completion of a graduate degree. The student should read these requirements carefully and become familiar with the requirements for his/her degree.

Also contained in this handbook are directions with regards to the various forms that must be completed for M.S. Non-Thesis projects, M.S. theses and Ph.D. dissertations. The student should become familiar with this information and insure that all of the forms are completed in a timely manner and that proper procedures are followed for completing his/her thesis or dissertation.
The departmental graduate program in Mechanical Engineering is structured to provide the student with a series of goals to be attained in an orderly fashion throughout the course of study. The ultimate goal in this sequence is the granting of the Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) degree, following a successful completion of the program. The general requirements of the Graduate School are described in the university catalog. The formal requirements for the M.S. and Ph.D. in Mechanical Engineering are set forth as follows:

I. Requirements for the M.S. Degree

All requirements satisfy University requirements:
https://www.clarkson.edu/graduate/mechanical-engineering (Consult Clarkson Catalog for complete details)

MECHANICAL ENGINEERING DEPARTMENT REQUIREMENTS

A. Prerequisites:
1. BS in engineering or equivalent. Students applying from other disciplines will be handled on a case-by-case basis. Those students who are not fully prepared to pursue graduate work in engineering may be required to take additional courses for which graduate credit will not be given. Admission to the M.S. program will be given only after the required prerequisite coursework has been completed.

B. Requirements:
1. Course work
   a) 18 credits of course work. Clarkson may grant permission to transfer up to 10 graduate credit hours from an undergraduate degree. With approval of the Dean of the Graduate School, a maximum of 12 credit hours may be granted. The student must have passed the graduate course(s) with a minimum grade of B (or equivalent).
   b) 2 credits of seminar
   c) One credit of ME614 or ME616 may be replaced by ES 542 – Fundamentals of Research and Graduate Study
   d) At least two of the courses must have an ME designation.
   e) At least one course must be a mathematics course. The following is a list of suggested courses:
      Any 500 level or higher math course (MA designator)
      CH561 Chemical Engineering Analysis
      ME515 Finite Element Methods
ME529 Stochastic Processes in Engineering
ME554 Continuum Mechanics

A good first class to take is CH561 Chemical Engineering Analysis. Other courses may also be acceptable with the written approval of the MAE Graduate Committee.

f) No more than two courses may be selected from the following group
ME591 Selected Topics in Materials Engineering
ME594 Selected Topics in Manufacturing
ME618 Selected Topics in Heat Transfer
ME628 Special Topics in Fluid Mechanics
ME657 Selected Topics in Solid Mechanics

2. Research/Project credits

Either:

a) 10 credits of ME 614 – Thesis/Dissertation with a MAE faculty advisor

b) All students must complete a thesis and defend it orally to a committee consisting of a minimum of three Clarkson faculty members. The committee must be approved by the MAE Chair and CSOE Dean using the CSOE Graduate Committee Appointment form. The committee should be approved before the second semester of graduate study.

or

c) 4 credits of ME 616 – Special Projects with a MAE faculty advisor

d) 6 credits of additional course work

e) All students must complete a project with a written report approved by the Chair of the graduate committee. With the faculty advisor’s approval, students enrolled in industrially sponsored distance learning programs may accomplish 7 credits of project work and 21 credits of course work.

or

f) By permission of the graduate committee chair, exceptional students may be allowed to proceed directly to the Ph.D.; such students will be awarded the M.S. upon completing 40 credit hours and passing the doctoral candidacy procedure (qualifying exam and proposal defense).

The M.S. student has the option of continuing towards a Ph.D. degree if accepted into the Ph.D. program by the MAE Graduate Committee.
II. Requirements For the Dual M.S./M.B.A. Degree

Detailed information on the dual MS Non-Thesis/MBA Program is available at http://www.clarkson.edu/engineering/graduate/ME_MBADualDegreeOption.html

MECHANICAL ENGINEERING DEPARTMENT REQUIREMENTS

A. Prerequisites:
   1. BS in mechanical engineering or equivalent

B. Requirements:
   1. During the first year the student completes M.S. degree
      a) Requirements for the M.S. degree are listed above, under item I.
   2. During the second year the MBA requirements are completed
      a) Check with the School of Business for the most recent requirements
III. Requirements for the Ph.D. Degree

All requirements satisfy University requirements: https://www.clarkson.edu/graduate/mechanical-engineering (Consult Clarkson Catalog for complete details)

MECHANICAL ENGINEERING DEPARTMENT REQUIREMENTS

A. Prerequisites

1. MS in engineering or equivalent. Students applying from other disciplines will be handled on a case-by-case basis.

B. Requirements:

1. Course work
   a) All coursework must be mutually agreed upon by the student and advisor.
   b) A minimum of 39 credit hours of course work must be completed. Students may transfer in up to 30 credits of research and course work from an MS degree, with a grade of B or better. A graduate transfer credit/waiver request form must be approved by the graduate committee chair and department chair. For instances where no equivalent Clarkson University course exists, but the advisor deems the course worthy of transfer, a Special Graduate Topics course number may be used; e.g., ES 999, CM 999, CH 999, etc.
   c) No more than four courses (inclusive of courses transferred for the M.S. degree) may be selected from the following list. Previous Selected Topics courses taken to satisfy the MS degree requirements do not count against this restriction.
      ME591 Selected Topics in Materials Engineering
      ME594 Selected Topics in Manufacturing
      ME618 Selected Topics in Heat Transfer
      ME628 Special Topics in Fluid Mechanics
      ME657 Selected Topics in Solid Mechanics
   d) 6 credits of seminar
   e) At least two additional ME courses beyond the M.S. degree course requirements (part of the 39 course credit hours required).

C. Graduate Committee Selection (within the first year of study)

1. In order to provide guidance to Ph.D. students, a Degree Committee must be selected within one year of entry into the Ph.D. program and prior to the student’s Research Proposal defense. In consultation with the student, the Committee will be selected by the student's Major Professor, who also serves as the dissertation advisor. Approval
for the Degree Committee must be obtained from the MAE Department Chair and the Dean of the Graduate School.

The Committee will consist of a minimum of five members, of which a minimum of three must be faculty members from Clarkson's MAE Department and at least one must be from a department at Clarkson other than MAE. With the approval of the Provost, the fifth member may be any person with appropriate credentials from either inside or outside the University. This Committee will judge the technical competence of the Research Proposal, the dissertation and other oral presentations. With the Provost’s approval, additional Committee members may be appointed from outside the faculty as necessary.

D. Qualifying Examination (within the first year of study, and after choosing the Graduate Committee)

1. Both a written and oral qualifying examination based on general preparation in the major field must be taken at the first offering after the student completes one semester in the Ph.D. program. M.S. students may take the exam one time prior to completion of their M.S. thesis with written permission from their advisor. The written exam will be offered in January, with the oral portion to be scheduled no less than one week after completion of the written exam.

2. If a Ph.D. student fails any portion of the exam, studies cannot proceed until approval is obtained from the Department Chairman and from the Dean of the Graduate School. If a Ph.D. student fails the qualifying exam twice, the student will be dropped from the Graduate School.

3. The written qualifying examination is comprised of two separate exams:
   a) Mathematics – all students must take this exam. Subject areas will include:
      • Integrals of delta/heavyside functions
      • Integration by parts, chain/product rule, Leibniz theorem, limits
      • Line and surface integrals, complex integrals and contour integration
      • Vector identities, indicial notation
      • Divergence/Green's theorem
      • Laplace transforms and applications
      • First order ODEs:
        o linear constant coefficient inhomogeneous systems
        o separable
        o dimensionless
      • Second order ODEs:
        o constant coefficient homogeneous
        o Green's functions
      • PDEs:
        o Separation of variables for steady and unsteady problems
Similarity solution
- Fourier solution
  - Linear algebra, eigenvalues/eigenvectors
  - Taylor and Fourier series
  - Calculus of variations
  - Lagrange multipliers
  - Numerical approximation: interpolation, integrals, derivatives

b) Subject exam – all students must take one subject exam

(1) Each subject exam has 3 major areas.
   The advisor will identify the subject and major area of the exam that the student will take. Students must notify the graduate committee chair of the subject and major area of the qualifying exam that they will take before the October 31 that precedes the January examination date.

(2) The subjects and associated major areas are:
   - Thermal Sciences (Fluid Mechanics/Thermodynamics/Heat Transfer)
   - Material Science (Solid Mechanics/Materials/Manufacturing)
   - Dynamics (Rigid Body Dynamics/System Dynamics/Vibrations/Orbital Mechanics) – Students will pick three of the four topics.

c) A total of 2 problems will be assigned for each major area. Students must answer both questions within their major area, and one question from either of the two remaining areas.

d) The problems will be open-ended, requiring students to draw upon various aspects of the major area. Grading will focus on the student’s ability to formulate a solution by making the necessary assumptions, applying appropriate equations/analysis, and reaching a reasonable answer.

4. Oral Exam

a) No less than one week after the written exam is completed, an oral exam will be administered. The oral examining committee will consist of at least the student’s research advisor and two members of the graduate committee.
   The student will be given the opportunity to explain their approach/justification for how they solved the problems on the written portion of the exam. The committee will also question the student to evaluate their decision-making process on the written portion of the oral exam. This is an opportunity for the committee to probe the level of understanding of the student, and also for the student to make-up for mistakes they may have made on the written portion. As such, students should be prepared to justify their solution approach, as well as explain what they would do differently, and how, if they were to answer the problems.
E. Research Proposal Defense Examination (within 24 months, and after passing the qualifying exam)

1. A formal written and oral presentation of a research proposal must be made to the Degree Committee within two years after enrollment in the Ph.D. program. It is also required that the written and oral proposal be completed at least one year prior to the completion date of the research work. The primary purpose of the research proposal defense examination is to provide an opportunity for the Degree Committee to evaluate the technical competency of the student and the scientific merit of the proposed research, and to make critical but constructive suggestions regarding the proposed work. The written proposal may be brief, but must clearly describe the justification for the work (i.e., an introduction), the research methods/analysis to be performed (i.e., methods), research performed to date (i.e., preliminary results), and the proposed research plan that will carry the student to completion. It is required that the proposal be distributed to the Degree Committee at least one week prior to the formal presentation. The oral presentation should provide an overview of the written proposal. The Degree Committee must approve the written and oral research proposal for successful completion of the proposal defense examination.

Note: A student is considered a Ph.D. candidate after passing both the Qualifying and Research Proposal Defense Examinations.

F. Examination on the Dissertation

1. Before the final dissertation examination can be taken, the candidate must submit at least two peer-reviewed research articles to academic journals. At the time of the examination, these papers must be either under review or accepted by the journal.

2. A final dissertation based on independent research must be written, and an examination must be passed. The written dissertation must be sent to the Graduate Committee members at least two weeks prior to the examination date. The final dissertation examination will include, as a minimum, an oral examination based on the dissertation. The candidate must give a presentation and defend his/her dissertation. The Degree Committee and the Dean of the Graduate School must approve the dissertation.

3. The candidate must submit an announcement flyer to the MAE Graduate Coordinator at least one week prior to the dissertation examination. Prior to submission, the flyer must be approved by the advisor.

G. 10. The chronological sequence and corresponding administrative responsibilities are listed in the following table:
<table>
<thead>
<tr>
<th>Task</th>
<th>Forms to be completed</th>
<th>Required signatures</th>
<th>Time frame</th>
</tr>
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</table>
| Qualifying Exam                             | Memo from the Graduate committee to the Graduate coordinator | 1. MAE Graduate Committee Chair  
2. Dean of graduate school                                                            | Must take the first offering after completing one semester of study        |
| Selection of Degree Committee               | Graduate Committee Appointment          | 1. Department chair  
2. Dean of graduate school                                                            | Within first year, and prior to completing the Research Proposal          |
| Approval of Research Proposal               | Ph.D. Candidacy Procedure Completion Notice | 1. Degree committee  
2. Dean of Graduate School                                                            | Within 24 months of matriculation into the Ph.D. program. (Part time students see note 3) |
| Approval and completion of dissertation     | See https://www.clarkson.edu/graduate-admissions/current-students/completion-information | 1. MAE Graduate Committee Chair  
2. Degree Committee  
3. Dean of Graduate School                                                            | At least 1 year after the research proposal, but within 7 years of becoming a PhD candidate |

NOTES:
1. Final copies of accepted dissertations or thesis must be received by the Graduate School no later than ten working days before commencement to qualify a student to receive a degree at the end of the spring semester (May commencement). This date is published each semester by the Provost’s office. Graduating students should check this date.
2. The copy of the thesis or dissertations must be distributed to the members of degree committee at least two weeks before the date of oral examination.
3. For part time students, the 24 month rule is replaced by “before 33 credit hours are completed toward the Ph.D.”
IV. Thesis Advisor

A. The thesis/project advisor for M.S. Non-Thesis, M.S. Thesis, and Ph.D. students in Mechanical Engineering must be a full time mechanical and aerospace engineering faculty member. A faculty member from another department who has a courtesy/research appointment in MAE Department could co-advice a mechanical engineering student with a full-time departmental faculty.

B. New graduate students with TA support will be assigned advisors based on their research interests and those of the faculty that qualify for a TA position. Students should meet with every MAE faculty member and indicate their four choices of faculty. This is done using the Research Meetings with MAE Faculty” form available in the MAE Department (257 CAMP).

V. Additional Considerations

A. For a graduate student to continue a minimum of B average is required. A graduate student who obtains more than two C or lower grades (although he/she may have a B average) will be subjected to a MAE Graduate Committee review before the student is allowed to continue. The Graduate Committee will request bi-annual progress reports from the graduate student regarding his/her performance in course work, seminar and research.

B. Teaching Assistantship, Research Assistantship, Fellowship, Instructorship, etc. are awarded on a competitive basis. To receive consideration for TA support, the student must have a B or better average. For M.S. degree students, the departmental support will be limited to a total of four semesters. For Ph.D. degree students the departmental support will be limited to a total of three years. Support for the Ph.D. student during the first year should be from an RA (except for newly hired tenure track faculty). Financial assistance in the form of a partial tuition waiver may be given to M.S. Non-Thesis or M.S. students on a competitive basis.

C. Qualifying foreign students with M.S. degrees from foreign countries will be admitted to the Ph.D. program provisionally. Each of these students are required to take the Ph.D. qualifying examination the first time it is given after his/her tentative admission to the Ph.D. program. If the student does not pass this exam, he/she will automatically be required to pursue a M.S. degree before being considered again for admission to the Ph.D. program.

D. The Graduate School may grant permission to a graduate student to participate in a Co-op experience. Eligibility for Co-op is limited to those graduate students who have matriculated (i.e., been accepted and enrolled) as a full-time student in residence in one of Clarkson’s graduate degree programs for at least one regular semester and have maintained a GPA of at least 3.0 for all graduate coursework. The graduate students’ request for permission to participate in the Co-op experience must include (1) a written acknowledgement that she or he has discussed the program with a Career Center
counselor; (2) documentation that indicates the Co-op experience is appropriate to the professional and educational objectives of the student, including a statement from the student’s graduate program advisor; and (3) a coursework and project/thesis plan that indicates the student’s intended path to completing degree requirements.

E. Seminar Attendance: Graduate students are expected to attend the MAE seminar series every semester they are in their respective programs. Students should additionally register for one credit of seminar until the seminar credit requirements for the degree have been met.

F. After their first year in the Ph.D. program, under special circumstances, Ph.D. students may register for two seminar credits in one semester. The student must obtain written permission from the seminar coordinator to register for two seminar credits, and a copy of the permission memorandum must be presented to the MAE graduate coordinator for inclusion in the student’s graduate record. The permission memorandum must include specific activities that the student must accomplish to receive the second credit. Typically, these activities could include attending ten additional seminars from other departments and documenting the attendance using the form at, or presenting a full-length seminar. The seminar coordinator will make the final decision concerning what activities will be required to earn the second credit. With prior approval of the seminar coordinator, off-campus students can receive seminar credit by attending ten professional presentations and documenting their attendance.