DOCTOR OF PHILOSOPHY IN THE FIELD OF MECHANICAL AND AEROSPACE ENGINEERING

Program Overview

The PhD in mechanical and aerospace engineering is a research-focused degree program with the objective of preparing students for a life of scholarship in their field of interest. Central to the program is original thesis research, which substantially advances the state-of-the-art in the field. Coursework to strengthen the command of the chosen discipline and enhance mathematical skills is also required. Thesis research is directed by the thesis advisor, with input from a small committee of faculty members who are selected for their expertise in the chosen field of study. Students have the opportunity to work on leading edge research and contribute to efforts to advance basic and applied sciences.

Specific admission requirements are shown on the Graduate Program Finder (http://www.gwu.edu/all-graduate-program). Visit the Department of Mechanical and Aerospace Engineering website (https://www.mae.seas.gwu.edu) for more information.

REQUIREMENTS

Credit Requirements:

The following requirements must be fulfilled:

1. The general requirements stated under School of Engineering, Doctoral Program Regulations (http://bulletin.gwu.edu/engineering-applied-science/#Doctor_of_Philosophy).

1. Direct-to-Ph.D. students should complete a minimum of 36 credit hours of coursework and 18 credit hours of research. Students who enter the program with an M.S. degree should complete a minimum of 12 credit hours of coursework and 18 credit hours of research. The student and advisor design the curriculum to meet the student’s needs and goals and can choose from the following areas of focus: Aerospace engineering; Design of mechanical engineering systems; Fluid mechanics, thermal sciences, and energy; Industrial engineering; Solid mechanics and materials science; Structures and dynamics; Robotics, mechatronics, and controls.

Academic Procedures for MAE Doctoral Students:

There are three distinct phases in the program of doctoral study in MAE. These are: 1) the period of preparation for the qualifying examination; 2) the qualifying examination; and 3) the period after admission to candidacy for the Ph.D. degree during which the student performs research leading to the doctoral dissertation. After admission to doctoral study, students in MAE are subject to specific procedures as outlined below in each of these program phases.

A. Period of Preparation for the Qualifying Examination:

As early as possible after their admission students should identify the faculty member who will serve as their coursework and research advisor. For research assistants, the faculty member providing the financial support is also the advisor. At the beginning of each semester, the doctoral student meets with the MAE faculty advisor to evaluate the progress towards taking the qualifying examination. Coursework consists of core courses and electives that are specific to the major area of research. The qualifying exam is given twice each year, once during the first two weeks of the Fall semester and once during the first two weeks of the Spring semester. All students should take the exam as early as possible after they complete at least 6 credits of core courses and 6 credits of electives and maintain an average GPA at least 3.4 (see Appendix A for specifics on required courses). It is recommended that the exam should be taken no later than the beginning of their 3rd semester. In case a student does not fulfill the above requirement(s) then he/she should develop a plan of action with the academic advisor, which needs to be approved by the Department Chair. The student should be advised of any additional coursework to be undertaken, or any additional preparation.

B. The Doctoral Qualifying Examination:

All Ph.D. students are required to take the Doctoral Qualifying Examination (DQE) held in the first two weeks of each semester. They must submit the DQE Notification form provided by the MAE department by the end of the preceding semester. The exam is distributed electronically. A written proposal and an oral presentation of the chosen problem are required. The goals of the exam include the following:

1. To determine the student’s aptitude and ability to do original and independent research at the doctoral level.

2. To assess the student’s ability to review previous work from the literature.

3. To determine the student’s ability to understand and apply fundamental concepts in his/her technical area.

Participation and subject areas: In consultation with his/her advisor (or faculty sponsor) the graduate student should notify the Graduate Curriculum Committee that he/she is taking the DQE before the end of the preceding semester by filling the DQE Notification form. At this time the student also selects a major subject area that reflect his/her background and dissertation fields. The date/time of the examination will be announced by the end of the preceding semester.

Exam Committee Selection: The committee is comprised of the following persons: the student’s advisor (or faculty sponsor), an exam committee chair, and a third member. Co-advisors are allowed to participate as silent observers during the first attempt. The members of this committee are selected by the Graduate Curriculum Committee in consultation with the
student’s advisor (or faculty sponsor). At least two out of three members of the committee should be regular faculty of the MAE department.

**Topic selection:** Ten calendar days before the date that the qualifying examination is to be held, each student will be assigned a research topic and one to two references related to one or more of the subject areas selected by the student. The topic is selected by the chair of the examination committee in consultation with both the student’s advisor (or faculty sponsor) and the third committee member. The topic may be relevant to the student’s future doctoral work, but is different for each student. The topic cannot be directly related to or be part of the student’s ongoing doctoral work.

**Written Proposal:** The objective of the written proposal is to communicate how a specific research problem may be investigated. The proposal is not to exceed 5 pages using an 11pt Arial font, 1-inch margins, and 1.0 line spacing. The 5-page limitation covers the proposal body text, as well as any figures and tables. The title page and cited references are the only sections that do not count toward the 5-page limitation.

A typical written proposal has the following structure (the proposal format has been adapted from the required standard NSF proposal format):

- **Title Page:** The first page should include your name, title of your proposal, and signed academic integrity pledge (1 page).

- **Motivation and Objectives:** Explain the importance of the problem, review the state of the art, and discuss critical barrier to progress in the field that the proposed project addresses. Outline the objectives of the proposed work.

- **Technical approach:** This is the core of the proposal, where you describe the overall methodology and analyses to be used to accomplish the objectives of the project. Include how the data will be collected, analyzed.

- **Cited References:** Cite sources for background information and technical plan (does not count towards the 5-page limit).

**Oral Exam:** The student will prepare a brief PowerPoint presentation describing his/her proposed approach. The exam begins with a 20 minute presentation by the student, which will be the starting point for the oral exam discussion. The presentation may lead to questions (based on the chosen subject areas and sometimes unrelated to the assigned topic and of a broader nature) related to the goals of the exam. The duration of the exam is two hours.

**Exam outcome:** Immediately after the end of the oral exam the committee deliberates and reach a decision on the exam outcome, and convey it by email to the Graduate Curriculum Committee. All students are notified in writing of the outcome of the exam by the chair of the Graduate Curriculum Committee, one week after all exams have been completed. The notification may include conditions that the student must fulfill prior to attaining candidacy or suggestions on certain skills or areas that may need strengthening.

Passing the exam requires a unanimous decision from all three committee members. Students who fail the exam in their first attempt may, upon recommendation of the examination committee and review by the Graduate Curriculum Committee, take it again later in the semester.

**C. Period of Dissertation Research**

After successful completion of the qualifying examination the student is admitted to be a candidate for the Ph.D. degree program and begins specialized research under the supervision of his/her thesis advisor. Research direction may be shared by a full-time faculty member and an outstanding external scientist or engineer, but the final responsibility for the academic aspects of the dissertation work lies with the MAE faculty thesis advisor.

**Dissertation Research Proposal:** During the research phase, each doctoral candidate is required to give a research proposal presentation to the Dissertation Committee. The student’s research progress is assessed by the committee and appropriate suggestions for continuing research directions are solicited from those in attendance. Scheduling of the research proposal presentation is done at a minimum of one year before the final Ph.D defense by the student’s director of research in consultation with the MAE chairman. Under no circumstances is a doctoral thesis defense allowed to proceed prior to one year after the research proposal presentation. The committee helps the student to define the research topic, and ultimately approves the research proposal. The dissertation advisor should propose the membership of the dissertation research committee, which must be approved by the department chair. Final approval rests with the Dean’s office. At least three individuals should serve on the committee; the research advisor is the dissertation director (also called the advocate) and two others. Two of the committee members must be full-time faculty.

Students are required to present the written dissertation proposal to the committee (two of the members must be full-time faculty) and to successfully defend the proposal in an oral defense subsequent to performing the bulk of their dissertation research. The “Request for Proposal Defense form” must be filed and approved two weeks prior to the defense. The “Form 5 Dissertation Form” is presented at the proposal defense and, after a successful defense, is signed by all committee members. After the proposal defense, the student submits the revised proposal, complying with all suggestions, clarifications, and corrections, as required by the dissertation committee, along with the signed Form 5 to the director of doctoral research, i.e. thesis advisor and to the departmental advanced degree program coordinator for the Ph.D program. They forward the Form 5 to the department chair for signature.

**Dissertation Defense:** The research advisor may decide that the research achieved by the doctoral student is sufficient to satisfy the requirement of the degree. He/she proposes an examining committee for the purpose of administering
the final dissertation examination (dissertation defense). The committee of examiners must consist of no fewer than five members, at least three of whom are normally full-time faculty members with scholarly specialties within the area of concentration; at least one member will normally be from an academic specialty outside the area of concentration. It is required that an external examiner be invited. The research advisor serves on the examining committee both as advocate and as a non-voting committee member. The committee elects its own chairman, who should not be the research advisor, or if different, the student’s faculty advisor, as its first order of business. The dissertation examining committee must be approved by the department chairperson prior to the date of the defense. Each member of the examination committee, no later than 3 weeks prior to the defense, should receive a copy of the dissertation. At the same time, the candidate must provide a 350 word long abstract and other information to the department office for the purpose of preparing an announcement of the defense.

The dissertation defense is an oral examination, which is open to the public. When the dissertation is accepted as complete, it should be submitted electronically no later than the date specified by the Registrar's Office.

Seminar and Colloquia Requirements: Prior to graduation, doctoral students must complete the Department of Mechanical and Aerospace Engineering (MAE) seminar attendance requirement, whereby the student must attend at least 80 percent of the MAE seminars offered during any two semesters of the student’s enrollment. In order for a seminar to count toward the requirement, the student must be present for the duration of the seminar. To track attendance, the student must obtain a certification signature on the MAE Seminar Attendance Form from an MAE faculty member present at the seminar and submit the completed form to the MAE departmental office at the end of the semester. The student may attempt to fulfill this requirement in as many semesters as needed. This requirement is applicable to doctoral students who matriculate during the 2016-2017 academic year or later.

Graduation and Scholarship Requirements: Students are responsible for knowing the university’s minimum GPA requirement for graduation and scholarships. Please visit the Graduation and Scholarship Requirements (http://bulletin.gwu.edu/engineering-applied-science/#graduation_requirements_phd) section on the GW Bulletin to read the requirements.

Students should contact the department for additional information and requirements.