General Guideline for the ME PhD Qualifying Exam

The PhD Qualifying Exam or preliminary evaluation is designed to assess the breadth of the student's knowledge of the discipline, the student's achievement during the first year of graduate study, and the potential to apply research methods independently. The evaluation is used to identify those students who may be expected to complete a doctoral program successfully and to reveal areas of weakness in the student's preparation.

The qualifying exam in the mechanical engineering PhD program is a two-component examination that includes the submission of a **written research proposal** to an examining committee and **a formal oral presentation** on the proposed research with **a period of open questioning** by an examining committee. *This period of open questioning may include fundamental topics relevant to achieving a PhD degree in the chosen field of study by the examining committee as it evaluates the student's case toward PhD candidacy.*

Scheduling

A student should take the exam as soon as he/she has completed the necessary coursework and other preparations such as minimum average quality point average (QPA) greater than 3.3, and involvement of some research activities. The qualifying exam must be attempted at approximately the end of the first year after the student begins the PhD program (see the section titled **Timing of the First Attempt** on page 3 for more details). The student must be enrolled in the semester that they are planning to take the exam and have completed a minimum of 12 credits of coursework before taking the qualifying exam. In no case shall a student be admitted to PhD candidacy before successfully completing the qualifying exam.

A student on provisional, inactive, or special status or on probation or has a QPA less than 3.3 is not eligible to take the PhD Qualifying Exam.

At the beginning of each semester, all ME graduate students will be invited to inform the PhD Qualifying Exam Coordinator and the Graduate Coordinator if they are going to take the PhD Qualifying Exam in that semester. A timeline for the qualifying exam in that semester will be announced as part of this invitation. If a student intends to take the exam in that semester, he/she must consult with their PhD advisor and fill in the application form and submit it to the PhD Qualifying Exam Coordinator according to the announced timeline.

A student is allowed to withdraw from taking the qualifying exam within four weeks after the application form is officially approved by the exam area committee. Students must discuss their withdrawal decision with their PhD advisor. The PhD advisor must concur and submit the withdrawal request along with a brief reasoning. Students who withdraw from taking a qualifying exam must take the exam in the next semester. Students can only withdraw from the exam once unless the withdrawal request is because of documented illness.

General Information

The PhD Qualifying Exam (preliminary evaluation) is a crucial aspect of the PhD program in that it is intended to evaluate a student's engineering knowledge, ability to conduct independent research, and capacity for critical thinking. Therefore, the ideas and content of the proposal must

be the student's work. ***It will be deemed an honor violation if a student solicits or receives help on any of the specific technical points of the research proposal.*** Special consideration is given for department sanctioned seminars and help sessions for this exam.

All ME faculty members are encouraged to attend the exams, and any SSOE faculty member may attend. A student's entire exam shall be closed to other students.

Formation of the Examining Committee

An Examining Committee will be appointed each year by the ME Graduate Committee for each of the following tracks:

1) Dynamic Systems and Control
2) Heat Transfer and Thermal sciences
3) Solid Mechanics and Biomechanics
4) Design and Manufacturing
5) Computational Methods
6) Fluid Mechanics

Students, in consultation with their advisor, must choose a track that is closely related to their intended area of PhD dissertation research. The examining committee consists of a minimum of three faculty members and **should not include the advisor of the student**. All members of the examining committee must be present at the oral exam.

Proposals submitted to the Computational Methods track should not be about using black-box modeling and simulation tools to solve an engineering and science problem. Students who select the Computational Methods track are expected to demonstrate a fundamental knowledge of the computational methods used in engineering and science as well as the specific methods that they discuss in their proposals. In their research proposals, students are expected to identify deficiencies in existing methods and propose new techniques to solve a science and engineering problem.

Format of the PhD Qualifying Exam

The PhD qualifying examination is a research proposal in a general topic area suited to each student's anticipated field of PhD research. The student shall write a technical report and then present the report orally. The oral exam consists of a maximum 30-minute presentation by the student followed by oral questions about the proposal and related core course material by the examining committee. The anticipated duration for the entire exam is 90 minutes. If needed, the examining committee can consult the advisor on proper questions on the subject.

Topic: The topic for the research proposal should be in the same general field as the student's PhD research, but not exactly the same as their specific PhD dissertation topic. The topic cannot be a prior MS thesis or undergraduate project or a proposal from the ME 3100 class. Appropriate topic descriptions should be developed by the student in consultation with their PhD advisor as a technical abstract (*maximum 250 words*) and submitted to the qualifying exam committee for review in advance. Both the student and the advisor must attest to the originality of the proposed topic. After the committee reviews the submitted abstract, the committee may recommend a

change to it. The student, in consultation with their advisor, must address the comments of the examination committee and resubmit his/her revision within a week.

Written Research Proposal: The student shall write a document on the topic agreed to by the Committee. **The written proposal must be submitted to the examination committee chair according to the timeline announced at the beginning of each semester (approximately eight weeks after the approval of the application).** The proposal shall not be more than 10 pages long (the format and content of the written document are detailed in the section titled *Student Guidelines for the Written Research Proposal* at the end of this document). The Committee will then review the submitted document and will either allow the student to continue with the oral examination part or reject the proposal if it is poorly prepared. This review of the written document must be formally completed by the examining committee before the start of the oral exam. The committee may provide written comments to the student for addressing during their oral presentation. **The written proposal is a gateway to the oral presentation, and if a student's written proposal is rejected by the exam committee, they cannot proceed with the oral presentation, and thus fail the exam.** The examination committee's decision to allow a student to proceed to the oral examination stage does not imply the student has performed satisfactorily on the written portion of the exam either. After the completion of oral presentation and the examination, the examination committee will make a pass/fail decision on the outcome of the qualifying exam. A student has only two attempts to pass the qualifying exam.

Timing of first attempt: The qualifying exam is offered in the fall and spring semesters of each academic year. Students who have started in the PhD program after completing their bachelor's degree (a.k.a. direct-entry PhD students) are advised to take the qualifying exam in their third semester in the program (e.g., a direct-entry PhD student starting the program in the Fall semester should attempt the PhD qualifying exam in their second Fall semester). Students who have started in the PhD program after completing their master's degree (a.k.a. post-MS PhD students) can take the qualifying exam in their second semester in the program but no later than the third semester. Special students (less prepared) may delay until the fourth semester if their advisor petitions the Graduate Committee. Students must be registered in courses or for research credits in the semester they are attempting the exam.

Timing of second attempts: If a student does not pass the exam in the first attempt, a retake is allowed if the advisor petitions the graduate committee and commits to continuing to support the student for the second year. If the petition is accepted, the second attempt must occur in the following semester. The committee of the second attempt must include the previous year's examining committee chair. The student may submit the written proposal from their first attempt with major revisions or may submit a new original proposal.

Evaluation and Outcomes of the Exam

The Examining Committee shall assess the student's performance in three areas:

1) Written research proposal,
2) Oral presentation,
3) Performance during the oral examination.

Each member of the examining committee must complete the standard *Evaluation Form for the ME PhD Qualifying Exam.*

The **30-minute oral presentation by the student** will be followed by an approximately one-hour question/answer session conducted by the Examining Committee. Performance on the oral exam will be evaluated based on the technical content of the presentation and how well the student responds to questions from the examining committee.

Outcomes of the Exam

The examining committee shall recommend the "Pass" or "Fail" outcome to the PhD Qualifying Exam Coordinator for the academic year. The outcome of the exam reflects the collective performance of the student on the written and oral portions of the exam. The ME Graduate Committee is the final arbiter regarding the Ph.D. Qualifying Exam.

Student Guideline for the Written Research Proposal

Your research proposal should consist of three major parts: Project Summary, Project Description, and Reference. In addition, your proposal should have a cover page with your project title, your name, name of your PhD advisor, and the specific track you have selected for your qualifying exam. Use single-spaced, 12-pt Times New Roman font, and 1-inch margins on all sides of a letter-sized paper consistently throughout the main body of document. Figures and tables should be appropriately sized and carefully captioned. The font size of tables and figures and their captions can be smaller than the standard font size of the main text. A larger font size can be used for section titles. Project summary should not exceed one page. The project description should be limited to 10 pages including figures, tables. A project timeline for proposed tasks is optional but encouraged. The project timeline and the references are not included in the 10-page limit.

Project Summary: (*maximum one page*)

Your proposal must contain a summary of the proposed science and/or engineering research project. The Project Summary should consist of a concise *overview* of the project, an explanation of the *intellectual merit* of the proposed activity, and a statement on the *broader impacts* of the proposed research. The *overview* includes a description of the proposed activities and objectives, and the methods that will be used. The statement on *intellectual merit* should describe how the proposed work will advance knowledge and understanding in the field. The statement on *broader impacts* should describe the potential of the proposed research to benefit society or benefit societal outcomes. More information on how to write the intellectual merit and broader impacts section will be provided during the information sessions on qualifying exams that are organized each semester.

Project Description: (*maximum ten pages, including figures and tables, excluding citations and the optional project timeline*)

The *Project Description* should provide a clear statement of the work to be undertaken. The scope of the proposed work should be such that a full-time graduate student should be able accomplish the proposed research tasks within 2-3 years. Students are strongly advised against proposing extensive multi-investigator research projects.

In the first part of *Project Description*, a discussion of the present state of knowledge in the field and the important technical challenges remaining is required (*Background* or *Literature Review*). The *Project Description* should include the motivation showing why the proposed work is of general importance. The *Project Description* should also describe, in sufficient detail, the plan of work and its objectives, the specific activities to be undertaken, and the experimental methods and/or theoretical/computational techniques and/or the methods of interpretation that will be used. A project timeline is typically required in actual research proposals, but it is not required for the intended purpose of qualifying exam research proposal, which is to assess the readiness of a student for PhD research.

Each method in the project description must be explained in terms of why it was selected and how the data will be analyzed and interpreted. The student must clearly establish what they propose to do, why they want to do it, how they plan to do it, and how they will measure success. Student should articulate in separate sections what the intellectual merit and broader impacts will be if the project is successful. The intellectual merits of the project could include, for instance, improved

fundamental technical understandings in a specific subject and potential scientific/engineering breakthroughs, and the broader impact could be a positive benefit to society as a whole.

References: (*no page limit*)

Literature reviewed, online resources, software and data repositories that have been discussed in the project description should be properly cited. Students should select a referencing style used in a representative journal of their field of research and apply it consistently. Use of a reference manager such as EndNote or Bibtex is highly recommended.

Academic Integrity and Avoiding Plagiarism: The writing must represent student's own original work. Student must paraphrase information from textbooks or research articles into their own writing. All sources and statements must be properly cited. **Students are required to enroll in the University's online Academic Integrity Canvas Course & Badge** available at the following link: https://pitt.libguides.com/academicintegrity/plagiarism

Plagiarism Checking: Students are required to submit a plagiarism report obtained from an online plagiarism detection software that allows uploading a written document and checking it against a massive record of published material. This report must be submitted along with the written research proposal. The University recommends Turnitin.