

Ph.D. Qualifying Exam – Faculty/Examiner & Student Instructions

Updated: August 29, 2012

I. Purpose of the Qualifying Exam

1. To be officially considered as admitted to candidacy in the Ph.D. program, applicants must pass a qualifying exam. The exam is designed to:
 - a. Evaluate a student's capacity to perform outstanding research
 - b. Test their oral communication skills and ability to "think on their feet"
 - c. Evaluate the student's fundamental knowledge in selected core areas of mechanical engineering
 - d. Identify areas that need strengthening as they work towards their Ph.D.
2. In preparing for and taking the qualifying exam, students will learn how to:
 - a. Formulate a useful problem
 - b. Understand prior work on their topic
 - c. Review and apply core engineering knowledge towards the completion of research

II. Format Overview

1. **The exam will consist of two parts:** i) a research paper written and presented by the student and ii) an oral examination of the student's knowledge in three areas pertinent to the student's research. For scoring purposes (pass/fail), there are five parts to the qualifying exam – i) the research paper, ii) the research presentation and student's answers pertaining to the presentation and the paper; iii) subject area 1, iv) subject area 2, and v) subject area 3. Each voting member of the examining committee will have a distinct vote (pass/fail) pertaining to these five parts of the exam.
2. **When to take the exam:** Students admitted with a master's degree will take the exam during their second semester in the Ph.D. program at the latest. Students admitted to the Ph.D. program with a bachelor's degree will take the exam during their third semester at the latest. In this case, summer does not count as a semester.
3. **Extensions:** Students may petition the Graduate Committee for an extension prior to taking the exam, if extenuating circumstances have left the student at an unfair disadvantage.
4. **Retakes:** Students will have two consecutive chances to take the exam. If a student does not pass the exam on the first chance, that student will have a second chance the next regular semester to pass. If that student does not pass the exam on the second try, the student will be dismissed from the Department's doctoral program.

III. Week by Week Timeline

1. If a student does not meet recommended deadlines (items a, c, and d below), he or she could become greatly disadvantaged. If a student does not meet strong deadlines (items e and f below), that student will forfeit the entire exam.
 - a. **Week 1:** By the end of the first week of the semester, the student will submit to the Graduate Advisor either a Notification of Intent to Take the Qualifying Exam or a petition for extension.
 - b. **Week 3:** By the end of the third week, the Graduate Committee will have approved the student's form and will assign professors to be on each student's

Exam Committee. The Graduate Committee will assign an exam date/time that does not conflict with the class schedules of the examiners and student. See Section 4, Item 5 for further detail.

- c. **Weeks 3-12:** Between the third week and the 12th week, it is highly recommended that students meet with their advisor and Exam Committee to discuss study methods and topics, as well as content of the paper.
- d. **Week 10:** By the end of the 10th week, students must have passed the Canvas plagiarism quiz. Any student who has not will automatically fail the qualifying exam. This will count as one of the student's attempts.
- e. **Week 11:** During the 11th week, students *must* submit their papers to Turnitin.com via the Canvas course.
 - i. The Grad Committee representative will review each paper and Turnitin Report. If a paper is suspected of plagiarism, the entire exam committee will review it. If a paper is deemed to have been severely plagiarized, the entire qualifying exam is failed. This will count as one of the student's attempts.
 - ii. Students must also send their committee a reminder of the date, time, and place of the exam.
- f. **Week 12:** During the 12th week, exams will be held as scheduled by the Graduate Committee.
- g. **Week 13-15:** At the next available faculty meeting following the exams, a summary of each exam will be presented for faculty review. In case of qualifying exam retakes, the faculty will also vote to pass or fail the student (based on the recommendations from the exam committee) and approval.
- h. **Week 16:** By the end of the 16th week, the results of the qualifying exam (complete pass, conditional pass, partial pass with the requirement to pass the remaining areas by the next attempt, or complete fail) will be mailed out to the students.

IV. Prior to the Exam: Detailed Procedures

1. **Student Preparation:** It is expected that prior to the examination semester, students will complete requisite coursework to achieve competency in the qualifying exam research and subject areas.
2. **Notification of Intent:** Students register for the exam each semester by submitting:
 - a. A form, available in the Graduate Advising Office and signed by the student's advisor
 - b. Current unofficial transcript (including current class schedule and current cumulative GPA)
 - c. Title and abstract for the research paper (less than 200 words)
 - d. List of three subject areas to be evaluated. These areas should be listed in decreasing order of expertise.
3. **Subject Areas:** The three subject areas must come from Table 9 below. The areas must be significantly different from each other (i.e. "Advanced Controls" would not be approved in addition to "Controls").

Table 9. Exam Subject Areas

Engineering Topics (alphabetical)			Mathematics Topics (max. 1 allowed)
<ul style="list-style-type: none"> • Controls • Robotics • Design • Dynamics • Ergonomics and Safety 	<ul style="list-style-type: none"> • Fluid Mechanics • Heat Transfer • Manufacturing • Materials Engineering 	<ul style="list-style-type: none"> • Strength of Materials • Thermodynamics • Biomechanics • Approved subject not on this list (max. 1 allowed) 	<ul style="list-style-type: none"> • Calculus & Differential Equations • Linear Algebra • Numerical Methods • Statistics &/or Experiment Design

4. **Formation of the Exam Committee:** Although students may request professors (including the student's advisor) to be the examiners, each Exam Committee will be appointed by the Graduate Committee according to the following regulations:
 - a. Students retaking any portion of the exam will be assigned the same committee members from the first attempt. In the event that a faculty member is unavailable (i.e., sabbaticals, etc.) then the Graduate Committee will assign a substitute examiner.
 - b. At maximum, only 1 examiner can be requested from an outside department. The majority of the committee must be mechanical engineering faculty members.
 - c. The Exam Committee consists of four members total – three examiners and representative from the Graduate Committee. Three members of this committee will be the voting members.
 - i. In case the student's advisor is a part of the examining committee, the advisor can be responsible to ask subject area questions (i.e., be a primary examiner) but he/she will not cast a vote at the conclusion of the oral examination. Instead the third vote to pass/fail the different parts of the qualifying exam will be cast by the Graduate Committee representative.
 - ii. The member from the Graduate Committee will ideally be chosen such that his/her expertise is as independent as possible from the student's research area. This is to provide an outside perspective on the research and provide some level of consistency and transparency across qualifying exams.
 - d. The committee will contain a primary examiner in each of the three subject areas.
 - e. Two of the three voting members of the committee must be regular ME faculty.
 - f. Nominated committee members will accept or decline this nomination within 1 week of the request in order to make alternate arrangements in a timely manner.
5. **Scheduling of the Exam:** Students and professors may make requests as to exam date and time, but ultimately the Graduate Committee will assign times that fall within the 12th week of the semester.
 - a. Examiners are asked to submit the dates and times of vital, immovable events to the Graduate Committee to allow for accommodation for such events.

- b. Professors might have to rearrange office hours or other student meetings, but since the Ph.D. program is so vital to this Department and since the exam period has been condensed to one week, it is expected that accommodations for exam commitments will be made.

V. Prior to the Exam: About the Research Paper

1. **Important:** The exam research paper is NOT a proposal defense and should not be treated as such. Do not include content that might confuse the research paper with a proposal.
2. **Content:** The student's research paper should meet the following specifications:
 - a. Communicate the motivation, intellectual merit, and background information (such as relevant equations, processes or theories) of the student's research
 - b. Survey the literature of the student's area
 - c. Explain how the literature will shape the direction of the student's research
 - d. Optional: Include preliminary results of research, if such results have been obtained already
 - e. Compare the preliminary results, if applicable, to related literature
3. **Alternative Content:** As an alternative, students may present a paper that has already been or will be submitted to a conference or refereed journal.
4. **Regardless of the topic, the paper should:**
 - a. Follow a standard format, such as those used by ASME, IEEE, etc
 - b. Be 5-10 pages in length
 - c. Include references and citations
 - d. Be clear and concise
 - e. Show depth of knowledge and ability to analyze and synthesize material
5. **Regardless of the topic, the paper should NOT:**
 - a. Exceed 10 pages
 - b. Plagiarize in any form to any extent. Please see Item 6 below for further detail.
 - c. Contain grammatical errors to the extent that meaning is obscured
 - d. Include content that is more appropriate for a proposal defense. The exam research paper is NOT a proposal defense and should not be treated as such.
6. **Plagiarism:** Plagiarism constitutes borrowing, referencing, or otherwise using - *without properly citing* – ideas, words, and/or phrasings from another source. Some examples (these are not all-encompassing; please see the U of U Student Handbook for further detail):
 - a. Failing to indicate that portions of text were taken verbatim from another source. Such indication is correctly done by using proper citations and double quotation marks (“ ”).
 - b. Including portions of text written by the student's advisor, members of the student's lab or anyone else but the student without properly attributing (see previous item).
 - c. Including portions “edited” by others to the extent that the editors have “ghost written” the paper.

Plagiarism of any degree – even accidental or unintentional plagiarism – will result in automatic failure of the entire exam.

VI. During the Exam: General Rules and Procedures

1. The exam is a closed format; no outside observers will be allowed.
2. Before the exam begins, one of the three voting members will be designated as the committee chair.
3. The exam will begin with the presentation of the research paper, followed by the oral examinations of the three knowledge areas. Detailed procedures for each part follow below.
4. Examiners are free to interject with questions as they deem appropriate.
5. General time limits will be as follows:
 - Presentation of the paper: 15 minutes
 - Questions related to the paper: 10 minutes
 - Subject area 1: 25 minutes
 - Subject area 2: 25 minutes
 - Subject area 3: 25 minutes
 - Committee discussion: 20 minutes
 - The entire qualifying exam period should not exceed 2 hours.
 - The Graduate Representative will monitor the time per area to ensure adherence to the 2 hour exam time.
6. After the examination of the third subject area has concluded, the Exam Committee will ask the student to leave the room and the committee will discuss the performance of the student, at which point the advisor (if he/she is a member of the examining committee) can provide additional background information on behalf of the examined student.
7. Once the discussion is complete, the student's advisor (if he/she is a member of the examining committee) will leave the exam room so that final deliberation and voting by the three voting members of the committee can be completed.

VII. During the Exam: Paper/Presentation Rules and Procedures

1. The student's presentation should demonstrate his or her ability to present information in front of a group and to communicate clearly even to those outside of the student's research area.
2. Student's who utilize a PowerPoint presentation are required to provide copies of the PowerPoint slide handouts for each exam committee member
3. Question Format:
 - a. Questions should be designed to establish a student's understanding of the essential fundamentals in an area, capability of independent thought, and academic potential for admission to the Ph.D. program
 - b. Questions should also test a student's ability to synthesize and respond to open-ended problems.
 - c. Examples of Appropriate Questions:
 - i. Questions from other areas related to the student's research
 - ii. Questions asked for the sole purpose of evaluating the student's ability to approach a problem.
 - iii. Questions that connect the research paper to one or more of the student's knowledge areas
 - d. Examples of Inappropriate Questions:
 - i. Asking about the validity of the student's research methods

- ii. Asking about broader implications of preliminary results
 - iii. Any questions that would routinely be asked during a proposal defense.
The exam research paper and presentation DO NOT constitute a proposal defense and should not be treated as such.
- 4. Interpreters may not be used in the Ph.D. Qualifying Exam except in the case of identified disabilities. The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you need accommodations for the qualifying exam, reasonable prior notice needs to be given to the graduate committee (at the time the notification of intent form is submitted to the Graduate Advisor) so that the graduate committee can make arrangements for accommodations. International students are expected to possess verbal and written English language skills equivalent to TOEFL scores greater than 590 (paper-based) or 96 (internet-based).

VIII. During the Exam: Subject Areas Rules and Procedures

- 1. The subject areas will be examined one at time.
- 2. Question format:
 - a. Questions will be asked to test the student's fundamental understanding of, and ability to apply, relevant knowledge.
 - b. Students may be asked to work out answers on the white/chalk board.
 - c. The committee member in each designated area is responsible to make sure that adequate questioning in that subject area has been conducted.
 - d. Other committee members may ask questions outside of their assigned area.
 - e. An examiner may decide that adequate knowledge in that subject area has been demonstrated in the student's paper/presentation. In such a case, the examiner may yield as much of his/her subject area time as he/she deems appropriate.
- 3. Question difficulty:
 - a. The level of difficulty will be at the advanced Bachelor of Science degree and possibly Master of Science degree levels (equivalent to 5000- and 6000-level courses at the University of Utah).
 - b. Questions beyond this level of difficulty should not be asked.

IX. After the Exam: Scoring

- 1. Each voting member of the Exam Committee will cast a vote of *pass* or *fail* on each of the 5 parts of the exam: three subject areas, research paper, and oral presentation. Each examiner will also complete an examiner summary sheet that summarizes the student's performance in their exam area (and other areas, in case they were involved in some manner). The majority vote will determine a pass or fail in each of the five parts of the exam. Students have a *maximum of 2 attempts* to pass all five parts of the exam in order to complete the PhD qualifying exam. The student will have to pass all 5 parts of the exam in order to pass the qualifying exam and thereby be admitted to the PhD program.

The Exam Committee is not required to inform a student right away of the exam results. If additional time is needed to determine result, then the committee may withhold the results until they come to a clear decision.

a. **Scoring example:**

	(1) Controls	(2) Robotics	(3) Linear Algebra	(4) Paper	(5) Presentation
Examiner 1	Pass	Fail	Pass	Pass	Fail
Examiner 2	Pass	Fail	Pass	Pass	Fail
Examiner 3	Fail	Pass	Pass	Pass	Pass
Majority Vote Per Subject Area	Pass	Fail	Pass	Pass	Fail

Overall Exam result: “Partial pass” with a requirement to retake the Robotics subject area and redo the paper presentation and pass these areas by the second (and last) attempt the subsequent semester.

2. The overall exam results will include one of the following:
 - a. Pass: Passed all areas of the exam outright.
 - b. Conditional pass: Passed with a requirement to take additional coursework, etc.
 - c. Partial pass: Passed some areas of the exam, but required to retake the failed portion(s) of the exam in the subsequent semester.
 - d. Fail: Significant weaknesses across all areas of the exam. Students will have to retake all portions of the exam in a second attempt in the subsequent semester.
3. The committee chair will tally the exam results and write a brief statement providing the majority votes, a summary of the student’s performance throughout the exam, and the committee’s decision concerning pass, conditional pass, partial pass or fail.
 - a. In the case of a conditional pass, the perceived weaknesses of the student and the required conditions to obtain a full pass must be outlined.
 - b. This summary is submitted to the Graduate Advisor no later than one week following the exam.
4. Exam retakes:
 - a. The same rules will apply and students will need a majority ‘pass’ vote in order to pass retaken portions of the exam. At the end of a retake, the committee will make an overall recommendation to the faculty on whether to pass or fail a student. This recommendation will be discussed at faculty meeting and the entire faculty will vote to pass or fail the student based on the recommendations of the committee and the discussion at the faculty meeting.

X. After the Exam: The Faculty Meeting

1. After the committee chair has submitted the score sheets and summary, the Graduate Advisor will compile the scores and recommendations for presentation to the faculty.
2. At the first regularly scheduled faculty meeting following the exams, the outcomes will be presented by the Chair of the Graduate Committee with a brief opportunity for the faculty to ask for any necessary clarifications.
 - a. Barring any objections, the faculty will move directly to a vote *only* on the results of students who have retaken the exam based on the committee’s recommendations of pass, conditional pass, partial pass, or fail.
 - b. A simple majority vote is required for approval.

3. In the case of conditional passes:
 - a. The conditions must be met in a timely manner, not to exceed 1 year from the exam date.
 - b. When the conditions have been met, with the faculty advisor's endorsement, the student will request a change in status from "Conditional Pass" to "Pass." The Chair of the Graduate Committee will act on the request.
4. The student's faculty advisor can appeal the Exam Committee's recommendations for exam retakes according to the following process:
 - a. The student must have passed three or more parts of the exam. No appeals are allowed if the student has passed only two or fewer parts of the exam at the retake (second and last attempt).
 - b. After the pass/fail votes are read at the faculty meeting, the student's advisor will be allowed to address the faculty. The advisor will state what recommendations he or she feels appropriate, then provide evidence to support this action.
 - c. A two-thirds majority from the faculty will be required to over-rule the recommendations of the examining committee.
5. After faculty approval has been obtained, the Graduate Advisor will prepare letters containing final exam results (including explanation of conditions, if applicable) to be mailed to the students no later than the end of the 16th week of the semester.