

Overview of the ME Ph.D. Qualifying Exam

The purpose of the qualifying exam is to ensure that students have the capability of synthesizing information from courses and literature to form a deep understanding of their research field. The exam will evaluate students' technical communication skills in both written and oral format. Students are required to review a research paper in a specific research area, submit a written summary and critique of the paper, and give an oral presentation.

Formation of the exam committee

Students must have identified a research advisor in order to schedule their qualifying exam. The exam committee consists of the student's research advisor and two other faculty members. Out of the three exam committee members, two must have a primary appointment within the ME Department. The committee elects a committee Chair (preferably a ME-affiliated faculty). The research advisor cannot be the Chair of the exam committee.

Selection of the research paper

A research paper on original research should be selected together by the student and the advisor. A review paper is not recommended. Paper selection should be made in such a way as to avoid apparent conflicts of interest. Therefore, authors of the selected paper must not have a close affiliation with the exam committee members. For example, exam committee members must not be authors of the selected paper. The research paper should be submitted to the exam committee together with the written report.

Written Report

Please see guidelines for instructions on how to put together a written report and the grading rubric. The written report will be evaluated by the exam committee according to the Written Report Grading Rubrics.

Oral Presentation

Please see guidelines for instructions on oral presentation and the grading rubric. The time allotted to the exam is two hours and the exam will start with the oral presentation (20 minutes), followed by discussion between the exam committee and the student, and a closed-door grading period towards the end.

Important Timelines*

Students are required to take the qualifying exam during either the spring semester or the Summer I semester of the first year. Students who have identified a research home during the fall semester are highly encouraged to take the spring exam. It is important that students follow the specified timelines strictly. Failure to meet the timelines will result in forfeiting the first attempt.

Spring exam	Summer exam	Action Items
3/1	5/1	Qualifying exam form due (#1-6 completed)
4/15	6/15	Written report due
5/10-5/21	7/10-7/21	Oral presentation
5/30	7/30	Notification of exam outcome by the Graduate Committee

* If the listed date falls on a holiday or weekend day, please defer to the next business day.

Instructions for the exam committee

- The exam committee members are expected to read the research paper and student's critique before the exam.
- A copy of the student's transcripts will be made available to the exam committee by the Department.
- The Program Coordinator will send the necessary paperwork related to the exam to all committee members ahead of the exam.
- The Chair of the exam committee is responsible for summarizing the feedback from the exam committee and submitting the feedback to the Graduate Committee.
- The feedback should clearly summarize the strengths and weaknesses of the student.
- The student should be given the first 20 minutes of the exam to finish the presentation. During the student's presentation, please limit questions for clarification purposes only.
- The exam committee DOES NOT notify the students about the official outcome of the exam but may provide the student informal feedback.

Suggested outcomes for the committee, should the exam not be satisfactory

- One possible outcome is that the exam committee will feel the oral and written exams reveal that the student is not fit to proceed with PhD research. In this case, the most common recommendation will be that the student graduate after completion of the MS degree.
- The committee may decide that the student needs to take an additional course, or courses (this could include a graded independent study), to rectify some background weaknesses. If so, the committee will decide on what will be acceptable passing grades for these courses.
- The committee may decide that the student can rectify certain background weaknesses with self-study, to be demonstrated with improvement with a future meeting with the committee. This meeting, at the discretion of the committee, might be in the form of presentation and Q&A, or just Q&A, again at the discretion of the committee.
- Other options are certainly possible, but the idea is that if the student stays in the PhD program, then whatever is to be done, is intended to improve the apparent inadequacies that are observed during the qualifying exam. Therefore, the committee should provide feedback that summarizes the strengths and weaknesses of the student achievement, and suggest directions for improvement.

Graduate Committee review

The Graduate Committee will review the outcomes of the exam together with the exam committee following the grading rubrics for the written report and oral presentation. Students will be notified of the official outcome of the exam by the Graduate Committee. Note that retake of the exam is not an automatic option for students who do not pass the exam.

WRITTEN REPORT GRADING RUBRICS

For each category, circle one score and provide comments in the provided space

Technical Correctness

- Demonstrate an accurate understanding of the fundamental concepts, technical details, methods, and their underlying assumptions, as well as correct interpretation of the results.
- Demonstrate the ability to critically evaluate the technical merits of the paper, such as the scientific advances of the methods and findings in the research field.
- Identify ways in which the work could be improved.

Does Not Meet Expectations

Meets Expectations

Exceeds Expectations

Synthesis of Information from Multiple Sources

- Demonstrate the ability to find related background material to fill in gaps in their knowledge when reading/understanding the paper.
- Briefly review the literature and then place the work in the context of the field. Discussion of some related papers, although not extensively, are expected.
- Analyze the conclusions of the paper and demonstrate an understanding of the key findings in the context of the field.
- Identify limitations of the work and how these might be addressed in future studies.

Does Not Meet Expectations

Meets Expectations

Exceeds Expectations

Writing Aptitude

- Demonstrate the ability to write clearly and concisely with well-organized thoughts.
- Convey the subject matter concisely using proper technical English.
- Choose a format that efficiently and professionally conveys the key ideas.

Does Not Meet Expectations

Meets Expectations

Exceeds Expectations

ORAL PRESENTATION GRADING RUBRICS

For each category, circle one score and write comments in provided space

Oral Communication Aptitude

- Demonstrate the ability to clearly and succinctly describe the main ideas in the paper.
- Demonstrate the ability to convey complex thoughts while lecturing and answering questions.
- Demonstrate the ability to apply fundamental core topics in mechanical engineering to research questions and the interpretation of the results.

Does Not Meet Expectations

Meets Expectations

Exceeds Expectations

Ability to Think and Derive in Person

- Demonstrate the ability to respond correctly to questions while incorporating information from multiple sources.
- Demonstrate the ability to apply concepts covered in the paper to new instances relevant to the student's research direction.
- Demonstrate an understanding of the 'think and derive' questions that are asked by the committee and systematically addresses them.
- When gaps in the student's knowledge are identified, demonstrate an ability to solicit the key information from the committee.

Does Not Meet Expectations

Meets Expectations

Exceeds Expectations

Grasp of the Breadth of the Field

- Include enough context in the presentation to help audience understand the background and objectives of the research paper.
- Demonstrate the ability to express remaining knowledge gaps within the field and why they are important.

Does Not Meet Expectations

Meets Expectations

Exceeds Expectations

FINAL SCORE

*Tally the scores of each category (total of 6). Sum up the numeric score with the weighting denoted.
Using this final score, circle one examination outcome.*

Grade	Value	Number
Does Not Meet Expectations	-1	
Meets Expectations	0	
Exceeds Expectations	+1	
Total:		

Does Not Pass
(Score <0)

Pass
($0 \geq \text{Score} \geq 2$)

High Pass
(Score >2)

ME Qualifying Exam Oral Presentation Instructions

The oral portion of the qualifying exam should consist of a short (~20) minute presentation by the student, followed by questions from the examining committee on the presentation and the subject area. The research question should be stated, and the presentation of the work described in the paper should be based on the student's own understanding and analysis, and should not be a passive summary of the work itself. The emphasis should be on conveying the main concepts and key insights of the paper. The expectation is that the majority of the time will be a discussion between the student and committee discussing the presentation, as well as the field and background knowledge of the student. The following format is recommended for the oral presentation:

1. Outline (presentation title should be different from paper title)
2. Introduction/purpose
 - a. Motivation and goals: define the field and problem that is being solved.
 - b. Background information/literature review: what other approaches have been taken to solve this problem? What are the pros and cons of each approach? The usage of figures, images and equations to help make points is very appropriate here.
3. Assigned paper
 - a. Description of the work/idea: how was the problem defined, and what approach did the authors take to resolve it?
 - b. Qualitative and quantitative analysis: how did the authors justify the correctness of their approach? What assumptions were used, and what impact do they have on the results?
 - c. Results and conclusions: what are the key findings? Are they expected or unexpected?
4. Critique of the work (pros and cons), proposed solutions: are there ways to improve upon this work?
5. Future research directions: what questions remain after the work, or what new questions have arisen due to the work?
6. Bibliography and sources used

Suggestions on preparing an Oral Presentation

- Try to keep to no more than about one slide per minute. Don't fill the slides up with lots of written words. Use the slides to guide your direction, and to help the audience to follow your thoughts, but do not just read the slides. A few bullets with a few words, pictures, plots, is all you should need. The rest should come from your own knowledge. Since the oral exam is expected to be about 20 minutes, then about 20 slides of this nature might be about right.
- Back up slides are fine, in case you anticipate their use in the Q&A part.
- Use of PowerPoint, Keynote, Google Slides, Beamer, etc., are all fine.
- You may want to bring a laser pointer unless you know it will be provided.
- If you present a figure, clearly note its source unless you prepared the figure yourself.

ME Qualifying Exam Written Report Instructions

TITLE (report title should be different from paper title)

Student name

Advisor

Abstract (max 100 words)

Full citation of the main paper, Vancouver citation style.

ME Qualifying Exam Written Report Instructions

The written report can be prepared in either Word or LaTeX (12pt Times New Roman font, single spaced, and 1" margins). The written report should contain a maximum of 2 pages of text, plus a title page, figures, and a list of references. The title page must include the Title, Student Name, Research Advisor, maximum 100-word or less abstract, full citation of the assigned paper, including the full title. The title of the report must be different than the title of the assigned paper, and should convey the research question being addressed. A minimum of 5 references should be listed after the 2 pages of text.

The following organization is recommended for the report:

1/2-page: What is the problem being addressed in the article? What is the state of the art in the field related to this problem? Why is the problem important?

1/2-page: What is the work/idea presented in the current paper? What approach did the authors take to resolve it? Why does it represent an advance over current/previous knowledge?

1/2-page: What are the strengths and weaknesses of the work in the present paper relative to other approaches, and why? (Read references and search to understand the field; students should be able to search and ideally other common approaches to date in the field; and be able to compare them).

1/2-page: Propose a future research problem in the field based on analysis of the current paper, and the insights gained from it. Specifically, what questions/limitations remain after the work, or what new research questions are worth studying?

Figures should be numbered in the order they are discussed in the report. Figure captions should clearly explain the content and importance of the figure. The caption also needs to indicate the source. If the student made the figure and it is unpublished, no reference is needed.

Use of references: All references should be properly cited (minimum 5 relevant citations, use Vancouver citation style).

ME Qualifying Exam Written Report Instructions

Figures should be numbered in the order they are discussed in the report. Figure captions should clearly explain the content and importance of the figure. The caption also needs to indicate the source. If the student made the figure and it is unpublished, no reference is needed.

Example:

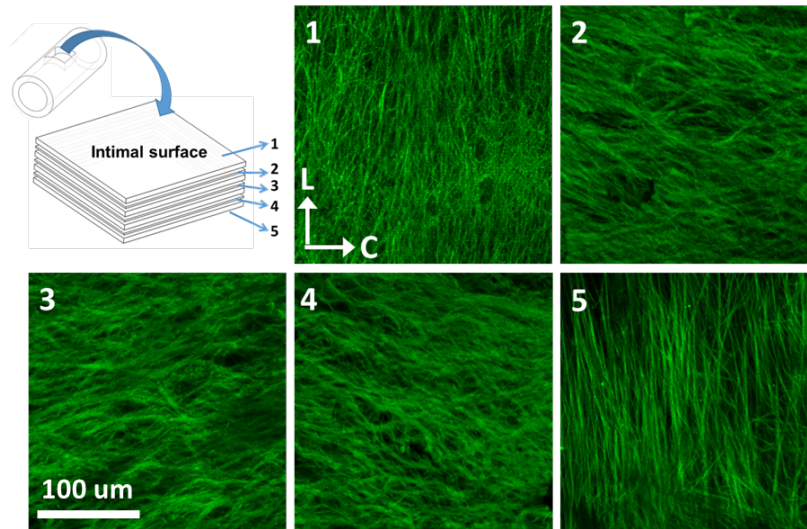


Figure 1: Transmural variation in elastin fiber orientation distribution observed in porcine thoracic aortic wall. Using multi-photon microscopy, the authors observed that the elastin fibers orientation changes from a relatively uniform distribution in regions close to the luminal surface (1) to a more circumferential distribution in regions that dominates the media (2, 3, 4), then to a longitudinal distribution in regions close to the outer media (5). In the figure L and C refers to the longitudinal and circumferential direction of the arterial wall, respectively. The transmural variation in elastin fiber distribution was then associated with tissue anisotropy through computational modeling. Figure obtained from Xu et al. [3].

ME Qualifying Exam Written Report Instructions

References

References should be placed after the 2 pages of text and figure pages.

1. A minimum 5 references should be used. Students should expect to answer questions on the references cited.
2. Use Vancouver citation style.

Example:

- [3] Yu X, Wang Y, Zhang Y. Transmural variation in elastin fiber orientation distribution in the arterial wall. Journal of the mechanical behavior of biomedical materials. 2018 Jan 1;77:745-53.