



Ph.D. Qualifying Examination Procedure

EXAMINATION OVERVIEW

The BME graduate committee will pick a set of three journal articles representing the current emphasis areas of the Biomedical Engineering Graduate Program. The student selects one of these three papers that becomes the basis for the oral exam. **The students will be instructed that they are to work alone without discussing or consulting each other, other students, faculty, post-docs, etc. about the topic.** *Students will have Uddfcl ja UYm' weeks from the date they receive the paper until the date of the oral exam.* Thus, once the paper and oral committees have been set, each student will contact his/her committee members and arrange a date and time for the exam.

EXAMINATION GOALS AND METHODS

The purpose of the examination is to ascertain if the student can formulate and communicate meritorious original research in the field of Biomedical Engineering. To achieve success the student must demonstrate scientific originality, effective oral and written communication, and planning to achieve a biomedical engineering project that has significant merit. This exam will use a limited set of papers to provide a more uniform basis of judging performance than could be done if each student was examined on a different topic. The papers will be chosen to avoid the specific research areas of all students taking the exam but still have appreciable biomedical engineering technical content. The exam will have both a written and oral component to determine if the student is capable of using both of these important methods of scientific communication. In both formats the students will be evaluated on their basic knowledge of the emphasis area that they are enrolled in, their ability to effectively communicate their ideas and knowledge, their scientific originality, and their ability to effectively plan a small research project.

EXAMINATION FORMAT AND PROCEDURES

Students will be expected to read the paper and research sufficient background and supplementary materials related to the paper to: (1) develop a solid understanding of the content and fundamentals in the paper, and (2) develop a proposal for a research project in an area directly related to some aspect of the paper. The research proposal should define a Ph.D. level research project, which might be appropriate for one person over a span of approximately two years, and achievable with reasonable equipment and resources. The proposal should address the classical elements of a research proposal: motivation/need for the work, objectives, approach and methods, anticipated results, and potential significance and impact of the work.

The written research proposal (described below) and the chosen paper will be provided to each of the committee members one week prior to the examination date. Both the written research proposal and the oral presentation (described below) will be the basis of the oral examination.

The written proposal is loosely based on the requirements of the research sections of a typical NIH Ruth Kirschstein Graduate Fellowship proposal. However, it has been shortened to ensure that the student keeps the smaller scope of their proposed project in mind and to ensure that it is not overly burdensome for the student to prepare or the committee to review. The basic format of the proposal will be as follows: 1. It will be no more than 5 pages in total length (not including the reference section). 2. The first page will contain the title of the proposal, the name of the student, and a short project summary of less than 300 words. 3. The remaining proposal (no more than 4 pages) will be divided into sub-sections including Specific Aims, Significance, and Approach. Students receive formal training on proposal writing in this NIH format in BME 547 Biomedical Engineering Research Practices; therefore, the required contents of these sections should be apparent after taking this core course. 4. The reference section will be formatted per the *Journal of American Chemical Society*, and will be the final section of the proposal. The reference section does not count against the page length of the proposal. Finally, to reduce the time required to prepare this proposal and to ensure consistency between students, the written research proposal shall have 1 inch margins in all directions, use at least 1.5 line spacing, use 11 point Arial font, and must have all figures embedded in the 5 pages.

Additionally, each student will be asked to prepare a 30-minute presentation for the oral exam. The talk should provide a critique of the paper, describe how the paper led to the proposed research, and present the research plan for the research proposal. This critique of the paper should be concise (no more than 1/3 of the presentation), communicate a basic understanding of what the paper was about, and summarize especially important conclusions, findings, analysis or experimental methods. Next, the student should briefly explain the bridge between the paper content and the research proposal. Finally, the student should describe the research proposal, including the proposed methods and the broader significance of the work (at least 1/3 of the presentation). One set of copies of the overheads used in the presentation should be prepared for each examination committee member.

During the 30-minute presentation, the committee may ask questions to interpret the presentation or to seek clarification of the presentation. After the presentation, the committee will excuse the student for a short time to discuss what topics will be discussed with the student. The student will be called back to the room and the discussion of the presentation and the written proposal will begin. This discussion should last about one hour. These discussions can address the details, rationale and thinking behind the proposal, as well as the students understanding of the content and fundamentals of the paper and the research proposal. In addition to a creative and carefully thought-out proposal, it will be expected that the students demonstrate an in-depth understanding of the content of the assigned paper and their research proposal. At the end of the discussion period, the student will be excused and may leave, as the results of the examination will be provided at a later date. The remaining portion of the examination period is used by the committee to fill out the performance rubrics (below) and discuss the outcome of the examination. At the end of the examination the evaluation rubrics are given to the chairperson who compiles a summary report of the outcome of the examination. The summary report is provided to the Chair of the BME Qualification Exam Committee (aka "Qual Advisor"), who reports out to the Biomedical Engineering Faculty. The BME Faculty vote determines whether a student passes or fails.

The 30-minute presentation is not open to the public. However, any UNM faculty member may also be present during all phases of the examination, which includes the student's primary mentor. Although the primary mentor may interject to assist in clarification of questions or matters of procedure, the primary mentor and any

other faculty members outside of the committee are explicitly forbidden to question the student, assist the student, or make comments during the time that the student is present in the room. All faculty should feel free to comment on all topics in closed session with the committee. The only faculty that vote on the result of the examination are the three faculty members assigned to the committee.

NOTES

Student Name: _____

Advisor Name: _____

BME PhD Qualifying Examination Report

(This page should be filled out by the student or committee Chair/advisor prior to the exam and one copy given to each committee member)

Chair of Evaluation Committee _____

Date of Qualifying Exam _____

Qualifying Exam Presentation Title

Committee Members Name	Departments

After evaluating the oral qualifying exam, each committee member should fill out the response sheets provided. For each attribute which a committee member feels is somewhat or very deficient, a short explanation should be provided. Committee members may be asked to defend their grading to the qualifying exam committee. Completed forms are to be treated as confidential and are to be turned in to the Qual Advisor.

A summary of written comments from committee members as well as any edited copies of the oral qualifying exam reports submitted by committee members will be provided to the student by the chair of the Qual Advisor). A verbal summarization of the overall evaluation of the designated activity by the committee may be provided to the student by the chair of the examining committee (or advisor) or during a prescheduled meeting of the qualifying exam committee.

All evaluation documents including rubrics and written comments must be completed by all committee members.

A copy of the completed forms (both rubrics and written comments) must be delivered to the BME Graduate Program Office immediately following the qualifying exam.

Student Name: _____

Advisor Name: _____

FACULTY NAME:		Student Performance (General Observations)		
Category	Unacceptable (0)	Marginal (1)	Good (2)	Rating (0 – 2)
ORAL PRESENTATION Organization & Structure	No clear organization.	Some organization is present, but there are several significant gaps in the presentation.	Organized, with a small number of minor gaps.	
ORAL PRESENTATION Timing	Significantly over or under the requested time for the presentation, with no justification.	Presentation is moderately over or under the requested time.	Presentation is slightly over or under the requested time.	
ORAL PRESENTATION Style and clarity	Confused speech, with poor use of technical English. Speaker is difficult to understand or even to hear properly.	Some significant flaws in use of technical English. Speech is awkward or some minor effort is required to understand the speaker.	Use of technical English is good, with only a few minor flaws. Speech is audible and understandable.	
ORAL PRESENTATION Visual Effectiveness	Visual aids are illegible or not understandable without substantial effort. Visual aids make no contribution to the overall effectiveness of the presentation.	A minority of visual aids are clear and well described. Most visuals do not contribute to the effectiveness of the presentation.	Most visual aids clear and well described. Most contribute to the overall effectiveness of the presentation.	
WRITTEN PROPOSAL Organization & Structure	No clear organization.	Some organization is present, but there are several significant gaps in the writing.	Organized, with a small number of minor gaps.	
WRITTEN PROPOSAL Length	Significantly over or under the requested length for the proposal, without justification.	Proposal is moderately over or under the requested length.	Proposal is slightly over or under the requested length.	
WRITTEN PROPOSAL Style and clarity	Confused writing, with poor use of technical English. Writing is difficult to understand or follow.	Some significant flaws in use of technical English. Writing is awkward or some minor effort is required to understand the proposal.	Written use of technical English is good, with only a few minor flaws. Proposal is clear and well written.	
WRITTEN PROPOSAL Use of figures	Figures are absent or extremely overused. Alternatively, they are illegible or not understandable without substantial effort.	A minority of figures are clear and well described. Most figures do not contribute to the effectiveness of the proposal.	Most figures clear and well described. Most contribute to the overall effectiveness of the proposal.	
			Total	
CIRCLE ONE PASS / FAIL			Score (Maximum 16)	

Student Name: _____

Advisor Name: _____

FACULTY NAME: Student Performance (Critical Analysis of Paper and Student's Research Proposal)					
Category	Unacceptable (0)	Marginal (2)	Good (4)	Excellent (6)	Rating (0 - 6)
Critical Analysis of Research Paper	Insufficient depth. Inappropriate technical level. Missed the big picture – impact and significance of the paper	Technical content was too low for a Ph.D. level.	Most topics sufficiently described, but not enough emphasis on the most important points. Technical level is appropriate.	Demonstrates excellent understanding of the paper with emphasis placed on the most significant areas, at a high technical level.	
Relevance of Proposed Research to the paper	Proposed research has no apparent connection to the paper reviewed.	Research is loosely related to the paper.	The proposed research covers similar ground as the paper, but does not lead to new directions.	Research proposal makes good use of the paper as a springboard to delve into new areas.	
Novelty & Originality	Proposed research lacks novelty and originality. Research is a simple continuation of previous work.	Proposed research has some novel aspects, but these are poorly developed and without a clear design.	Research breaks new ground, demonstrates a clear understanding of the needs and goals.	Proposes original work that is well thought out and justified. The research problem is clearly stated..	
Technical Feasibility of proposed research	Research isn't feasible.	Not much thought given to how the research can be accomplished.	The necessary equipment or theoretical framework is well defined, but with some gaps.	The proposed research is both feasible and novel and the tools – experimental and theoretical are available.	
Research Plan	No appreciation for the timeline, how long it would take to do the research.	A reasonable timeline is presented, but the resources available (time and equipment) do not match what is needed.	A good deal of thought has been devoted to the conduct of the research, an experimental plan is proposed.	A well-defined research plan, with clear milestones and deliverables. The work can definitely be accomplished within the scope of a Ph.D. dissertation..	
Discussion	No discussion generated. Speaker evades answering any questions that were asked.	Speaker has clear difficulties in handling most questions.	Speaker is able to address most questions with confidence.	Speaker is able to answer all questions clearly, effectively, and with confidence.	
				Total	
CIRCLE ONE					
PASS / FAIL				Score = total out of 36	

Student Name: _____

Advisor Name: _____

FACULTY NAME: _____

Overall Rating

- 0-30. Based on the proposal, presentation, and discussion, this student is **not prepared** for successfully completing work at the PhD level.
- 30-40. Based on the proposal, presentation, and questions, this student is **minimally prepared** for successfully completing work at the next level. A student at this level may struggle with the tasks necessary for successfully completing work at the next level. For example, this student may have a hard time conducting a thorough literature review or writing about the literature in a way that integrates findings and ideas from the review. As additional examples, a student at this level may have a difficult time stating research questions, identifying an appropriate research design, analyzing data, or interpreting the results without serious assistance from an advisor.
- 40-46. Based on the current product, this student is **satisfactorily prepared** for successfully completing work at the next level. A student at this level will have little difficulty producing quality work at the next level. However, some areas of improvement are recommended. For example, a student at this level may need to state their ideas more clearly, discuss results more concisely, or review fundamental concepts.
- 47-52. Based on the current product, this student is **well prepared** for successfully completing work at the next level. This student can produce high quality work at the next level with little or no supervision or input from others.

RECOMMENDATION

Presentation Section Recommendation – (Circle one) - PASS / FAIL - Points _____

Technical Section Recommendation – (Circle one) - PASS / FAIL - Point _____

OVERALL Recommendation – (Circle one) - PASS / FAIL - Points _____

COMMITTEE MEMBER COMMENTS

BME STUDENT

Qualifying Exam Check List

DATE	Description	✓
	Attend Qualifying Exam Orientation	
	Contracts due/receive research papers	
	Inform Qual Advisor of paper choice	
	Receive names of committee members from Qual Advisor. Send paper you selected to all committee members.	
	Set a day and time with all committee members and inform Qual Advisor	
	Reserve a room for your qualifying exam. (2 hour block) Reserve (if needed) a projector for your qualifying exam.	
	Provide electronic and printed versions of written proposal to committee members and Qual Advisor	
Day of Exam	Borrow laser pointer & have extra batteries.	
	Create handouts (3 slides per page) of your PPT presentation - one for each committee member.	
	Provide the committee with THREE qualifying exam reports (one for each faculty member) with all information filled in, so the committee can use these forms for scoring.	

Eligibility To Take the Oral Qualifications Exam In the BME Graduate Program

Student Information

It is expected that students in the BME graduate PhD program will sign up to take the exam following their first year in the PhD program. As this degree program is an interdisciplinary one, students enrolled come from a variety of undergraduate degree programs. In order to assist the BME Graduate Program's Oral Qualification Exam Committee to assemble the most appropriate advisors for your exam, please provide the following information:

BME Graduate Student	
Name	
Email address	
Primary research area	
Semester/year began BME PhD program	
Undergraduate degree/Year	
Other Graduate degrees/Year (if applicable)	

Advisor Information

In order to ensure that the student's qualifications across the spectrum of Biomedical Engineering is assessed, if the student has already identified a primary advisor and committee members, they are not eligible to be members of their Qualification Exam committee. In the table below, provide the names and affiliations of the student's PhD advisor, as well as any co-mentors or committee members who have already identified.

BME Graduate Program Advisors	
Primary Advisor's Name	
Primary Advisor's Department Affiliation	
Additional Committee Member(s) or Mentor(s)	

Eligibility for the BME graduate Oral Qualification Exam

In the table below, indicate the semester and year in the candidate took each of the 5 BME graduate core courses, and the grade earned in the course.

BME Graduate Program Core Courses			
Course #	Course Title	Semester/Year Course Was Taken	Grade Earned in Course
BME 515	Applied Biology for Biomedical Engineers		
BME 544	Mechanics and Thermodynamics of Molecular Components in Cells		
BME 547	Biomedical Engineering Research Practices		
BME 556	Protein and Nucleic Acid Engineering		
BME 558	Methods of Analysis in Bioengineering		

In addition to the core courses, students in the BME graduate program must take 18 credit hours of courses in elective courses, 9 of which must be from courses offered through the School of Engineering. Listed below are the courses currently approved as electives and substitutes by the BME graduate program's Curriculum Committee. Indicate which graduate electives have been completed, the semester and year in the candidate took the courses, and the grade earned in the course.

Revised 9 December 2019

BME Graduate Program Elective Courses			
Department	Course Title	Semester/Year Course Was Taken	Grade Earned in Course
BME	Physical Bioanalytical Methods Biomaterials Tissue Engineering Biomedical Engineering Research Seminar		
BIOL	General Microbiology Advanced Techniques in Light Microscopy		
BIOM	Advanced Molecular Biology Advanced Cell Biology Principles of Neurobiology Physiology Immunobiology Cancer Biology Molecular Genetics and Genomics		
CHNE/NSMS	Fundamentals of Nanofluidics Surface and Interfacial Phenomena Biosensors Fundamentals and Applications Nanomaterials Advanced Transport Phenomena I		
CS	Introduction to Machine Learning Geometric and Probabilistic Methods in CS Algorithms and Data Structures Topics: Complex Adaptive Systems		
ECE	Theory of Linear Systems Medical Imaging Digital Image Processing Fundamentals of Computing Digital Signal Processing I		
ME	Advanced Mechanics of Materials Computational Mechanics Introduction to Continuum Mechanics Theoretical Fluid Mechanics I Advanced Materials Science		

In certain cases, students may substitute other electives for the required 18 hours of electives toward the BME PhD program. These substitutions must be approved by the BMEGP Graduate Advisor or the BMEGP Curriculum Committee. In the table below, indicate which electives have been completed, the semester and year in the candidate took the courses, and the grade earned in the course.

Other Graduate Elective Courses Not Listed Above				
Department	Course Title	Semester/Year Course Was Taken	Grade Earned in Course	Substitution Approved by (signature)

I certify that the information given above is complete and accurate, and wish to be considered to take the BME graduate program's Oral Qualification Exam.

(Student's Signature)

(Date)

(Student's Name—printed)

In addition, please provide your advisor's signature, to indicate that you have discussed this with him/her.

(PhD Advisor's Signature)

(Date)

(PhD Advisor's Name—printed)

Policies and Instructions

Policies are found in the UNM University Catalog, under the subject heading "Biomedical Engineering Concentration: PhD Degree Completion Requirements."

After it has been completed, submit this form to the BME Graduate Program Administrator (Stephanie Sanchez). The forms will be distributed to the BME Graduate Program's Oral Qualification Exam Committee Chair (Prof. Heather Canavan). The completed form must be approved prior to the Qual Exam's Orientation session (given approximately one month prior to the exam, which will take place the week prior to the Fall and Spring Semesters).

Exceptions

*Students who have not yet finished their first year in the PhD program may request to take the Qualification Exam despite not yet having finished the required core and elective courses. To do so, the student and their advisor must sign the following release:

I understand that the BME Graduate Qualifications Exam Committee is based on my preparation through the graduate curriculum. I understand that the committee will evaluate all students taking this exam with the assumption that they have completed the graduate core curriculum, as well as a number of elective courses. I request that the BME Graduate Qualifications Exam Committee grant my request to take the Qual exam early, and I accept any risks implied in applying early.

(Student's Signature)

(Date)

(Student's Name—printed)