TO: Examiners and Students, Biomedical Engineering Department  
FROM: Graduate Education Committee (GEC)  
RE: Biomedical Engineering (BME) Qualifying Examination  

This memo describes the Qualifying Examination (QE) procedure for the BME Department. Questions about the QE should first be directed to Maria Steele with follow up from the GEC as necessary.

1. The qualifying exam consists of a single oral examination conducted by the student’s Dissertation Committee. In the exam, the student will present his/her doctoral research proposal to the Committee (typically a talk of approximately 20-30 minutes) and respond to their questions and comments. In the course of the exam, the Committee will question the student about the content and plan of the proposal, as well as general didactic knowledge in the engineering and biology areas relevant to the proposed research.

2. The Committee must conform to the standard Rackham Dissertation Committee and BME guidelines for committees with three additional requirements: (1) At least one faculty member must be on the Committee, (2) For the purposes of administering the examination the Examination Chair cannot be the student’s advisor, but it must be a core faculty member or an affiliated faculty member included on the list below, and (3) The student’s advisor must be on the Committee as a voting member. The student must meet with their entire Committee, either as a group or individually, at least one time prior to taking the exam. The student’s advisor(s) must fill out the Qualifying Examination and Candidacy Student Evaluation Form and return the completed form to Maria no later than one month prior to the date of the exam. The student must also have their Committee sign the Qualifying Examination Form which states that the student has met with the members of their Committee. This form also needs to be returned to Maria no later than one month prior to the date of the exam.

Affiliated faculty that meet the requirements to serve as the Chair of the BME QE, but are not required to serve as Chair and can turn down a request from a student:

- Arruda, Ellen
- Banaszak Holl, Mark
- Barald, Kate
- Burns, Mark
- Carson, Paul
- Ferris, Daniel
- Fessler, Jeffrey
- Fowlkes, J Brian
- Giannobile, William
- Hernandez-Garcia, Luis
- Huggins, Jane
- Kopelman, Raoul
- Kotov, Nicholas
- Kozloff, Kenneth
- Krebsbach, Paul
- Lahann, Joerg
- Larkin, Lisa
- Ma, Peter
- Patil, Parag
- Shih, Albert
- Sienko, Kathleen
- Stacey, William
- Wang, Thomas
- Yoon, Euisik

3. A written proposal must be submitted to the Committee at least two weeks prior to the exam. This proposal must be in the general form of an NIH R01 proposal. The proposed research project can be either hypothesis driven or design driven, without prejudice. Hypothesis-driven plans must include specific testable hypotheses. Design-driven plans must have well-defined outcome measures and success criteria. It is expected that the student, advisor and the Committee go through several iterations of the proposal and that the student discuss the proposal with each Committee member prior to taking the exam. The student must email a copy of their proposal to Maria at least two weeks prior to the date of the exam.

4. **Timing.** BME’s program deadline for achieving candidacy is within two years of completion of the M.S. degree in BME or of making their M.S. degree relevant. The GEC recommends that the QE be completed within one year of completion of the M.S. degree or within one year of entry into the program for students who enter with an equivalent M.S. degree.

5. **Eligibility.** The student must complete the M.S. degree requirements or if entering with an M.S., fulfill any requirements to make his/her M.S. equivalent prior to taking the exam. The student must have a research advisor and be working in a relevant laboratory. The student’s advisor must commit to be willing to support (academically and financially) the student during his/her doctoral work. The student must form his/her Dissertation Committee. The student must meet the minimum requirement of a 3.5 GPA, with any petition argued by the student’s advisor in person at a GEC meeting. The GEC requires that students who enter the
BME Department with an equivalent M.S. degree satisfactorily complete a minimum of 6 credit hours of letter graded graduate level courses (didactic or laboratory, but not seminars) before taking the exam. If the student’s advisor approves, this coursework can be counted toward the student’s Ph.D. course work. Note that the student is required to complete training in responsible conduct of research and scholarship before advancing to candidacy.

6. Roles and Responsibilities of the Committee. The Committee decides the student’s advancement to candidacy based on both the written proposal and the oral examination. The Committee is expected to maintain a high standard for evaluating the written proposal in terms of both content (knowledge in engineering/scientific areas), and the plan itself. It is also expected to evaluate deficiencies in the student’s background (e.g., poor grade in a course or lack of coursework in an area vital to the student’s area of research).

The Committee’s recommendation for candidacy must be unanimous and unconditional. Any agreements must be fulfilled by the student and approved by the Committee prior to recommendation for advancement to candidacy. The Committee is expected to work to reach a consensus among its members.

The Committee may take the following actions as a result of the outcome of the examination:

1- Recommend the student be advanced to candidacy without further conditions.
2- Recommend the student be advanced to candidacy conditionally – i.e. the student will not be advanced to candidacy until completion of
   a. change in the focus or scope of the proposal.
   b. re-write of all or part of the proposal.
   c. the student takes extra course(s).
   d. the student reads and/or reviews additional material (books, papers, etc) to fulfill notable deficiencies in his/her background.
   e. the student takes additional preliminary data, or re-analyzes existing data.
   f. any other action that the committee feels is in the best interests of the student.
3- Recommend that the student discontinue their doctoral work at UM.

The Committee may also:
4- Require a subsequent e-mail vote among the Committee on the acceptability of further work, or
5- Give the Committee Chair authority to certify that the Committee recommendations are completed, or,
6- Require that the student reconvene the Committee after a set period of time.

After the examination, the Examination Chair will submit a memo, which has been approved by all Committee members, to Maria and she will then forward a copy to the student. The memo will include:

1- A summary of the required action to be taken by the student, if any.
2- A brief summary of the results of the examination.
3- When applicable, a draft of the agreement to be carried out by the student. This agreement must be explicit with quantitative values where appropriate (time limits, minimum GPA requirements for additional course work, etc.).

Within six months of passing the BME QE, or earlier if the student plans to defend their Ph.D. within a few months, the student must email the list of their Dissertation Committee members (names and role of each member) to Maria. The list is for the student’s Dissertation Committee and the student should list his/her research advisor, not their QE Chair, as the Chair of their Dissertation Committee. Students must adhere to Rackham’s guidelines for their Dissertation Committee.

The GEC has observed several common “red flags” or conditions that students needed to address before they were advanced to candidacy. These non-inclusive items are listed below, and it is recommended that students, advisors and Committee members familiarize themselves with these.

- Too ambitious a plan – need to narrow scope/eliminate an aim
- Need to clearly state your hypothesis
- Need to better develop experiments to address testable hypotheses
- Sparse knowledge of relevant literature
- Limited understanding of <some topic, typically a biology sub-topic>
- Need to develop command of known methods for analyzing … and articulate why techniques are used and impact of technique
- Need to link aims to biological measures and explore biological relevance of technique
- Incomplete research plan
- Describe specifically how ... will be determined
- Need greater detail in experimental protocols, data analysis
- Need to clearly define metrics for success
- Need meaningful control experiments
- Prepare summary of factors known to affect <biological process>
- Clarify statistical methods to be used; perform power analysis
- Distinguish what is your independent work
- Need to improve quality of written proposal

Notes/Reminders for the Student:
The student should email the list of their proposed QE Committee members and their roles to Maria at least two months prior to the exam so that she can check to make sure that the Committee meets the requirements. If the Committee does not meet the requirements, the student will either need to revise their Committee or get approval from the BME Department (via Maria) to submit Special Memberships on the Dissertation Committee materials to Rackham. The Deans in Rackham review the special membership paperwork and a staff member in Rackham relays their decision to the student. It should be noted that it can take more than one month to receive a decision on the materials. If the Committee does not meet the requirements, the student will need to revise their Committee or submit additional materials to Rackham which could result in a delay taking the exam.

If a student has more than one research advisor both advisors must submit a Qualifying Examination and Candidacy Student Evaluation Form, or if they prefer they can both complete and sign the same form. Students are responsible for reminding their research advisor to keep a copy of this form and bring it with them to the exam in case other Committee members have questions or would like to see it.

Most QE Committees have members who are not primarily appointed in BME. To better ensure that all Committee members understand the exam process, the student is responsible for printing off hard copies of the QE Memo for each of their Committee members and giving the copies to the Chair of the Committee on the day of their exam. The Chair will then distribute copies to the other Committee members before the student takes the exam, and summarize the document so that all members understand the exam process.

Remember that students are required to complete training in responsible conduct of research and scholarship before advancing to candidacy.

Materials due to Maria at least two weeks prior to the date of the exam.
  - Proposal

Forms due to Maria at least one month prior to the date of the exam.
  - Qualifying Examination and Candidacy Student Evaluation signed by the student's research advisor(s)
  - Qualifying Examination signed by the student's QE Committee

08.26.15