

Ph.D. Milestones and Examination Requirements

Department of Biomedical Engineering

1. Preface

This document details guidelines for conducting the Ph.D. preliminary exams (written and oral) as well as the research proposal. These milestones will be required of all Ph.D. students in the program starting in Fall, 2005.

2. Milestones

The Ph.D. degree has several milestones to be met in order to achieve suitable academic progress toward the degree and attain candidacy for the Ph.D. degree. In the first few years, these milestones are laid out in a regimented, roughly annual structure. As the student progresses toward more advanced status in the Ph.D. program, the milestones are less strongly scheduled.

The key milestones are listed below:

- By the end of the first year in the program, the student must submit an approved **Plan of Work**;
- By the end of the second year in the program, the student must complete the **Core Topics course requirements** with grades suitable to advance in the Ph.D. program;
- By the end of the third year in the program, the student must make a first attempt at the **written preliminary exam**;
- By the end of the first semester of the fourth year of the program, the student must have passed the written preliminary exam;
- The student must complete a **research proposal** (There is no set time at which this must be completed, but it is required to advance to the next milestone.);
- The student must stand for the **oral preliminary exam** (The exam should be roughly 1-2 years before the student expects to complete the degree. The oral preliminary exam must be passed within six years of entry.).

After passing the oral preliminary exam, the student attains Ph.D. candidacy. At that point, it remains for the student to complete the research, write the dissertation, and defend at the final oral exam.

Note that funding situations may necessitate scheduling exam milestones earlier for some students, and advisors must be aware of funding impacts when working with a student to plan the program.

The milestones are summarized in flowchart form in Figure 1. Failure to meet any milestone will be considered evidence of unsatisfactory academic progress and may result in discontinuation of any support and/or termination.

3. Plan of Work

After two semesters, and before the third semester, all students must complete the Plan of Work. The Plan of Work lists the student's advisory committee (primary advisor(s) and selected committee members), all courses to be applied to degree requirements, and a preliminary dissertation topic. Any of these entries can be changed later, but the student must submit a plan that meets all requirements to meet the milestone. The committee selections must meet the department's composition requirements (a chair or co-chair who is a core faculty member, and a majority of members with BME appointments). All BME graduate students whose primary

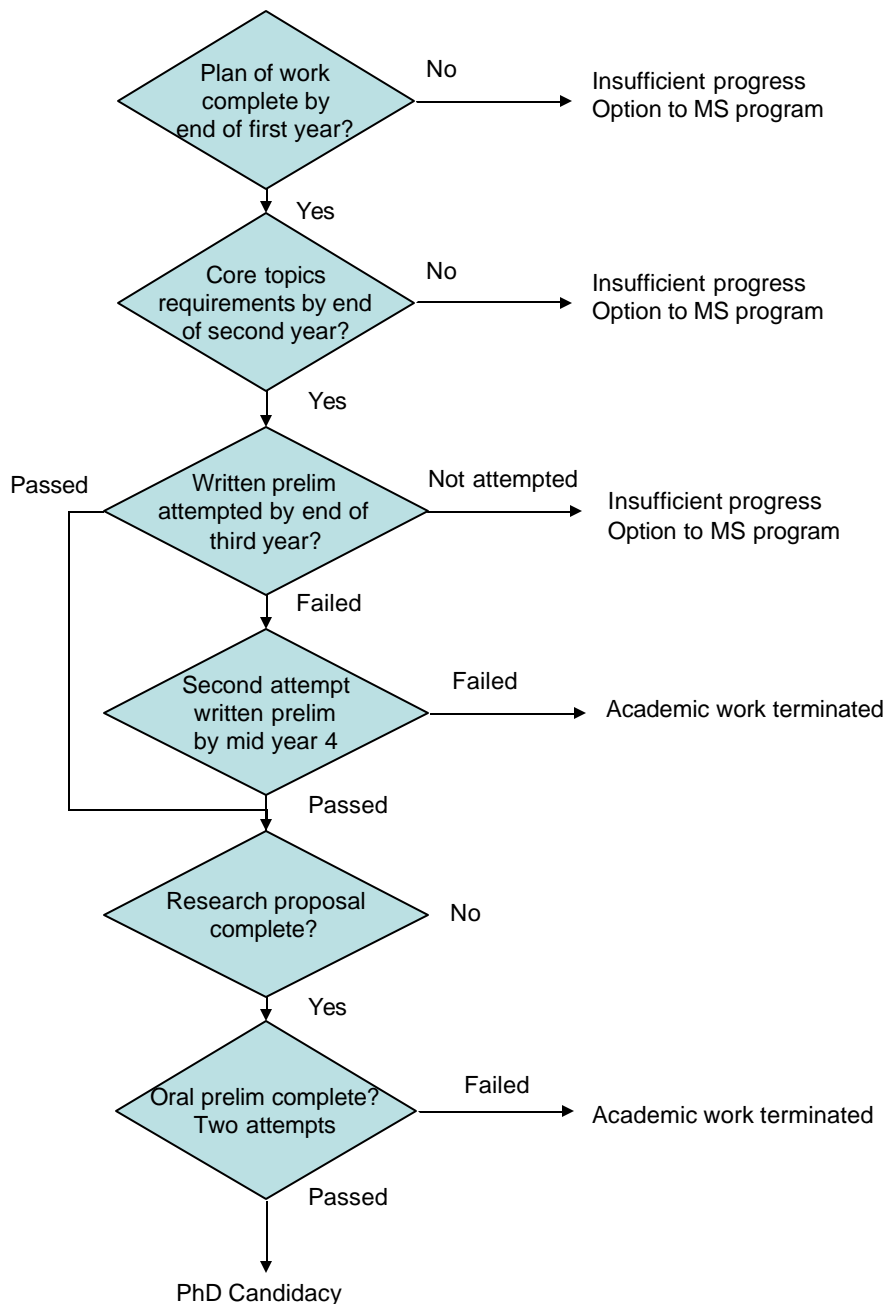


Figure 1: Flowchart of Ph.D. program milestones to Ph.D. candidacy.

research advisor is not a BME core faculty member must have an “academic advisor” as co-chair of the committee. The academic advisor is responsible for monitoring the student’s academic progress and ensuring that BME standards are maintained in the student’s work.

Note that the Plan of Work is required to be submitted to the graduate school for NC State home students, and becomes part of the student’s electronic record. UNC home students must also meet this milestone, and the approved plan will be maintained in the student’s departmental file.

4. Core Topics Requirement

To meet the Core Topics requirement, students must complete five courses with grades of B(P) or better in the first two years of the program. The Core Topics requirements are detailed in another document (see *Core Topics Requirements for the MS and PhD Degrees*), and are only summarized here.

Core topics include Life Sciences (8 credits required) and Engineering (9 credits required). The Life Science courses are drawn from courses approved by the BME Graduate Curriculum Committee. Engineering Core Topics require the student to complete three courses in three different engineering topic areas.

To advance in the Ph.D. program, students must complete five courses (two life science and three engineering) with acceptable grades (three of five courses with grades of A- or better at NC State; H or better at UNC, and none with grades below B- at NC State, P at UNC) in the first two years of the program. Any combination of applicable courses may be applied to this requirement; students may choose the most advantageous combination.

Failure to meet the core topic requirement in two years (four semesters) makes the student ineligible to advance in the Ph.D. program. The student may elect to transfer to the MS program or to leave the BME program entirely.

5. Written Preliminary Exam

The written preliminary exam is intended to examine the student's ability to integrate coursework from a variety of disciplines and apply that knowledge to solving meaningful problems.

5.1. Administration

The written preliminary exam is to be administered by the student's Ph.D. committee. In cases where the research advisor (co-chair) is not a core faculty member in the department, the academic co-chair may organize the exam, by agreement among both chairs and the student. The academic co-chair will review the questions prior to the exam in order to ensure that they meet department standards.

5.2. Timing

To meet guidelines of both Universities, the exam is to be taken after most formal coursework is completed or in progress, but not before the student has completed two years in the program. The exam should be taken as soon as possible in order to provide feedback to the student in making career decisions. Thus, the exam should be taken early in the third year. Students who enter the program with a Master's degree may be able to take the exam before two years if other requirements are met.

Students must attempt the exam by the end of the third year in the program. Students failing to meet this milestone are not eligible to advance in the Ph.D. program. Such students may choose to transfer to the MS program or to leave the BME program entirely.

5.3. Procedures

The following procedures will be followed for the exam. Upon agreement between the student and the committee, other rules and procedures may be applied, if they are not in conflict with those listed here.

- Students must schedule the exam by contacting the committee members and the Director of Graduate Studies/Programs. Students should supply a list of courses taken to the committee members.
- The exam organizer (chair or co-chair) will solicit questions from each committee member. There must be at least five questions. The chair (if core faculty) or academic co-chair is responsible for reviewing the questions in advance to verify that they are suitable and meet department standards.
- The start time/date and end time/date will be agreed upon in advance. The time permitted for the exam is expected to be about one week, but may be longer or shorter by agreement among the committee and the student.
- The student must submit the exam before the due date/time. Changes are not permitted after submission.
- The exam organizer will distribute the questions to the committee members for grading. Up to four weeks should be allowed for grading.
- Committee members will submit grades to the exam organizer. Committee members should also provide written feedback that may be helpful to the student.
- The exam organizer will write a letter to the student stating whether the student has passed the exam or not. Committee members and the DGS/DGP should be copied on this letter.
- Copies of the exam, the student's responses, and the result letter will be kept in the student's file. Any member of the core faculty may view the exams for any student after they are filed. The Graduate Curriculum Committee will review examination questions used each year and provide a report to the faculty with general concerns and recommendations.
- The form, *Doctoral Exam Report Form*, is required at UNC.

5.4. Rules

Specific rules for the exam will be determined by the committee. In general, students should be permitted to use any printed or electronic resources, but should not be permitted to consult other persons. Specific circumstances may require different rules. The exam organizer is responsible for clarifying and policing the rules for the student. Students may ask clarification questions of committee members, who may choose whether or not to answer.

Exams must adhere to the Rules of Student Conduct at both Universities. Students should review these rules prior to taking the exam. Submission of the exam constitutes the student's assurance that the exam is the student's own work.

Late exams will not be accepted unless a change in the due date/time is negotiated in advance with the exam organizer. Late, incomplete, or unsubmitted exams will count as a failure of the exam.

5.5. Exam Questions

Questions should be directed at the integration of the student's coursework with practical biomedical engineering applications and predoctoral activities (such as critical analysis of literature and research planning). Questions should be in-depth and should permit the student to exhibit the capability to apply skills and knowledge at the graduate level. Each question should be scaled such that a typical student would require about one full working day to complete it.

Examples of types of questions follow, though others may be used if found suitable by the exam organizer and committee:

- System design problems
- Implementation and/or analysis of models
- Simulations
- In-depth critical analysis of peer-reviewed literature
- Design of experiments
- Processing and/or analysis of experimental data
- Mathematical derivations or proofs
- Numerical solutions of mathematical problems

5.6. Responses to Exam Questions

There are no departmental requirements for the form of student response, as this may depend on the type of question. In most cases, the response can be articulated in a word processor file. If an unusual form of response is required, this should be made absolutely clear in the question, and there must be some documentation of the response.

Student responses must be separable into individual questions for grading, i.e., separate files or separate sheets. Students must supply a list of references or resources consulted at the end of each question response (journal articles, books, websites, computer programs, etc.) and proper rules of citing sources must be followed.

5.7. Grading

Each committee member will assign a grade of satisfactory or unsatisfactory to the student's response to the member's question. A satisfactory grade indicates that the student has met the objectives of the question and exhibited the necessary skills required. Areas of particular strength or areas for improvement should be noted. An unsatisfactory grade indicates that the student has failed in some critical objective of the question. Specific reasons for an unsatisfactory grade must be given. Graders should also make comments for the record, to be included in the student's file.

Grades must be based on the student's submission as of the due date. Committee members may not return the response to the student for further work.

Any member of the committee may review any responses to other member's questions and may provide feedback to the student. Committee members may also base their determination of whether the student has passed the exam on the student's responses to other questions, if they choose. That is, a committee member has the right to vote to pass or fail the student on the basis of the entire exam, not just on the member's individual question.

5.8. Passing/Failing

All members of the committee vote on whether the student has passed the exam. *A unanimous vote of the committee is required for the student to pass the exam.*

5.9. Retaking the Exam

A student failing all or part of the exam may retake all or part of the exam one time at the discretion of the committee. Timing and composition of the re-examination will be determined by the committee. A student must complete the re-examination by the end of the first semester

of the fourth year in the program. Students not meeting this milestone may elect to transfer to the MS program or to leave the BME program.

5.10. Appeals

A student may use the appeals process at the home institution to appeal any action of the committee. Refer to the graduate school appeals procedures at the home institution for procedures.

6. Research Proposal

All students must prepare a research proposal detailing the research to be conducted for the dissertation. The format and length of the proposal are to be determined by the committee. However, at a minimum, it should include the following sections:

- Abstract
- Specific Aims
- Background and Literature Review
- Preliminary Results
- Research Design and Methods
- References

The research proposal must be distributed to all committee members prior to the oral preliminary exam, with sufficient time for the committee members to review it and return comments to the student. The chair or academic co-chair must solicit tentative approvals of the proposal from all members of the committee before the oral preliminary exam may be conducted. Following the oral preliminary exam, the approved research proposal will be added to the student's file.

7. Oral Preliminary Exam

The oral preliminary exam is intended to examine the student's mastery of concepts related to the dissertation topic, the suitability of the research to be undertaken, and the student's readiness to perform Ph.D.-level original research.

7.1. Administration

The exam is to be administered by the student's advisory committee. In cases where the research advisor (co-chair) is outside the Department, the academic co-chair may organize the exam, by agreement between both chairs.

7.2. Timing

The exam is to be taken after the written preliminary exam is passed and after the research proposal is completed and tentatively approved by all members of the committee. The exam should not be taken until the student has advanced far enough in the research to be able to give a reasonably specific description of the remaining research to be performed. In general, the exam should be taken 1-2 years before completion of the research.

The oral preliminary exam must be passed and Ph.D. candidacy achieved within six years of entry into the program. Students who do not meet this time limit through extenuating circumstances may request an extension through the DGS/DGP. At NC State, this request must be approved by the Graduate School. Also, funding considerations may necessitate completing the oral preliminary exam earlier for some students (see Section 2).

7.3. Procedures

The following procedures will be followed for the exam. Upon agreement between the student and the committee, other rules and procedures may be applied, if they are not in conflict with those listed here.

- Students must schedule the exam by contacting the committee members and the Director of Graduate Studies/Programs. The form, *Request to Schedule the Doctoral Oral Examination*, is required at NC State. The form, *Report of Doctoral Committee Composition*, is required at UNC.
- The exam organizer (chair or co-chair) will announce the time, date, and place of the exam to the department.
- The format of the exam may be determined by the committee. It must consist of the following:
 - A presentation of the proposed research by the student
 - An opportunity for spectators (including non-committee faculty) to ask questions
 - An opportunity for committee members to ask questions (open or closed session)
- Following the questions, the committee will meet in closed session. Non-committee faculty members in attendance may attend the closed session and participate in the discussion.
- Each committee member determines whether the student has passed or failed the oral exam. *A unanimous vote of the committee is required for the student to pass.* Passing may be conditioned on some further work on the student's part, in which case the signature form will be held until the conditions are met.
- The form, *Doctoral Exam Report Form*, is required at UNC.

7.4. Rules

Questions for the student will generally relate to the application of the student's academic work to the research topic. Any coursework in the student's plan of work is a fair topic for a question. Committee members may consider the quality of the student's presentation, the student's responses to questions from committee members and spectators, and comments from attending faculty in the determination of passing.

7.5. Retaking the Exam

A student failing the exam may request re-examination one time. Changing the committee membership is permitted, but a student may still take a preliminary exam no more than twice in the student's BME career. The exam may not be retaken in the same semester nor until after three months have passed.

Students failing the exam twice must leave the program. There is no option to transfer to the MS program after the second failure. Students may elect to transfer to the MS program after the first failure.

7.6. Appeals

A student may use the appeals process at the home institution to appeal any action of the committee. Refer to the graduate school appeals procedures at the home institution for procedures.

8. Final Doctoral Exam

The Final Doctoral Exam (also called the *Defense*) is a defense of the work presented in the dissertation. It is intended to be an opportunity for the student to showcase his/her work in a public forum. Any procedures, formats, or requirements not specifically laid out here or in the policies of the home institution are left to the committee to determine.

8.1. Administration

The exam is to be administered by the student's Ph.D. committee. In cases where the research advisor (co-chair) is outside the Department, the academic co-chair may organize the exam, by agreement among both chairs and the student. All committee members are expected to be present. Committee members may attend by video- or tele-conference provided suitable accommodations are made.

8.2. Timing

The student must have met all program requirements required to this point. NC State requires that students complete the Ph.D. in ten years from the date of entry. Leaves of absence are still counted in the ten-year limit. UNC requires that the Ph.D. be completed in eight years, not counting leaves of absence. The time limit and procedures for extension of the student's home institution apply.

The Final Doctoral Exam may not be scheduled in the same semester that the student is admitted to candidacy.

8.3. Procedures

The exam is to be administered by the student's Ph.D. committee. In cases where the research advisor (co-chair) is outside the Department, the academic co-chair may organize the exam, by agreement among both chairs and the student.

- Students must schedule the exam by contacting the committee members and the Director of Graduate Studies/Programs. A form, *Request to Schedule the Doctoral Oral Examination*, is required at NC State.
- The exam organizer (chair or co-chair) will announce the time, date, and place of the exam to the department.
- The dissertation must be complete (save for revisions resulting from the defense) and circulated to the committee *two weeks* prior to the defense.
- The format of the defense may be determined by the committee. It must consist of the following:
 - A presentation of the research by the student
 - An opportunity for spectators (including non-committee faculty) to ask questions
 - An opportunity for committee members to ask questions (open or closed session)
- Following the questions, the committee will meet in closed session. Non-committee faculty members in attendance may attend the first part of the closed session and offer any comments. Non-committee faculty must then leave. The final deliberations and vote are open only to the committee.
- Each committee member determines whether the student has passed or failed the oral exam. *A unanimous vote of the committee is required for the student to pass.*
- The form, *Doctoral Exam Report Form*, is required at UNC.

8.4. Rules

Questions for the student will generally relate to the dissertation. Committee members may consider the quality of the student's presentation, the student's responses to questions from committee members and spectators, and comments from attending faculty in the determination of passing.

8.5. Retaking the Exam

A student failing the defense may request re-examination one time. Re-examination will only be permitted if recommended by the committee. The exam may not be retaken in the same semester nor until after three months have passed.

Students failing the exam twice must leave the program. There is no option to transfer to the MS program.

8.6. Appeals

A student may use the appeals process at the home institution to appeal any action of the committee. Refer to the graduate school appeals procedures at the home institution for procedures.

9. MS Students Changing to Ph.D. Status

After entering the program, a student with MS status may request a change to Ph.D. status. The following rules apply:

- The student must submit a Plan of Work for a Ph.D. program, complete with courses and an advisory committee. The committee's approval of the Plan of Work constitutes a faculty recommendation for the student to be admitted to Ph.D. status.
- The two-year time limit for the Core Topics requirement applies from the date the student began in the program, not from the date of submission of the Plan of Work.
- It must be possible for the student to meet the Ph.D.-level Core Topics requirement. For example, a student requesting change of status in the fourth semester without a possibility of meeting the Core Topics grade requirement cannot be admitted to the Ph.D. program.

10. Obtaining the MS Degree while in Ph.D. Status

A student in Ph.D. status may obtain an MS degree on the way to the Ph.D. degree. All time limits and milestones for both degrees must still be met. There are no extensions to the Ph.D. milestones for such students.

11. Part-time Students

In general, the Ph.D. program in BME is not designed or recommended for part-time students. At least the first two years should be taken as a full-time student in order to meet the Ph.D. milestones. No extensions to milestone time limits will be considered for part-time students.

12. Extensions to Milestone Time Limits for Leave of Absence

Extensions to milestone time limits are only permitted in the case of a student who is granted a formal leave of absence from the Graduate School at the home institution. During a leave of absence (up to one year), a student does not make academic progress, and that time will not be counted against the milestone time limits.