
2018-19

Graduate Program Handbook

Department of Biomedical
Engineering | UVA

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1. INTRODUCTION

1.1 WELCOME TO THE DEPARTMENT OF BIOMEDICAL ENGINEERING (BME)

We welcome you to the Department of Biomedical Engineering. Our mission is to develop intellectual leaders in the field of biomedical engineering. We hope that this student handbook will help you accomplish this goal, and make your time here both stimulating and rewarding.

Our program has a long-standing commitment to teaching and research education. Faculty research focuses in cardiovascular bioengineering, biomedical & molecular imaging, cellular & molecular bioengineering, cancer engineering, tissue engineering & biomaterials, musculoskeletal bioengineering, and systems biology & computational bioengineering. This diversity highlights the field of biomedical engineering as an exciting multidisciplinary engineering profession.

The BME Department leads several partnerships between the Schools of Engineering and Medicine and the College of Arts and Sciences. As an example, a number of faculty in the department collaborate closely with researchers in the Cardiovascular Research Center, Cancer Center, and Departments of Radiology, Surgery, Cardiology, Center for Public Health Genomics, and many other centers and departments across Grounds. The integration of a wide spectrum of engineering and medical research in the BME department provides the foundation for a leadership position in BME research and education at the University of Virginia and in the nation.

Graduate school is a place to explore the boundaries of the possible and develop your scholarship potential to the highest level. This is the time to develop your independent thinking, seize the opportunity to interact with a wide range of talented student and faculty colleagues, enjoy the riches of the university environment, and be creative in everything you do. We welcome you as a partner in learning and as a colleague in BME.

Frederick Epstein, Ph.D.
Professor and Chair
Department of Biomedical Engineering

Jason Papin, Ph.D.
Professor and Graduate Program Director
Department of Biomedical Engineering

1.2 FROM THE GRADUATE PROGRAM COORDINATOR

This handbook has been prepared to assist you to make the transition into our graduate program and to serve as a resource for you during your pursuit of a graduate degree. The Graduate Record of the University of Virginia provides a comprehensive guide of your rights and responsibilities as a graduate student and can be found at <http://records.ureg.virginia.edu/index.php?catoid=44>. In addition to the handbook, there are a number of “people behind the scenes” who help the day-to-day work of the department go forward smoothly, and who are also able to serve as resources for you.

Name	Role	Duties
Tracy Burcin	Lab Specialist /IT Assistant	Assist with laboratory equipment purchasing/troubleshooting/repair. Assist with IT equipment purchasing/troubleshooting/repair.
Henry Pritchard	Information Technology	The department’s computer support technician
Kitter Bishop	Undergrad Program Coordinator and Public Relations/Special Projects	Manages undergraduate program, Manages special events and handles department public relations/communications.
Ian Gercheck	Grants Administrator	Assist faculty and students with grant proposals and submissions.
Keisha Jones	Executive Assistant to Chair	Chair’s Assistant; Room Reservations; office supplies; Seminar Speaker Schedules.
Crystal Lamm	Unit Administrator /Human Resources	Manages BME Office Staff Human Resources contact for Faculty, PRS and Staff; Department Budget
Anita Dodds	Senior Purchaser	Assists with purchases and travel reimbursements.
Hannah Moore	Coulter Translational Partnership Coordinator	Manages Coulter Program.
Kim Fitzhugh	Graduate Student Coordinator	Manages BME Graduate Program/ BIMS Administrator

Biomedical Engineering represents an interface between engineering, medicine, and science. Consequently, it must draw on the full range of knowledge accumulated in the life sciences, medicine, the physical sciences and mathematics, and engineering. Technological development as well as the implementation of concepts, methods, and products in biomedical engineering requires competency in both the fields of engineering and medicine.

The ME, MS, and PhD degrees form the core of the BME graduate educational program. These degrees have the broad goal of educating students with the knowledge and skills needed to succeed in careers in research and development. Successful completion of these degrees will require that a student meet the following expectations, in addition to the formal degree requirements:

1. **Completion of original research.** Students will complete a research project under direction of their faculty advisor. The end goal of this work should be experimental or simulation results, methods, and analysis which are of a level of quality sufficient for presentation in a refereed publication. To achieve this end, students will need to make a novel contribution to their respective fields. Students should always be aware that research is not a job performed for the benefit of his or her faculty advisor, but rather is an integral part of graduate education. As such, students must take initiative and responsibility for the success of their research.
2. **An ability to think critically.** Successful students will be able to evaluate the validity of new results and ideas. They will be able to make precise statements about limitations of experimental methods and identify the weaknesses of new and existing hypotheses. They will be able to identify the next step in their research and design experiments to test their hypotheses and/or designs.
3. **Critical knowledge of the core literature in their field.** Students should know the central literature in their field. They should be aware of the important implications and possible limitations of existing knowledge.
4. **Excellent oral and written presentation skills.** Success in both academics and industry requires clear communication of ideas to technical and lay audiences. Students should use graduate school as an opportunity to hone presentation skills.
5. **Completion of formal course requirements.** Course work provides students with basic knowledge and problem solving skills central to the field of Biomedical Engineering. In addition, advanced courses in the School of Engineering and Applied Science and in the School of Medicine offer knowledge and skills that can be applied to specialized areas of research.

Students intending to pursue a PhD in Biomedical Engineering are encouraged to apply to do so at the beginning of their studies at Virginia. *They may proceed directly to a PhD or earn a Master of Science or Master of Engineering degree along the way.*

2. EDUCATION PROGRAMS AND REQUIREMENTS

2.1 PROGRAM ADMINISTRATION

Following is a list of committees designated to advise you on all aspects of BME graduate education. The committee members, your advisor, and the Department Chair are all available for consultation. A complete listing of committees and their members is included in **Appendix III**.

2.1.1 GRADUATE RECRUITMENT AND ADMISSIONS COMMITTEE

- a. Recruits students to apply and evaluates admission applications.
- b. Recommends new graduate students for admission and financial support.

2.1.2 GRADUATE PROGRAM COMMITTEE

- a. Sets the ME, MS, and PhD requirements and approves programs of study.
- b. Formulates and assesses the course requirements for the degrees of ME, MS, and PhD.
- c. Advises students (along with their doctoral advisory committee) concerning the PhD program, including the announcement of the defense of the proposal and dissertation.
- d. Validates and approves results of all relevant examinations (comprehensive exams, dissertation proposals, master's thesis and dissertation defenses).
- e. Processes administrative forms such as **Plan of Study** and **Doctoral Advisory Committee**.

2.2 MENTORING POLICY

2.2.1 FACULTY ADVISOR

Faculty advisors (usually the research project advisor) provide guidance to students on structuring their programs of study, career goals, identifying learning opportunities, and carrying out research of mutual interest. It is expected that advisors and students meet regularly to discuss progress.

2.2.2 ADVISORY COMMITTEE

The doctoral advisory committee provides broader scientific and academic advising for the student. The **committee should meet with the student at least once a year** to advise and evaluate progress towards graduation. The committee chair leads this committee and supports the student and the advisor through the process of meeting graduation requirements.

The Doctoral Advisory Committee should consist of a *minimum* of five faculty members, including the student's faculty advisor; *at least two members* must be primary BME faculty, and one should be a minor representative from outside the BME department. The chairperson of the committee (who may **not** be the student's faculty advisor) **must** have a primary appointment in the BME department. (When the student's advisor is not on the BME faculty, the committee chairperson will function as a co-advisor and department representative.)

For the Master of Science, the committee must consist of at least three faculty members including at least one primary BME faculty member and at least one member from outside the department. Adjunct faculty are acceptable outside members if they provide an objective and diverse viewpoint.

2.2.3 OMBUDS

Students are encouraged to express their comments and concerns regarding their experiences in the graduate program in Biomedical Engineering. In order to ensure that students have a point of contact for such concerns, the Graduate Program Committee chair (currently Dr. Jason Papin) and one additional faculty member (currently Dr. Shayn Peirce-Cottler) serve as points of contact. In addition, there is a university ombuds (Brad Holland) that can be reached at ombuds@virginia.edu, with additional contact information here: <https://eocr.virginia.edu/ombuds/contactlocation>. The ombuds should be considered by the students as individuals who are available for open discussion of concerns regarding their education. Any student can request a meeting with the ombuds at any time.

This site explains the purpose and limitations of ombuds: <https://eocr.virginia.edu/ombuds-faqs>. Additional resources are provided here: <https://eocr.virginia.edu/ombuds/university-resources-students>.

2.3 ENGLISH LANGUAGE PROFICIENCY

All new graduate students whose first language is not English are tested for English proficiency prior to their first semester at UVa. All non-native speakers of English take the Virginia English Language Proficiency Exam (UVELPE) and the SPEAK Test, which are administered by the Center for American

English Language and Culture (CAELC). Students must pass the SPEAK Test before commencing their BME Teaching Experience. If a pass grade is not achieved on the SPEAK Test, CAELC offers a program of courses in preparation for a repeat test at a later date. If a student takes the SPEAK Test in the Fall, portions of the VELP and the SPEAK Test are merged into a single composite exam.

2.4 GENERAL ACADEMIC REGULATIONS

2.4.1 STUDENT STATUS AND RESIDENCY REQUIREMENTS

Candidates for the Master of Science degree must complete at least one semester in residence as a full-time student at the University of Virginia. Candidates for the Doctor of Philosophy degree must complete at least six semesters (not including Summer semesters) of graduate study beyond the baccalaureate degree, or four semesters (not including Summer semesters) beyond the master's degree. At least two semesters beyond the master's degree must be in full residence at the University of Virginia in Charlottesville.

A student receiving financial support from the Biomedical Engineering Department, the School of Engineering and Applied Science, or the School of Medicine, must be registered full-time, defined as at least 12 credit hours of lecture/laboratory courses and/or research per semester during the academic year, and 6 credit hours of research only during the Summer. Students receiving financial support are not permitted to have other employment without prior approval from the Director of Graduate Education.

2.4.2 TIME LIMIT FOR DEGREES

The time limit for completion of the MS is five years after admission. The time limit for the ME and PhD degrees is seven years after admission.

2.4.3 TRANSFER OF CREDIT

Master of Science candidates may transfer a maximum of 6 credits of approved graduate courses into the program. Master of Engineering candidates may transfer 12 hours of graduate credit. Doctor of Philosophy candidates' requests for transfer of courses from other schools of recognized standing must be submitted for approval *at the same time as* the program of study.

These graduate courses must have been completed at another school of recognized standing. They cannot have been used to satisfy requirements for another degree, and only courses with a grade of B or better may be transferred. All requests for the inclusion of transfer credit in the University of Virginia program of study are subject to the approval of the candidate's academic department and the Director of Graduate Education. Transfer credits should be submitted on the Request [Approval of Transfer Credits form](#).

2.4.4 GRADUATE COURSE DROP DEADLINE

The last date for dropping a graduate course is posted in the UVA academic calendar. It differs by school. <http://www.virginia.edu/registrar/reginst1188.html#Deadlines>

2.4.5 INCOMPLETE GRADES AND REPEATED COURSES

A 10-day period past the end of the semester (end of the examination period) is automatically allowed to remove an incomplete. Maximum extension to the end of the following semester (following Fall for a Spring class, and following Spring for a Fall class) may be granted by special request to the Dean's office. If a course is repeated, both grades are used in the GPA calculation.

2.4.6 OUTCOME ASSESSMENT

The School of Engineering and Applied Science has instituted an outcome assessment program. A set of student learning outcomes and associated assessment forms has been defined for each graduate

program. The level of achievement of each outcome will be evaluated for every student as the student proceeds through the program. More information about outcome assessment (and the associated forms) can be found at the following links:

<http://www.seas.virginia.edu/advising/allforms.php#assessment>

<http://www.seas.virginia.edu/advising/allforms.php>

2.5 BME ACADEMIC REQUIREMENTS

	ME	MS	PhD	PhD (prior MS)	PhD/MSTP ⁵
Coursework Requirements					
Core Courses ¹ BME 6101 and 6102 BME 6310 and 6311					BME 6310 and 6311
BME 8995 (ME Project)	3 credits	No	No	No	No
Graded credit hours of coursework	30	24	24	12	18
Elective Educational Experiences	No	No	2	2	1
Research course hours ²	No	BME 8999 6 credits	BME 8999 (before comps), BME 9999 (after comps), 24 credits	BME 8999 (before comps), BME 9999 (after comps), 24 credits	BME 9999 24 credits
Total overall credits	30	30	48	36	42
Other Requirements					
Qualifying/Comprehensive Exam (by beginning of 3 rd year)	No	No	Yes	Yes	Yes
Proposal of Research	Written	Written ³	Oral & Written	Oral & Written	Oral & Written
Oral Defense of Thesis/Dissertation	No	Yes	Yes	Yes	Yes
Written Final Report of Research/Thesis/Dissertation	Yes	Yes	Yes	Yes	Yes
Outcome Assessments	Yes	Yes	Yes	Yes	Yes
Teaching Assistant ⁴	No	No	2 semesters	2 semesters	1 semester
Attend BME Seminars	Yes	Yes	Yes	Yes	Yes

¹ Students with equivalent prior course work may place out of some or all of the core classes listed above by obtaining written permission from the course instructor and approval of the Graduate Program Committee. The "Permission to Opt-out of Department Core Course" form can be obtained from the Graduate Program Coordinator. Opt-out procedures typically include an oral or written examination on the course material. Opt-out course must be replaced with a graduate elective.

² Research credit does not count towards graded course credit hour requirement.

³ MS Students are expected to provide their committee with a written proposal prior to scheduling defense.

⁴ Teaching is an integral part of graduate training in Biomedical Engineering. All PhD students must participate in BME teaching assistantships in BME undergraduate or graduate courses as part of the

requirement for the degree, regardless of their source of funding for the stipend or fellowship. The teaching experience will normally be performed in the second and third years of doctoral study.

⁵ See special note on MSTP students in section 2.8 below.

2.6 ME PROGRAM

The Master of Engineering degree has similar course requirements to those for the MS degree (see Academic Requirements Table on pg. 9). The same course *cannot* be used to satisfy more than one of the requirements. An average GPA of at least 3.0 is required for graduation. Students are expected to complete all requirements by May of the second year. Instead of a thesis, a supervised research project must be completed and described in a written report to be accepted by the advisor.

Completion of an ME Project

- a. **Timing:** Student should register for the project (BME 8995) at an appropriate time. (Typically in their second or third term) This is a graded course and unlike thesis research, tuition is charged for 3 hours of credit.
- b. **Approval:** The project proposal must be approved by the advisor. A one or two page proposal that the advisor finds acceptable is suggested to help the student focus on the intent and scope of the project. The project should require approximately two (2) months of full time effort.
- c. **Report:** A written report describing the project is required. Be sure to discuss the format of the report with your project mentor.

ME Degree Administrative Requirements:

1. File a **Master's Degree Plan of Study** form by the end of the first term. Available on the BME Grad Program Collab site.
2. Attend the BME seminars during residence.
3. Complete the following **Outcome Assessment Forms** and submit them to the Graduate Program Coordinator (Forms are available online at <http://www.seas.virginia.edu/advising/allforms.php>):
 - [Engineering Design](#)
 - [Engineering Analysis](#)
 - [Technical Writing](#)
 - [Oral Communication](#)

2.7 MS PROGRAM

The Master of Science degree requires a minimum of 24 graded credit hours of course work, 6 credits of MS thesis research and satisfactory defense of a thesis. In addition to these academic requirements, certain administrative requirements must also be met. The same course *cannot* be used to satisfy more than one of the above requirements. An average GPA of at least 3.0 is required for graduation.

MS Degree Administrative Requirements:

1. File a **Master's Degree Plan of Study** form within first year of matriculation. Form is available on the BME Grad Program Collab site and must be approved by your Advisory Committee and the Graduate Program Committee.
2. File **Report on Final Exam** and **Thesis Outcome Assessment** upon successful passage of an oral thesis examination given by the student's MS committee. This committee must consist of at least three faculty members including at least one primary BME faculty member and at least one member from outside the department. Adjunct faculty are acceptable outside members if they provide an objective and diverse viewpoint.
3. Upload final Thesis to LIBRA prior to graduation.

2.8 PhD PROGRAM

The Doctor of Philosophy degree requires 24 graded credits of course work past the bachelor's degree (including any completed during a Master's program), plus two Elective Educational Experiences (see below). Students who enter the program already holding a Master's degree in an engineering discipline from a school *other than* the University of Virginia must take the core BME courses, completing at least 12 credit hours of graduate level coursework. A minimum 3.0 GPA is required for graduation.

Elective Educational Experiences

Elective Educational Experiences (EEEs) are intended to encourage students to begin the process of life-long learning essential to a career in Biomedical Engineering. We anticipate that students will often pursue EEEs later in the course of their PhD studies and select them based on their PhD research and future career plans. All EEEs must be approved by the student's thesis committee in advance. Students must submit to their committee a brief proposal stating the rationale for their EEE (how it fits with their individual plan of study), their goals for the EEE, and the metrics they will use to assess how well the EEE fulfilled those goals. At the completion of the EEE, students must submit a brief report to their committee assessing the EEE using the proposed metrics. EEEs must be approved prior to the thesis proposal, and students are encouraged to complete them prior to the proposal. Students are also encouraged to include a slide on their EEEs in their PhD proposal and/or defense presentations in order to share information on potentially valuable experiences with other students. An appropriate EEE is expected to involve roughly the time commitment of a typical graduate course; possible examples include:

1. Taking an additional graduate course beyond the normal course requirements.
2. Taking an intensive 2-week "short course" to learn a series of specialized techniques.
3. Completing a summer internship at a biotechnology company.

PhD Administrative Requirements:

1. Select an Advisor and form a [Doctoral Advisory Committee](#). Fill out the appropriate forms *no later* than the end of the second semester of doctoral study.
2. File a **PhD Plan of Study** *no later* than the end of the second semester of doctoral study (but preferably much sooner). The form is available on the Grad Program Collab site and must be approved by your Advisory Committee and the BME Graduate Program Committee.
3. Students are required to meet with their committee each year and at least 4 members are required to be present during the meeting. A committee meeting form will need to be filled out and signed by committee members and submitted to the BME Graduate Program Coordinator. The form is available on the Grad Program Collab site.

Special Note for MSTP (MD/PhD) Students:

Medical school physiology courses will be accepted in lieu of BME 6101 and BME 6102. These courses may not have to be replaced with additional credits. MSTP students need to complete at least 18 graded credits. An EEE with a focus on developing computer programming skills should be completed before the end of the first semester after transitioning to the PhD program if the student does not have sufficient programming experience to succeed in the core graduate BME curriculum. In addition, a three credit independent study may be required to completely satisfy SEAS credit requirements. See the graduate program coordinator for details.

2.8.1 FORMATION OF DOCTORAL ADVISORY COMMITTEE

Upon admission to the PhD program students should arrange for the appointment of a Doctoral Advisory Committee. The Doctoral Advisory Committee is a *resource* for you as you pursue graduate studies. It recommends, and gives initial approval to, a formal program of study, discusses research objectives and research plans with the student, and advises on the areas of study for the Comprehensive Examination. The Committee will meet with the student as needed to review progress and, if necessary, to revise the program of study. Students should consult with their Doctoral Advisory Committee *at least once a year* as their research progresses to ensure that their continuing research work is adequate as a doctoral dissertation. The Doctoral Advisory Committee *also* functions as the student's Examining Committee as he or she progresses through the PhD program.

The Doctoral Advisory Committee should consist of a *minimum* of five faculty members, including the student's faculty advisor; *at least two members* must be primary BME faculty, and one should be a minor representative from outside the BME department. The outside member must have a 0% appointment with the BME department. The chairperson of the committee (who may **not** be the student's faculty advisor) **must** have a primary appointment in the BME department. (When the student's advisor is not on the BME faculty, the committee chairperson will function as a co-advisor and department representative.)

Students should consult with their advisors about the composition of their Doctoral Advisory Committees. The committee is officially formed by the completion of the **Appointment of Doctoral Advisory Committee form** which is reviewed and approved by the Graduate Program Director. Because the Doctoral Advisory Committee is a resource for you, it should be formed *as soon as possible*. For most students, this will be at the end of the first year of graduate study. At the latest, the Doctoral Advisory Committee should be formed by the end of the second semester of graduate study. Students who have not formed a Doctoral Advisory Committee *will not* be permitted to take the comprehensive exam.

2.8.2 DOCTORAL DEGREE PLAN OF STUDY AND COURSE WORK

In deciding the doctoral course work and finalizing the PhD plan of study, students should seek assistance from their advisor and Doctoral Advisory Committee members and must obtain their approval. Because this is a *plan* of study, not a contract, students should make every effort to complete and submit it as soon as possible. This will allow the maximum flexibility for any necessary revisions to be made without delaying the student's progress to the PhD. The Plan of Study may be revised as necessary throughout the student's graduate study. Preparation of the **PhD Plan of Study** is an appropriate time to schedule the initial meeting with your Doctoral Advisory Committee. Students, their advisors, and Doctoral Advisory Committee members are responsible to design a plan of study suitable for the individual and that meets the academic requirements of the BME PhD program. The plan of study may consist of more than the minimum required credits.

The Plan of Study should be submitted to the Graduate Program Coordinator *no later than the end of the summer after second semester of doctoral study* but preferably sooner. These forms may also be revised as necessary during the course of the PhD program, in consultation with the student's Doctoral Advisory Committee. Students who have not submitted a Plan of Study and Distribution Requirements form by the *will not* be permitted to take the comprehensive (qualifying) exam.

2.8.3 COMPREHENSIVE (QUALIFYING) EXAMINATION

The Comprehensive (or Qualifying) Examination is required by the School of Engineering and Applied Science and all doctoral engineering students must take the exam (see UVA Graduate Record for general guidelines). Students intending to take the Comprehensive (Qualifying) Examination must complete the **PhD Plan of Study** and turn it in to the Graduate Student Coordinator for review by the Graduate Program Committee. This should be done *no later* than May 1 of the year that the student plans to take the comprehensive exam.

1. **Purpose:** To determine whether the student is able to comprehend and integrate a body of advanced knowledge, and is capable of original research. The student's ability to think, formulate, and present ideas is also evaluated.
2. **Timing:** All students should take the Comprehensive Examination before the end of the summer after the fourth semester of graduate study. Students may elect to take the Comprehensive Exam as early as after the second semester. Delayed examination is subject to the approval of his or her Doctoral Advisory Committee. Passage is required to continue the PhD program.
3. **Date of the Exam:** Exams are generally scheduled between the third week of May and the end of June. In March, an email will be sent to qualified students. Students should obtain approval from their Doctoral Advisory Committee before signing up for the Comprehensive Exam. Students who have not previously met with their Doctoral Advisory Committees, **must** schedule an initial meeting. Failure to comply with this guideline may result in delay in the completion of your degree. Students **must** have an approved Plan of Study on file before signing up for the Comprehensive Exam.

The student will need to work with their Advisory Committee to select a date for the exam and reserve a room. Once this is set, the student needs to alert the Graduate Program Coordinator. The Graduate Program Coordinator will then alert the Advisory Committee of the appropriate timeline for submitting the questions to the Graduate Program Director for approval, and then distribution to the student one week prior to the exam. The Graduate Program Coordinator will prepare the required forms and have them ready for the Advisory Committee chair to pick up the day of the exam.

4. **Format of the Comprehensive Examination:**

- a. **Oral Examination:** The oral exam will be administered by the student's Doctoral Advisory Committee. At least four (4) members of the Doctoral Advisory Committee must be present for the Comprehensive Examination in accord with SEAS rules, including at least two (2) primary BME faculty members. The chairperson of the student's Doctoral Advisory Committee will coordinate the preparation of the oral questions, with input from the entire committee. The duration of the exam is three hours or less. The chairperson of the student's Doctoral Advisory Committee should submit a copy of the oral exam questions to the Graduate Program Coordinator for inclusion in the student's file 14 days prior to the scheduled date of the exam. The chair of the Doctoral Advisory Committee will deliver the exam questions to the student and the Graduate Program Coordinator (by hard copy or by e-mail) seven (7) days prior to the scheduled exam date.

The oral examination will consist of a set of integrative questions (typically three) that have been prepared by the student's Doctoral Advisory Committee and provided to the student one week in advance of the oral examination. The questions will be based upon the individual's program of study, and include some aspects relevant to the anticipated thesis topic. The questions will:

- assess the ability to integrate a body of advanced knowledge in biomedical engineering
- include experimental design and hypothesis testing
- have a design or a quantitative analysis component

The student may research the questions to develop his or her answers in the week prior to the oral examination. However, the student may not enlist the help of other individuals in preparing answers - to do so will be considered a violation of the honor code. The student will provide an oral answer to each of these questions and, at the discretion of the Doctoral Advisory Committee, further defend the answers.

In preparing materials to be presented for the oral exam, the traditional method has been to give oral answers, with some graphs, equations, etc. as needed on the board. You may **not** use PowerPoint slides or the overhead projector. You are expected to write on the board using handwritten notes, if necessary. The objective is to convey your approach and solution to the problems concisely and convincingly.

You may also give hand-outs to the members of your Doctoral Advisory Committee (which functions as your Examining Committee) at the start of the exam at the discretion of the Chair of the Doctoral Advisory Committee. You **may not** hand out extensive background literature, appendices of any type, or additional materials such as derivations, etc., if you do not plan to include them in your own oral answer.

If deemed necessary or appropriate by the Doctoral Advisory Committee, the student may then be questioned on any material germane to his or her plan of study. Successful completion of the oral examination is determined by the Doctoral Advisory Committee.

- b. **Passing:** Students must pass the oral examination.
- c. **Number of Chances:** At the discretion of the Doctoral Advisory Committee, a student may be allowed at most two attempts to pass the Comprehensive Examination.

2.8.4 DEFENSE OF DISSERTATION PROPOSAL

1. **Purpose:** The student's Doctoral Advisory Committee will assess the quality of the student's research plan (including hypotheses to be tested, experimental design and methodology).
2. **Timing:** The PhD candidate is expected to complete the dissertation proposal **no later than 12** months after the Comprehensive Examination. Failure to complete and defend a dissertation proposal by the end of the third year of doctoral study may result in a delay in the completion of the program or even dismissal from the program. The student is responsible for working with the Advisory Committee to schedule a date and room for the event. Upon selecting a date and location, the student is then responsible for notifying the Graduate Program Coordinator at least 2 weeks prior to defense.

The written dissertation proposal is submitted to the Advisory Committee one week before the scheduled oral dissertation proposal examination which consists of a public oral presentation during which the student highlights the existing knowledge and the proposed new study. This will be followed by a private question and answer period with the Doctoral Advisory Committee. The total duration of the dissertation proposal defense is typically two (2) hours, at the discretion of the Doctoral Advisory Committee. At least four (4) members of the Doctoral Advisory Committee must be present for the proposal defense in accord with SEAS guidelines, including two (2) primary BME faculty.

3. **Defense Committee Composition:** The Examining Committee for the dissertation proposal is the student's Doctoral Advisory Committee. Four of the members of your committee must be present during the proposal. One of the four members must be the outside committee member.
4. **Proposal Format:** The written proposal should follow the general form of an NIH grant application, including page limits. Format guidelines can be found at: http://grants.nih.gov/grants/grant_basics.htm

2.8.5 DISSERTATION DEFENSE

The doctoral dissertation should be typed according to the format of the School of Engineering and Applied Science.

1. **Purpose:** To demonstrate competence in the field of the dissertation research and the quality of the dissertation for publication in scientific journals.
2. **Timing:** At completion of writing an approved dissertation. The properly formatted draft with all the figures should be submitted to the Doctoral Advisory Committee at least two weeks before the examination. Using the [Final Examination Committee](#) form, inform the Graduate Program Coordinator of the date selected for your defense, provide the title and a short abstract of the work, so that an announcement of the defense may be sent out. Public announcement of the dissertation

defense **must be made two weeks prior** to the scheduled examination date. Failure to do so will result in the rescheduling of the dissertation defense.

3. **Defense Committee Composition:** The Examining Committee for the dissertation defense is the student's Doctoral Advisory Committee. All 5 members of your committee must be present during the defense.
4. **Subject:** Defense of dissertation and questions about subject areas related to research field or arising from discussion of thesis work.
5. **Form:** The first part (40 minutes) is an oral presentation of the thesis which is open to the public. It is followed by a 1-2 hour oral defense before the Doctoral Advisory Committee and interested faculty.
6. **Failure:** Possibility for re-examination is determined by the Doctoral Advisory Committee.

2.8.6 GOING PRO

Biomedical Engineering PhD graduates are well-positioned to be leaders in industry. Going Pro is a unique opportunity for professional development, a significant deficiency in many graduate programs across the nation. Through the curriculum, mentoring programs, and department-sponsored internship, alums of this program will be well-positioned to lead in the biomedical engineering industry.

Program Description

There are three key elements of the Going Pro:

1. Industry Internship. Participants in Going Pro will be supported to participate in a two-month industry internship approved by the BME graduate program committee.
2. Mentoring. Students will be paired up with an alum of the department and required to meet throughout their training.
3. Course. Going Pro participants will take a 1-credit course in the Spring semester focused on professional development and BME industry.

Application Process

Students that have completed their 2nd year of the PhD program and successfully passed their comprehensive exam are invited to apply. See here for an application form.

Please contact Dr. Jason Papin (papin@virginia.edu) with any questions.

2.9 PUBLICATION OF THESIS/DISSERTATION

Students will upload their thesis or dissertation to LIBRA upon notification from the SEAS Graduate Programs Office (after final exam forms have been submitted). Paper bound copies are no longer required.

For more information on LIBRA and instruction of how to upload, please visit:

<http://pages.shanti.virginia.edu/libra/>

3. STUDENT ACTIVITIES, FINANCIAL AID AND SUPPORT

3.1 BMES STUDENT CHAPTER AT THE UNIVERSITY OF VIRGINIA

The University of Virginia student chapter of the Biomedical Engineering Society (BMES) plays several roles within the department. Primarily, the chapter works to promote the exchange of ideas among

students and faculty. We coordinate various educational and professional development, social, sporting, and service events throughout the year while reaching out to students who are interested in the application of science and engineering principles to medicine. Our chapter is comprised of undergraduate and graduate students within the BME department as well as students from other university departments who have an interest in BME. Our chapter has a strong record of service within the UVa and central Virginia communities and has been recognized by the National Biomedical Engineering Society several times.

Our BMES student chapter is dedicated to promoting the personal and professional development of its members and enhancing the community of scholarship within the department and the university. Our core values include:

1. Fostering a welcoming environment for our diverse student body and the development of our members via participation in BMES general body meetings and attendance at national conferences, departmental symposia, and university-wide colloquia.
2. Enhancing the sense of community within the department, the university, and the central Virginia area via service events, orientation events for incoming students, jointly sponsored guest lectures with other student societies, sponsoring student-student and student-faculty interactions both within and outside of the classroom.
3. Increasing the chapter's visibility on the national scale via attendance and participation at national and international conferences, recruiting guest speakers from national corporations, and enhancing communication with the BMES national chapter through the president and vice president of graduate and national affairs. BMES typically has funds available to provide travel awards for students to help achieve this goal.

We are dedicated to improving understanding of the field of biomedical engineering, fulfilling the intellectual needs of our students, and assisting in their preparation for careers in biomedical engineering. BMES focuses much of its energy on identifying and reconciling the needs of its students and the larger community.

The Biomedical Engineering Society is devoted to fostering a collegial and collaborative environment between undergraduate students, graduate students, and faculty. To build a strong community we sponsor intramural sports teams, organize wine tasting tours, picnics, happy hours and bar nights, and other organized social activities. In addition to student activities, we help to coordinate and organize a faculty-student fall picnic and holiday party.

Our chapter holds approximately six meetings throughout the year that are open to undergraduate BME students, graduate BME students, and other non-BME students interested in the field. Example meeting agendas include grant writing and alumni panels. We invite you to browse through our website at <http://www.bme.virginia.edu/bmes/index.html>.

Our chapter has a strong record of excellence. We hope to continue this tradition and look forward to you joining us! There are several officer positions available for interested graduate students and a number of opportunities to help and contribute to BMES. Any questions, ideas, or suggestions regarding BMES can be directed to either the Graduate BMES President or Vice President (current list in appendix II).

3.2 FINANCIAL SUPPORT AND DEAN'S FELLOWSHIPS

Graduate students in the Department of Biomedical Engineering are typically supported through a combination of Graduate Research Assistantships (GRAs), Graduate Teaching Assistantships (GTAs), appointments on training grants, and Fellowships. Students on GTAs receive partial tuition and stipend support in return for their effort in assisting with education in specific courses at the University. Specific requirements and expectations will be defined by the instructor with whom the student is working. All doctoral students are required to participate as teaching assistants in BME courses as part of the degree program.

Students on GRAs receive tuition and stipend support in return for their contribution to a specific research laboratory in the Department. Since these funds originate from individual faculty research

grants, requirements and expectations are determined by the Principal Investigator, usually the student's research advisor. Students are expected to contribute at least 20 hours per week during the academic year and 40 hours per week in summer.

The 12-month base salary for GRAs and GTAs is \$30,500 for PhD students. Students receiving financial support are not generally allowed to work outside the University. There are periodic adjustments to the base stipend level to reflect cost-of-living-increases. Health Insurance is provided as part of your annual support. Enrollment occurs in August of each year and you will receive notices from student health directing you to the online enrollment site.

In order to be eligible for full financial support, students must register for 12 hours in each semester (6 research hours in the summer). The hours may be any combination of course credits and research credits, or may be research only if all course requirements have been completed.

Students are encouraged to seek fellowship opportunities available to them from foundations, national societies, and the government, with the help of the faculty. All BME graduate students are members of the "BME Grad Awards" site on Collab which serves as a repository of information on graduate awards, fellowships, and scholarships.

The University offers free tax help to US and Permanent Resident students each year between February and April. You will receive a flyer via email when the services become available each year. Appointments can be made online at: www.cvilletaxaid.org.

A partial list of the internal and external fellowships is available below. Students are encouraged to discuss with their faculty advisor for nominations.

BME and UVA-specific Fellowships:

- UVA Award for Excellence in Graduate Diversity
- Robert R. Wagner Fellowship
- Mary and Otis Updike Professional Development Award in BME
- John McGaughy Award
- Jill E. Hungerford Award
- Peach Fellowship Award
- Micron Fellowship
- Sture G Olsson Fellowship
- ARCS Fellowship
- L. William Ballard Jr. Fellowship
- Virginia Engineering Foundation
- James G Simmonds (Applied mechanics/mathematics)
- Volkswagen Group of North America Fellowship

External Fellowships:

- NSF Graduate Research Fellowship
- Ruth L. Kirschstein National Research Service Awards for Individual Predoctoral Fellows
- American Heart Association Predoctoral Fellowship
- Ford Foundation Fellowship
- RWJF Health Policy Research Fellowship
- P.D. Soros Fellowship for New Americans
- SREB Doctoral Scholars Program Fellowship
- Graduate Women in Science National Fellowship
- UNCF/Merck Graduate Science Research Dissertation Fellowships
- American Association of University Women American Fellowship
- Office of Navajo Nation Scholarship & Financial Assistance Scholarship
- American Indian Graduate Center Fellowships
- NASA Harriett G. Jenkins Predoctoral Fellowship Project
- NDSEG Graduate Fellowship
- DoD SMART Fellowship

- Merck Graduate Science Research Fellowships
- Society for Women Engineers (SWE) Scholarships
- Schlumberger Foundation Faculty for the Future Fellowship
- Golden Key Fellowships
- Microsoft PhD Fellowship
- Women Techmakers Scholars Program
- American Society for Microbiology Graduate Research Fellowship
- ARCS Award: Achievement Rewards for College Scientists

3.3 ROTATION PROGRAM AND FELLOWSHIPS

Students supported by fellowships receive tuition and stipend as described under the conditions of the specific fellowship. In many situations, fellowships are meant to support a student's general education and do not entail specific time or task requirements. Departmental and training fellowships awarded to first-year students may require completion of a rotation program in the first semester of study. The rotation program is designed to broaden the perspective of students in biomedical engineering research and to help them to make an informed choice of laboratory for their thesis work. Students typically rotate in two to three laboratories identified during the interview and admissions process. It is expected that students will spend six weeks working in each lab during the Fall semester. Activities in the laboratory will consist of literature reading, participation in designated experiments, learning the specific aims and rationale of the faculty member's research, attending lab or journal club meetings, and preparing a summary of their experiences in each lab.

3.4 DEPARTMENT SEMINARS AND STUDENT RESEARCH SYMPOSIA

During the academic year, BME holds a weekly Seminar Series, a weekly event that brings together faculty, students, and clinicians across disciplines from the University and Medical Center to learn about new research and technologies in the biomedical sciences and engineering. Research presentations are given by prominent speakers from within the university community and nationally recognized biomedical engineers, cell and molecular biologists and clinicians in academia and industry. There are also special seminars presented throughout the year such as: a BMES student chapter sponsored speaker, BME Graduate Student Research Symposium, and the BME Distinguished Speaker Seminar Series. The Distinguished Speaker series is a great opportunity for all of us to hear from a prominent and internationally recognized leader in the field of biomedical science and engineering. These may include department chairs, national academy members, and industrial leaders in biotechnology.

All students and faculty are expected to attend each weekly Friday seminar. A "Meet the Speaker" session is open for all graduate students following the seminar presentation, and provides a unique opportunity for students to engage with seminar speakers in a more informal manner.

3.5 STUDENT TRAVEL

All students, particularly those in the PhD program, are encouraged to attend national, and where possible, international conferences with their laboratory group. Attendance at such meetings gives students opportunities to meet and interact with researchers with a broad range of interests. These experiences are instrumental in assisting students to develop, formulate, and modify their Master's and PhD projects and career plans. Also, excellent Career Fairs or networking opportunities exist at most major meetings.

Some student fellowships and traineeships have specific allotments for travel and other related purposes. Students working on research projects can sometimes arrange to have special expenses paid by a research grant. Consult your project director or faculty advisor.

In exceptional circumstances, students seeking travel and other funds for paper presentation who have exhausted other possibilities for funding their travel should submit a request accompanied by the research paper to the department Chair. Prior approval is required. Students should also be familiar with state regulations governing, for example, receipts to justify the expenditures, the use of state cars and the

limits on lodging and meal costs. Students are responsible for making their own travel arrangements in compliance with University requirements regarding travel.

3.6 OFFICE SPACE ASSIGNMENT

Students may use desks in their advisor's laboratory or office space. Other spaces in the department are available upon request for student meetings or activities. The BME Department also has a small collection of books and journals in the Library (Rm. 2019). This is a reading/reference library and journals and books should not be removed from the room.

3.7 USE OF COMPUTER EQUIPMENT, LIBRARY, AND EXTERNAL FACILITIES

BME Students are welcome to use the department's computer lab, network printers, and other technology resources for academic purposes. Laboratory computers and research equipment should only be used with permission from the responsible laboratory director.

University computing accounts are managed by the Information Technology Services (ITS) group and are used by BME to access network resources. ITS also provides limited network file storage at no cost to users. Please contact BME IT Support with questions.

3.8 GRADUATE DIVERSITY ACTION COMMITTEE

The committee consists of graduate student volunteers with the goal of recruiting students from diverse backgrounds and ensuring that the department remains a welcoming environment for all. This committee promotes access to UVA resources for underrepresented minorities, women, families, LGBT, and nontraditional students. For more information or to get involved contact the chair of the Diversity Action Committee (see Appendix).

3.9 FORMS

A listing of all SEAS required forms can be found at: <https://engineering.virginia.edu/current-students/current-graduate-students#accordion88012>

In addition to the forms published on the SEAS website, there are several forms that BME requires that are not available on the SEAS website. These include the Plan of Study forms for all of the degree plans and the Educational Elective Forms for the PhD plan. The forms can be accessed via the BME Graduate Program Collab site: <https://collab.itc.virginia.edu/portal>. You will be subscribed to this collab site and the Grad Awards Collab Site once you have activated your UVA email account.

CHECKLIST FOR MASTER'S PROGRAMS

- ___ Request an advisor. Due no later than end of 1st semester
- ___ ME and MS Plans --Meet with your advisor and prepare a **Plan of Study** form. Due no later than end of 1st year
- ___ ME Plan--Submit draft of ME Project proposal to advisor by the end of your first term. Project completion timeline TBD by advisor and student.
- ___ MS Plan --written draft of thesis proposal to advisor and committee. Ideally by the end of your first year.
- ___ MS Plan--Schedule Final Defense of Thesis. No later than 5th year.

This examination is public and announcement of it must be distributed at least 7 days in advance.

Two forms must be prepared in advance of the scheduled defense: **Report on Final Examination** and **Thesis Outcome Assessment**. Your Graduate Program Coordinator will prepare these using the information you submit for the public announcement – Date, Time, Location, Committee Members Names, Title and Abstract.

There are specific deadlines set by the Registrar's Office and the SEAS Deans Office that must be met in order to complete your degree requirements to have your degree conferred during the applied term. Once you apply for your degree you will receive the notification emails with those specific dates. You MUST adhere to those dates or you will be removed from the degree candidate list.

- ___ ME Plan – Complete 3 program assessments and submit to SEAS Deans Office.
- ___ Apply for your degree in the Student Information System (SIS). **Dependent on defense date.**
Graduation application DUE DATES – October 1 for January graduation, February 1 for May graduation, and June 1 for august graduation.
- ___ Upload your dissertation to LIBRA.
Due date – refer to date published by the SEAS Graduate Office for the term you have applied for graduation.

CHECKLIST FOR PHD PROGRAM

- ___ Select or Request an advisor. **Due no later than end of 1st semester**
- ___ Appointment of a doctoral advisory committee. **Due no later than end of 1st year**
- ___ Submit a **Program of Study** Due **end of 3rd Semester**

MUST BE COMPLETED PRIOR TO SCHEDULING COMPREHENSIVE EXAM.

- ___ Request and take the Ph.D. comprehensive examinations. **Schedule in May/June of 2nd Year**
(Approximately the same time course work is completed.)
- ___ Submit written draft of dissertation proposal to advisor. **Middle of 3rd year. No later than 4th year**
- ___ Schedule presentation of dissertation proposal with committee. **No later than 4th year.**
- ___ Schedule defense (final oral examination). **No later than 5th year.**

This examination is public and announcement of it must be distributed at least 7 days in advance.

Two forms must be prepared in advance of the scheduled defense: **Report on Final Examination** and **Dissertation Outcome Assessment**. Your Graduate Program Coordinator will prepare these using the information you submit for the public announcement – Date, Time, Location, Committee Members Names, Title and Abstract.

There are specific deadlines set by the Registrar's Office and the SEAS Deans Office that must be met in order to complete your degree requirements to have your degree conferred during the applied term. Once you apply for your degree you will receive the notification emails with those specific dates. You MUST adhere to those dates or you will be removed from the degree candidate list.

- ___ Apply for your degree in the Student Information System (SIS). **Dependent on defense date.**
TERM DUE DATES – by October 1 for January graduation, February 1 for May graduation, and June 1 for August graduation.

- ___ Upload your dissertation to LIBRA.

Due date – refer to date published by seas grad office for term you have applied for graduation.

- ___ Submit Survey of Earned Doctorates. Print completion certificate, scan and email to Barbara Graves, bag2y@virginia.edu, SEAS Graduate Engineering Registrar.

Due date – refer to date published by seas grad office for term you have applied for graduation.

APPENDIX I: COMMITTEES AND DIRECTORS

UNDERGRADUATE PROGRAM DIRECTOR

William Guilford, Associate Professor
Tel. 243-2740; Email whg2n@virginia.edu

GRADUATE PROGRAM DIRECTOR

Jason Papin, Professor
Tel. 924-8195; Email papin@virginia.edu

GRADUATE PROGRAM COMMITTEE

Chair: J. Papin (papin@virginia.edu; 924-8195) Members: S. Blemker, D. Griffin, S. Hu, G. Rohde, E. Zunder

GRADUATE RECRUITMENT AND ADMISSIONS COMMITTEE (2016-2017)

Chair: S. Hu (sh6ps@virginia.edu, 243- 5795) Members: G. Rohde, K. Kelly, T. Barker, M. Civelek, E. Zunder, N. Sheffield, M. Lazzara, C. Meyer, K. Janes

SEMINAR COMMITTEE

Chair: C. Meyer (cmeyer@virginia.edu, 243-9495). Members: F. Epstein and K. Janes.

DIVERSITY COMMITTEE

Chair: M. Civelek (mete@virginia.edu 243-1669). Members: K. Kelly, K. Janes and S. Blemker.

APPENDIX II: STUDENT ORGANIZATION OFFICERS

BMES STUDENT CHAPTER OFFICERS

Kristen Fread, President
Cailey Fitzgerald, Outreach Chair
Laura Dunphy, Career and Professional Development Chair
Laura Rose Caggiano, Social Chair
Katie Gorick & TK Phung, Recruiting Chairs
Helen Sporkin & Katya Risu, Symposium and Seminar Co-Chairs
Samantha Perez & Adrienne Williams, Diversity Co-Chairs

APPENDIX III: IMPORTANT AND USEFUL STUDENT LIFE RESOURCES

General UVA information:

BME home page: <http://www.bme.virginia.edu>

BIMS home page: <http://www.bims.virginia.edu>

UVA Graduate Guide: <http://www.virginia.edu/graduateguide/>

UVA Health System home page: <http://www.med.virginia.edu/>

School of Engineering: <http://www.seas.virginia.edu/index.php>

School of Medicine: <http://www.healthsystem.virginia.edu/education-research/medschl.cfm>

Academic information:

Academic Calendar: <http://www.virginia.edu/registrar/calendar.html>

Course Offering Directory: <http://www.virginia.edu/registrar/> -- click on Course Offering Directory link

Registrar's Office: <http://www.virginia.edu/registrar/>

Summer Session Office: <http://www.virginia.edu/summer>

Library and computing facilities:

Charles L. Brown Science and Engineering Library: <http://www.lib.virginia.edu/brown>

Health Sciences Library: <http://www.healthsystem.virginia.edu/internet/library/>

ITC Web: <http://www.itc.virginia.edu>

OVID: <http://www.healthsystem.virginia.edu/internet/library/collections/databases/medlinehome.cfm>

Career planning:

Office of Career Planning and Placement: <http://www.career.virginia.edu/>

Office of Engineering Career Services: <http://www.seas.virginia.edu/careerdevelopment/>

Resources for Underrepresented Minority Students and Women in Science

Graduate and Postdoctoral Diversity Programs: <https://graddiversity.virginia.edu/>

Center for Diversity in Engineering: <http://www.seas.virginia.edu/admin/diversity/>

Black Graduate and Professional Student Organization (BGPSO): <https://www.facebook.com/bgpso/>

Graduate Student LatinX Organization (gradLatinX):

<https://www.facebook.com/groups/UVAgradLatinX/>

Society for Women Engineers (SWE): <https://www.facebook.com/groups/UVAgradSWE>

Women in Math and Science (WIMS): <http://wimsuva.wixsite.com/wims-uva>

LGBTQ Center: <http://www.virginia.edu/deanofstudents/lgbtq/>

Nursing Mother Room Locations: <http://www.hr.virginia.edu/news-events/news/nursing-mothers>

Maternity Leave Policy: <http://uvapolicy.virginia.edu/policy/PROV-028>

Housing Resources

International Center Temporary Student Lodging: <https://internationalcenter.virginia.edu/lodgings>

On-grounds graduate housing: <https://housing.virginia.edu/graduate-students>

Off-grounds housing: <https://offgroundshousing.student.virginia.edu/>

Graduate and Family Housing Association: <https://pages.shanti.virginia.edu/GFHA/>

Other useful information:

UVA Collab: <https://collab.itc.virginia.edu/portal> - BME Awards, BME GradLife, BME Graduate Program

Athletics: <http://virginiasports.collegesports.com/>

Housing Division: <http://www.virginia.edu/housing/>

International Studies Office: <http://www.virginia.edu/iso/>

Intramural/Recreational Sports: <http://www.virginia.edu/ims/>

Parking and Transportation: <http://www.virginia.edu/parking/>

Student Health: <http://www.virginia.edu/studenthealth/>

Counseling and Psychological Services: <http://www.virginia.edu/studenthealth/caps.html>

Faculty Employee Assistance Program: <https://www.medicalcenter.virginia.edu/feap/general-information/staff.html>

Maxine Platzner Lynn Center: <http://womenscenter.virginia.edu/>

UVA News: <http://www.virginia.edu/topnews/>