

University of Vermont
Biomedical Engineering Graduate Program

I.

II. INTRODUCTION

This document is intended as a guide for BME graduate students but does not include the full detail of the University of Vermont (UVM) Graduate College requirements. Consult the Graduate College for further information, <https://www.uvm.edu/graduate>.

The Biomedical Engineering (BME) program at UVM offers programs of study leading to Master of

III. MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

Program of Study

The M.S. degree in BME requires, at a minimum, 30 credit hours at the (2xx) 5xxx level or higher and the completion of a comprehensive examination. To bolster background knowledge and with pre-approval from the Graduate College and the student's advisor, a student may apply up to three credits of (1xx) 3xxx or 4xxx level coursework to their M.S. degree requirements.

Students can choose, in consultation with their graduate advisor or the BME Graduate Director, between the Thesis, Project, or Coursework options. M.S. students are rarely funded, and only Thesis option students are eligible for GTA or GRA funding, which requires approval from a thesis advisor and a signed offer letter from the EBE Department. Table 1 summarizes the requirements for the three M.S. BME degree options.

Table 1. M.S. Requirements for thesis, project, and coursework options.

Requirement	M.S. Thesis	M.S. Project	M.S. Coursework
Total Credits	30 credits, selected with guidance from faculty advisor. At least 6 credits of coursework must have a BME designation and at least 6 credits must be at the (3xx) 6xxx-level.		
BME Courses	coursework (Prefix BME, EE, ME, CS, CEMS, EMGT, or CEE) at the (2xx) 5xxx-level and above, selected with guidance from faculty advisor and/or the BME Graduate Director.		

Elective Courses

Selected from BME or related courses in STEM

committee members will be from the BME program, including the thesis advisor. The third member, who acts as chair of the committee, must be a member of the graduate faculty, must be from a different program and department than the candidate and advisor, and must be approved by the Graduate College. Committee members external to UVM must be approved by the Graduate College prior to serving. It is the responsibility of the graduate studies committee to supervise the graduate student's program of study and to review progress at regular intervals. The defense examination committee and the graduate studies committee do not have to be the same but frequently are.

Thesis Option Comprehensive Exam

The comprehensive exam for M.S. BME thesis students is an orally presented research proposal and must be completed at least 3 months prior to the last day of classes of the semester in which the candidate intends to graduate.

to UVM students and faculty. The proposal meeting will begin with a statement of the ground rules for the meeting given by the committee chair and a brief introduction

candidate will then give a presentation (typically 30 minutes) in which their research progress to date is outlined and plans for the completion of the thesis are described. The candidate must present a tentative table of contents for the thesis as well as an estimated timeline of completion of their degree. The

committee in closed session. The committee will then deliberate in private after which its recommendations will be passed to the candidate. The entire thesis proposal meeting will take roughly 90 minutes.

The purpose of the proposal is to satisfy the committee members that the candidate is on track toward the completion of their thesis and that the research contained within it will meet the standards of scholarship required for the M.S. degree. One re-examination is permitted for a failed comprehensive examination. The Proof of Successful Completion of Comprehensive Exam form should be submitted, and the BME Graduate Director should be informed of the successful completion.

Thesis Defense

The Graduate College resources must be carefully utilized during this process; specifically, the Defense Committee Membership form, Intent to Graduate form, and Defense Notice form must be submitted in addition to conducting a format/record check. The Thesis/Dissertation Guidelines and Timetable, which are available on the Graduate College website, must be closely followed.

The defense of a M.S. thesis will take place at the discretion of the candidate and their supervisor at a point when the thesis is complete and has been distributed (at least 1120((i)7(dbJETQq0. (i)7q0. (i)Tm0.000e)7(e)7(n

Project Option Comprehensive Exam and Final Poster Presentation

A project is defined for the purposes of the M.S. Project degree path as an engineering product with a needs statement, an iterative approach, testing, and a design goal or output that can be evaluated by faculty mentors as meeting the standards of scholarship. The product that results can be a physical object, code, or any other product that fits the definition above.

The project topic is selected by the student in consultation with a supervising faculty member and must not be the same as any project performed as part of a paid position. If the faculty supervising the project is not a BME graduate faculty, approval for the topic should be sought from the BME Graduate Director. The proposal and project must be approved by 2 faculty mentors, one of whom is the supervising faculty and at least one of whom must be BME faculty. The project spans two semesters. The student must register

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For the comprehensive exam, the student must write a proposal for the M.S. project, which is one of the requirements of BME 6995. The proposal must be evaluated by the 2 faculty project mentors, one of whom will directly supervise the project, and at least one of whom must be a BME faculty member. The student will be evaluated as to whether they have a reasonable plan to complete a project that meets the M.S. standards of scholarship. If failed, one re-examination is permitted. Upon passing, the Successful Completion of Comprehensive Exam form should be submitted.

- In order to be admitted to the AMP, the student must have a cumulative grade point average of at least 3.2 at the time of application, and they must include a statement indicating which BME graduate program faculty member has agreed to serve as their graduate advisor in the cover letter of their application.
- Upon being admitted into the AMP, the student may take up to 9 credit hours of courses for graduate credit while still an undergraduate. Of these, up to 6 credit hours of (2xx) 5xxx level or higher courses can be counted toward both the B.S. and M.S. degrees, subject to the approval of
- AMP students are not permitted to count 3xxx or 4xxx level coursework for graduate credit prior to earning their B.S. degree. They can count up to 3 credits of 3xxx or 4xxx level coursework for graduate credit once they have earned their B.S. degree and the MS is their primary curriculum.

All other requirements for the M.S. degree apply, and students must select the Thesis, Project, or Coursework option. AMP students are not typically eligible for GTA or GRA funding. While the AMP M.S. Coursework and Project options are typically completed in one year, the MS Thesis is the same rigorous research pathway as the traditional M.S. Thesis and should be expected to take more than one academic year. Students who pursue the AMP T thesis as early as the summer following their junior year. All thesis requirements delineated above must be met.

IV. DOCTOR OF PHILOSOPHY IN BIOMEDICAL ENGINEERING

Program of Study

Students will have a primary research advisor from the list of affiliated Biomedical Engineering faculty, and they must form a graduate studies committee by the end of the first year of enrollment. The graduate studies committee will be comprised of four regular members of the graduate faculty from both the *College of Engineering and Mathematical Sciences* and the *Larner College of Medicine* and should bridge both experimental and computational expertise. The chair of the graduate studies committee serves as the student's academic advisor and also as the dissertation advisor or supervisor. The committee should be approved by the BME Graduate Director and the Dean of the Graduate College. Committee members external to UVM must be approved by the Graduate College prior to serving. It is the responsibility of the graduate studies committee to supervise the graduate student's program and to review progress at regular intervals. Students must take at least 75 credits in courses and dissertation research including 14 credits of Core Courses, at least 16 credits of Technical Electives, and a minimum of 20 credits of dissertation research. To bolster their background in a particular area and with pre-approval from the Graduate College and the student's advisor, a Ph.D. student may apply up to six credits of (1xx) 2xxx, 3xxx, or 4xxx level coursework to their Ph.D. degree requirements.

Students are required to develop an **Individual Development Plan** (uvm.edu/graduate/resources) annually and discuss it with their primary advisor and graduate studies committee.

Biomedical Engineering Core Courses 14 credits

The core courses required of all Biomedical Engineering Ph.D. students are:

- Domain-Specific Courses (e.g., Adv. Bioeng. Systems, Complex Sys, or Biomaterials) (6 credits)
- Human Physiology (e.g. MPBP 301 (6010) Human Physiology & Pharmacology) (or equivalent) (4 credits)
- Mathematics or Statistics Course (3 credits)
- Research Ethics Course or equivalent (e.g. CEMS 301 (6010) Research Methods, Ethics, and Communication, NSCI 327 (6270) Responsible Conduct in Biomedical Research, PBIO 295 (3990) Ethics in Graduate Research, NFS 362 (6362) Intro to Research Methods) (1+ credit)

Note that students may pursue alternatives to any of the above core courses as befits the goals of their graduate training, but this requires approval from the BME Graduate Director. A student wishing to make a substitution should submit a justification in writing to the BME Graduate Director who will then seek approval from the BME Curriculum Committee and transmit this back to the student. The student should provide the following documentation when submitting their request: current copies of the syllabi of the course they are proposing to replace and its proposed replacement as well as a statement about why the proposed course would be more suitable for their research area. Ethics and rigor in research are paramount and cannot be overstated; advice on equivalent options if listed courses are not available should be sought from the BME Graduate Director.

Technical Electives (at least 16 credits)

Any BHSC, BIOC, BIOL, BME, CEE, CEMS, CHEM, CLBI, CS, CSYS, DPT, EE, EMGT, ENGR, ENSC, EXSC, HLTH, MATH, ME, MLS, MMG, MPBP, NSCI, OT, PATH, PH, PHRM, PHYS, RAD, or STAT course at the 5(,)-s

The Oral Exam

The oral part of the comprehensive examination will be a formal seminar by the student in front of their graduate studies committee, to take place after the committee members have had a chance to review the written proposal, which should be submitted at least 2 weeks before the oral presentation. The student will be asked to defend the proposal and to answer any additional questions the committee members feel appropriate after the seminar. It is expected that there will be specific questions directly associated with broad engineering and biomedical sciences.

After the oral part of the exam, the committee will meet to discuss both written and verbal components. The committee will then decide if the student can proceed to complete the Ph.D.; if the exam needs to be retaken, or (in the case of repeat failure),

degree. If successful, the [Proof of Successful Completion of Comprehensive Exam](#) form must be submitted to the BME Graduate Director and Graduate College.

Dissertation Proposal

Students will present a proposal around the end of the 6th semester (i.e., third year) of study. The proposal will take place in _____ dissertation committee, and it will be open to UVM students and faculty. Committee membership must meet the Requirements for the Doctor of Philosophy degree stipulations (<https://catalogue.uvm.edu/graduate/degreerequirements/>). The proposal meeting will begin with a statement of the ground rules for the meeting given by the committee chair and a brief introduction _____ the candidate will then give a presentation (typically 45 minutes) in which their research progress to date is outlined and plans for the completion of the dissertation are described.

The candidate must prepare a tentative table of contents for the dissertation with a brief paragraph describing what they anticipate will be the subject of each major chapter (including the focus of their literature review) and forward this to the committee at least 1 week prior to the meeting.

dissertation committee in closed session. The committee will then deliberate in private after which its recommendations will be passed to the candidate. The entire dissertation proposal meeting will take roughly 90 minutes.

The purpose of the dissertation proposal is to satisfy the dissertation committee members that the candidate is on track toward the completion of their dissertation and that the research contained within it will meet the standards of scholarship and originality required for the Ph.D. degree. Note that the purpose of the dissertation proposal is not to conduct an in-significant adjustments to the direction or nature of their research. The BME Graduate Director should be informed of the successful completion of the dissertation proposal.

Dissertation Defense

The Graduate College resources must be carefully utilized during this process; specifically, the Defense Committee Membership form, Intent to Graduate form, and Defense Notice form must be submitted in addition to conducting a format/record check. The Thesis/Dissertation Guidelines and Timetable, which are available on the Graduate College website, must be closely followed.

The dissertation defense examination committee consists of a minimum of 4 members of the graduate faculty. If a student has co-advisors, they count as one defense committee member. At least two graduate faculty members must be from inside the department or program. The chair must be both a member of the

graduate faculty and from outside the candidate's and advisor's department and program. The dissertation defense examination committee must be approved by the Graduate College prior to the defense. The dissertation defense examination committee and the graduate studies committee do not have to be the same.

The defense of a Ph.D. dissertation will take place at the discretion of the candidate and their supervisor at a point when the dissertation is complete and has been distributed (at least 2 weeks prior) to the members of the committee. A Public Notice of the defense is required at least 3 weeks prior to the scheduled defense date in order for the student to defend.

The defense will begin with a statement of the ground rules for the meeting given by the committee chair

about 1 hour. This will be followed by questions from the audience and then questions from the examining committee in a closed session. The committee will then deliberate in private after which its recommendations will be passed to the candidate. The entire dissertation defense will take 2-3 hours. If a student's defense examination performance is not satisfactory, then one reexamination, and one only, is permitted.

