

## BIOMEDICAL ENGINEERING PH.D.

All students must meet the Requirements for the Doctor of Philosophy Degree (<http://catalogue.uvm.edu/graduate/degree/requirements/requirementsfortheactorofphilosophydegree/>)

### OVERVIEW

The program in Biomedical Engineering is interdisciplinary and offers the Doctor of Philosophy degree. Graduate students obtain the Ph.D. degree through a program administered by the Department of Electrical and Biomedical Engineering.

Participating faculty with strong commitments to biomedical engineering research and education are from the College of Engineering and Mathematical Sciences, the College of Medicine, and other departments and colleges across campus. The extensive research facilities of the participating faculty and departments are available to all graduate students enrolled in the program and the program provides the flexibility necessary for students to gain competence in the area of their choice. Research includes: bioinstrumentation, biomechanics, biomedical imaging, biomedical systems and signal analysis, clinical engineering, digital health, implant design, rehabilitation engineering, simulation and modeling, biomaterials, tissue engineering, and biomathematics.

Students in the program are generally supported by sponsored research projects, participating departments and training grants.

### SPECIFIC REQUIREMENTS

#### Requirements for Admission to Graduate Studies for the Degree of Doctor of Philosophy

Students applying for admission to the graduate program must meet the general requirements of admission of the University of Vermont Graduate College. Admission is competitive and students are selected on the basis of their scholastic preparation and intellectual capacity.

The following minimum preparation is recommended:

- Biology, Chemistry: 2 semesters each, or 4 introductory courses in the following subjects - anatomy, biology, biophysics, chemistry, physiology
- Engineering: 2 introductory courses in 1 or more of the following subjects - biomechanics, mechanics, thermodynamics, electrical engineering, control theory, or fluid mechanics
- Mathematics: 1 course past differential equations
- Physics: 2 semesters of physics
- Satisfactory scores on the general Graduate Record Examination (GRE) may be presented, but are not required.

Special arrangements may be made, on an individual basis, for students who are highly prepared in one area, but less well prepared in another.

### Minimum Degree Requirements

Candidates for the degree of Doctor of Philosophy must complete 13 graduate credits of required courses (advanced bioengineering systems, complex systems, human physiology and pharmacology or equivalent, and an advanced mathematics or statistics course) plus at least 17 credits of approved technical electives. In addition, the candidate must complete a teaching requirement, pass a comprehensive examination, complete up to 45 credits of dissertation research, and pass a final oral examination.

### Comprehensive Examination

The comprehensive exam for the Biomedical Engineering Ph.D. will normally be taken at the end of a candidate's fourth semester of study (typically around May of Year 2) and will consist of a written part and an oral part.

**The Written Part:** The written part of the comprehensive examination will be a report written in the form of a research grant proposal based around a research idea in the area of the candidate's dissertation work, and will comprise three Specific Aims. The first 2 aims will be focused in the area of the candidate's Ph.D. research, and will be expected to include some preliminary data and a research plan that is grounded in techniques that are well understood by the candidate. The third aim will be a "stretch aim" that extends beyond the scope of the candidate's research. In this third aim, the candidate will be expected to exhibit evidence of an ability to generate imaginative and thoughtful hypotheses, and to think laterally about how their Ph.D. research area could be developed in a new direction.

**The Oral Part:** The oral part of the comprehensive examination will be a formal seminar by the student in front of their advisory committee. 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 biological sciences, as well as complex systems analyses and approaches.

### Requirements for Advancement to Candidacy for the Degree of Doctor of Philosophy

Successful completion of the Comprehensive Examination and fulfillment of the graduate course requirements.