**DOCTOR OF PHILOSOPHY IN THE FIELD OF BIOMEDICAL ENGINEERING**

**Program Overview**

The Ph.D. in biomedical engineering (BME) is designed to prepare rising scholars and researchers to apply engineering principles to problems in medicine and biology; to understand and model attributes of living systems; and to synthesize biomedical systems and devices to produce original research. Students work closely with a faculty advisor in their chosen research area to create a curriculum plan and to receive guidance for the doctoral dissertation. Students may focus their dissertation research in areas such as cardiac electrophysiology, therapeutic ultrasound, drug delivery, image analysis and image processing, medical imaging and computer-aided diagnosis, assistive robotics, optogenetics, microfluidics, and lab-on-a-chip technologies. Research partnerships between departmental faculty and the GW School of Medicine and Health Sciences, the GW Hospital, Children’s National Health System, the U.S. Food and Drug Administration, and the National Institutes of Health offer valuable synergistic research experiences for BME doctoral trainees.

Specific admission requirements are shown on the Graduate Program Finder (http://www.gwu.edu/all-graduate-programs).

More information is available on the departmental website (https://www.bme.seas.gwu.edu).

**REQUIREMENTS**

**Credit Requirements:**

The following requirements must be fulfilled:

1. The general requirements are stated under School of Engineering, Doctoral Program Regulations (http://bulletin.gwu.edu/engineering-applied-science/#Doctor_of_Philosophy).
2. Students with an MS degree must take a minimum of 30 credits, of which at least 18 must be credits from courses available for graduate credit, and at least 12 must be dissertation research credits. The courses to be taken by the student must be approved by the student's advisor. Students with a BS degree must take a minimum of 54 credits, of which at least 36 must be credits from courses available for graduate credit, and at least 12 must be dissertation research credits. The courses to be taken by the student must be approved by the student's advisor.

*Note that 36+12=48, so this means that the 6 other credits (to provide a total of 54) can be non-graduate courses, graduate courses, dissertation research credits, or a combination of all.

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**Preliminary/Qualifying Exams:**

All BME Ph.D. students are required to take a Doctoral Preliminary Examination held at the beginning of each semester. The goal of the exam is to determine the student's aptitude and ability to complete original and independent research at the doctoral level, to assess the student's ability to review previous work from the literature, and to determine the student's ability to understand and apply fundamental concepts in his/her technical area. A written proposal and an oral presentation of the pre-determined question are required. All students should take the exam as early as possible after they complete at least 6 credits of core courses and 6 credits of electives and maintain an average GPA of at least 3.4. The exam should typically be completed no later than the beginning of a student’s 4th semester.

**Dissertation:**

After successful completion of the preliminary examination the student is admitted to be a candidate for the Ph.D. degree program and begins specialized research under the supervision of his/her dissertation advisor. Research direction may be shared by a full-time faculty member and an outstanding external scientist or engineer, but the final responsibility for the academic aspects of the dissertation work lies with the BME faculty advisor.

Dissertation Research Proposal: During the research phase, each doctoral candidate will be required to give a research proposal presentation to the Dissertation Committee. The student’s research progress will be assessed by the committee and appropriate suggestions for continuing research directions will be solicited from those in attendance. Scheduling of the research proposal presentation will be done at a minimum of one year before the final dissertation defense by the student’s dissertation advisor. The committee helps the student to define the research topic, and ultimately approves the research proposal. The dissertation advisor should propose the membership of the dissertation research committee, which must be approved by the Associate Chair for Research and Graduate Affairs. At least four individuals should serve on the research proposal committee; the research advisor is the dissertation director (also called the advocate) and three others. Two of the committee members must be full-time BME faculty. Students are required to present the written dissertation proposal to the committee and to successfully defend the proposal in an oral defense subsequent to performing the bulk of their dissertation research. After the proposal defense, the student will submit the revised proposal, complying with all suggestions, clarifications, and corrections, as required by the dissertation committee.

Dissertation Defense: The dissertation advisor may decide that the research achieved by the doctoral student is sufficient to satisfy the requirement of the degree. He/she proposes an examining committee for the purpose of administering the final dissertation examination (dissertation defense). The
committee of examiners must consist of no fewer than five members, at least three of whom will normally be full-time BME faculty members with scholarly specialties within the area of concentration; at least one member will normally be from an academic specialty outside the area of concentration. An external examiner must be invited. The dissertation advisor serves on the examining committee both as advocate and as a non-voting committee member. As its first order of business, the committee will elect its own chairman, who should not be the dissertation advisor or the student's faculty advisor. The dissertation examining committee must be approved by the Associate Chair for Research and Graduate Affairs prior to the date of the defense. Each member of the examination committee, no later than 3 weeks prior to the defense, should receive a copy of the dissertation document. At the same time, the candidate must provide a 350-word abstract and other information to the department office for the purpose of preparing an announcement of the defense. The dissertation defense is an oral examination, which is open to the public. When the dissertation is accepted as complete, it should be submitted electronically no later than the date specified by the Registrar's Office.

**Seminar and Colloquia Requirements:**

No seminars or colloquia are required for the BME doctoral program at this time.

**Publication Requirements:**

Before the doctoral defense, the Ph.D. student must publish at least one manuscript in a peer-reviewed journal on original work related to the topic of the doctoral dissertation.

**Graduation and Scholarship Requirements:**

Students are responsible for adhering to the university's minimum GPA requirement for graduation and scholarships. Please visit the Graduation and Scholarship Requirements (http://bulletin.gwu.edu/engineering-applied-science/#graduation_requirements_phd) section on the GW Bulletin to read the requirements.

Students should contact the department for additional information and requirements.