Biomedical Engineering, Ph.D.

Curriculum in Doctor of Philosophy – Biomedical Engineering

A candidate for the Ph.D. degree with a major in biomedical engineering must comply with the rules and regulations as outlined in the WVU Graduate Catalog and the specific requirements of the Statler College and the Chemical and Biomedical Engineering Department.

Program Requirements

The doctor of philosophy degree with a major in biomedical engineering is administered through the college’s interdisciplinary Ph.D. program. The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the art and science of biomedical engineering.

All Ph.D. degree candidates are required to perform research and follow a planned program of study. The student’s research advisor, in conjunction with the student’s Advising and Examining Committee (AEC) will be responsible for determining the plan of study appropriate to the student’s needs. The underlying principle of the planned program is to provide the students with the necessary support to complete their degree and prepare them for their career.

The College requires Ph.D. programs to have a minimum of 18 semester hours of course work, beyond the course credit required for a master’s degree, at the 500 and higher levels with an average of 3.0 or better. The faculty of the college believes that the experience gained in performing and reporting a research endeavor should be over a prolonged period. Therefore, a significant portion of doctoral credit is research based. Specifically, beside the accumulation of a minimum of 18 credit hours of coursework taken at WVU, there are also required 2 credit hours of seminar and a minimum of 24 credit hours of research, also taken at WVU. The remaining requirements for this graduate degree are as follows: (1) passing the qualifying examination, (2) admission to candidacy, (3) completion of dissertation research, and (4) defense of a research dissertation; these requirements are well detailed below. Briefly:

- The student should form a 5 member AEC and file a draft plan of study by the end of their 1st semester of enrollment in the graduate program. At least one member of the graduate faculty from outside the student’s home Department is required to serve on the AEC;
- The student’s research advisor, in conjunction with the student’s AEC will be responsible for determining the plan of study appropriate to the student’s interests/needs. The underlying principle of the planned program is to provide the students with the necessary support to complete their degree and prepare them for their future career in BMEG-related areas;
- All students pursuing a Ph.D. degree are expected to engage in research and complete and successfully defend a Ph.D. dissertation. The doctoral dissertation must show a high degree of originality, i.e. be an original contribution to BMEG-related areas;
- The integrity of the research conduct is the utmost importance to the institution and our department. We are committed to promoting and supporting the ethical and responsible conduct of research across all disciplines. As a result, all students are required to take an online RCR training in their first year;
- The Ph.D. degree signifies that the holder has the competence to function independently at the highest level in the chosen field. Hence, the number of years involved in attaining or retaining competency cannot be readily specified, nor can the exact program of study be defined. However, one has a maximum of 5 years to complete all the requirements for Ph.D. from the date of admission to candidacy.

Curriculum Requirements

A minimum GPA of 3.0 is required in all courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEG 501</td>
<td>Principles and Applications of Biomedical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 601</td>
<td>Numerical and Statistical Methods for Biomedical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 602</td>
<td>Interfacial Phenomena in Living and Non-Living Systems</td>
<td>3</td>
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<tr>
<td>Any BIOM, BMEG, BMS, CCB, CCMD, CE, CHE, CHEM, CPE, CS, CTS, EDP, EE, EXPH, IENG, IH&amp;S, MAE, MATH, MINE, OEHS, PNGE, PHYS, PT, SAFM, SENG, or STAT courses 500-795, as approved by the student's AEC</td>
<td>18</td>
<td></td>
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<tr>
<td>Graduate Seminar</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>BMEG 797</td>
<td>Research</td>
<td>24</td>
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</tbody>
</table>

Examinations

- Plan of Study
- Qualifying Examination
- Candidacy Examination
- Final Examination
Examinations

QUALIFYING EXAMINATION

All Ph.D. students must pass a Ph.D. qualifying examination. This examination is designed to assess the basic competency in BMEG-related fields and determine whether or not students have sufficient knowledge to undertake independent research. Students are required to pass such qualifying examination by the end of their 2nd semester of enrollment in the program; however, it is normally required that full-time students pass the qualifying examination no later than the end of the 3rd semester of enrollment.

The structure of the Ph.D. qualifying examination for all students pursuing the Ph.D. degree in BMEG will be comprised of two components: a written examination that will test on the student’s knowledge in the 3 core areas studied in BMEG 501, Principles and Applications of Biomedical Engineering, BMEG 601 Numerical and Statistical Methods for Biomedical Engineering and BMEG 602 Interfacial phenomena in living and non-living systems respectively, or their equivalent. Students who do not pass this examination on their initial attempt will be allowed a 2nd attempt which should be scheduled in the follow up semester. If they are not successful on their 2nd attempt, then they will be dismissed from the program.

CANDIDACY EXAMINATION

In order to be admitted to candidacy, the student must pass a candidacy exam, which is designed to evaluate student’s overall ability to engage in high-level research. Admission to candidacy can be assessed by a dissertation proposal and/or additional examination. Within a maximum of one semester after passing the PhD qualifying examination or entering the Ph.D. program, whichever is later, a student must successfully defend his/her dissertation research proposal. This proposal is a written document which must be reviewed and accepted by their AEC and subsequently defended in an oral presentation; the proposed research work should show a high degree of originality in the field. A student who has successfully completed all coursework, passed the qualifying examination, and successfully defended the research proposal is defined as one who is a candidate for the Ph.D. degree in BMEG at WVU.

Doctoral candidates are allowed no more than 5 years to complete the remaining degree requirements after formal admission to candidacy. An extension of time can be obtained only by repeating the qualifying and candidacy examinations and meeting any other requirements specified by the student’s advisory and examining committee.

FINAL EXAMINATION

At the completion of the dissertation research, candidates must prepare a dissertation and pass the final oral examination (defense) administered by their AEC. Candidates should be demonstrating an original contribution to scientific knowledge and engineering practice in BMEG. The defense examination is open to the public and, in order to evaluate critically the student's competency, may include testing on material in related fields, as deemed necessary by the AEC. In addition, since the Ph.D. degree is primarily a research degree that embodies the results of an original research proposal and represents a significant contribution to scientific literature, the student must submit a manuscript on this research to the AEC. The rules for this defense and the timing for the manuscript submission are specified by the Office of Graduate Studies at WVU and the Statler College; neither a foreign language nor a minor is required for the Ph.D.

Student Learning Outcomes

BIO MEDICAL ENGINEERING

The learning outcomes of students graduating in biomedical engineering (BMEG) will be defined and measured as follows:

1. Mastery of basic and advanced graduate level knowledge in their chosen areas of specialty as related to BMEG. This outcome will be measured through the grades that the students earn in their coursework;
2. Ability to complete on time specific research tasks. This outcome will be measured through the grade (Satisfactory, Incomplete, or Unsatisfactory) that the student receives every semester from his/her major research advisor for the appropriate research course (700 level);
3. Strong oral communication skills. This outcome will be measured through the quality and number of oral presentations and reports given by the student to his/her Advising and Examining Committee (AEC), at technical meetings or conferences, as well as meetings of his/her research team;
4. Strong communication skills in writing. This outcome will be measured through the quality and number of technical reports, articles or reviews that the student may write during his/her graduate studies. Additionally, the quality of student’s communication skills in writing will be measured through the dissertation;
5. Ability to work independently in a collaborative environment – This outcome will be measured through feedback solicited from the members of student’s AEC, his/her peers, as well as the length of time the student needs to complete his/her graduate studies.