
**Doctor of Philosophy in Engineering
with emphasis in Biomedical Engineering
Handbook**



UNIVERSITY OF
ARKANSAS
COLLEGE OF
ENGINEERING

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Ph.D. DEGREE IN ENGINEERING WITH EMPHASIS IN BIOMEDICAL ENGINEERING

The Ph.D. degree in Engineering with emphasis in Biomedical Engineering (BME) is an interdisciplinary research degree awarded through the College of Engineering in cooperation with the Graduate School (at the University of Arkansas, there is a common Ph.D. degree for all engineering disciplines). The Ph.D. degree is earned through advanced coursework and in-depth, specialized research. Graduates from this program will be well-prepared for research careers in academia, industry or government or as entrepreneurs in technology-based start-up companies.

1. Admission Requirements

Admission to the Ph.D. program in Biomedical Engineering is a two-step process. First, the prospective student must be admitted to graduate standing by the University of Arkansas Graduate School. For complete details visit <http://catalog.uark.edu/graduatecatalog/admissions/>. Second, the student must be admitted to the Department of Biomedical Engineering on the basis of academic transcripts, standardized test scores, three letters of recommendation, and statement of purpose. All students in the Ph.D. program are offered either a research or teaching assistantship. A member of the faculty who is eligible (graduate faculty status of Group I), must agree to serve as the major adviser to the prospective student. Because of the multidisciplinary nature of Biomedical Engineering, students holding either Engineering or non-Engineering degrees are eligible to apply. Eligibility criteria are outlined below:

- *Engineering Academic Background:* Students with a BS or MS degree in engineering or engineering equivalent are eligible to apply for the Ph.D. program.
- *Non-engineering Academic Background:* Students with a non-engineering degree must fulfill the admission requirements for the Master of Science in Biomedical Engineering (M.S.B.M.E.) including the Minimum Admission Criteria for non-Engineering Majors (see admission requirements for the M.S.B.M.E.). Students with a non-engineering background may be admitted directly into the Ph.D. program; however, it is recommended that students first complete the M.S.B.M.E. degree before entering the Ph.D. program.

Summary of requirements for admission to the Ph.D. program in Biomedical Engineering:

1. A B.S. or M.S. degree in engineering or engineering equivalent or completion of the Minimum Admission Criteria (see below) with a GPA of at least 3.0.
2. A GPA of 3.0 or higher on the last 60 hours of the baccalaureate degree.
3. A GRE score of 302 or above (verbal and quantitative).
4. A TOEFL score of at least 213 (computer-based) or 80 (internet based). This requirement is waived for applicants whose native language is English or who earn a bachelor's or master's degree from a U.S. institution.
5. Three letters of recommendation (submitted through the Graduate School Admissions Portal)
6. Statement of Purpose (submitted through the Graduate School Admissions Portal)
7. A member of the faculty who is eligible (graduate status of group I) must agree to serve as the Major Advisor to the prospective student.

1.1 Minimum Admission Criteria for non-Engineering Majors:

Prior to gaining admission into the M.S.B.M.E. program, students with a non-engineering degree or a non-ABET-accredited engineering degree must demonstrate completion of the following coursework with a GPA of at least 3.0: 3 courses in Mathematics (selected from Calculus I, Calculus II, Calculus III, Linear Algebra, and/or Differential Equations), 2 courses of university-level Biology, 2 courses of university-level Chemistry, and 2 courses of university-level (calculus-based) Physics. In addition, students will be required to enroll and complete one of the following courses to provide adequate background in Engineering Design ([BMEG 2904](#) Biomedical Instrumentation, [BMEG 3634](#) Biomaterials, [BMEG 3124](#) Biomedical Signals and Systems, or [BMEG 3824](#) Biomolecular Engineering). Students should consult the Graduate Coordinator for a complete list of courses that satisfy the Minimum Admission Criteria.

1.2 Selection of Major Advisor

The Major Advisor must be either a core or affiliated faculty member in the Department of Biomedical Engineering. The name of the Major Advisor is provided to the Graduate School at the same time that admission to the department's graduate program is granted. Therefore, it is suggested that prior to applying, all prospective students contact faculty members with whom they share mutual research interests. It is essential that the prospective student and Major Advisor have open honest discussions concerning the expectations of each relative to the other before final selection is made.

Circumstances may arise in which the Major Advisor has not been selected prior to admission to the department's graduate program. In such cases, the department head or his/her designee will serve as the student's research advisor until a permanent advisor is selected. This should occur no later than the end of the first semester of graduate study and, in most situations, it is expected that the selection process will be made early in the first semester.

The selection of a research advisor is mutual; that is, the professor also chooses the students with whom he or she wishes to work. In addition, the interest of the Major Advisor is, by necessity, often driven by research contracts. Thus, the research area chosen by the student is expected to fit into the overall research program of the advisor.

If a student wishes to change Major Advisors, the request should be made both orally and in writing to the department head. The department head will consult with all parties involved before establishing the conditions, if any, under which the change may be made. Similarly, the student should consult with the department head in situations where his or her Major Advisor is unable to continue to serve in that capacity.

1.3 Assistantships

All students in the Ph.D. program in Biomedical Engineering are supported by Graduate Assistantships or external Fellowships (e.g. NSF or other foundational fellowships) on a 50% appointment. A 50% appointed Graduate Assistant must earn a minimum of 6 credit hours and may register for a maximum of 12 credit hours per semester, although this limit may be exceeded with approval of the Department Head/Graduate Coordinator and the Graduate Dean. ***Reduced appointments, e.g. 25% Graduate Assistantships, are discouraged by the Department and will only be approved in exceedingly rare circumstances.***

1.4 Deadlines

The application deadlines for the Ph.D. program are April 1, September 1, and February 1 for the Fall, Spring and Summer semesters, respectively. Applications sent after the deadline will be considered on a case-by-case rolling basis.

2. Degree Requirements

The following list is a summary of the degree requirements for the Ph.D. in Engineering with emphasis in Biomedical Engineering. Detailed information can be found in subsequent sections.

1. Develop a Plan of Study within the first year after matriculation
2. Complete an [Annual Progress Report](#) for each year of study.
3. Complete at least 42 graduate semester hours.
 - a. For B.S. to Ph.D. candidates, a minimum of 50 percent of the first 30 hours, and all of the remaining hours of course work, must be at the 5000 level or above.
 - b. For M.S. to Ph.D. candidates, all course work must be at the 5000 level or above.
4. The cumulative grade-point average on all graduate courses presented for the degree must be at least 3.0. Students holding a MS degree may request a reduction of their program of study of up to 24 graduate semester hours with approval of their [Program Advisory Committee](#).
5. Complete 30 dissertation hours. Students holding a MS degree may request a reduction of their program of study of up to 6 thesis hours with approval of their [Program Advisory Committee](#).
6. Pass the written and oral [candidacy exam](#).
7. Complete two semesters of [teaching assignments](#).
8. Submit and defend the final [dissertation](#) to the student's [Dissertation Committee](#).

2.1 Curriculum

Students pursuing a Ph.D. in Engineering with emphasis in Biomedical Engineering must complete 42 graduate semester hours beyond the B.S. degree including: 5 hours of Biomedical Engineering Graduate Core classes, at least 6 additional hours of graduate-level classes in Biomedical Engineering, at least 6 hours of Life Sciences Electives, at least 9 hours of Engineering Electives, and at least 6 hours of General Electives.

2.1.1 Biomedical Engineering Graduate Core (5 hours)

1. BMEG 5103 Design and Analysis of Experiments in Biomedical Research
2. BMEG 5801 Graduate Seminar I
3. BMEG 5811 Graduate Seminar II

NOTE: BMEG graduate students must be enrolled in Graduate Seminar every semester. If the student has completed the 5801/5811 sequence, then they are required to enroll in 5800 and 5810 until graduation.

2.1.2 Transfer of Credit

For doctoral degrees, UA does not officially transfer graduate credits from other institutions. However, students holding a MS degree may apply up to 24 graduate semester hours to their degree requirements with approval of their [Program Advisory Committee](#). The student's program of study can be adjusted in lieu of work taken at other colleges or universities and recognized by the candidates' committee but it will not appear on the University of Arkansas academic record.

2.1.3 Retroactive Graduate Credit

Graduate students fully admitted into a degree program may request that up to twelve hours of courses taken in the final semester of their undergraduate degree count toward their graduate degree, if these courses were taken on the University of Arkansas, Fayetteville campus. These courses may not have been used for the undergraduate degree, must be approved by the student's advisory committee, and must be at the 5000 level or above. The [Request for Retroactive Graduate Credit Form](#) must be submitted to the Graduate School.

Note: If a student receives financial aid in their final semester in the baccalaureate program, no courses used to fulfill the minimum enrollment requirement for financial aid will be retroactively changed to graduate credit.

2.1.4 Course Repetition

Graduate students who attended the University of Arkansas, Fayetteville for their bachelor's degree should not enroll in the graduate version of any course they completed as an undergraduate. If a student previously completed one of the required BMEG graduate core courses as an undergraduate, they will be allowed to replace that core course with any graduate level course, as recommended by their [Program Advisory Committee](#).

2.1.5 3000-Level Courses

3000-level courses will not be allowed for credit for doctoral students.

2.1.6 4000-Level Courses

Because 4000-level courses can carry dual level credit, a 4000-level course which has specifically been created to carry ONLY undergraduate credit must be individually petitioned to carry graduate credit. The [Request for Graduate Credit for 3000 or 4000 Level Courses Form](#) must be processed by the Graduate School **before the course begins**.

A minimum of 50% of the first 30 hours and at least 42 of the total credit hours presented for the degree must be at the 5000 level or above.

2.2 Doctoral Program Advisory Committee

The student's Doctoral Program Advisory Committee, or simply Advisory Committee, is comprised of at least four members of the graduate faculty including the Major Advisor who serves as Chair. At least two members must be selected from the core Biomedical Engineering faculty and at least one member must not be affiliated with the Biomedical Engineering program. All members of the committee must be members of the Graduate Faculty of the University of Arkansas.

The Program Advisory Committee should be assembled within one year of entering the program. Once the Advisory Committee has been selected, the [Doctoral Program Advisory Committee Form](#) must be submitted to the Graduate School.

The Program Advisory Committee oversees the student's program of study and administers the [BMEG Doctoral Candidacy Examination](#). All decisions of the Advisory Committee are made by majority vote. In the situation when there is a split decision among Advisory committee members, the situation must be resolved to the satisfaction of each committee member. In the event that each committee member is not satisfied, the committee member may insist on the necessary steps to reach a resolution or elect to step down from the committee. In unusual circumstances, the Dean of the Graduate School may remove a faculty member from a student's advisory committee, or make an alternative arrangement (e.g. assign a representative from the Graduate faculty to serve on the committee).

2.3 BMEG Doctoral Candidacy Examination/Proposal

The Ph.D. candidacy examination consists of both written and oral components not only covering general didactic knowledge in biomedical engineering but also measuring the student's potential preparedness in a narrowly focused area sufficient to propose a rigorous research plan. The written component is a proposal encompassing the student's dissertation research and should include the following seven components: 1) Background or literature review; 2) Preliminary Data; 3) Hypothesis or Objective; 4) Specific Aims; 5) Research Strategy; 6) Timeline for completion of the proposed work; and 7) Cited References.

The proposal should be detailed enough to allow for a comprehensive evaluation by the Advisory Committee, but also concise enough to demonstrate the student's ability to focus on a narrow research topic. The length of a proposal is expected to vary greatly depending on the amount and nature of preliminary data. However, the text of the proposal is expected to range from 15-20 single spaced pages with embedded figures and tables (not including references or appendices). The proposal must be distributed to the committee at least one week prior to the oral examination.

The oral component is a presentation of the written proposal. The candidacy exam assesses the student's understanding of the proposed research area, and why the proposed research plan is the most appropriate and practical approach given the current state of scientific understanding and the available resources. The Advisory Committee will assess the student's preparedness for continuation in the doctoral program. **Note that questions will be asked to probe the student's depth and breadth of understanding beyond that included in the written document.**

The candidacy examination is administered by the student's Program Advisory Committee. All members must participate in the candidacy examination. This participation may be by distance. The candidacy examination should be scheduled after enough preliminary data has been gathered to allow the Advisory Committee to assess the feasibility of the proposed research, yet sufficiently early so that revisions to the research plan do not result in significant lost effort. ***The candidacy examination should be completed by the end of the 3rd year after enrolling in the program with a B.S. degree or by the end of the 2nd year after enrolling in the program with a M.S. degree.***

The Program Advisory Committee will evaluate the student using the [Ph.D. Candidacy Evaluation Form](#). Each committee member will fill out this form, provide comments/recommendations to the student and provide a (I) pass, (II) pass with contingency, or (III) fail decision. The student's major advisor will then collate the forms and deliver the final decision with comments/recommendations to the student. An absolute majority pass decision is required for a student to pass the examination. If any committee member indicates a pass with contingency or fail decision, the deficiencies or

concerns, together with recommendations have to be explicitly stated by the committee member. The student will then have to address any deficiencies or recommendations raised by that member, to the satisfaction of each committee member.

In the situation when there is a split decision among Advisory committee members, the situation must be resolved to the satisfaction of each committee member. In the event that each committee member is not satisfied, the committee member may insist on the necessary steps to reach a resolution or elect to step down from the committee. In unusual circumstances, the Dean of the Graduate School may remove a faculty member from a student's advisory committee, or make an alternative arrangement (e.g. assign a representative from the Graduate faculty to serve on the committee).

Only after passing the candidacy exam is the student recognized by the Graduate School as a Ph.D. candidate. The Major Advisor submits the [Candidacy Exam Notification Form](#) to the Graduate School on behalf of the Advisory Committee.

Students may retake a failed candidacy exam once upon the approval of the student's Advisory Committee. A student who fails the candidacy examination twice will be terminated from the program. Under no circumstances will a student be allowed to take the candidacy examination more than twice.

2.4 Doctoral Dissertation Committee

The Doctoral Dissertation Committee is responsible for insuring that the dissertation contributes new knowledge of fundamental importance or significantly modifies, amplifies, or interprets existing knowledge in a new and important manner. The Dissertation Committee supervises the preparation, submission and defense of the dissertation.

In most instances, the student's Program Advisory Committee and Dissertation Committee will have the same composition. Like the Advisory Committee, the Dissertation Committee is comprised of at least four members of the graduate faculty including the Major Advisor who serves as Chair. At least two members must be selected from the core Biomedical Engineering faculty and at least one member must not be affiliated with the Biomedical Engineering program. All members of the committee must be members of the Graduate Faculty of the University of Arkansas and three (including the Major Advisor) must possess full Graduate Faculty status. Once the Dissertation Committee has been selected, the [Doctoral Dissertation Committee form](#) must be submitted to the department head and Graduate School at least one year prior to the defense of the dissertation.

All decisions of the Dissertation Committee are made by majority vote. In the situation when there is a split decision among Dissertation committee members, the situation must be resolved to the satisfaction of each committee member. In the event that each committee member is not satisfied, the committee member may insist on the necessary steps to reach a resolution or elect to step down from the committee. In unusual circumstances, the Dean of the Graduate School may remove a faculty member from a student's thesis/dissertation committee, or make an alternative arrangement (e.g. assign a representative from the Graduate faculty to serve on the committee).

2.5 Annual Progress Reports

Each student in the BMEG graduate program is required to submit a completed [PhD BMEG](#)

[Progress Report](#) to the graduate coordinator by May 15th of each year. The Progress Report includes a brief summary of the student's academic and research progress in the previous year as well as a brief discussion of plans for the upcoming year. The report must be presented in-person to the Program Advisory Committee, if prior to the candidacy exam, or Dissertation Committee, if after the candidacy exam (either via individual or group meetings) for full approval. The purpose of the Annual Progress Report is to keep the student's committees informed of progress so that they can function in its intended capacity. It also provides an opportunity for the student and the Major Advisor to gauge progress and adjust the program if necessary.

In addition to the Annual Progress Report, the student and the Major Advisor are required to submit the [Annual Graduate Student Academic Review Form](#) to the Graduate School by May 15th of each year.

2.6 Teaching Assignments

Teaching is an integral part of the doctoral student experience. It prepares students for academic and research careers by providing experience in lecturing, tutoring/mentoring and developing laboratory experiments. Teaching also helps students improve their overall communication skills.

Ph.D. students are required to fulfill **two** teaching assignments as a degree requirement. To count as a teaching assignment, students must be actively engaged in the teaching process. Grading alone will not be sufficient to fulfill this requirement.

For example, Ph.D. students are used in undergraduate courses to:

- Set up and conduct laboratory exercises;
- Periodically deliver lectures;
- Grade homework, lab reports and exams; and
- Supplement faculty office hours.

Upon completion of a teaching assignment, the student will describe his/her teaching responsibilities in section **C. Teaching Assignments** of the [PhD BMEG Degree Requirements Check Form](#) and have the Course Instructor sign off.

2.7 Dissertation

The Doctoral Dissertation is the culmination of the student's study and research in a Ph.D. degree program. The dissertation should make substantial original contributions through generation of important new knowledge. It is expected that the Doctoral Dissertation be of sufficient quality to allow for at least 3 first author publications by the student in peer-reviewed, mid-tier journals indexed on PubMed. This guideline is not intended to represent a required minimum or maximum number of publications required for graduation. Evaluation of whether the student's scientific contributions satisfy the PhD degree requirements will ultimately be made by the Dissertation Committee.

The subject should be current and pertinent to the discipline; the language should be clear and free from jargon; the grammar should be perfect; and the style, format, and quality of paper **MUST** meet requirements stated in the [Guide for Preparing Dissertations](#). The dissertation must be distributed to the dissertation committee **at least one week** prior to the oral defense.

2.8 Defense

The oral defense is an oral presentation of the dissertation to the Dissertation Committee. The candidate is tasked with constructing a convincing scientific argument which demonstrates: 1) the ability to clearly define a biomedical engineering research problem; 2) technical competency within his/her field; and 3) an understanding of the impact of the project relative to a broader scientific field.

All members of the dissertation committee must participate in the final oral defense of the dissertation unless the Dean of the Graduate School has approved an exception. This participation may be by distance. If they do not participate in the final oral defense, in person or by distance, they will be asked by the Graduate School to resign from the committee.

The candidate's defense is mandatorily open to the public. After the presentation, members of the public are excused and the Dissertation Committee is permitted to ask questions related to any aspect of the student's work.

Similar to the Candidacy Examination, the Dissertation Committee will evaluate the student using the [Ph.D. Dissertation Evaluation Form](#). Each committee member will fill out this form, provide comments/recommendations to the student and provide a (I) pass, (II) pass with contingency, or (III) fail decision. The student's major advisor will then collate the forms and deliver the final decision with comments/recommendations to the student. An absolute majority pass decision is required for a student to pass the examination. If any committee member indicates a pass with contingency or fail decision, the deficiencies or concerns, together with recommendations have to be explicitly stated by the committee member. The student will then have to address any deficiencies or recommendations raised by that member, to the satisfaction of each committee member. In rare instances, another defense may be required.

In the situation when there is a split decision among Dissertation committee members, the situation must be resolved to the satisfaction of each committee member. In the event that each committee member is not satisfied, the committee member may insist on the necessary steps to reach a resolution or elect to step down from the committee. In unusual circumstances, the Dean of the Graduate School may remove a faculty member from a student's advisory committee, or make an alternative arrangement (e.g. assign a representative from the Graduate faculty to serve on the committee).

Upon successful completion of the defense, the Dissertation Committee will sign the [Doctoral Record of Progress form](#) followed by the BMEG Graduate Coordinator. Students should bring the completed [PhD BMEG Degree Requirements Form](#) when requesting the graduate coordinator's signature.

TWO WEEKS before the defense, the student must complete the [Doctoral Student Announcement](#) on the Graduate School Website.

2.9 Ph.D BMEG Degree Requirements Form

Prior to obtaining the BMEG Graduate Coordinator's signature on the [Doctoral Record of Progress Form](#), students must complete the [Ph.D. BMEG Degree Requirements Check Form](#).

3. Other Academic Requirements/Policies

3.1 Getting Ready to Graduate

At the beginning of the semester the student anticipates graduating, he/she should download the relevant [Graduation Checklist](#) (Spring, Summer or Fall). The Graduation Checklist contains all important deadlines that must be met prior to graduation.

3.2 Tax Guidelines

Students are strongly encouraged to consult the [Tax Guidelines for Graduate Students](#) to learn about tax rules of interest to graduate students.

3.3 Academic Dismissal and Grade Point Requirements

Students may be dropped from further study in the Graduate School if at any time their performance is considered unsatisfactory as determined by either the program faculty or the Dean of the Graduate School. Academic dishonesty and failure to maintain a specified cumulative grade point average are considered to be unsatisfactory performance.

Students must obtain a minimum 3.0 cumulative grade point average on all graded graduate course work to receive a doctoral degree from the University of Arkansas.

3.4 Time Limit

All requirements for a doctoral degree must be completed within seven consecutive calendar years from the date of admission to the program.

3.5 Limits on Number of Appointments to a Graduate Assistantship

Students pursuing a doctoral degree beginning with the baccalaureate degree may receive financial support as a graduate assistant for no more than ten semesters beyond the baccalaureate degree. Subsequent appointment beyond ten semesters requires approval from the Dean of the Graduate School.

Students should consult the [UA Graduate Student Handbook](#) for complete information regarding academic requirements and policies.

4. Doctoral Student Forms

4.1 Required Degree Forms

[Doctoral Program Advisory Committee Form](#) – Submitted to the Graduate School as soon as the committee has been assembled and within one year of entering the program.

[Ph.D. BMEG Progress Report](#) – Submitted to the BMEG Graduate Coordinator by May 15th of each year.

[Annual Graduate Student Academic Review Form](#) – Submitted to the Graduate School by May 15th of each year.

[Doctoral Dissertation Committee Form](#) – Submitted to the Graduate School when the committee has been assembled and at least one year prior to the date of the dissertation defense (Same as Program Advisory Committee Form)

[Doctoral Dissertation Title Form](#) – Submitted to the Graduate School when the title of the dissertation has been established and at least one year prior to the date of the dissertation defense

[Ph.D. BMEG Degree Requirements Check Form](#) – Submitted to the BMEG Graduate Coordinator after all coursework, dissertation and teaching requirements have been met.

[Record of Progress Form](#) – Completed after the dissertation defense and conveys the completion of the student's program. A completed form with original signatures is submitted to the Graduate School

[Intellectual Property Disclosure Form](#) – This form must be submitted to the Graduate School with the final copies of the dissertation for deposit in the University Libraries

[Thesis/Dissertation Submission Form](#) - This form must be submitted to the Graduate School with the final copies of the dissertation for deposit in the University Libraries

4.2 Other Forms

[Request for Retroactive Graduate Credit Form](#)

[Request for Graduate Credit for 3000 or 4000 Level Courses Form](#)