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## INTRODUCTION

### Objective of the Handbook

The objective of this document is to summarize for new entering graduate students and continuing graduate students the current academic requirements for the Doctor of Philosophy degree in Biomedical Engineering (BME). The handbook serves as a guide for doctoral study by outlining for the student important deadlines, degree requirements and rules and regulations imposed by the School of Biological and Health Systems Engineering (SBHSE), the Ira A. Fulton Schools of Engineering, and the Graduate College. It also outlines the standards of performance expected of all doctoral degree candidates. In some cases inconsistencies arise between the contents of the handbook and the Graduate College as policies are changed by the Graduate College and the Schools of Engineering. In these cases, the University's published rules and policies take precedence. Inconsistencies are eliminated in future revisions of the handbook. Please report any inconsistencies to the chair of the department's graduate committee.

Students can use the departmental forms on the SBHSE website. Graduate College Offices are located in Interdisciplinary B Building, Room 171 and their webpage is <http://graduate.asu.edu/>. You should become familiar with the website and use it as a resource for forms and important information.

### Graduate Student Responsibilities

It is the responsibility of the graduate student to know and to observe all procedures and requirements as defined in this handbook, the Graduate Catalog, the Schedule of Classes, and the Guide to the Preparation of Doctoral Dissertation. A copy of the Schedule of Classes is available on-line at <https://webapp4.asu.edu/catalog/>. Graduate students are expected to be familiar with the Code of Conduct, which is available in the Office of Student Affairs. *Violations of the Code of Conduct or incidents of dishonesty such as cheating in examinations, cheating in laboratory work or plagiarism is subject to university discipline whether committed by individuals or groups.* **Graduate students are expected to demonstrate satisfactory progress.** They are also expected to maintain the highest degree of academic integrity, enthusiasm for their academic studies, and a high degree of:

<http://engineering.asu.edu/students/integrity>

### Faculty Responsibilities

Faculty members accepting the responsibility of mentoring graduate students are expected to know and to observe the procedures and requirements defined in this handbook and the other publications listed above.

### Safety

The School is committed to providing a safe work environment for faculty, staff and students. Students are required to follow safe procedures in accomplishing their research and teaching assignments. All graduate students are required to attend a safety orientation outlining University and School safety guidelines and regulations. Students are required to take safety refresher courses EVERY year.

**Critical Path to the Ph.D. Degree**

The student must accomplish several activities in the process of acquiring the Ph.D. degree. The flowchart that follows summarizes the chronological steps that must be followed in this process.

**CRITICAL PATH TO THE DOCTOR OF PHILOSOPHY DEGREE**

Complete deficiencies		1 <sup>st</sup> year
	↓	
Select faculty advisor		1 <sup>st</sup> semester
	↓	
File Program of Study		End of 1 <sup>st</sup> year
	↓	
Select dissertation committee		Spring of 2 <sup>nd</sup> year
	↓	
Take and pass comprehensive examination	*	During 2 <sup>nd</sup> year
	↓	
Complete coursework		End of 2 <sup>nd</sup> year
	↓	
Defend dissertation prospectus		During 3 <sup>rd</sup> year
	↓	
File Master in Passing (MIP) degree		After comps and prospectus
	↓	
Research and dissertation work		3 <sup>rd</sup> and 4 <sup>th</sup> year*
	↓	
Graduation preparation		During 4 <sup>th</sup> year**
	↓	
Dissertation in final format and oral defense		Final semester
	↓	
Return all keys, dept. property, lab clean-up		Final semester

↓

**GRADUATE**

\* Students must graduate within 5 years of passing the comprehensive exam.

\*\* Completion of degree may be considered for extension in special circumstances with faculty advisor and School approval, if approved by the Graduate College via a petition.

## GOAL OF THE DOCTORAL PROGRAM

The Doctor of Philosophy degree is the highest university degree. It is granted to students upon evidence of excellence in research and the demonstration of independent, creative scholarship culminating in a dissertation. Coursework in the doctoral program focuses primarily on the engineering science concepts in the student's major and in certain basic sciences. The graduate research program introduces the student to the techniques, procedures and philosophical attitudes necessary for exploring unknown areas in his/her chosen profession. After receiving the degree, the student is able to identify areas within his/her major suitable for research; identify the current state of knowledge in these areas using literature search resources; propose plans for investigating the area; apply fundamental principals of science and engineering to complete the investigation and teach these skills to others who follow. The student is taught the scientific method by intensely studying a specific research topic. This also yields a more in-depth knowledge of his/her professional major. Often included in the graduate educational experience is an opportunity to teach undergraduates by preparing selected lectures in undergraduate courses, assisting in undergraduate laboratories or serving as tutors or mentors.

## SELECTION OF A RESEARCH TOPIC

Of paramount importance to a successful doctoral program is the selection of a suitable research topic. **The selection of the research topic is the responsibility of the student.** Students are urged to select a topic and a research advisor early in their program of study, no later than the end of the first year in residence. The advisor selected must meet the qualification required by the Graduate College. To accomplish this, the student should visit graduate program members (see [http://graduate.asu.edu/graduate\\_faculty/degree/ESBIOENPHD](http://graduate.asu.edu/graduate_faculty/degree/ESBIOENPHD) for a list of the faculty currently participating in our graduate program) and select an advisor and dissertation topic that matches his/her goals and interests. The program does not guarantee that a student will be selected to work on a specific project offered by a given faculty member. This is particularly true of funded research projects. Several students often desire to work on the same project in these cases. For this reason, the student should identify several projects of interest among those offered by the faculty. In some instances, students propose projects that may or may not be of interest to the faculty. The program does not require faculty to advise students on projects of this nature. In all cases, the student must obtain the agreement of a faculty member to serve as the research advisor and chair of the supervisory or dissertation committee. Likewise, the student is responsible for recruiting faculty to serve as members on the supervisory or dissertation committee.

The research advisor (major professor) works closely with the student to help plan his/her overall program and to coordinate coursework and research activities. Generally, the advisor helps the student select other members of his/her supervisory committees. Frequent contact between the student and the advisor is necessary to accurately define the research project. This helps to ensure that the student's research prospectus is acceptable.

The dissertation topic can be initiated by either the student or the faculty research advisor. Most doctoral research plans include both theoretical analysis and experimental measurements. The Ph.D. student is expected to have a major input in defining the research topic.

Research by nature is not precisely programmed. Often, well-planned experimental designs are unsuccessful. This requires the application of different procedures. For these reasons, students should initiate their dissertation research before they are able to devote full-time to the project. This helps to eliminate unnecessary delays in graduation.

Original work is required for the Doctor of Philosophy degree. One or more research publications or presentations should result from the research project. Throughout their program of study, the student is encouraged to actively participate in efforts to acquire funding in support of the advisor's research program. The student should assist the research advisor in the preparation of grant proposals to local, state and national agencies seeking funding for the project.

The student-advisor relationship is a vital one during the Ph.D. years, and often continues well beyond them. Each such relationship is unique, and usually offers personal and professional benefits beyond the conduct of the Ph.D. research. These benefits might include meeting important post-degree job contacts, advice on professional development and training in non research-related professional skills (e.g. teaching). It is expected that in most circumstances student-advisor disagreements will be minor and will be amicably resolved by those involved. In the uncommon instances that attempts to resolve disagreements are unsuccessful, the student and advisor are encouraged to meet with the program chair for further assistance in resolving any difficulties.

## **GENERAL ADMISSION REQUIREMENTS**

### **Regular Admission**

To be eligible for regular admission, the student must have a Bachelor's degree in Bioengineering. United States citizens normally will have a minimum grade point average (GPA) of 3.2 out of a total possible 4.0 or equivalent. Foreign applicants normally will be in the top 10% of their graduating class. Students entering with master's degree are required to have a minimum GPA in their master's degree coursework of 3.5 out of a possible 4.0. The Graduate Record Exam (GRE) is required for all applicants. Foreign students must also submit test scores from the Test of English as a Foreign Language Exam (TOEFL).

### **Regular Admission with Deficiencies**

Regular admission may also be given to students with a Bachelor of Science degree in another discipline. In this case, however, the student may be required to take a number of undergraduate courses to eliminate deficiencies. These courses are in addition to the graduate program of study. The letter of admission specifies the deficiencies that must be completed before the student is awarded the graduate degree. Students will be required to complete any deficiencies at the first opportunity after admission preferably within the first year.

### **Provisional Admission**

Applicants with scholastic records below the standards for regular admission may be admitted provisionally in certain special cases at the discretion of the departmental graduate committee with the approval of the chair of the graduate committee and the department chair. A student admitted with provisional status must make no grade lower than a "B" in their first 12 hours of graduate coursework. Full-time provisional students must take a minimum of nine (9) hours during their first semester in residence. Part-time provisional students may take fewer than nine (9) hours of coursework during their first semester. Failure to do this will result in suspension from the program. Students who meet this requirement are reclassified as a regular graduate student and the regulations governing academic performance for regular students apply. **It is the student's responsibility to see that their status is changed from provisional to regular after having successfully completed these requirements.** Please contact your Graduate Advisor when you have fulfilled the provisional requirements.

## REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE

The Graduate College sets certain general requirements for the Doctor of Philosophy degree. In addition to these general requirements, the department sets specific program requirements, which exceed those imposed by the Graduate College. This section outlines both the general requirements specified by the Graduate College and the additional requirements specified by the Bioengineering Program.

### Grading

Grades are assigned in graduate courses as follows:

A+	4.33
A	Excellent 4.00
A-	3.67
B+	3.33
B	Good 3.00
B-	2.67
C+	2.33
C	Passing 2.00
D	No Graduate Credit 1.00**
E	Failure 0.00**
W	Withdrawal*
I	Incomplete
X	Audit
Y	Satisfactory
Z	Course in progress***

\* This grade is given whenever a student officially withdraws from a class.

\*\* This grade cannot be applied to a graduate degree but is included in the calculation of a grade point average.

\*\*\* This grade is given pending completion of courses in research, thesis, dissertation or practicum. All grades of "Z" that appear on the plan of study must be changed to "Y" before graduation. A student cannot graduate with an "I" on their transcript so all courses where an "I" has been issued must have some grade resolution.

A grade of "P" (Pass) in a 400 or higher level course may not appear on a program of study. Grades of "D" or "E" cannot be used to meet the requirements for a degree although they are used to compute the grade point averages. A student receiving a grade of "D" or "E" must repeat the course in a regularly scheduled (not an independent study) class if it is to be included in the program of study. However, both the "D" or "E" and the new grade are used to compute the grade point averages. Grades on transfer work will not be used in computing grade point averages.

### Repeating ASU Courses

Graduate students (degree or nondegree) may retake any course at any level at ASU, but all grades remain on the student transcript as well as in GPA calculations

## Academic Standing

To be eligible for a degree from the Graduate College a student must achieve two grade point averages of "B" (3.00) or better. The first grade point average is based on all courses numbered 500 or higher which appear on the transcript. (Deficiency courses are not included.) The second grade point average is based on all courses that appear on the program of study. Academic excellence is expected of students doing graduate work. Upon recommendation from the chair of the Department of Bioengineering, the Dean of the Graduate College can withdraw a student who is not progressing satisfactorily.

## Good Standing

A student who has been admitted to a graduate degree program in Engineering, with either regular or provisional admission status, must maintain a 3.0 or higher grade point average (GPA):

1. in all work taken for graduate credit (courses numbered 500 or higher),
  2. in the coursework in the student's approved program of study, and
  3. in all course work taken at ASU (overall GPA) post baccalaureate.
- A. A student will be placed on academic probation if one or more of the student's GPAs listed above falls below 3.0. Students will be notified by mail when placed on academic probation.
  - B. A student will earn academic good standing by obtaining a 3.0 or better in the GPAs listed above by the time the next nine hours are completed. Coursework such as research and dissertation registration that are for Z or Y grade cannot be included in these nine hours.
  - C. A student may be recommended for dismissal from a graduate program if the student fails to increase all of the GPAs listed above to 3.0 or better by the time he/she completes at least nine credit hours as defined in section B.

A student may appeal actions concerning dismissal by petitioning the departmental unit in which they are enrolled.

## Misconduct

The highest standards of academic integrity are expected of all students. The failure of any student to meet these standards may result in suspension or expulsion from the university and/or other sanctions as specified in the academic integrity policies of the individual colleges. Violations of academic integrity include, but are not limited to, cheating, fabrication, tampering, plagiarism, falsification or misrepresentation of data or facilitating such activities. The university and colleges academic integrity policies are available in the Office of the Senior Vice President and Provost and the offices of the deans of the individual colleges.

## Graduate Credit Courses

Courses at the 500, 600 and 700 levels are graduate credit courses. Courses at the 400 level satisfy graduate degree requirements when appearing on an approved plan of study. There is a limit of 6 credits of 400 level courses that can be included on the plan of study.

## Transfer Credit

Transfer of credit is the acceptance of credit from another institution for inclusion in a program of study leading to a degree awarded by ASU. Transfer of credit can also apply to credits taken at ASU as a non-degree student.

Transfer credits may not be applied toward the minimum degree requirements for an ASU degree if they have been counted toward the minimum requirements for a previously-awarded degree.

The number of hours transferred from other institutions may not exceed 20 percent of the total minimum semester hours required for a master's degree unless stated otherwise for a specific degree program. Up to 12 semester hours of credit taken at another institution and not counted toward a previous degree may be counted toward the minimum semester hours required for a specific ASU doctoral degree program. In all cases, the inclusion of transfer courses on a program of study is subject to approval by the academic unit and the Graduate College.

Certain types of graduate credits cannot be transferred to ASU, including the following:

1. credits awarded by postsecondary institutions in the United States that lack candidate status or accreditation by a regional accrediting association;
2. credits awarded by postsecondary institutions for life experience;
3. credits awarded by postsecondary institutions for courses taken at noncollegiate institutions (e.g., government agencies, corporations, and industrial firms);
4. credits awarded by postsecondary institutions for noncredit courses, workshops, and seminars offered by other postsecondary institutions as part of continuing education programs;
5. credits given for extension courses; and
6. credits completed before the posting of a bachelor's degree.
7. Acceptable academic credits earned at other institutions that are based on a unit of credit different from the ones prescribed by the Arizona Board of Regents are subject to conversion before being transferred to ASU.

Transfer credits must be acceptable toward graduate degrees at the institution where the courses were completed. Only resident graduate courses (at the institution where the courses were completed) with an "A" (4.00) or "B" (3.00) grade may be transferred. A course with the grade of pass, credit, or satisfactory may not be transferred. Additionally, transfer credits must be within the six-year time limit to be used on a master's plan of study.

Official transcripts of any transfer credit to be used on a plan of study must be sent directly to the Graduate Admissions Office from the Office of the Registrar at the institution where the credit was earned.

## Course load

Course load is not to exceed 12 semester hours (without approval) of credit during each of the two semesters, 6 semester hours during each 6-week summer session or 9 semester hours of credit during the 8-week summer session or a petition must be submitted. **All students must register for a minimum of one credit each semester to continue as a graduate student at ASU.**

All graduate assistants and associates (RA/TA's) must enroll for 12 credit hours (this may include research credit hours) during each semester of their employment. This departmental requirement exceeds the Graduate College minimum of six (6) hours. The hours cannot include audit enrollment. A half-time (50%) graduate assistant or associate working 20 clock hours per week may not register for more than 12 hours of coursework each semester; a one-third time (33%)



assistant or associate for more than 13 hours and a one-quarter-time (25%) assistant or associate for more than 15 hours. A graduate assistant or associate (RA/TA) may petition to take more than 12 credit hours for a semester.

During the summer session, graduate assistants and associates must be enrolled in at least one credit in coursework related to their degree program in each of the summer session terms. During the summer sessions, graduate assistants employed 25% time may enroll for a maximum of 6 semester hours during a 6-week session or 9 hours during an 8-week session; those employed 50% may enroll for a maximum of 5 hours during a 6-week session or 7 hours during the 8-week session and those employed 100% time may enroll for a maximum of 3 hours during the 6-week session or 4 hours during the 8-week session.

All graduate students doing research, working on thesis or dissertations, taking comprehensive final examinations or using university facilities or faculty time, must be registered for a minimum of one hour of credit that appears on the program of study or is an appropriate graduate level course. For additional information, visit the Graduate College handbook for RA/TA's at [http://graduate.asu.edu/faculty\\_staff/tara](http://graduate.asu.edu/faculty_staff/tara)

## Graduate Student Orientation

All new entering graduate students are expected to attend an Biomedical Engineering Graduate Program graduate student orientation meeting. The meeting is held the week prior to the beginning of classes of the student's semester in residence. This is normally held in the fall; however, students admitted during the spring semester should attend the fall meeting if there was no meeting during their first semester. During this orientation meeting, students are advised regarding departmental policies and are given initial advice regarding registration for courses.

## Program/Comprehensive Examination/ Dissertation Committees

As described in the Graduate Catalog, each student interacts with one committee appointed by the dean of the Graduate College, the Dissertation Supervisory Committee. Although not required, under most circumstances, this committee will oversee the Comprehensive Examination as well as the Prospectus and Dissertation Defense. The Dissertation Committee should be formed by the end of the third semester. This committee will oversee the student's curriculum and research. **Forms are available on the SBHSE website.** The committee chair is generally the research advisor but does not have to be. **The committee chair is generally a tenure track faculty member in the Graduate Program of Biomedical Engineering, in instances where the student selects a chair of the supervisory committee who is not a member of the program with endorsement to chair, two co-chairs must be appointed instead. The co-chair must be listed on the Graduate college BME Faculty list with endorsement to chair.** Upon the recommendation of the head of the academic unit, the dean of the Graduate College appoints the student's dissertation committee. The committee should consist of five members, a chair (or two co-chairs) and other faculty or experts in the student's field of research with 50% of the committee being tenure/tenure track SBHSE faculty. The members of the dissertation committee must have the necessary knowledge and skills to administer the student's Comprehensive Examination, to advise the student during the formulation of the research topic and during the completion of the research and the dissertation. The committee must be approved by the dean of the Graduate College before the student may apply for the comprehensive examinations, defend the dissertation prospectus, and register for 799 Dissertation hours as part of the dissertation requirement, if required for the degree program. If the head of the academic unit recommends changes in membership for the committee after the committee has been appointed, the student must submit a change of committee form to the Graduate College and receive the approval of the dean of the Graduate College.

## Interactive Plan of Study

The student is required to file an interactive plan of study (iPOS) with SBHSE and the Graduate College before the end of their 1<sup>st</sup> year and before completion of 50% of the PhD coursework. The plan of study (POS) will be available on MyASU. Changes in the planned program may be made with the approval of the student's program committee and the approval of the Program Chair(s) or Director of the School of Biological and Health Systems Engineering.

A step-by-step guide is available at <http://graduate.asu.edu/how-to>.

## Course Requirements

### Total Requirement

A minimum of eighty four (84) semester hours is the total course/seminar/research/dissertation requirement. Total hours are determined by the student's supervisory committee. The program of study for students pursuing the Doctor of Philosophy degree with the major Biomedical Engineering consists of a minimum of 84 semester hours of graduate-level courses.

1. Doctoral students are required to complete 6 credits from each of the following 3 areas (at least 18 credits):

BME Courses (BME Prefix) – at least 6 credits

Life Science/Biology Courses – at least 6 credits

Quantitative Math or Engineering – at least 6 credits

2. Technical Electives – at least 9 credits

3. BME 591: Seminar – at least 5 credits

4. BME 780: Teaching Practicum – at least 3 credits

5. BME 799: Dissertation – EXACTLY 12 credits

6. BME 792: Research – at least 37 credits

\*\* A maximum of 6 of the above credits may be at the 400-level

### Teaching Practicum

The teaching practicum is a mentored teaching experience that the student participates in in cooperation with a faculty member of their choosing. At a minimum, the student will experience several elements of teaching: preparation and delivery of at least 3 class sections, holding office hours, selection/creation and evaluation of student work, design, and preparation and evaluation of one examination. In addition, the student and the course instructor will come up with a specific plan for providing the student with feedback regarding his or her performance during the experience. Once the experience is completed, the student and the instructor will file brief reports with the graduate director describing the practicum.

In order to register for practicum, the student will first have to file a "Teaching Practicum Course Definition" form with the advising office. This ensures that the student and faculty member have reached agreement over expectations for the practicum experience. The form is available on the SBHSE website in PhD forms.

## Transfer Credit

Students with a Master's Degree in Bioengineering from another institution may transfer up to 30 semester hours of credit towards the course requirements for the Doctor of Philosophy degree with the approval of the departmental graduate committee and Graduate College. The overall course credits, however, must conform to the above requirements. The student must have credit for the Bioengineering core courses, and sufficient Bioengineering graduate electives regardless of the institution where they were taken. The Graduate College requires at least 54 hours of the program of study are taken at ASU. The determination of applicable courses will be made by the Chair of the committee and should be completed within the first semester of coursework.

## Transition Program Requirements

Students without a Bachelor's degree in Bioengineering and without the equivalent of the following courses in their undergraduate program of study are deficient in some skills needed for graduate study in Bioengineering. These courses must be completed in addition to the required graduate coursework. In addition, the student's supervisory committee may outline additional transition program requirements to ensure that the student can successfully pass the Comprehensive Examination.

### Mathematics and Basic Sciences

- Mathematics: Calculus through "Ordinary Differential Equations" (e.g. MAT 270, 271, 272 AND 274; typically at least 13 semester hours credit total).
- Physics: One year of calculus-based physics including laboratory (8 semester hours).
- Biology: Minimum of one "General Biology" course, preferably upper division (4 semester hours).
- Chemistry: Minimum of one Chemistry course including laboratory (4 semester hours).
- Computers: Demonstration of computer literacy (e.g. via course, exam).

### General Engineering Fundamentals

Students without the equivalent courses must complete additional course work in four of the following six topics:

- Thermodynamics
- Fluid Mechanics
- Mechanics of Rigid Bodies
- Electrical Networks
- Signals and Systems
- Materials Science and Engineering
- Any other course work that is a prerequisite for a course in the student's graduate program of study.

Students should be aware that their research advisor might impose other course requirements. These courses vary depending on their specific field of research. For example, BME 334 "Heat and Mass Transfer" is a common prerequisite for Chemical Engineering related courses of study, ECE 334 "Electronic Devices" for Electrical Engineering related fields, and ECE 313 or ECE 314 "Deformable Solids" for Mechanical Engineering related research. Additionally, students without undergraduate degrees in Bioengineering or a closely related engineering discipline may have to take additional engineering course work in preparation for the comprehensive examination.

### **Foreign Language Requirement**

None.

### **Comprehensive Examination**

To achieve PhD candidacy, a student is required to request permission from the Graduate College to take the comprehensive examinations by sending an e-mail to the BME Graduate Program graduate advisor. These examinations are designed to test the student's mastery of the field of their completed coursework. The comprehensive exam committee administers the exam. Failure in the comprehensive examination is considered final unless the committee administering the exam and the head of the academic unit recommend and the dean of the Graduate College approves a re-examination. A re-examination may be administered no sooner than three months and no later than one year after the date of the original examination. Only one re-examination is permitted. Students failing the re-examination will be removed from the doctoral program, and will be given the opportunity instead to convert to the Master's Program in Biomedical Engineering, applying the work completed at that stage to the degree requirements of that program

The student is required to take the comprehensive examination after completing their required core coursework (typically during the fourth semester) but no later than two years after entering the program. The comprehensive examination is designed to test the student's knowledge of their graduate coursework and their development of skills to carry out a research plan in their selected sub-discipline of Bioengineering.

The comprehensive exam is administered in two parts. The first part is a written exam. From one to several essay type questions will be provided to the student by their Supervisory Committee. These questions will be chosen by the Committee in consultation with the student's advisor in order to best assess and drive the candidates skills in their chosen area.

The student will be given a week to provide written answers to these questions and return them to the committee. No less than one week, and no more than two weeks, after submission of the written exam, an oral exam will be administered by this same exam committee, using the questions and responses from the written exam as a starting point for discussion.

In addition to the student's Supervisory Committee, both portions of the comprehensive exam will also be observed by 1 representative from the Grad Committee

### **Dissertation Prospectus**

#### **Guidelines for Conducting the Dissertation Prospectus**

A rough draft of a research proposal should be shown to the student's research advisor for approval of content prior to scheduling the oral presentation. The oral presentation of the dissertation prospectus is made to the student's dissertation committee. Other interested members of the faculty are invited to attend the presentation but are invited to leave prior to questioning by the dissertation committee begins. The student's presentation should take advantage of appropriate audio visual aids and should be limited to no more than 50 minutes. Copies of the

written dissertation prospectus must be distributed to all members of the student's dissertation committee no later than one week prior to the oral presentation

In the oral examination, the student is expected to defend their prospectus and justify that the proposed research is of the acceptable quality and magnitude consistent with quality doctoral education. Following the oral presentation of the research proposition, questions are welcomed from members of the departmental faculty. Following general questions, departmental faculty members other than those on the student's dissertation committee are excused and the student's dissertation committee and interested faculty from the student's major will remain to ask questions of the candidate regarding his proposed research.

Generally, the oral discussion of the dissertation prospectus is limited to three hours. If necessary, however, the proceedings may be adjourned and rescheduled for a mutually convenient date within one week. Only one adjournment is permissible.

After questioning, the candidate is excused from the room while the dissertation committee conducts its deliberations. The decision regarding whether or not the dissertation prospectus is acceptable is the decision of the dissertation committee alone. The student's dissertation committee conveys its evaluation of the acceptability of the dissertation prospectus to the chair of the departmental graduate committee by signing the Dissertation Prospectus part of the Comprehensive Examinations and Approval of the Ph.D. Dissertation Prospectus form available at the weblink: <http://www.asu.edu/graduate/forms/wordforms/RtDcCmEx05.doc>.

If the student's dissertation prospectus is considered acceptable, the chair of the departmental graduate committee will recommend to the Graduate College that the student be advanced to PhD candidacy status. At this stage the student may also apply for a Master's In Passing.

If the student's dissertation prospectus is unacceptable, the chair of the dissertation committee formulates recommendations for future action and submits them to the chair of the departmental graduate committee and the chair of the department. Either of two recommendations is possible:

- A re-examination may be scheduled and the entire process repeated, or
- The student may be removed from the doctoral program. The results of the dissertation prospectus presentation are conveyed to the student by the chair of the departmental graduate committee.

### **Admission to Candidacy**

PhD students achieve candidacy status in a letter from the dean of the Graduate College upon:

1. passing the comprehensive examinations; and
2. successfully defending the dissertation prospectus.

## Completion of the Dissertation

The dissertation forms the culminating experience of the doctoral program. This document should reflect substantial effort on the part of the candidate to enhance the boundaries of knowledge in a field of relevance to biomedical engineering. The work should be novel and original, and of sufficient quality to merit publication in a peer-reviewed journal in the candidate's chosen area of research. In addition to carrying out the research and writing it up, the BME Graduate Program and the Graduate College have several requirements that must be met.

### Format Approval

For format, Graduate College must review the final copy of the dissertation. Copies of the Format Manual are available on the web at <http://graduate.asu.edu/> and in the graduate college. The student is required to submit appropriate signed forms and a complete copy of the thesis for format review at least 10 working days (two weeks if there are no holidays during the time period) before the oral defense.

The student must submit two final copies of the thesis. The student is responsible for the binding fees. Binding services are available through Arizona Library Binding at 602-253-1861.

The process for completing the necessary degree requirements and steps can be found in the document titled "How to Graduate: Doctorate" available at <http://graduate.asu.edu/how-to>.

### Oral Defense of the Dissertation

The final oral examination in defense of the dissertation is mandatory and must be held on the campus of Arizona State University. The student will complete the Doctoral Defense Schedule Form to schedule the dissertation and get approval by the dissertation committee and the dean of the Graduate College to schedule the oral defense. The form is available at the following website: <http://www.asu.edu/graduate/forms/wordforms/DissSchedSED.doc>.

The Graduate College requires that the oral defense of the dissertation be published in the university bulletin, "Insight", to ensure that the university community is invited to attend.

Please review the following website for additional deadlines and dissertation requirements: <http://graduate.asu.edu/graddeadlines.html>.

The oral defense of the student's dissertation is a formal occasion and the student should treat it as such by dressing appropriately and scheduling the meeting for an appropriate seminar room. It is the responsibility of the student to arrange for all audiovisual aids and to schedule the room location.

At the beginning of the examination, the student's research advisor introduces the student and the topic of their research to the general audience. The student is then expected to present a brief seminar outlining the results of their research. The presentation should be limited to 45 minutes. Following the presentation by the student, the general audience is invited to ask questions. Following this question and answer session, the general audience is excused and the student's dissertation committee continues to question the student in depth regarding his/her research findings. The student should be prepared to defend the research methodology used in the study and the results obtained.

The oral defense of the dissertation is limited to a period of three hours. If necessary, however, the proceedings may be adjourned and rescheduled for a mutually convenient date within one week. Only one adjournment is permissible. When the dissertation committee completes its questioning, the student is asked to leave the room and the committee discusses whether or not the student successfully defended their research and whether or not the completed dissertation is acceptable.

### **LEVEL OF PASS OR FAIL**

**Pass: Only minor format corrections need to be made (e.g., typographical errors, and pagination).** At the conclusion of the defense, 1) the committee chair should indicate "pass" and briefly describe needed revisions, and 2) all committee members should report the examination results at the bottom of form and sign the dissertation approval page.

**Pass with minor revisions: Extensive format/editorial corrections and/or minor substantive changes need to be made (e.g., rewrite some text, correct grammatical errors).** At the conclusion of the defense, 1) the committee chair should indicate "pass with minor revisions" and briefly describe revisions, and 2) the committee members, not including the chairperson, should report the examination results at the bottom of the form and sign the thesis approval page. 3) After revisions are made, the chairperson should report the exam results at the bottom of the form and sign the dissertation approval page.

**Pass with major revisions: Extensive substantive changes need to be made (e.g., chapter rewrite).** 1) At the conclusion of the defense, the committee chair should indicate "pass with major revisions" and briefly describe revisions. 2) After revisions are made, all committee members should report the examination results at the bottom of the form, and sign the dissertation page.

**Fail: The basic design and/or overall execution of the study are flawed or the candidate's performance in the oral examination is seriously deficient.** At the conclusion of the defense, 1) the committee chairperson should indicate "fail", and 2) all committee members should report the examination results at the bottom of the form. The dissertation approval page should not be signed.

The results of the oral defense are conveyed to the student by the chair of the supervisory committee or dissertation committee, whichever is appropriate. The results are transmitted to the Graduate College on the "Announcement & Report for Doctoral Dissertation Defense" following the approval of the Director of the School of Biological and Health Systems Engineering.

### **Applying for Graduation**

The student is eligible for graduation when the Graduate College scholarship requirements are met, the final oral examination is passed and the dissertation is approved by the supervisory committee and accepted by the Director of the School of Biological and Health Systems Engineering and the Dean of the Graduate College; and after the required number of dissertation copies are submitted to the bookstore for binding.

Application for graduation should be made no later than the date specified in the Graduate College calendar (Refer to Graduate College website for current information). All fees are payable at this time.

The graduation application process can be found online at <http://graduate.asu.edu/how-to>

An additional late fee will be assessed if these procedures are completed after the date specified in the Graduation Catalog calendar. If the student wishes to apply the filing fee to a subsequent semester, he/she must withdraw the application no later than the application deadline. During the

summer, the graduation application must be withdrawn by the last day of the five-week summer session. If a student does not complete all degree requirements by the date of graduation for which he/she has applied and has not withdrawn the application by the designated time, a \$45 fee must again be paid to reapply.

## Enrollment

Students must be enrolled for at least one hour of credit that appears on the plan of study or one hour of appropriate graduate-level credit during the semester or summer session in which they defend a dissertation.

**Summer:** During the summer session, enrollment in any one of the summer sessions will fulfill the requirement.

**Break Period.** Students with an oral defense scheduled during a break period must be enrolled in both the proceeding semester and the following semester, including summer term. If the break is between the summer and fall, enrollment during any one of the summer session will fulfill the requirement.

## Continuous Enrollment in a Doctoral Degree Program

**Once admitted to a doctoral degree program, the student is expected to be enrolled continuously, excluding summer sessions, until all requirements for the degree have been fulfilled.** Students must be enrolled in courses that meet the program requirements, which may include coursework, 792 Research, or 799 Dissertation. Credits that do not meet program requirements will not count toward continuous enrollment. If no additional credit is required toward the doctoral degree, the student may enroll for 695 or 795 Continuing Registration.

Continuing Registration does not carry credit; no grade is given.

If a plan of study must be interrupted, the student may apply for leave status. The approved petition must be filed no later than the last day to register for classes in the semester for which the student is requesting a leave.

**A student who interrupts a program without obtaining leave status may be removed automatically from the program.**

## Maximum Time Limit

Doctoral students must complete all program requirements within a ten-year period. The ten-year period starts with the initial enrollment into the doctoral program. In addition, the student must take the final oral examination in defense of the dissertation within five years after passing the comprehensive examinations. Any exception must be approved by the supervisory committee and the dean of the Graduate College and ordinarily involves repetition of the comprehensive examinations.

*Other dissertation requirements.* The student must submit three copies of the dissertation for binding. Bound copies are placed in the University Library, department office, and Archives. Bound copies of the dissertation are also prepared for the student's research advisor. Doctoral candidates must also submit one copy of the title page and one copy of the abstract (which must not exceed 350 words) to the bookstore. Binding services are available through Arizona Library



Binding at 602-253-1861. The student is responsible for the binding fees. Doctoral students must also pay to have their dissertations microfilmed by University Microfilms International (UMI).

*Other requirements.* Keys must be returned, all departmental property must be returned, samples and notebooks must be turned over to the advisor, wastes must be disposed of and the student's desk must be cleaned out.

## FINANCIAL SUPPORT

Financial support for graduate students in the Department of Bioengineering is available from several sources. These include research assistantships, teaching assistantships, and academic scholarships.

### Teaching Assistantships

Some teaching assistantships may be available to qualified individuals. (All teaching assistants whose native language is not English must achieve a Test of Spoken English (TSE) score of 230 or better before they are allowed primary teaching responsibilities. The TSE is offered on the ASU campus as the SPEAK Test. Students receiving teaching assistantships may be assigned appointments that are half-time (20 hours per week) or quarter-time (10 hours per week). Assignments may include sole responsibility for the teaching of undergraduate laboratories, assistance in the teaching of undergraduate laboratories or assistance in the grading of undergraduate homework. Occasionally the student may be asked to prepare specific lectures in undergraduate courses and administer examinations. Teaching responsibilities are in addition to the time spent on research for the graduate degree. Teaching assistantships often are also available in other departments at the University. This includes, for example, Chemistry, Mathematics and Computer Science. A tuition waiver is usually given to students awarded graduate assistantships. In some cases, a doctoral student may be listed as instructor of record for a course, and deliver the entire course. In addition to the above requirements, a student must also complete their Teaching Practicum prior to being listed as instructor of record.

### Research Assistantships

Research assistantship appointments pay the student a stipend to participate in a particular research project that may serve as his/her thesis research topic. Research assistantships may also be available for projects that will not serve as the student's research topic. The research assistant may be appointed 50% time (20 hours per week) or 25% time (10 hours per week). Students receiving stipends for research activity that also constitutes the dissertation research spend considerably more time each week working on the project than that dictated by the assistantship.

### Scholarships

The Graduate College provides a variety of mechanisms to support funding for outstanding graduate students recommended by the program if funds are available (see <http://graduate.asu.edu/financing>). Students may apply for these awards provided by the Graduate College. Generally students receiving research assistantships or teaching assistantships qualify for out-of-state tuition waivers. Only a very limited amount of support is available. These are awarded to the students with the most outstanding academic credentials.

### Policies Related to Financial Support of Graduate Students

It is the desire of the School to provide financial support for as many students as possible. Financial resources, however, are limited. For this reason, a limited number of students receive

written offers of financial aid prior to entering the program. Students who elect to enter the program without a written commitment of financial aid are responsible for providing their own financial support. Although it is the desire of the faculty to assist students by the aggressive pursuit of research grants, the faculty is not committed to provide funding when a student enrolls in the program without a written commitment from the department chair. All supported students are expected to complete their work assignments in a satisfactory manner as judged by the faculty. Additionally, supported students are required to register for at least 12 semester hours of coursework during each semester of residence. This may include research hours. It is understood that any suspension from the graduate program results in the loss of financial support. Finally, departmental decisions on financial aid are based on consideration of all aspects of each individual student's situation within the framework of these guidelines.

### **Intellectual Property**

Key intellectual property policies can be found within the Arizona Board of Regents Policy Manual as well as ASU's Research and Sponsored Projects Manual. It is the student's responsibility to understand and remain in compliance with these key policies. These policies confirm and clarify ownership of research data and materials. For additional information, visit <http://www.asu.edu/aad/manuals/rsp/rsp604.html>

### **Conflict of Interest**

In some cases, students can find themselves working on projects which are part of a commercial development, either of their own, or associated with a faculty member. Once a conflict of interest has been identified, the graduate committee will determine an appropriate course in consultation with the student, the mentor, and, if necessary, University Counsel.

## **ACCESS TO SBHSE STAFF AND FACILITIES**

### **ISAAC and Building Access**

ISAAC (key card) provides access for the offices and laboratories in the Ira A. Fulton Schools of Engineering: Engineering Research Center (ERC), ITBS1, Schwada (SCOB) Classroom Office Building, and Goldwater Center (GWC) are obtained by filling out an online ISAAC form available on the SBHSE website. The student's research advisor and an authorized department signor must also sign the form.

### **Office Equipment**

Graduate students are not permitted to use office (computers, printers) without departmental approval. Students are urged to familiarize themselves with the extensive free computer facilities on campus available for word processing.

### **Copier**

The SBHSE copier is for faculty and staff use. Faculty may authorize their students to use the copier for teaching duties or for research. Large jobs (greater than 100 copies) require approval by the Business Operations Manager. No personal copying can be done on the SBHSE machine. Pay copiers are available at many locations on and off campus.

## Miscellaneous

Department announcements and important information are listed on the SBHSE website.

Misuse of departmental telephones, copiers, supplies, facilities is a serious offense that will lead to disciplinary action. At a minimum, students found to have used departmental resources for non-department approved purposes will be required to reimburse the department for such uses.

Email etiquette:

You will have many reasons to communicate with instructors and staff outside of class. The preferred method of communication is via email.

Two rules that you should follow:

1. Begin the Subject Line of your message with a course designator such as "BME 213: Ethics"
2. Keep all communications professional in tone. Begin your email with a proper salutation (Dear Dr. ..." or "Dear Professor..." , etc.) Be direct, clear, and brief with your questions or comments. Do not make demands of your instructor or staff member. Proofread your note Proofread your note prior to sending it: misspelled words and grammatically incorrect constructions generate a bad impression. And please, don't pepper your message with exclamation points and emotions.

\*Emails which violate rule 2 will either be ignored or returned with editorial comments.

Here is an example of an inappropriate email:

To: BME294 Instructor

Subject: Yo

Dude its freakin hot out today!!! ASU should get it's act together and build like enclosed walkways or something for us!!! Right?? Its cool I guess ;) Anyway, yo, I could get the answer sheet today cuz their all gone. Put on on your door and I'll snag it tonight.

L8trs.

A much more appropriate email:

To BME213 Instructor

Subject: BME 213: Answer Sheet

Hello Professor,

I was unable to get to class to pick up an answer sheet today. Would there be a time that I might come by to pick one up?

Thank you.

Student