TABLE OF CONTENTS
1. INTRODUCTION................................................................. 3
2. GRADUATE STUDIES AND DEGREES................................. 3
2.1 MASTER OF SCIENCE DEGREE ...................................... 3
2.1.1 Traditional Entry......................................................... 3
2.1.2 Fast-track Entry .......................................................... 4
2.2 DOCTOR OF PHILOSOPHY DEGREE................................. 5
2.3 SPECIAL REQUIREMENTS FOR FOREIGN STUDENTS...... 6
3. FINANCIAL SUPPORT ....................................................... 6
4. ACADEMIC STANDING, PROBATION, DISMISSAL AND REVIEW PROCEDURES......................................................... 7
5. ADVISING AND PROGRAM PLANNING............................ 7
5.1 SELECTION OF ACADEMIC ADVISORS AND COMMITTEES. 7
5.2 PLAN OF STUDY............................................................... 8
5.3 THESIS FORMAT ............................................................. 8
5.4 SEMINARS ..................................................................... 9
5.5 RESEARCH INTEGRITY COURSE.................................... 9
6. GRADUATE CURRICULUM ............................................... 9
6.1 Graduate Core Coursework ............................................. 10
APPENDIX: EXAMINATIONS................................................ 11
M.S. PROGRAM...................................................................... 11
PH.D. PROGRAM................................................................... 11
1. INTRODUCTION

This Handbook describes the graduate programs in the Department of Biomedical Engineering of The University of Iowa. The plans of study, policies, regulations, and procedures applicable to the student pursuing an M.S. or Ph.D. degree are contained herein. All graduate students are subject to the rights and responsibilities mandated by the Graduate College. For more information on the Graduate College at the University of Iowa, see: http://www.grad.uiowa.edu/Publications/NewStudentHandbook/index.htm

Course descriptions may be found in the separately printed extract of the university catalog, or on the departmental web site: http://www.bme.engineering.uiowa.edu. A complete listing of the Graduate College's Policies and Procedures can be found at: http://www.grad.uiowa.edu/Publications/ManualOfRulesAndRegs/index.htm

2. GRADUATE STUDIES AND DEGREES

The goal of graduate study in the Department of Biomedical Engineering at both the M.S. and Ph.D. levels is to educate students more deeply and broadly than is possible at the B.S. level in the discipline of Biomedical Engineering. The students can then apply this knowledge towards a professional career in engineering design and development, or may pursue a career in academic education. Each student's course of study is based on his/her background, career objectives, and sound academic practice. The course of study is normally in an area in which the departmental faculty has teaching and research expertise. These areas include Musculoskeletal and cardiovascular biomechanics, biomaterials, tissue engineering, biomedical imaging, computational biology and bioinformatics, and cellular systems modeling. An individual program for each student may be developed from courses offered by our department and other departments in the College of Engineering, especially Mechanical Engineering, Electrical & Computer Engineering, or basic science departments in the Colleges of Liberal Arts and Medicine. Students desiring a more general program may combine disciplines, while those desiring some specialization in any particular field may accommodate these preferences through the combination of departmental courses and appropriate electives from other departments of the College of Engineering and the University.

2.1 Master of Science Degree

2.1.1 Traditional Entry

Students who have earned a baccalaureate degree in an engineering curriculum or a curriculum in the mathematical, physical, or life sciences are eligible to be considered for admission to the Master of Science Degree study in Biomedical Engineering provided they have a minimum grade point average of 3.00 out of 4.00, and have attained an acceptable score on the Graduate Record Examination (typically, a combined score of 310 for Verbal and Quantitative).

Students may, under exceptional circumstances, be considered for conditional admission with a lower grade point average and GRE scores. The student on conditional status must achieve regular status within 9 semester hours of initial registration by attaining a grade point average at The University of Iowa of at least 3.00 and regular acceptance by the department faculty, or be subject to dismissal.

During the first semester of attendance, a tentative Plan of Study for each student is
determined through consultation with an adviser. An Examining Committee is also formed at this time to guide the student through their period of graduate study (see Section 5.2). Under some conditions, admitted students without a strong background in physical and/or engineering sciences will include in their Plan of Study necessary remedial studies in order to achieve parity in these fields. The student's Plan of Study must approved by the Examining Committee prior to completion of 18 hours of coursework. The Plan of Study is then submitted for approval to the Department Chair and the Dean of the Graduate College. To earn the M.S. degree, the student is required to attain a minimum grade point average of 3.00 on a minimum of 30 semester hours of graduate work and be successful in the Final Examination administered by the student's Examining Committee, as described in Appendix I.

The M.S. degree can be obtained in one of three ways:

1. A thesis-based degree requires a minimum of 30 semester hours of course work. A formal thesis is written, and a degree is granted if the course work is successfully completed and the student’s committee accepts the thesis. Those choosing the thesis program may count up to six (6) semester hours of credit for thesis research and writing towards satisfying the 30-semester hour requirement. Students desiring a thesis-based M.S. degree must fulfill the graduate college requirements (http://www.grad.uiowa.edu) before graduation. In addition, students are encouraged to publish their thesis work in peer-reviewed journals and present them in the BME graduate seminar, where possible. The requirements for the traditional M.S. degree may be completed within three or four semesters. However, students with assistantship duties and/or other constraints may take longer to complete the degree.

2. A project-based degree requires 30 semester hours of course work, with at least six hours of 200-level courses. A degree is granted if the course work is successfully completed, and a significant design project is completed that normally includes the submission of a scientific manuscript or a final report. It is anticipated that the design project is related to a need identified by an industry sponsor, or a design project continued as part of a senior design class completed as part of the requirements for the fast-track B.S./M.S. joint degree program.

3. A non-thesis degree requires 30 semester hours of course work, with at least six hours of 200-level courses. A degree is granted if the course work is successfully completed, and the student passes an oral examination given by the student's Examining Committee.

2.1.2 Fast-Track Entry

Students who desire to complete both the B.S. degree and the M.S. degree at The University of Iowa in Biomedical Engineering may seek to enter the fast-track B.S./M.S. joint degree program offered in BME. Application to the B.S./M.S. joint degree program will require the following: (1) completion of at least 80 semester credits towards the B.S. degree, (2) a minimum cumulative GPA of 3.5, and (3) a letter of application submitted to the BME Department in which the student indicates the intended area of specialization, and the name of the M.S. adviser. Students in the B.S./M.S. joint degree program will receive a B.S. degree in Biomedical Engineering when all of the requirements for the
B.S. degree have been completed. After receipt of the B.S. degree, the student will enter the M.S. degree program. The student is required to take the GRE examination before the end of the first semester after entering the M.S. program. A portion (up to 12 s.h.) of the courses taken to complete the B.S. degree can be used to satisfy the course requirements for the M.S. degree. These courses are: Fast-Track Biomedical Eng. Design 1-A (BME:5910), Fast-Track Biomedical Eng. Design 2-A (BME:5920), Human Physiology (HHP:3500) and Introduction to Biostatistics (BIOS:5110). The student will enter either the regular M.S. with thesis program, or the special M.S. with project program. Those students entering the M.S. with thesis program should complete their degree requirements within three semesters after the completion of the B.S. degree. Of the semester hours from undergraduate coursework that can be applied towards the Master’s degree, six are typically research credits, therefore the student does not have to register for Research Biomed Eng MS thesis hours. This requirement has already been fulfilled with the Fast-track Biomedical Eng. Design 1-A and Fast-Track Biomedical Eng Design 2-A courses. Those students who go on to PhD studies after the fast-track M.S degree can apply formal classroom semester hours towards the PhD requirements; these graduate semester hours do not include research credits double-counted for this special degree program.

2.2 Doctor of Philosophy Degree

Students who have earned a baccalaureate or post-baccalaureate degree in an engineering curriculum or a curriculum in the mathematical or physical sciences may be conditionally admitted to the Ph.D. program if they have a minimum undergraduate grade point average of 3.25 of 4.00 and an acceptable score on the Graduate Record Examination (typically, a combined score of 310 for Verbal and Quantitative).

Reference letters, student research interests, previous graduate-study grade point average, and other factors may also be considered in making the decision to admit a student. The doctoral program, including acceptable transfer credits, requires a minimum of 72 semester hours of graduate work. Of these 72 hours, at least 42 semester hours must be in formal course work taken after the B.S. degree. These are minimum requirements; the student and their Examining Committee will establish reasonable course requirements individually suited to the goals and background of the student. The remaining semester hours will be a mix of course electives, independent study, and research.

Admission to the Ph.D. program is conditional until the student successfully completes the Qualifying Examination (as described in Appendix I). Students intending to pursue the Ph.D. degree are normally required to complete the qualifying examination within 12 months of the date they begin graduate study at The University of Iowa. Students enrolled in a thesis-based Master's program in the Department may elect to substitute the Master's Thesis Defense for the Qualifying Examination (see Appendix I). The student's Examining Committee shall make the decision on whether the student's performance in this examination is adequate for unconditional admission to the Ph.D. program.

Upon completion of the course work specified in the Plan of Study, with the GPA of 3.25 on all graduate work done at the University of Iowa, upon passing the Qualifying Examination and upon the student's Examining Committee's recommendation, the student will be admitted to the Comprehensive Examination, as described in Appendix I. Having satisfactorily completed these examinations, the student normally has only to complete and defend the dissertation at the Final Examination. Requirements for the Ph.D. degree can generally be completed in about three years beyond the Master's degree.
2.3 Special Requirements for Foreign Students

A minimum TOEFL score of 550 (215 on the computer-based examination) is a requirement for admission to a University of Iowa graduate program. In addition, the English as a Second Language (ESL) program must evaluate students with TOEFL scores between 550 and 600 (or under 250 on the computer-based exam) as soon as they arrive on campus. This evaluation is the basis for ESL recommendations for Intensive English or other coursework to improve English proficiency. Students are required to enroll in the prescribed courses within the first year of graduate study. The Graduate College will monitor the results of on-campus English evaluations of students subject to the TOEFL requirements. Students will be expected to enroll in courses recommended by ESL during their first semester and to continue enrollment until satisfactory grades are earned or until subsequent evaluation indicates that the required level of English proficiency has been achieved. New students taking the English Proficiency Evaluation are notified of the results shortly prior to the start of the semester. In addition, copies of the results are sent to advisers so that they have them when they meet with students. Results may include recommendations by ESL for enrollment in English preparation courses. Students will be required to continue registration in appropriate ESL courses until certified to have achieved the desired level of proficiency. This policy may preclude some students from enrolling in ANY graduate level course work during their first semester, and may limit the amount of graduate course work they may take in subsequent semesters if ESL determines that additional English preparation is required. Failure to enroll in required ESL course work would prohibit future registration in the graduate program until requirements are fulfilled.

Completion of the Graduate Record Examination (GRE) examination is required for a final admission decision. Applicants are strongly encouraged to take this examination prior to filing an application for admission. The University requires English proficiency certification for graduate Teaching Assistants whose native language is not English. All such TAs must pass this test before they can be assigned a teaching assistantship. All foreign students should follow the same rules and codes as the domestic students.

3. FINANCIAL SUPPORT

Financial support may be available to M.S. as well as Ph.D. students primarily through fellowships, research and teaching assistantships from faculty members' research grant support or the Department of Biomedical Engineering. These awards may be made on a semester, academic year, or calendar year basis. Awards and re-appointments are competitive and are based upon the student's potential contribution to the research and teaching goals of the department. Students who fulfill their assistantship responsibilities adequately and continue to make satisfactory progress toward their degree objective will receive preference in the awarding of new assistantships. All applications for financial support should be sent directly to the BME Department Chair.
4. ACADEMIC STANDING, PROBATION, DISMISSAL AND REVIEW PROCEDURES

A student in the M.S. program shall be placed on probation if, after completing nine (9) semester hours of graduate work, his/her cumulative grade point average on graduate work done at The University of Iowa falls below 3.00. The corresponding minimum requirements on cumulative course work taken in the Ph.D. program are 3.00 after the first 12 hours and 3.25 after 24 hours have been completed. If a student is not removed from probation after one semester he/she may be denied permission to re-register. Students may also be denied re-registration or be dismissed directly for less than full professional conduct. The student is also subject to the more general provisions of the University's current "Policies and Regulations Affecting Students" document, a copy of which is provided to students at registration. Should a student feel his/her dismissal is unfair the student may seek departmental faculty review of the dismissal. The procedure for academic dismissal is described in the Manual of Rules and Regulations of the Graduate College.

5. ADVISING AND PROGRAM PLANNING

5.1 Selection of Academic Advisers and Committees

**Academic and Research Advisors:** An academic advisor is a BME faculty member (Professors Karim Abdel-Malek, Terry Braun, Thomas Casavant, K.B. Chandran, Edwin Dove, Nicole Grosland, Tae-Hong Lim, Michael Mackey, M.L. Raghavan, Joseph Reinhardt (chair), Edward Sander, Michael Schnieders, Kai Tan, Sarah Vigmostad, David Wilder, or Yi Xing) who is in charge of ensuring the student’s satisfactory completion of general academic requirements for BME graduate studies. A research advisor is a faculty member who holds any appointment in the BME department (i.e., BME Faculty and Affiliated Faculty in UI BME web site) and is in charge of supervising the quality and progress of the student’s thesis research project. An academic advisor can be a research advisor for a graduate student as well. The BME Graduate Program Committee assigns an academic advisor to each of the new incoming students and current graduate students who have no academic advisor based upon the research area of interest in the students’ application. The assigned academic advisor may serve either as the student’s permanent academic and/or research advisor throughout the student’s graduate study based upon the mutual agreement between the assigned advisor and the student or as a temporary advisor until the student finds another individual(s) qualified for being academic and/or research advisor for his/her thesis research project.

**Examining Committee:** Each student, with advisors, is expected to form an Examining Committee by the appropriate deadline (end of first and second semester for MS and PhD Program, respectively) according to the following rules.

**Examining Committee for MS** The examining committee for the master’s degree consists of at least three members. These committees are composed of as follows:

- At least 2 of the committee members must be members of the University of Iowa tenure-track faculty;
• At least one of the committee members must be a BME faculty member who is eligible to be an academic advisor;
• At least two committee members should be faculty members who hold any appointment in BME (i.e., affiliated BME faculty); and
• The chair of the examining committee should hold any appointment in BME and is a member of the University of Iowa tenure-track faculty.

Examining Committee for PhD  The examining committee for the doctoral degree (PhD) consists of at least 5 members. These committees are composed of as follows:
• At least four of the committee members must be members of the University of Iowa tenure-track faculty;
• At least one of the committee members must be a BME faculty member who is eligible to be an academic advisor;
• At least two committee members should be faculty members who hold any appointment in BME (i.e., affiliated BME faculty); and
• The chair of the examining committee should hold any appointment in BME and is a member of the University of Iowa tenure-track faculty.

The student’s Examining Committee is expected to tailor the student’s graduate curriculum to suit their research interests and to ensure the satisfactory completion of all degree requirements. Accordingly, this committee will be involved in crafting the student's Plan of Study and will attend all examinations and thesis defenses for this student.

5.2 Plan of Study
All graduate students shall complete a tentative Plan of Study in consultation with their Examining Committee, as soon as this committee is formed. Copies of this plan will be placed in the student's file. A formal Plan of Study Summary must be filed with the Graduate College prior to the M.S. Final or Ph.D. Comprehensive Examination. This form will typically be completed by the student and the Examining Committee in the semester in which the student anticipates graduation and applies for a degree.

5.3 Thesis Format
The student should check carefully with the Graduate College Thesis Manual and their research adviser on matters pertaining to thesis format and detail. All committee members have the right to examine corrected drafts as well as earlier drafts to assure that recommended changes have been made before the thesis is submitted to the Graduate College. In addition to the Graduate College requirements, the student is required to provide one bound copy of the approved thesis for department file use and other copies as required by the Committee. Details on the various examinations required by the M.S. and Ph.D. degrees are contained in Appendix I. The student should consult with their research adviser to determine the form, time, and place for each examination. It is the student's responsibility to contact all committee members and schedule the examinations, including reserving an appropriate meeting room.
5.4 Seminars

Attendance and participation at seminars is an important part of graduate education. All Biomedical Engineering graduate students are required to attend the weekly BME Graduate Seminar (BME:5010:0001 or BME:5010:0002) with the following exceptions.

1. In the case of a course schedule conflict, a student may request to be excused from attending the seminar.
2. Graduate students involved in research programs that are associated with other formal graduate-level seminars may request to substitute these other seminars for the BME Graduate Seminar after the first year of the study.
3. Students who have successfully completed their PhD Comprehensive Exam must register for the BME Graduate Seminar but may request to be excused from attending the seminar up to two semesters.

For all cases, to request the above mentioned waiver/substitution a student must submit “Petition to Waive/Substitute Graduate Seminar” form no later than the last day for graduate students to late register or add courses. Even if the petition to waive/substitute the seminar is approved, the student should still register for the BME Graduate Seminar.

All PhD students in their final year are encouraged to present their thesis research in the BME Graduate Seminar.

5.5 Research integrity course

Training in the responsible conduct of research and scholarly activities is a crucial part of graduate education. All Biomedical Engineering graduate students who started graduate study on or after Fall 2012 semester are required to enroll in the course, Engineering Ethics, ENGR:7270 (057:270).

6. GRADUATE CURRICULUM

The field of Biomedical Engineering is rapidly evolving to include, in addition to the established disciplines such as solid biomechanics, cardiovascular and fluid biomechanics, biomaterials, bioinstrumentation, and biomedical imaging, the more recently developed fields of tissue and cellular engineering, computational biology, bioinformatics, and cellular systems modeling. The graduate curriculum in Biomedical Engineering at the University of Iowa has been designed to foster continued development in the established biomedical engineering disciplines, and to embrace newly emerging applications of engineering approaches to problems of broad interest in the life sciences. To accomplish these goals, a course of study that is individually tailored to a student's research interest is developed through close interaction between the student and their Examining Committee. A key aspect of the graduate course curriculum lies in the successful completion of the Graduate Core Course Curriculum.
6.1 Graduate Core Coursework (required for all MS and PhD students)

All MS and PhD students must successfully complete the Graduate Core Courses as part of their graduate curriculum. Students are expected to complete the Graduate Core Courses during their first year of study.

Graduate Core Courses

- Human Physiology, HHP:3500 (27:130)
- Mathematical Methods in Engineering, ME:5113 (58:113) or equivalent 100-level Mathematics course (i.e., MATH:36xx excluding History of Math or Philosophy of Math)
- Biostatistics, BIOS:5110 (171:161) or Biostatistics, STAT:3510 (22S:101)
- Engineering Ethics, ENGR:7270 (required for all graduate students starting Fall 2012 or later)

Depending upon a student’s performance in these Graduate Core Courses and the nature of their research project, the student’s examining committee may specify additional course work to be completed to satisfy the Graduate Core Coursework requirement.

Graduate Core Courses may be substituted by other equivalent courses by the discretion of the student’s Examining Committee. Equivalent coursework taken as part of either student’s’ undergraduate or graduate studies prior to starting the BME graduate programs at the University of Iowa may satisfy one or more of the Graduate Core Coursework requirements. Students wishing to request a substitution or a waiver of a Graduate Core course must submit a “Petition to Waive/Substitute Graduate Core Course” form located in the BME Department Office (1402 SC).
APPENDIX: Examinations

M.S. Program

As a requirement for graduation from the M.S. program, an oral examination is administered by the student's Examining Committee. For a thesis-based Master's, this exam is primarily concerned with the defense of the student's thesis. In the case of a non-thesis or project M.S. degree candidate, mastery of a subject area must be demonstrated in an oral examination. Scheduling of the exam at a time convenient for the committee members is the student's responsibility, as is reservation of the meeting room. For those exams related to a thesis, a final draft of the thesis must be available to committee members two weeks before the scheduled exam.

Ph.D. Program

The Ph.D. student must successfully complete three examinations.

(1) The Qualifying Examination

The general goal of the Qualifying Exam (QE) is to provide a mechanism for the predoctoral candidate to demonstrate their ability to solve open-ended problems in a particular emphasis area.

For each student, the student's Examining Committee will administer the examination for the QE, the student will be assigned an open-ended problem in the area of the student's intended thesis research. The student will be presented with this problem no later than the end of the Spring Semester of the first year of study, along with a designated date/time for the examination (typically at the beginning of the Fall semester), and the student will be expected to develop a solution during the summer. On the assigned date, the student will submit a written response to the assigned problem. The student will be expected to defend this response at an oral examination at the beginning of the Fall semester before the Examining Committee. The actual format of the response will depend on the specific problem assigned, and be specified by the Committee in the problem description, but is expected to involve the application of engineering principles towards the solution of a specific problem within the student's research area. Under certain circumstances, these guidelines with respect to the problem due date and oral examination might require modification to suit extenuating circumstances of the student or the Committee. Successful completion of the PhD QE is required before a student is to be considered a PhD graduate student. Students will have two chances to pass the PhD QE.

The Master's thesis oral defense may serve as the PhD QE, at the option of the student. For the thesis defense to qualify as the QE, the committee must contain at least 5 members, and be otherwise constituted as for that of a PhD student. It will be possible to pass the MS thesis defense, but not the PhD QE. If the student passes the defense but not the PhD QE, the student will have to take the usual PhD QE at a later date.

With the exception of the case described above involving a Master's student applying their thesis defense to the QE requirement, if a student fails to pass this exam the second time they must leave the graduate program. The deadline for submission of the QE response by the student is hard and fast. Failure of the student to complete the response
by the assigned date will constitute failure of the examination.

(2) The Comprehensive Examination
The PhD Comprehensive Examination (CE) consists of a proposal (in the style of an NIH grant proposal) outlining the student's PhD research. It is expected that the PhD CE will be completed one year after the PhD QE, but might be completed later at the discretion of the student's Examining Committee. The quality of the proposal will be determined through its assessment by the Examining Committee, and a formal oral presentation is required.
The proposal should include the following:
1. TITLE PAGE
   - Student name
   - Committee members and their academic departments
   - Committee chairman (research adviser)
2. RESEARCH PROPOSAL - Give a detailed description of the research, including:
   - Specific Aims
   - Background and Significance
   - Preliminary Studies (optional, but recommended)
   - Research Plan (include expected results and their significance, and a discussion of potential pitfalls / workarounds)
3. TIMELINE
   Give a specific schedule for the completion of the proposed studies, with explicit reference to the work proposed in the Research Plan.
4. BIBLIOGRAPHY - A complete list of cited references.

(3) Final Examination
Upon satisfactory completion of the PhD thesis, the student will submit a final draft of the dissertation to the members of their Examining Committee. Following an assessment of the dissertation by the student's Examining Committee, the student will defend it orally to the Committee. Satisfactory performance in this final examination will result in a recommendation by the Committee to the Graduate College that the student be awarded a PhD in Biomedical Engineering.