

# **GRADUATE HANDBOOK**

Department of Biomedical Engineering  
Colleges of Engineering & Medicine  
University of Cincinnati

Revised: September, 2004

*www.bme.uc.edu*

## INTRODUCTION

Dear Candidate:

It is indeed a pleasure to welcome each of you to the Graduate Program in the Department of Biomedical Engineering at the University of Cincinnati! Our Graduate Committee has conducted a rigorous evaluation process in selecting you and you join a group of superb graduate students working in the fields of tissue engineering and biomechanics, medical imaging, and bioinformatics. The size of the graduate program is small, permitting one-on-one mentoring by your advisor. The curriculum is strong and focused, yet flexible enough to permit students with pre-existing strengths to concentrate on areas requiring development. The facilities are excellent in the department and are growing as new faculty and students join our programs.

This handbook is designed to meet several needs. In sections I and II, we describe the application and admission process as well as registration procedures. Section III highlights the graduate credit requirements and grading policies. The Master's (Section IV) and Doctoral Degree Programs (Section V) are then described in detail, including course requirements, minimum academic performance, and the Ph.D. Qualifying Exam and thesis and dissertation proposals and defense. The document concludes with Special Rules and Provisions. We encourage you to become familiar with the entire document as it provides you with valuable information as you proceed through your graduate program.

Welcome again to UCBME. We trust that you will have a valuable experience while you are with us and that the resulting degree(s) will provide the necessary foundation for a successful career in academia, industry, medicine, or whatever path you pursue!

Best Wishes,

David L. Butler, PhD

Director, Graduate Program in Biomedical Engineering

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**2004-05 ACADEMIC YEAR**  
**Administrative Officers and Support Personnel**

<u>Director of Graduate Program</u>	<u>David L. Butler, Ph.D.</u>
<u>Graduate Committee</u>	<u>David L. Butler, Ph.D.</u> <u>Linda Moeller, B.S.</u> <u>Bruce Aronow, Ph.D.</u> <u>Steven Boyce, Ph.D.</u> <u>Jeffrey Johnson, Ph.D.</u> <u>Edward S. Groot, Ph.D.</u> <u>Christy K. Holland, Ph.D.</u> <u>Scott K. Holland, Ph.D.</u>
<u>Department Head</u>	<u>William S. Ball, Jr., M.D.</u>
<u>Graduate Program Coordinator</u>	<u>Linda L. Moeller, B.S.</u>
<u>Business Manager</u>	<u>Lori Beth Derenski, B.S.</u>
<u>Interim Dean, College of Medicine</u>	<u>Ronald A. Sacher, M.D.</u>
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<u>Academic Affairs, College of Engineering</u>	<u>Roy Eckart, Ph.D.</u>
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**Deadline for Application and for Financial Aid**  
**for the following Academic Year is December 31**

**[www.bme.uc.edu](http://www.bme.uc.edu)**

## PREFACE

All graduate students in the Department should familiarize themselves with the contents of this document. This way, most questions will be answered and many difficulties will be avoided. It is recommended that graduate students retain the handbook for their personal use throughout their degree program. All students are expected to be thoroughly aware of, and conform to, all the requirements and regulations of the graduate program of the Department.

## Chapter One Application and Admission

### A. Application

#### 1. Process

The application procedure is as follows:

- Complete the on-line University application available at:  
<https://www.grad.uc.edu/admissions/app/Program.cfm>
- Submit application fee of \$50
- Complete College of Engineering application
- Submit application and materials listed below no later than December 31<sup>st</sup>
- Take the Graduate Record Exam (GRE) and submit the score
- Take the TOEFL and submit the report (if English is not your native language)
- Obtain two letters of recommendation
- Write and submit a one-page personal statement
- Submit transcripts from previous degree program

All the information should be submitted to:

The College of Engineering Graduate Programs  
University of Cincinnati  
Mail Location 0077  
Cincinnati, OH 45221-0077

Students are only admitted for the Autumn quarter of any academic year.

#### 2. Requirements

Admission to the Graduate Program requires a baccalaureate degree (or its equivalent) in engineering, physics, mechanics, mathematics or some other related area. Those having non-engineering degrees should take core courses in engineering early in their graduate program. Applicants are expected to have a minimum undergraduate grade point average (GPA) of 3.0 (out of 4.0). A Graduate Record Examination (GRE) score must be submitted with the application. Flexibility in the admissions criteria will be maintained, and students will be treated individually. In exceptional cases, a student lacking the minimal requirement may be granted admission, on a provisional basis.

#### 3. Types of Admission

##### a. Full Graduate Standing

Students meeting the minimum criteria for admission are admitted with full graduate standing. These students are eligible for financial aid, if available, and are entitled to all rights and privileges (as well as subject to all regulations) as any other graduate students in good standing.

##### b. Provisional Admission

Students may be admitted to the Program under special circumstances or with provisional status. This may include such conditions as probation or satisfactory completion of deficiencies. It should be emphasized that these contingencies will be made on a case-by-case basis, that they will last for a stated period of time (usually one academic year), and will be specified in the admission letter. Students may attain full graduate standing when the conditions responsible for their provisional status are corrected, subject to approval of the Graduate Committee.

##### c. Joint Advisors and Interdisciplinary Programs

If a graduate student enrolled in the Department wishes (1) to have a joint advisor in another department, or (2) to carry out his/her thesis research in a laboratory

outside the department, or (3) to pursue an Interdisciplinary Graduate Program involving the Department of BME, such arrangements will require advanced approval of the Graduate Committee. In all cases, active participation by one or more faculty of the Department of BME will be necessary.

#### 4. Admissions, Advisors, and Financial Aid Decisions

##### a. Admission

All Admissions to the Graduate Program in the Department of Biomedical Engineering are competitive and subject to review by the Graduate Committee

Each applicant will be judged on the basis of:

- Overall grade point average (GPA); GPA in the junior and senior years, GPA in the major area. A value of 3.0 (B) or above is expected in at least one of these.
- Graduate Record Examination (GRE) verbal, quantitative and written portion, are required, subject tests are optional
- At least two letters of recommendation on the supplied forms
- Official transcripts of all previous baccalaureate and graduate work.
- Departmental faculty interest and available laboratory space or research activity.
- Availability of financial aid, availability of research funds, or evidence that the applicant has financial means to support him/herself.

##### International Student Admission

- [International](#) students applying to the department for admission must demonstrate evidence of ability to speak and write English. A minimal score of 600 (on the written test) and 243 (on the computer-based test) for the Test of English as a Foreign Language (TOEFL) is required.

##### b. Advisors

- Upon acceptance a student will be assigned a temporary faculty contact. Upon arrival a temporary faculty advisor is assigned. The temporary faculty advisor may be the same as the temporary faculty contact. Prior to the end of the second quarter after arrival on campus, the student must select a permanent research advisor. Once a permanent advisor is selected, any change of advisor requires the approval of the new advisor. A form for this purpose can be obtained from the Graduate Office.

##### c. Financial Aid

Types of awards and guidelines for graduate awards are described in the Graduate Award Manual published by the Division of Research and Advanced Studies.

##### d. Types of Support

The Department of Biomedical Engineering has a variety of Assistantships and Scholarships which are awarded to deserving students in support of their graduate education.

- Graduate Assistantships (GA) awards provide for full time students a stipend for a [twelve](#)-month period: Oct. 1- [Sept 30](#). In addition, a University Graduate Scholarship (UGS) will be awarded to cover the costs of tuition and fees. The value of the stipend will be announced in the award letter. The University has determined that the stipend should be treated as taxable pay, and federal, state, and city taxes are withheld from the stipend checks. The duties of the Assistant are an integral part of the Graduate Program.

Those students receiving a GA are required to work approximately (20) hours per week for the Department. These students are also assigned to an Assistantship Advisor. (Usually the Assistantship Advisor is also the temporary Academic Advisor.) Each Graduate Assistant is expected to participate in the teaching and research functions of the Department, usually helping with the research efforts of his/her Assistantship Advisor, assisting in laboratory courses, grading papers, or possibly teaching a course. Specific department assignments are made each year by the Director usually in consultation with advisors and students. The specific duties for the research assignment will be given by the Assistantship Advisor.

- In some cases, Graduate Research Assistantships (RA), which are funded from research grants or contracts of individual faculty members, may be awarded. These awards are made by individual faculty members. It is the responsibility of the student to meet with faculty members in the students' area of interest to determine the availability of RA positions. The stipend level for RAs will be set by the individual faculty member to a level comparable to that paid to a GA. Students awarded an RA will be eligible to receive a UGS if they satisfy the guidelines for support stated below and apply for such an award to the Director.
- Graduate students admitted into the program are awarded a University Graduate Scholarship (UGS). Such awards cover the costs of tuition and all fees except the general fee.

e. Guidelines for Financial Awards

Decisions on awards are based solely on academic potential as indicated by credentials for new students or by actual performance in the case of continuing students. The guidelines below are followed by the Graduate Committee when awarding financial aid.

- Initial awards are for two academic years. However, support for a second year is based on the student's academic performance. Those with a GPA of less than 3.0 during the first year will not be considered for support of any kind during the second year.
- Further support will depend on the availability of aid, the student's academic performance, teaching or research performance, and normal progress towards the degree (2 years for MS and three years beyond the MS for the PhD.)
- Graduate Assistantship (GA) support is generally offered to incoming students only. It is expected that further financial aid will be as a research assistant supported by the student's major advisor. The student should make arrangements with his/her advisor for any financial support during summer quarters or beyond the second year of graduate study.
- Financial aid is not normally terminated during the period for which it has been granted. However, for serious reasons such as poor academic performance, teaching or research duties, or moral turpitude, a dismissal hearing by the Graduate Committee may be convened. If the dismissal

hearing warrants it, the Graduate Committee may terminate prematurely a student support.

- International students who are interested in teaching assignments must pass the Oral English Proficiency (OEP) Test. This exam must be taken twice during each year of study by all International students for whom English is not the native language until it is passed.

The special course in English for the OEP exam is allowed for graduate credit and can be applied toward the (15) UGS credit hours.

- Under ordinary circumstances, tuition scholarships will not be awarded to students who have attempted 260 or more quarter hours. Students with master's degrees from other institutions will not be eligible for tuition scholarships after attempting 209 quarter hours at our University.

## B. Pre-Registration Procedures and Requirements

### 1. Supplementary Information Form

The supplementary information form must be completed prior to registration by the following individuals:

- a. New students entering the University
- b. Students not enrolled in the previous academic year
- c. Students who transfer to another college, or
- d. Students who have earned their Masters' degrees and are admitted to the Department's Ph.D. programs

### 2. Physical Examination (***For International Students only***)

A physical examination is required of each applicant. A tuberculin Tine test or chest x-ray is required within three months of registration.

### 3. Transfer of Credits

As a means of assuring that the character and standards embodied in graduate degrees awarded by the University of Cincinnati are preserved, limits are set on the amount of work completed at other institutions which can be included as fulfilling graduate degree requirements. Transfer of credits from other universities, summer programs, etc., are subject to the approval of the student's Advisor and the Director of Graduate Studies. Limits are as follows:

- **Master's Degrees.**

The minimum requirement for these degrees is one year's full-time graduate study, or it's equivalent. Eligibility for graduation requires a minimum of forty eight (48) graduate credits for a thesis or a non-thesis program, the latter half or (15) of which must be completed while in residence at the University of Cincinnati. Three (3) credits for the departmental seminar is included in the (48) credits total. The M.S. thesis is fifteen (15) credits. A student who has previous graduate work at another institution that has not been used towards a degree may petition the Graduate Committee to transfer up to (9) quarter credit hours of relevant course work with grades of 'B' or better. Total out of the department courses are still limited to section c.

- **Doctoral Degrees.**

These degrees are conferred on the basis of extensive study and high scholarly attainment in a special field of learning. In no case, however, will

the degree be granted for less than three years of full-time graduate study or its equivalent, of which the last year must be in residence at the University of Cincinnati or under the University's direction. Eligibility for graduation requires a minimum of (138) graduate credits, the last (45) of which, exclusive of research credits, must be completed at the University of Cincinnati. One (1) credit for the departmental seminar is included in the (138) credits total. A student who enters the department with a MS degree may be credited with a maximum of (45) credits, of which a maximum of (30) course credits may be from another university. In addition, a maximum of (15) research credits can also be transferred.

#### 4. Out of Department Course Limits

MS students are allowed to use 9 credit hours of coursework outside of the BME department. The 9 credit hours do not include any Math courses needed to meet the degree math requirements. PhD students who have earned an MS degree are allowed to use 12 credit hours of their PhD coursework taken outside of the department toward their degree requirements. The 12 credit hours do not include any math courses needed to meet the degree math requirements. PhD students who choose not to earn an MS degree are allowed to use 21 credit hours of coursework taken outside of the department toward their degree requirements. The 21 hours do not include any math courses needed to meet the degree math requirements.

## Chapter Two **Registration**

A graduate student must be registered in the Graduate Division in order to earn graduate credit. However, unclassified students may be eligible to apply specific course credits towards their degree if later admitted into the Graduate Program.

### A. Registration Procedures

A student who has applied to, and has been admitted by, the Graduate Division registers each quarter by securing registration materials from the appropriate administrative unit, seeking counsel from his/her Advisor and obtaining his/her approval, properly completing and processing registration materials and promptly making full payment when billed. A student may not attend classes until registration is completed. [Twelve \(12\) credits is the minimum full time load at UC. A student can register for a maximum of 19 credit hours without paying for additional tuition..](#) A full-time Graduate Student is required to register for (15) graduate credits in the Autumn quarter. Registration for courses that will not be included in your Program of Study, requires written approval from your BME Advisor or this can result in termination of your UGS. An updated Program of Study must be on file in the Graduate Office at all times.

### B. Registration Change Procedure (Drop/Add)

Once a student has completed registration, the official record can be changed only with a registration change form (Drop/Add) secured from the student's college office, to be used only when changes in a program are absolutely necessary. Such changes can be made in the regular registration period without charge. Beginning on the first day of classes of any academic period, a service fee is charged for all changes involving addition of a course, change in course section, change from graduate to undergraduate credit, change from credit to audit or vice versa, regardless of the reason. Such changes must be processed through the Office of Registration and scheduling by Friday of the second week of classes, unless the college offering the course has established an earlier deadline. After Friday of the second week of the quarter, course drops will be accepted.

### C. Audit Regulations

The audit option is intended for cases in which course work is desired or advised but in which a grade is deemed unnecessary by the student in consultation with the Advisor. Admissions and conditions for participation in audit courses are at the discretion of the instructor, who is not obligated to accept a student for audit. Audited courses cannot be used to satisfy any graduate degree course requirements.

Audit hours may not be charged to a UGS unless (12) graduate credits are taken that same quarter (and if the total is less than 19 credits). Also, no more than one audit course per quarter may be charged to a UGS.

### D. Pass/Fail

A graduate student may not take courses for graduate credit on a pass/fail basis, except when approved by the Advisor. The pass/fail option is limited to research, seminars or courses outside the requirements of the graduate program (e.g. deficiency credits, extra-departmental electives). Under no circumstances may a course taken pass/fail be counted towards fulfilling a graduate degree course requirement.

### E. Withdrawals

#### 1. Academic Consideration

For withdrawals on or before the third Friday of the quarter, the grade of "W" is assigned by the Registrar's Office and the course is deleted from the student's official record. For withdrawals after the third Friday and on or before the sixth Friday, the grade of "W" is

required to be assigned by the instructor. For withdrawals thereafter, the instructor is required to submit a grade of "W" for students whose work has been of passing quality, and "F" for students whose work has been failing quality up to the time of withdrawal.

No withdrawal is permitted after the eighth Friday of any quarter

Exceptions to this rule will be with the approval of both the advisor and the Associate Dean for Graduate Studies and Research and will require both detailed and adequate justification.

Every withdrawal slip must be signed by the student's academic advisor. The advisor's signature is required so that the advisor is aware of the student action, and to advise the student of possible academic, fiscal, or visa problems. (Full time graduate students must carry at least (12) graduate credits but are encouraged to take (15) graduate credits, exclusive of audits. A withdrawal which brings to student below that level placed the UGS support in jeopardy. The student will then become liable for the quarter's tuition. International students must maintain full time status.

A student may be withdrawn by the instructor at any time in the quarter when excessive absences have been incurred. A student who withdraws due to excessive absences is not eligible for academic credit, refund of fees, or reinstatement as an auditor in that course.

## 2. Leave of Absence

Students may request a leave of absence from the program, for a period of up to one year, for medical, financial, or personal reasons. Such requests must be made in writing to the Director and must be endorsed by the student's advisor. Upon return to the program the student's status will be the same as when he/she started the leave. Students, however, are cautioned that, if they had financial aid at the time of the leave, there is no guarantee that aid will be available when they resume their studies at the end of the leave.

Unofficial leaves of absence or vacations during the academic year may not be taken. Students who do so may have their financial aid withdrawn and/or may be placed on probation or dismissed from the program by the Graduate Committee.

Under normal circumstances it is anticipated that students who request leave on the basis of maternity/paternity considerations will be granted up to 8 weeks continuous absence. During such leave necessary registrations will be maintained, and the stipend will be paid for the 8-week duration of the leave; however, it is anticipated that students afforded such leave will take no additional vacation leave for the balance of the academic year. Under exceptional circumstances the 8-week period can be extended, but the Graduate Program Director must be informed and medical certificates of justification provided in such instances. In no case will stipend be paid for more than an 8-week period of absence. Requests for maternity/paternity leave must be made in writing to the Graduate Program Director or Department Head.

## Chapter Three Graduate Credits and Grading Practices

### A. Course Load

All graduate students are expected to carry a minimum of (12) graduate credit hours (courses at the 600 level or above) per quarter for Autumn, Winter and Spring quarters. Students do not have to register for Summer quarter to maintain full-time status. Students taking courses for audit must still take an additional (12) graduate credit hours. The recommended course load is (15) graduate credit hours per quarter.

Credit can be earned for only those courses in the University listed in the current Learning Opportunities/Courses of Instruction of the Graduate Division.

Most [International](#) students, under the terms of their visas, must be enrolled as full-time students.

### B. Graduate Assistants and University Graduate Scholarship Recipients

Any students receiving a GA, RA, or UGS must carry a full credit load each quarter (at least 12 graduate credits, exclusive of audit credits).

Full-time students who have received a UGS or GA are required to register for (15) hours during the Autumn and/or Summer quarters and are encouraged to register for (15) hours during the other quarters.

The Ohio Board of Regents denies state subsidy for graduate students who have earned more than 260 graduate credit hours. Graduate students who graduate credit hours at the University of Cincinnati exceed 260 are not eligible for financial aid from general funds (UGS and GA).

### C. Graduate Credit in 600 and above 600 level courses

The College of Engineering has a (5) year cooperative undergraduate program. Therefore, courses designated at the 100 through 500 levels are strictly undergraduate courses. [Graduate courses in the College of Engineering are numbered at the 600 level and above. Graduate courses in other Colleges may begin at the 500 level. Students taking courses at the 500 level or above from other UC colleges should verify that these courses will be counted toward their graduate degree.](#)

### D. Grading Practices

The Department of Biomedical Engineering uses the grading practices specified in the Handbook of the Division of [Research and Advanced Studies \(www.grad.uc.edu\)](http://www.grad.uc.edu). If a student receives a grade of F in a course, the student must retake the course or its approved equivalent. Upon receiving a grade of A, B, or C after retaking the course, the F grade will still be considered in calculating the student's grade point average.

## Chapter Four Master's Degree Program

### A. Types of M.S. Programs

The Department of Biomedical Engineering offers courses of study leading to the Master of Science degree in

- Medical Imaging
- Tissue Engineering/ Biomechanics
- Bioinformatics

### B. General Program Requirements

#### *Graduate Program Summary*

	MS	PhD	MS + PhD
BME Survey (20 BME 601)	3	3	3
Bioinstrumentation (20 BME 602)	3	0	3
Primary BME Technical Focus Area <i>SEE BELOW</i>	9	9	18
General Medical Sciences <i>SEE BELOW</i>	6	12	18
Mathematics (26 BE 787) or approved Math substitute* 3		3	6
Technical Elective <i>SEE BELOW</i>	6	3	9
Thesis Research	15*	60*	75
<b>Research Design (20 BME 705)</b>	<b>3</b>	<b>3</b>	<b>3</b>
Ethics in Research (26 GNTD 730)	0	1	1
<b>BME Career Building Blocks (20 BME 702, 703)</b>	<b>0</b>	<b>2</b>	<b>2</b>
<b>Total Required Graduate Credit Hours</b>	<b>48</b>	<b>96</b>	<b>138</b>

\* If you have already taken the 26 BE 787 (Biostatistics course, you can take an approved math substitute instead.

Listed below are the **primary focus area** courses

#### **Bioinformatics:**

Course #	Name	Credit Hours
20-BME-657	Computational Genomics	3
20/26-BME-658	Functional Genomics	3
20/26-BME-680	Large Biological Database	3
20/26-BME-712	Adv. Comput. Biology	3
20/26-BME-723	Independent Study	3
20/26-BME-752	Statistical Genetics	3
26-MG-719	Proteins, Struct, Funct, Engrg	4
15-BIOL-876	Phylogenetic Systematics	3

26-DB-852	Developmental Biology I	5
26-DB-981	Human Genetics I	4
26-DB-982	Human Genetics II	3
26-MG-599	Intro Immunology	3
26-MG-710	Adv. Mol. Gen. I: Gene Regulation	4
26-MG-719	Proteins	4
26-MG-821	Human Genetics	4 W
20-ECES-629	Intro Operating Systems	3 W
20-ECES-637	Machine Learning	3 S
20-ECES-639	Software Engineering	3 A
20-ECES-651	Database Theory	3 A/S
20-ECES-661	Digital Libraries	3 A
20-ECES-665	Computer Networks	3 A
20-ECES-666	Computer Networks	3 A
20-ECES-667	User Interface I	3 W
20-ECES-671	Design & Analysis of Algorithms I	3 A/S
20-ECES-672	Design & Analysis of Algorithms II	3 W
20-ECES-688	Wireless Communications	3 A
20-ECES-798	Performance Evaluation	3 A
20-ECES-821	Pattern Recognition	3 S
20-ECES-858	Data Mining	3 S

**Medical Imaging:**

20/26-BME-608	Medical Imaging with Ionizing Rad	3 W
20/26-BME-609	Medical Imaging w/o Ionizing Rad	3 S
20/26-BME-610	Adv. Topics in MRI	3 A
20/26-BME-721	Independent Study	3 A/W/S
20-ECES-626	Communication Theory	3 A
20-ECES-642	Digital Image Processing	3 W
20-ECES-644	Digital Signal Processing Lab	3 S
20-ECES-645	Intro Digital Signal Processing	3 A
20-ECES-692	Principles of Databases	3 W
20-ECES-821	Pattern Recognition	3 S
20-MECH-829	Viscous Fluid Flow- Turbulent	3 W
15-CHEM-852	NMR Applications in Biochemistry	3 W
15-CHEM-858	Intro 2D NMR Spect. of BioMacr	3 A
20-MECH-666	Acoustics I	3 W
20-MECH-667	Acoustics II	3 S
20-AEEM-614	Intro Compressible Flow	3 W
20-AEEM-672	Finite Element Techniques I	3 A
20-AEEM-673	Finite Element Techniques II	3 W
20-AEEM-674	Finite Element Techniques III	3 S
20-AEEM-725	Nonlinear Finite Elements	3 A
20-AEEM-728	Intro to Ultrasonics	3 S
20-AEEM-780	Num. Methods for Inviscid Flow	3 W
20-AEEM-781	Num. Methods for Viscous Flow	3 A
20-AEEM-846	Theory of Turbulence	3 W

**BME Core Courses:**

20/26-BME-601	BME Survey Course	3 A
20/26-BME-602	Biomedical Instrumentation	3 S
20/26-BME-701	Seminar	1 A/S
20/26-BME-708	Research Design	3 S

**Tissue Engineering/Biomechanics**

20/26-BME 620	Tissue Engineering	3W
20/26-BME-621	Tissue Biomechanics	3W
20/26-BME-622	Ligament/Tendon Biomechanics	3S
20/26-BME 624	Joint Biomechanics	3W
20/26-BME-627	Intro to Biomechanics	3A
20/26-BME-722	Independent Study	3 A/W/S
20/26-BME-734	Cell Engineering	3W
26-OSE-744	Biomech./Phys.Aspects/	3A
26-EIH-790	Phys /aspects of the Environment	3W
26-OSE-792	Principles of Ergonomics	3S
20-MTSC-794	Intro to Polymer Science	3A
20-MINE-687	Whole Body Dynamics	3S
20-AEEM-672	Finite Element Techniques I	3A
20-AEEM-673	Finite Element Techniques II	3A
20-AEEM-674	Finite Element Techniques III	3A
20-AEEM-725	Nonlinear Finite Elements	3A

**General Medical Sciences:**

26-MCBP-823	Molecular and Cellular Pharmacol	4 W
26-MCP-841	Integrative/Organ Physiology I	7 A
26-MCP-842	Integrative/Organ Physiology II	5 W
26-GNTD-871	Intro Molecular Genetics	3 A
26-GNTD-872	Molecular Biology Cell I	4 A
26-GNTD-862	Molecular Biology Cell II	5 W
26-GNTD-873	Molecular Biology Cell III	4 S
20-CB-871	Human Gross Anatomy	4 U
26-955-885	Basic Principles of Pathology	3 W

**Mathematics:**

26-BE-787	Intro to Biostatistics	4 A
15-MATH--533	PDE& Fourier Analysis I	3 A
15-MATH--534	PDE& Fourier Analysis II	3 W
15-MATH-555	Applied Linear Algebra I	3 A
15-MATH-556	Applied Linear Algebra II	3 W
15-MATH-561	Numerical Methods &Applied Math	3 S
15-MATH-577	Appl. Prob. & Stochastic Proc. I	3 A
15-MATH-578	Appl. Prob. & Stochastic Proc. II	3 W
15-MATH-580	Mathematics using Mathematica	3 W
15-MATH-584	Combinatorics	3 S
15-MATH-701	Analytical Methods I	3 A
15-MATH-702	Analytical Methods II	3 W
15-MATH-703	Analytical Methods III	3 S

The purpose of the **BME Graduate Survey Course** is to familiarize incoming graduate students with existing BME faculty and the research they perform. The class will consist of faculty speakers giving individual presentations each day. By the end of quarter, the new BME graduate students in the course will identify faculty in their specific focus area with the goal of rotating through his/her lab during the Winter or Spring Quarters of 2005. Each student will work with one faculty member in one lab for 3 credits in the Winter Quarter and with a different faculty member in a second lab for 3 credits in the Spring Quarter (one laboratory only per quarter). Each credit is the equivalent of 1 hour of in class time and 2-3 hours of out of class time (so 3 credits is the equivalent of 90-120 hours of lab experience in a 10-week quarter). Each faculty member must agree to take on each student for that quarter. Near the end of the Spring Quarter, the student will be expected to choose a laboratory and advisor where he/she would like to do thesis/dissertation research. The faculty member must again agree to take on (i.e. support) the student until they complete their dissertation.

### C. Minimum Academic Performance

The Handbook of the Division of [Research and Advanced Studies \(on pg. 66, at www.grad.uc.edu\)](#) states that a student must maintain a grade point average (GPA) of at least 3.0 to obtain a Master's degree at the University of Cincinnati. At least two-thirds of the minimum graduate credits for the degree must be at the level of 3.0 or higher.

The Department of Biomedical Engineering has also established the following requirements:

A Master's degree student must achieve an overall average of B on all graduate coursework. A student in the BME Department failing to maintain this B average will be placed on probation for one quarter and may be dismissed if his/her overall technical coursework GPA is not restored to a 3.0.

If coursework is repeated all grades of a repeated course count toward these requirements.

The Graduate Program Director will review graduate student's grades once they become available after the end of each quarter. All graduate students with grade deficiencies will be notified by the Director and reminded of the above requirements. A notice of probation will follow if GPA falls below the minimum (3.0). Students will have one quarter to comply with the terms of probation. If not corrected, a letter of dismissal will be sent.

Please note that remaining in good academic standing (3.0) does not guarantee financial support.

### [D.](#) Candidacy

Students are not required to submit a formal application for Master's candidacy. A student becomes a candidate for the Master's Degree upon entering into the Master's Program in which he/she has been accepted. To maintain status as a graduate student and thus be eligible for a graduate degree, students must register for at least one (1) credit each academic year during the Autumn Quarter. International students must register for at least (1) credit each academic year during the Autumn Quarter.

### [E.](#) Time Limitations

A minimum requirement for the master's degree is the equivalent of one academic year of full-time graduate study, consisting of at least 45 graduate credits in one program completed to the

satisfaction of the program. All master's requirements must be completed no later than seven years from the date of first registration in the degree program.

## F. Research Projects, Thesis and Examinations

### 1. Thesis Research Projects

A student electing a thesis Master's Degree will select a research advisor and a Research Advisory Committee (RAC). The committee normally consists of the research advisor and at least two other appropriate representatives, see [the Graduate Handbook of the Division of Research and Advanced Studies \(Chapter 7, www.grad.uc.edu\)](#) for more details. The student will then select a research project in consultation with the research advisor and with approval from his/her Research Advisory Committee (RAC). The advisor and the RAC have the responsibility to see that the project is carried out under currently accepted scientific standards. Upon completion of the research, a thesis will be prepared and defended orally in public. A grade of "S" should be given if applicable.

### 2. Thesis Preparation

The Office of the Division of Graduate Education and Research provides graduate degree candidates with detailed information concerning the written form of the thesis and the mechanics of preparing the final draft and abstract. Regulations regarding payment of binding fees, number of thesis copies to be submitted, and other documents required are also available from that office. In particular, the student must submit (2) typed copies and a binding receipt to the University Dean's Office for the (2) university bound copies. Two additional bound copies of the thesis should be prepared by the student. One is for the student's Research Advisor and one is for the department library. A list of binding companies is available.

It is the responsibility of the student to see that he/she is in compliance with these regulations.

### 3. Thesis Defense

Prior to graduation, the thesis student will give an oral defense. In this defense the student will give a 30 to 45 minute presentation of his/her thesis to the RAC. After the thesis presentation, the student will be questioned by the committee on both the thesis, and the subject matter related to the thesis topic. Successful completion of this defense and the courses required in this program plus submission of the thesis for binding (in accordance with the rules of the Engineering College) constitute completion of the requirement for the Masters degree.

If the defense is failed, the student may repeat the defense at a later date to be arranged through his/her Advisor. A second failure of the defense is disqualifying.

The final version of the M.S. Thesis ready for binding must be submitted to the Office of Vice President for Research and Advanced Studies (no) later than the published date.

Each student who has successfully completed all requirements for any of the Master's Degree Programs in the Department of Biomedical Engineering should apply to

the office of the Division of Graduate Education and Research for graduation. It is the responsibility of the student to insure that all forms, procedures and regulations required by that office for graduation are fulfilled. See Section 8.7.7 of the Handbook of the Division of [Research and Advanced Studies](#) for these requirements.

## Chapter Five Doctoral Degree Program

### A. Course of Study

The Department of BME offers courses of study leading to the PhD degree in Biomedical Engineering.

A prospective candidate for the doctorate follows a plan of full time study that ordinarily lasts three (3) years beyond a Master's Degree.

- The first year of study is generally directed toward completing most of the course work in the major area of study and mathematics, and passing the PhD Qualifying Examination.
- The second year of study is generally aimed toward completing all course work, initiating a dissertation research project, and completing the PhD Dissertation Proposal.
- The third year and any subsequent years of study, is generally focused on completing the dissertation.

The Dissertation Committee, together with the student, will prepare the student's program of study and submit it to the Graduate Committee for their information and review. The student and his/her committee will endeavor to draft a program with a central emphasis on some option in Biomedical Engineering with mathematics and some other option in this or another appropriate department in a supporting role.

An important function of the Dissertation Committee is to supervise the study program of the student. The student may request a meeting with the Dissertation Committee when there is an important academic matter to discuss.

- B. A student is required to satisfactorily complete a minimum of (138) quarter credits beyond the Bachelor's degree and a minimum of (96) quarter credits beyond the Master's degree requirements, whichever is greater. Work in the major option should represent at least (36) credit hours of study beyond the Bachelor's degree, not counting credits for thesis and dissertation, and with at least (18) credits in 700 or above courses. One minor of (12) credits, (15) credits of Mathematics hours, (12) credits of technical electives, plus (60) credits of research, with at least (45) credits of Ph.D. Dissertation Research are also required. Three credits for registration in the Department seminar after M.S. degree, is not included in the above total. These requirements are summarized below.

### DOCTOR OF PHILOSOPHY IN BIOMEDICAL ENGINEERING

Major Option (focus area)	9 cr. hrs*
Gen Med Sciences	12 cr. hrs*
Mathematics	3 cr. hrs.*
Technical Electives	3 cr. hrs.
Ph.D. Research	60 cr. hrs. **
BME Survey	3 cr. Hrs
<u>Research Design</u>	<u>3 cr. Hrs</u>
Ethics in Research	1 cr. hr
BME <u>Career Building Blocks</u>	2cr. hrs.
Total	96 cr. hrs.

\* Course listing on pages 8-10

\*\* With at least 45 cr. hrs. in PhD Dissertation Research

### C. Minimum Academic Performance

The ***Handbook of the Division of [Research and Advanced Studies](#)*** states that a doctoral student must maintain a grade point average (GPA) of at least 3.0 in all doctoral course work.

The Department of BME/EM also has established the following requirements:

A doctoral candidate must achieve an overall Grade Point Average of 3.0 or greater on all graduate coursework. A 3.0 average or greater GPA is also required for coursework in each of the major and minor groupings. A student in the Biomedical Engineering degree program may be dismissed if his/her coursework GPA in any area falls below 3.0.

If coursework is repeated, all grades of a repeated course count toward these requirements.

Graduate student's grades will be reviewed by the Director once they become available after the end of each quarter. All graduate students with grade deficiencies will be notified by the Director and reminded of the above requirements. A notice of probation will follow if GPA falls below the minimum (3.0). Students will have one quarter to comply with the terms of probation. If not corrected, a letter of dismissal will be sent.

A doctoral student must achieve an overall average of B on all graduate coursework. A student in the BME Department failing to maintain this B average will be placed on probation for one quarter and may be dismissed if his/her overall technical coursework GPA is not restored to a 3.0.

### D. Residency

The ***Handbook of the Division of [Research and Advanced Studies](#)*** stipulates (University Rule 3361:50-77-23) that all doctoral students must meet a residency requirement. A minimum requirement would consist of enrollment for at least 12 graduate credits during each of three quarters out of five consecutive quarters, including the summer quarter(s) so long as the student registers for at least (12) hours in each autumn quarter involved.

### E. Ph.D. Qualifying Examination

All doctoral students in the Department of Biomedical Engineering are required to pass a candidacy examination, hereafter referred to as Ph.D. Qualifying examination, in accordance with the rules and guidelines of the ***Handbook of the Division of [Research and Advanced Studies](#)***. In order to take the exam, a student must have at least a 3.25 overall GPA and at least a 3.0 GPA in the major. Passing the exam is only one of the requirements for candidacy (see ***Handbook of the Division of the [Research and Advanced Studies](#)***).

The Ph.D. Qualifying Examination will be offered during the Autumn and Spring quarters only and will consist of two parts (i) A written research proposal identifying an important problem and demonstrating knowledge of a broader area of research and (ii) An oral presentation, to be given based upon the proposal. The objective and examination grading are based on the student's:

- (1) understanding of general engineering and biomedical engineering concepts and ability to apply these concepts in research and design.
- (2) ability to critically analyze an engineering problem
- (3) ability to organize and communicate a body of knowledge
- (4) ability to answer questions related to a defined body of knowledge

IT IS EXPECTED THAT THE STUDENT SHOULD SHOW A THOROUGH UNDERSTANDING OF UNDERLYING PHYSICAL AND MATHEMATICAL CONCEPTS, AND DEMONSTRATE THE ABILITY TO SUCCESSFULLY COMPLETE AN ORIGINAL RESEARCH DISSERTATION.

### 1. PHD QUALIFYING EXAM – WRITTEN PORTION

It is of the utmost importance that the proposal be the product of only the student. THE WRITTEN PORTION OF THE EXAM WILL CONSIST OF A 20-PAGE RESEARCH PROPOSAL (NIH STYLE – SEE BELOW) DOUBLE-SPACED AND 12 POINT TIMES ROMAN FONT WITH 1 INCH MARGINS.

#### a. Specific Aims

List the broad, long-term objectives and what the specific research proposed in this application is intended to accomplish, e.g., to test a stated hypothesis, create a novel design, solve a specific problem, or develop new technology. **Two pages are recommended.**

#### b. Background and Significance

Briefly sketch the background leading to the present application, critically evaluate existing knowledge, and specifically identify the gaps that the project is intended to fill. State concisely the importance and health relevance of the research described in this application by relating the specific aims to the broad, long-term objectives. **Five pages are recommended.**

#### c. Preliminary Studies

Preliminary Studies. Use this section to provide an account of the preliminary studies pertinent to the application information that will also help to establish the experience and competence of the investigator to pursue the proposed project.

Provide a succinct account of published and unpublished results, indicating feasibility of the project. **Six pages are recommended.**

#### d. Research Design and Methods

Describe the research design and the procedures to be used to accomplish the specific aims of the project. Include how the data will be collected, analyzed, and interpreted as well as the data sharing plan as appropriate. Describe any new methodology and its advantage over existing methodologies. Discuss the potential difficulties and limitations of the proposed procedures and alternative approaches to achieve the aims. As part of this section, provide a tentative sequence or timetable for the project. Point out any procedures, situations, or

materials that may be hazardous to personnel and the precautions to be exercised. **Six pages are recommended.**

#### e. Bibliography

The written proposal should contain a minimum of 20 references. This part DOES NOT count to the 20-page limit.

#### f. Appendix

Here the figures and tables can be included. Again this part DOES NOT count towards the 20-page limit.

Upon a student delivering his/her PhD proposal to the qualifying committee, committee members will begin to review it as if on an NIH study section. Each committee member will provide a pass/fail decision, although discussion amongst the committee members is allowed. The student must receive either a 3-0 or 2-1 decision to pass in order to schedule the oral exam. Following the pass/fail decision, the student is encouraged to meet with the qualifying exam committee members individually to receive written and oral comments that can be used in preparation for the oral exam.

If the student passes, he/she must take the oral exam before the end of the same academic quarter. If the student fails, he/she must retake and pass both the written and oral exams by the end of the following round of qualifying exams (either Spring or Autumn quarters). The advisor/committee chairman should provide the student with the committee's comments regarding the written exam.

## 2. PHD QUALIFYING EXAM – ARAL PORTION

The advisor and student should schedule the oral exam in consultation with the other qualifying exam committee members. The student should distribute the written proposal to all members of the graduate committee for review (preferably 7-10 days before the oral exam). In addition, the student must provide the oral exam (title, topic, date, time, and location) to the Graduate Program Coordinator at least two weeks before the exam. The oral seminar should be advertised so that all BME faculty and students can attend. All BME graduate students are strongly encouraged to attend oral exams in all focus areas.

At the oral exam the student should present for 20-30 minutes and then answer questions from the audience for another 30-45 minutes. This will be followed by a closed discussion between the student and the exam committee. The committee should then convene separately, make a decision to pass or fail the student and provide that decision to the student at the end of the examination. If the student passes the oral exam, the committee will notify the Graduate Director to enter into the student's record. The student must then prepare and defend his/her dissertation proposal to be formally admitted to candidacy for the PhD degree in BME. If the student fails the oral exam, the department should also be notified and the student

must then reschedule and pass the oral exam during the next qualifying exam quarter. Those students who fail the oral exam a second time will be required to leave the program by the end of the academic year. Funding is not guaranteed during the period following failure of the qualifying exam.

**Any Graduate student, whether holding a MS degree or not, who has declared his/her intention to pursue a Ph.D. degree is a Doctoral student and as such is required to pass the Ph.D. Qualifying Examination and is subject to the requirements of this Section.**

### 3. Time Requirements

The Ph.D. Qualifying Examination is to begin during the second year of the program and to be completed by the end of the autumn quarter of the third year. As such, the following time table applies only to second year students:

Phase One (Winter Quarter) – The Qualifying Exam committee must be in place and the student must turn in the attached QE form to Graduate Program Coordinator. This is notification to the Graduate Committee indicating the student’s intent to take the exam, the suggested topic area to be presented, and signatures of all committee members.

Phase Two (End of Winter quarter) – Qualifying Committee and student agree on topic area and references to be reviewed for written proposal. Although topics related to work performed in the lab are permitted, topics must be different than the one that will be the subject of the PhD dissertation.

Phase Three (four weeks) – Student must submit written proposal to PhD Qualifying committee with a copy to the UCBME Graduate Committee.

Phase Four (three weeks) – Qualifying Committee will provide their decision (pass or fail) about the written exam to the student and the UCBME Graduate Committee. If the student passes, he/she will schedule an oral presentation. If the student fails, he/she will receive a written critique and be permitted to resubmit the written portion of the qualifying exam the next Autumn quarter (Autumn 2005).

Phase Five (two weeks) – Deadline for student to successfully complete the oral examination related to the written proposal. Decision (pass or fail) must be provided to the student and the UCBME Graduate Committee by the end of the examination.

### 4. Petition Requirements

A student wishing to depart from the time requirements of Section A shall notify by petition the Director of his/her intentions. This **written petition**, detailing the reasons for the departure, should be received and approved **prior** to the scheduled exam.

Prior to taking the Qualifying exam, the following steps must be taken:

- i. Identify the problem
- ii. Assemble a Qualifying Exam Committee
- iii. Approval of proposal by the Qualifying Committee
- iv. Submit petition to the BME Graduate Committee

The Qualifying Committee should consist of the following people:

- Primary Research Advisor
- One BME Faculty
- One Faculty in your focus area

A student wishing to take the Qualifying exam must notify the Director, by petition, of his/her intention to take the exam during the quarter preceding the exam. On the petition the student must indicate his/her [focus](#) area and must secure the signature of a faculty member who has agreed to act as Dissertation advisor should he/she pass the exam.

Approved BME focus areas are Tissue Engineering/Biomechanics, Bioinformatics and Medical Imaging.

#### [5. Special requirement for International students](#)

[International](#) students subject to TOEFL requirements are strongly urged to pass the Oral English Proficiency Exam before taking the PhD Qualifying Examination because of the inherent language skills required for the oral portions of the exam.

#### [6. Procedure](#)

An application to take the Ph.D. Qualifying Examination must be completed and returned to the graduate office no later than ten days before the published date of the written examination. The seminar topic and reference material must be defined by the student and faculty advisor, and included on the application.

A written seminar announcement must be distributed to all members of the faculty, stating the time and place of the presentation, at least two weeks before the scheduled date.

All faculty members of the student's major area of study, with a minimum of three, are expected to be present at the oral examination; however, all members of the faculty are welcome.

Failure, to meet any of the student requirements is justification for failure of the Ph.D. Qualifying Examination.

#### [7. Change of focus area](#)

If a student changes focus area of study, the Qualifying examination does not need to be repeated.

### F. Ph.D. Dissertation Proposal

All doctoral students in the Department of Biomedical Engineering who have passed the Ph.D. Qualifying Examination must have a Dissertation Proposal accepted before they can be admitted into candidacy in accordance with the rules and guidelines of the Division of Graduate Studies and Research as set forth in the ***Handbook of the Division of [Research and Advanced Studies](#)*** (page [81](#)).

The purpose of the Dissertation Proposal is to ascertain the appropriateness of the student's proposed research to constitute a Doctoral Dissertation as well as the student's ability to

carry through with the proposed research. The following specific rules and regulations govern the Dissertation Proposal in the Department of Biomedical Engineering.

### 1. Time Requirements

At least one year prior to graduation, the student must have a Dissertation Proposal presented to and accepted by his/her Dissertation Committee. A completion form must be submitted to the Director at that time. Forms are available in the Graduate Office. Recall, that only five (5) years are allowed prior to Ph.D. candidacy.

A student who changes dissertation advisor and/or Dissertation Committee must still satisfy the last of these time requirements and have an accepted Dissertation Proposal no later than during the fourth quarter following the quarter during which he/she has passed the Ph.D. Qualifying Examination.

The timeline below summarized the above time requirements.

Q0	Q1	Q2	Q3	At Least One Year prior to Graduation
Student passes Ph.D. Qual. Exam	Student must have selected Dissertation Advisor	Student must have selected Dissertation Committee and notified Director		Student's Dissertation Proposal has been presented and accepted

In exceptional cases the time requirements specified above may be waived upon petition for the Director (see Section 2 below).

### 2. Petition Requirements

A student wishing to depart from the time requirements of Section A shall notify, by petition, the Director of Graduate Studies of his/her intentions. This **written** petition, detailing the reasons for the departure, should be received and approved prior to the expiration of the time requirements for which departure is requested.

### 3. The Ph.D. Dissertation Proposal

The Dissertation Proposal is a typed document detailing the student's proposed Dissertation Research. The student is required to present orally the Dissertation Proposal to his/her Dissertation Committee. The Dissertation Proposal must be distributed by the student to the members of his/her Dissertation Committee at least one week prior to the oral presentation.

After the oral presentation, the Dissertation Committee shall evaluate the Dissertation Proposal and accept or reject it. The evaluation criteria are:

- The scientific merits of the proposed research, in particular its originality and contribution to the state of the art in the discipline of the proposed research.
- The realism and reasonableness of the proposed research.
- The qualifications of the student to conduct the proposed research.

The result of this evaluation shall be communicated in writing by the Dissertation Committee, to the Director of Graduate Studies. A copy of the Dissertation Proposal shall be attached to this written evaluation and both will be included in the student's departmental file.

A doctoral student is not allowed to have more than one rejection of a Dissertation Proposal. Thus a student who has had a proposal rejected twice or two proposals rejected once shall be asked to leave the departmental doctoral program.

#### G. Candidacy and Time Limitations

A student admitted to the Ph.D. program becomes a Ph.D. candidate when he/she has passed the Candidacy Exam (Ph.D. Qualifying Examination) and has satisfactorily completed all required course work beyond the M.S. degree. As stated in the [\*Handbook of the Division of Research and Advanced Studies\*](#) (page 79) a doctoral student shall be admitted into candidacy when he/she has:

Achieved and maintained a GPA of at least 3.0 in all doctoral course work/  
Acceptance of dissertation proposal.

The student who has completed all requirements for candidacy will be officially admitted into candidacy when the advisory department fills out the proper candidacy form, **including the Dissertation Advisor and Committee form**, and submits it for inclusion in the student's official student record.

The doctoral degree will be granted for no less than the equivalent of three (3) years of full-time graduate study.

The overall maximum time limit for doctoral degree completion is (9) years; (5) years to candidacy and (4) years from candidacy to degree completion.

Candidacy for the doctorate automatically terminates after four consecutive calendar years. Candidates may petition the Graduate Council through their department, college, and the University Dean for extension of candidacy prior to its expiration or for reinstatement if candidacy has expired. In reinstatement is approved, **the student will be readmitted to candidacy only after satisfying the formal candidacy examination requirements administered by the department.**

Registration and fee payment for at least one credit hour in the Autumn Quarter is required for each student if his/her candidacy is not to lapse.

Student's, who interrupt their graduate studies by withdrawing from the University, either officially or by failing to register for an entire academic year, will be held responsible for the graduate program requirements in force and published at the time they re-enter that program.

## H. Dissertation

### 1. Dissertation Advisor and Committee

The student in consultation with the Dissertation Advisor should form an advisory committee that includes at least two additional faculty members after he/she passes the qualifying exam. At least one member of the committee must be a member of the Biomedical Engineering Department. If the advisor is from outside the Department of BME a faculty member from the Department of BME will serve as co-chairperson of the Committee.

### 2. Final Defense of Dissertation

After completing the Dissertation, the candidate will give an oral presentation of the dissertation to the Advisory Committee and any other interested (or appointed) members of the Graduate Faculty of the University in an open seminar.

The date of this presentation will be arranged by the Dissertation Advisor and presentation of copies for binding (in accordance with the rules of the Engineering College) constitute the final requirements for the doctor degree. The final version of the Ph.D. Dissertation ready for binding must be submitted to the Office of Vice President for Research and Advanced Studies no later than the published date. A grade of "S" should be given.

### 3. Publication of Dissertation

The Office of Vice President for Research and Advanced Studies provides graduate degree candidates with detailed information concerning the written form of the Dissertation and the mechanics of preparing the final draft and abstract. Regulations regarding payment of binding fees, number of Dissertation copies to be submitted, and other documents required are also available from that office. **It is the responsibility of the student to see that he/she is in compliance with these regulations.**

The student must submit (2) typed copies and a binding receipt to the Office of the Vice President for Research and Advanced Studies for them to bind the (2) university copies. Two additional bound copies of the Dissertation should be prepared by the student. One is for the student's Dissertation Advisor and one is for the department library. A list of binding companies is available.

## I. Graduation

Upon successful completing of the Dissertation defense, the Dissertation Advisor will forward a letter to the Director of Graduate Studies certifying that the student has completed all requirements for the degree. The letter must be accompanied by a duplicate copy of the front page of the dissertation, signed by the members of the examining committee and a completed "Certification for Graduate Form." The Director of Graduate Studies will sign the form and forward it to the Graduate Dean.

Each student who has successfully completed all requirements for any of the Ph.D. Programs in the Department of BME may apply to the Office of Vice President for Research and Advanced Studies for graduation. **It is the responsibility of the student to ensure that all forms, procedures and regulations required by that office for graduation are fulfilled.** See the *Handbook of the Division of [Research and Advanced Studies](#)* for these requirements. [The Deadlines, Procedures and Dates related to graduation for each quarter is updated on the Graduate Studies website \(www.grad.uc.edu\).](#)

## Chapter Six Special Rules and Provisions

### A. Nondiscriminatory Policy

The Department of BME reaffirms the University of Cincinnati policy that discrimination on the basis of race, color, religion, national origin, sex, sexual orientation, handicap or age will neither be practiced nor tolerated in any of its activities. Complaints involving discrimination should be directed to the Director of Graduate Studies and/or the Head of the Department.

### B. Right to Review Records

Students, once enrolled, have the right to review their educational records, except for those excluded by law, such as those maintained by a physician or psychiatrist, or parent's financial statement. Educational records are maintained in such offices and Student Records, the Engineering Dean's Office, the Graduate Dean's Office, Student Financial Aid, Career Development and Placement, Educational Advising, as well as in the BME Graduate Office.

In order to gain a review of such records, along with any appropriate explanation or interpretation, the student should first address the proper university or collegiate office. In the Department of BME, files are maintained which include: (a) the original applications from the admission; (b) University personnel payroll forms; (c) university grade forms; (d) Research Advisor and Research Advisory Committee progress reports and letters; (e) copies of all correspondence from the Director of Graduate Studies and Department Head; (f) results of candidacy examinations; (g) certification of candidacy and graduation forms; (h) a copy of the front page of the thesis signed by the student's RAC. Students wishing to review these files must submit a request with the Director. If the student feels there are inaccuracies, he/she may place a letter of explanation in the file.

### C. Grievance Procedure

Each student shall receive a copy of the university document titled **Graduate Student Grievance Procedures** at the time of entrance into the graduate program. Copies will be made available at the new graduate student orientation program conducted in September of each year. Other copies are available in the Department Office and from the BME Graduate Student Association. The Department of BME reaffirms its adherence to these procedures.

At any time a graduate student may petition the Graduate Committee to hear a grievance on any matter concerning the Graduate Program (probation, teaching duties, examinations, use of departmental equipment, etc.) and the Graduate Committee will attempt to resolve the issue. However, the student has the right to pursue any and all procedures outside of the Department.

### D. Academic Honesty

Academic dishonesty in any form is a serious offense and cannot be tolerated in an academic community. Dishonesty in any form, including cheating, plagiarism, deception of effort, unauthorized assistance, or manufacturing of data may result in a failing grade in a course or graduate credits, and/or immediate suspension or dismissal.

E. Implementation of Provisions of this Handbook

The provisions of this handbook have been previously adopted by the Department of BME and were contained in preceding departmental documents and minutes of the Graduate Committee or the BME meetings. Provisions not specifically addressed in this and earlier documents follow those of the ***Handbook of Division of Research and Advanced Studies***.

The current ***Graduate Handbook of the Department of BME*** is adopted as the official graduate procedures as of April, 2003. All graduate students entering or reentering a graduate program in the Department of BME after that date are subject to all the rules and regulations herein. [This handbook contains information about those topics that are of utmost importance to BME Graduate Students. For other topics and further details, the students are advised to refer to the \*\*\*Hanbook of the division of Research and Advanced Studies\*\*\* \(see Graduate Studies link below\).](#)

#### Top 10 UC links

1. [Graduate Studies: www.grad.uc.edu](http://www.grad.uc.edu)
2. [Graduate Housing: www.uc.edu/gradfamilyhousing/](http://www.uc.edu/gradfamilyhousing/)
3. [Student Organizations: www.sald.uc.edu/orgs.html](http://www.sald.uc.edu/orgs.html)
4. [Career Development Center: www.uc.edu/career/](http://www.uc.edu/career/)
5. [Graduate Student Governance Association: www.sald.uc.edu/org/gsga/](http://www.sald.uc.edu/org/gsga/)
6. [International Student Services: www.isso.uc.edu](http://www.isso.uc.edu)
7. [Informational Technologies: www.ucit.uc.edu](http://www.ucit.uc.edu)
8. [Recreational Sports: www.recsports.uc.edu](http://www.recsports.uc.edu)
9. [Libraries: www.libraries.uc.edu](http://www.libraries.uc.edu)
10. [One Stop Student Services: www.onestop.uc.edu](http://www.onestop.uc.edu)

**APPENDIX A. Entrance Requirements for New Graduate Students in UCBME**

The primary faculty met to set the pre-requisites for incoming graduate students into the program. These pre-requisites are intended to account for the very different backgrounds of students entering into the program. For example, engineering and computer science students will likely have extensive backgrounds in math, physics, and computer science but be weak in anatomy and physiology. Likewise, students from the biological sciences will need to develop these strengths in higher-level mathematics.

Listed below are the required pre-requisites for all students entering the graduate program.

- 1 year of Anatomy & Physiology\*
- 1 year of Chemistry
- 1 year of Physics
- 1 year of Calculus
- 1 course in Statistics
- 1 course in Computer Programming
- 1 course in Linear Algebra or Matrix Methods\*
- 1 course in Differential Equations\*
- 1 course in Cell Biology \*

\* These courses can be completed during the first year of graduate school along with 12 credit hours of graduate course work.

In order to make up any deficiencies once the students enter the program, UCBME recommends that engineering students take the following biology courses and biological sciences students take the following math courses.

**Pre-requisites for graduate students with an Engineering or Computer Science undergraduate degree:**

<b>Autumn</b>	<b>Winter</b>	<b>Spring</b>
BIOL 201 ( <i>Anatomy &amp; Phys</i> )	BIOL 202 ( <i>Anatomy &amp; Phys</i> )	BIOL 203 ( <i>Anatomy &amp; Phys</i> )
	BIOL 301 ( <i>Cell Biology</i> )	

**Pre-requisites for graduate students with a Biological Sciences undergraduate degree:**

<b>Autumn</b>	<b>Winter</b>	<b>Spring</b>
MATH 254 ( <i>Calculus</i> )	MATH 351 ( <i>Linear Algebra</i> )	MATH 273 ( <i>Diff Equations</i> )
	<i>Computer Programming</i>	

## APPENDIX B. Graduate Curricula

### Graduate Program Summary

	MS	PhD	MS + PhD
BME Survey	3	3	3
Biomed. Instrumentation	3	0	3
Primary BME Technical Focus Area	3	9	18
General Medical Sciences	6	12	18
Mathematics	3	3	6
Technical Elective/Independent Study	6	3	9
Thesis Research	15*	60*	75
<u>Research Design</u>	<u>3</u>	<u>3</u>	<u>3</u>
Ethics in Research	0	1	1
BME <a href="#">Career Building Blocks</a> <sup>1</sup>	0	2	2
Total Required Graduate Credit Hours	<u>48</u>	<u>96</u>	<u>138</u>

<sup>1</sup> Two credits of [Career Building Blocks \(Seminars\)](#) to include Guest Speakers, Student Research Presentations, Intellectual Property, Experimental Methods and Design.

## **Appendix C Program Courses for Biomedical Engineering**

<b>BME Core Courses</b>		<b>Cr</b>	<b>Qtr<sup>2</sup></b>	<b>20-AEEM-725</b>	<b>Nonlinear Finite Elements</b>	<b>3</b>	<b>A</b>
20/26-BME-601	BME Survey Course	3	A	20-AEEM-728	Intro to Ultrasonics	3	S
20/26-BME-602	Biomedical Instrumentation	3	S	20-AEEM-780	Num. Methods for Inviscid Flow	3	W
20/26-BME-701	Seminar	1	A/S	20-AEEM-781	Num. Methods for Viscous Flow	3	A
20/26-BME-708	Research Design	3	S	20-AEEM-846	Theory of Turbulence	3	W
26-GNTD-730	Ethics in Research	1	W	<b>Tissue Engineering/Biomechanics</b>		<b>Cr</b>	<b>Qtr</b>
20-CB-871	Human Gross Anatomy	4	U	20/26-BME-605	Ligament/Tendon Biomech	3	S
26-BE-787	Intro to Biostatistics	4	A	20/26-BME-612	Bone Biomechanics	3	S
<b>General Medical Sciences</b>				20/26-BME-624	Joint Biomechanics	3	W
26-MCBP-823	Molecular and Cellular Pharmacol	4	W	20/26-BME-620	Tissue Engineering	3	W
26-MCP-841	Integrative/Organ Physiology I	6	A	20/26-BME-627	Intro. to Biomechanics	3	A
26-MCP-842	Integrative/Organ Physiology II	6	W	20/26-BME-633	Cell Biomechanics	3	A
26-GNTD-871	Intro Molecular Genetics	3	A	20/26-BME-704	Tissue Biomechanics	3	W
26-GNTD-872	Molecular Biology Cell I	4	A	20/26-BME-722	Independent Study	3	A/W/S
26-GNTD-862	Molecular Biology Cell II	5	W	20/26-BME-734	Cell Propagation & Delivery	3	W
26-GNTD-873	Molecular Biology Cell III	4	S	20/26-BME-735	Cellular/Molec Wound Healing	3	W
20-CB-871	Human Gross Anatomy	4	U	26-OSE-744	Biomech./Phys. Aspects/Musc. Act.	3	A
26-955-885	Basic Principles of Pathology	3	W	26-EIH-790	Phys Aspects of the Environment	3	W
<b>Mathematics</b>				26-OSE-792	Principles of Ergonomics	3	S
26-BE-787	Intro to Biostatistics	4	A	20-MTSC-794	Introduction to Polymer Science	3	A
15-MATH--533	PDE& Fourier Analysis I	3	A	20-MINE-687	Whole Body Dynamics	3	S
15-MATH--534	PDE& Fourier Analysis II	3	W	<b>Bioinformatics</b>			
15-MATH-555	Applied Linear Algebra I	3	A	20/26-BME-657	Computational Genomics	3	W
15-MATH-556	Applied Linear Algebra II	3	W	20/26-BME-658	Functional Genomics	3	S
15-MATH-561	Numerical Methods & Applied Math S	3	W	20/26-BME-680	Large Biological Database	3	S
15-MATH-577	Appl. Prob. & Stochastic Proc. I	3	A	20/26-BME-712	Adv. Comput. Biology	3	S
15-MATH-578	Appl. Prob. & Stochastic Proc. II	3	W	20/26-BME-723	Independent Study	3	A/W/S
15-MATH-580	Mathematics using Mathematica	3	W	20/26-BME-752	Statistical Genetics	3	A
15-MATH-584	Combinatorics	3	S	26-MG-719	Proteins, Struct, Funct, Engrg	4	W
15-MATH-701	Analytical Methods I	3	A	15-BIOL-876	Phylogenetic Systematics	3	S
15-MATH-702	Analytical Methods II	3	W	26-DB-852	Developmental Biology I	5	A
15-MATH-703	Analytical Methods III	3	S	26-DB-981	Human Genetics I	4	S
<b>Medical Imaging</b>				26-DB-982	Human Genetics II	3	W
20/26-BME-608	Medical Imaging with Ionizing Rad. W	3	W	26-MG-599	Intro Immunology	3	W
20/26-BME-609	Medical Imaging w/o Ionizing Rad.	3	S	26-MG-710	Adv. Mol. Gen. I: Gene Regulation	4	W
20/26-BME-610	Adv. Topics in MRI	3	A	26-MG-719	Proteins	4	W
20/26-BME-721	Independent Study	3	A/W/S	26-MG-821	Human Genetics	4	W
20-ECES-626	Communication Theory	3	A	20-ECES-629	Intro Operating Systems	3	W
20-ECES-642	Digital Image Processing	3	W	20-ECES-637	Machine Learning	3	S
20-ECES-644	Digital Signal Processing Lab	3	S	20-ECES-639	Software Engineering	3	A
20-ECES-645	Intro Digital Signal Processing	3	A	20-ECES-651	Database Theory	3	A/S
20-ECES-692	Principles of Databases	3	W	20-ECES-661	Digital Libraries	3	A
20-ECES-821	Pattern Recognition	3	S	20-ECES-665	Computer Networks	3	A
20-MECH-829	Viscous Fluid Flow- Turbulent	3	W	20-ECES-666	Computer Networks	3	W
15-CHEM-852	NMR Applications in Biochemistry	3	W	20-ECES-667	User Interface I	3	W
15-CHEM-858	Intro 2D NMR Spect. of BioMacr.	3	A	20-ECES-671	Design & Analysis of Algorithms I	3	A/S
20-MECH-666	Acoustics I	3	W	20-ECES-672	Design & Analysis of Algorithms II	3	W
20-MECH-667	Acoustics II	3	S	20-ECES-688	Wireless Communications	3	A
20-AEEM-614	Intro Compressible Flow	3	W	20-ECES-798	Performance Evaluation	3	A
20-AEEM-672	Finite Element Techniques I	3	A	20-ECES-821	Pattern Recognition	3	S
20-AEEM-673	Finite Element Techniques II	3	W	20-ECES-858	Data Mining	3	S
20-AEEM-674	Finite Element Techniques III	3	S				

<sup>2</sup> A=Autumn, W=Winter, S=Spring, U=Summer

**Appendix D**

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Qualifying Exam Committee Form

Qualifying Exam Committee

**BME Student Name:** \_\_\_\_\_ **SS#:** \_\_\_\_\_

**Exam Topic/Title:** \_\_\_\_\_

The following faculty agree to serve on the Qualifying Exam Committee for the above named student:

**1. Primary Research Advisor:** \_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature Date

**2. BME Faculty:** \_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature Date

**3. Faculty in Focus Area:** \_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature Date

**4. Additional Faculty (Optional):** \_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature Date