

Biomedical Engineering Master of Science Program Guidelines

I. Minimum Entrance Requirements

Admission to the BME master's program is subject to final approval by the BME graduate committee. Students meeting the following minimum guidelines will be selected on a competitive basis.

A. Minimum Qualifications for Admission

1. Bachelor of Science or Bachelor of Arts degree in Biomedical Engineering, Chemical Engineering, Mechanical Engineering, Computer Science, Computer Engineering, Electrical Engineering, or a closely related discipline.
2. Undergraduate GPA of 3.0/4.0 or equivalent.

B. Case-by-Case Admission

Applicants for admission with an undergraduate GPA below 3.0, or with degrees in a related area, will be carefully considered for admission by the BME Graduate Committee. Applicants with degrees in a related area shall meet the following prerequisites for unconditional admission:

Two-course sequence in physics (e.g., PHYS 251, 252)

Two-course sequence in calculus (e.g., MATH 263A, MATH 263B; MATH 263C)

One course in differential equations (e.g., MATH 340)

Students without credit in these courses or their equivalents should be prepared to obtain credit in these early in the program.

II. Curriculum and Degree Requirements

A total of 45 credit hours are required for graduation, including course work and thesis. The course portion of the M.S. BME curriculum is divided into four groups: (A) two life science core courses, (B) two biomedical engineering focus courses, (C) a set of common experience courses that will enhance the student's professional development and broaden his or her background in BME, and (D) a set of technical electives in the student's focus area.

A. Life Science Core Courses. Students must complete two courses selected from the following:

BIOS 501a (3 credits) – Human Anatomy.

PBIO 531 (3 credits) – Fundamentals of Cell Biology.

BIOS 542 (3 credits) – Principles of Physiology I.

BIOS 527 (3 credits) – Gene Regulation.

PBIO 550 (4 credits) – Biotechnology and Genetic Engineering.

PBIO 527 (3 credits) - Molecular Genetics OR BIOS 526 (3 credits) – Molecular Genetics.

- B. Biomedical Engineering Focus Courses.** Students must complete two biomedical engineering focus courses. The current focus areas are: Biomechanics, Cellular and Biomolecular Engineering, and Biomedical Information Processing.

BME 504 (3 credits) – Applied Cellular and Molecular Biology.

CS 516 (4 credits) – Problem Solving with Bioinformatics Tools.

BME 517 (4 credits) – Programming for Bioinformatics.

BME 567 (4 credits) – Biomechanics.

CHE 581 (3 credits) – Biochemical Engineering.

BME 641 (4 credits) – Medical Image Analysis.

BME 642 (4 credits) – Artificial Intelligence in Medicine.

BME 690 (3 credits) – Topics in Cellular Engineering.

- C. Common Experience Courses.** Students must complete the following courses. Students will receive five credits total toward graduation for BME 501, BME 506, and ET 602. Although students will receive credit for seminar (BME 698), these credits will not count toward graduation.

BME 501 (1 credit) – Introduction to Biomedical Engineering at Ohio University.

BME 506 (3 credits) – Biomedical Engineering Professional Development.

BME 698 (1 credit) – Seminars in Biomedical Engineering. This course will be taken by all students at every offering. These credits will not count toward the 45 credits needed for graduation. All students are required to make at least one seminar presentation. The student's research advisor must give approval prior to the presentation.

ET 602 (1 credit) – Technical Writing Seminar.

- D. Electives.** Students will complete an additional six hours of electives. Students will choose elective courses in consultation with their thesis committees. The courses can come from any approved graduate level engineering or life sciences elective. BME focus courses not used to meet requirement B above can be used to fulfill the electives requirement. Approved electives are listed in Appendix A. Other relevant courses may be taken subject to approval by the student's thesis committee.

- E. Research and Thesis.** Research will be an integral component of the graduate program. Students will complete at least 21 credit hours of thesis (BME 695). Research work conducted by each student will culminate in a master's thesis that will be a required formal written document. Each student will be required to successfully defend his or her thesis. The thesis defense will be an oral examination based on the student's written thesis and program of study.

III. Academic Standards

- A. **Grade-Point Average Required for Graduation.** Conferral of the M.S. in BME requires at least a 3.0 grade-point average. The grade-point average is based on all programmed work, excluding transfer credits.
- B. **Additional Grade-Point Average Requirements.** No more than six (6) quarter hours below B- and no hours below C may be applied toward fulfilling degree requirements. More than twelve (12) hours below B- will result in the removal of the student from the M.S. program.
- C. **Probation Status.** A candidate having an overall grade-point average below 3.0 will be placed on probation status. Failure to raise the grade-point average to 3.0 or above by the end of the subsequent quarter will result in the removal of the student from the program.

IV. Thesis Advisor and Thesis Committee Selection

All forms are available online at www.ohio.edu/engineering/biomedical/forms and should be submitted to the BME office for the Chair of the BME Graduate Committee's signature.

A. Temporary Advisor. Upon entering the program, the Chair of the BME Graduate Committee acts as the student's temporary advisor until a thesis advisor has been obtained. In most cases, the Chair will not assist the student with course selection; rather, he or she will direct the student to a Russ College faculty member with similar research interests for advice on course selection. The student should understand that giving such advice does not mean that the faculty member has agreed to serve as the student's thesis advisor. Typically, this faculty member will aid the student in course selection for only one or two quarters.

B. Thesis Advisor. The thesis advisor is a faculty member in the student's field of interest who will serve as the thesis research advisor and plan a program of study. The student must select a faculty member who is willing to serve as his or her thesis advisor by **no later than the first week of the second quarter**. The tentative M.S. course of study form must be submitted by **no later than the first week of the second quarter** and must be signed by the advisor and the Chair of the BME Graduate Committee.

C. Thesis Committee. The student's thesis examining committee is chosen in consultation with the thesis advisor. **The thesis committee must be established by no later than the end of the second quarter and no later than four weeks prior to the thesis proposal presentation.** The student thesis advisory committee shall consist of a minimum of four faculty members. Three of these must be members of the BME faculty, including the chair/advisor. Two committee members must be members of the Russ College and hold associate graduate or graduate faculty status. One of the members must be from outside the Russ College and hold associate or full graduate faculty status in his or her College. The committee member from outside the Russ College is appointed by the College at the request of the student. The student makes the request by submitting the Russ College thesis committee information and approval form to the Chair of the BME Graduate Committee. **This form must be submitted by no later than the end of the second quarter and no later than four weeks prior to the thesis proposal presentation.**

V. Thesis Proposal and Defense

All forms except the Thesis Defense Approval Form are available at www.ohio.edu/engineering/biomedical/forms and should be submitted to the BME office for the Chair of the BME Graduate Committee's signature. The Thesis Defense Approval Form is available from the BME office.

A. Thesis Proposal. The student will prepare a written formal research proposal. Students must review Russ College policies on plagiarism prior to preparing their theses (www.ohio.edu/engineering/plagiarism). He or she will give an oral presentation of the proposal to the thesis committee. The length of the written proposal is expected to be 10 to 20 double-spaced typewritten pages. The oral presentation should take approximately 20 minutes and should include the use of visual aids (e.g., PowerPoint slides). A copy of the written proposal must be in the hands of the thesis committee members no later than 14 days prior to the oral presentation. The members of the thesis committee must be informed of the date, place, and time of the oral presentation no later than 14 days prior to the oral presentation. **Students must pass the thesis proposal no later than the end of the third quarter.** Students should take the Final M.S. Course of Study Proposal Approval Form to the oral presentation. If they pass, they should obtain all signatures at that time and submit the form along with a copy of the proposal to the BME office for the Chair of the BME Graduate Committee's signature. Note that changes to the program of study may be made by obtaining the Revised M.S. Course of Study Form. Once all signatures are obtained, submit the form to the BME office for the Chair of the BME Graduate Committee's signature. No changes in the program of study will be approved for the addition or deletion of a course for which a grade has already been received.

B. Thesis Defense. A written thesis must be prepared describing the student's completed research work. The thesis must be defended orally before the thesis committee. An electronic thesis prepared according to the university guidelines is required. Students must again review Russ College policies on plagiarism prior to preparing their theses (www.ohio.edu/engineering/plagiarism).

1. At least four weeks prior to the date of the thesis defense, submit the Russ College of Engineering and Technology Arrangements for Oral Examination Form and the Statement of Originality to the BME office, which will rout the forms to the Russ College Dean's office.

2. At least two weeks prior to the date of the examination:

- (a) submit a copy of the thesis to each member of the thesis committee;
- (b) submit an electronic copy of the thesis in PDF format to the administrative associate in the Dean's office.
- (c) advise the thesis committee of the place, date, and time of the defense at least two weeks prior to the defense.

3. Thesis Defense Approval Form. The student should obtain five copies of the Thesis Defense Approval Form from the BME office and take them to the thesis defense. Upon passing the thesis defense, the student should obtain signatures from the committee members on all five forms and submit four of the signed forms to the BME office. Retain one copy for your records.

4. Submission of Final Thesis. When you are ready to submit your final copy (at least one week before the electronic thesis submission deadline for your graduation quarter), ask your advisor to pull THREE copies of the signed "Defense" form from your file. Take them to the administrative associate in the Dean's office along with the electronic version of your thesis. (The Dean's office will initiate screening of your final copy for plagiarism and then will submit your thesis to the electronic thesis office on your behalf for the initial format check.) From this point, you should follow the Guidelines for Submission of Electronic Theses and Dissertations, available at www.ohio.edu/graduate/etd.cfm, to complete final submission of your thesis. (Final submission must be complete by the deadline for the quarter in which you graduate.)

VI. Transfer of Credit

A maximum of 12 quarter hours, or the equivalent, may be transferred from an accredited university and applied toward a student's M.S. BME degree, provided:

- A. The credits are designated at the transferring institution as graduate level only.
- B. The credits were obtained by taking formal coursework within the past five years. No correspondence credit will be accepted.
- C. Grades earned on all transfer credits are B or better.

VII. Time Limit

Students must complete all requirements for the degree within six calendar years from the first quarter of study in the M.S. BME program.

Appendix A

Approved Electives for the MS BME Degree

Life Science Core Courses and BME Focus Courses not used to meet requirements A and B of the curriculum can be used to meet the electives requirement. These courses are not listed here.

*--course is offered irregularly

Course Title	Number	Hours
*Topics in Bioseparations	CHE 582	3
Advanced Biomedical Engineering	CHE 783	3
*Physical Chemistry of Macromolecules	CHEM 571	4
General Biochemistry	CHEM 590	5
Drug Discovery and Design	CHEM 710	3
Protein Chemistry	CHEM 711	4
Molecular Basis of Cancer	CHEM 715	3
Enzymology	CHEM 716	4
Cell and Molecular Biophysics	PHYS 561	4

Advances in Signal Transduction	MCB 710	5
Molecular Biology	MCB 720	4
Advanced Cell Biology	MCB 760	4
Comparative Vertebrate Anatomy	BIOS 503	6
Developmental Biology	BIOS 507	4
Human Neuroscience	BIOS 513	4
Molecular and Cellular Neurobiology	BIOS 514	4
Neural Basis of Sensation and Movement	BIOS 515	4
Cognitive Neuroscience	BIOS 517	4
Methods in Computational Neuroscience	BIOS 518	4
Principles of Physiology II	BIOS 543	3
Tropical Disease Biology	BIOS 544	4
*Advanced Topics in Physiology	BIOS 556	4
Cell Chemistry	BIOS 563	4
Immunology	BIOS 586a	3
*Current Topics in Biological Transport	BIOS 653	3
*Cardiovascular Physiology	BIOS 655	3
*Advances in Signal Transduction	BIOS 710	5
*Neuroscience Methods	BIOS 711	4
Plant Cell Biology	PBIO 531	5
Biotechnology and Genetic Engineering	PBIO 550	4
Continuum Mechanics	ME 523	4
CAD/CAM I	ME 557	4
Advanced CAD	ME 751	4
Non-Newtonian Fluid Dynamics	ME 762	5
Statistical Foundations for Bioinformatics	CS 518	4

Artificial Intelligence	CS 580	4
Bioinformatics Research Seminar	CS 690	4
Computer Graphics and Visualization	CS 625	4
Advanced Artificial Intelligence	CS 680	4
AI: Case-based Reasoning	CS 682	4
Image Understanding	CS 685	4
Digital Image Processing	EE 664	3
Pattern Recognition	EE 666	3
Neural Networks	EE 667	3
Introduction to Bioinformatics	MATH 586	5