BIOENGINEERING, MS (PENDING SCHEV APPROVAL)

Banner Code: VS-MS-BIOE

Academic Advising

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Email: lbray2@gmu.edu
Website: bioengineering.gmu.edu/bioengineering-masters-program/

Note: as of catalog publication in April, the program described below has been approved by the Board of Visitors and sent to the State Council of Higher Education in Virginia for consideration as a new degree program. The university cannot accept applications or enroll students in this program until SCHEV approval has been granted. Check the college/school website for current program status.

The Bioengineering graduate program prepares students for research and professional practice in bioengineering and related fields. The program includes both fundamentals and advanced work to apply engineering techniques to solve problems in biology and medicine. A major distinguishing feature of the curriculum is that it is designed to educate leaders who understand and appreciate how biomedical technology is translated from bench to bedside. Regardless whether they will eventually serve at universities, industry or government, they will understand that new types of devices and processes resulting from their graduate experience need to be improved and made cost-effective to reach the public. As demanded by their leadership positions, they will recognize that entrepreneurial considerations that are essential for determining whether a planned diagnostic or therapeutic approach is practical from an investment perspective and is likely to produce societal benefit.

Admissions & Policies

Admissions

Applicants must have completed a baccalaureate degree in engineering or the sciences from an accredited program and an earned GPA of 3.0 or better in their 60 highest-level credits.

In addition to fulfilling Mason’s admission requirements for graduate study, applicants seeking to be admitted must:

- Demonstrate interest in combining engineering or natural sciences with basic or applied biology as demonstrated by the BS degree, course selection, or project work.
- Provide two letters of recommendation, from references who are familiar with the applicant’s professional accomplishments.
- Provide a resume and detailed statement of career goals and professional aspirations.
- If their native language is not English, students must earn a minimum TOEFL score of 575 for the paper-based exam or 230 for the computer-based exam.
- Official GRE scores.

Requirements

Degree Requirements

Total credits: 30-33

Students complete the Core Bioengineering requirements, the Additional Training Requirement, and Requirements within one selected option.

Core Bioengineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BENG 525</td>
<td>Neural Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BENG 538</td>
<td>Medical Imaging</td>
<td>3</td>
</tr>
<tr>
<td>BENG 541</td>
<td>Biomaterials</td>
<td>3</td>
</tr>
<tr>
<td>BENG 550</td>
<td>Advanced Biomechanics</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

Thesis Option

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BENG 501</td>
<td>Bioengineering Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>Thesis Research</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

Career Specialization

These courses are to be chosen to give students career skills in teaching, entrepreneurship and/or health care policy.

Select one course from one of the following specializations: 3

Teaching

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 602</td>
<td>College Teaching</td>
</tr>
<tr>
<td>HE 704</td>
<td>The Scholarship of Teaching and Learning</td>
</tr>
</tbody>
</table>

Entrepreneurship

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBP 781</td>
<td>Entrepreneurship and Economic Development</td>
</tr>
</tbody>
</table>

Health Care Policy

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAP 715</td>
<td>Health Economics</td>
</tr>
<tr>
<td>HAP 742</td>
<td>Health Policy Development and Analysis</td>
</tr>
<tr>
<td>HAP 762</td>
<td>Cost-Effectiveness for Health Care Management and Policy Decisions</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
</tr>
</tbody>
</table>

Technical Specialization

These upper-level technical courses are to be chosen to give students technical depth in an area of their interest. The courses are to be selected under the guidance and with the approval of the student’s advisor. At least one of the two classes must be at the 700 level.

Select two of the following: 6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>BENG 636</td>
<td>Advanced Biomedical Signal Processing</td>
</tr>
<tr>
<td>BENG 641</td>
<td>Advanced Nanotechnology in Health</td>
</tr>
<tr>
<td>BENG 699</td>
<td>Advanced Topics in Bioengineering</td>
</tr>
<tr>
<td>BENG 725</td>
<td>Computational Motor Control</td>
</tr>
<tr>
<td>BENG 738</td>
<td>Advanced Medical Image Processing</td>
</tr>
<tr>
<td>BENG 745</td>
<td>Biomedical Systems and Microdevices</td>
</tr>
<tr>
<td>BENG 750</td>
<td>Modeling and Simulation of Human Movement</td>
</tr>
</tbody>
</table>
Thesis Research Proposal
Each student must prepare a written thesis proposal, and it must be presented before the completion of the first semester. The proposal must be made available to the committee at least two weeks in advance of the presentation. The proposal must be presented to and approved by the committee. The committee determines whether the proposal has merit and can lead to significant contributions to the area and whether the student has the knowledge and skills to complete the proposed work successfully and in a timely manner. If the student fails to defend the proposal, the student may present a proposal a second time, no later than 60 days from the first attempt. Failure in the second attempt results in dismissal from the program.

Thesis Preparation and Defense
While preparing the thesis, the candidate enrolls in thesis research. The candidate can proceed to a public defense of the thesis once it has been approved by the committee.

The defense must be announced at least two weeks in advance. The thesis draft must be submitted to the library and made publicly available at least two weeks in advance of the defense. The entire committee must be present at the defense. If the candidate fails to defend the thesis, the candidate may request a second defense, following the same procedures as for the initial defense. A candidate who fails a second attempt to defend the thesis is terminated from the program.

Practicum Option
BENG 551 Translational Bioengineering 3

Internship/Co-Op
BENG 798 Independent Reading and Research in Bioengineering 1

Total Credits 6

1 Students are expected to complete 6 credits of BENG 798 Independent Reading and Research in Bioengineering towards their degree. Students cannot enroll in BENG 798 Independent Reading and Research in Bioengineering until the completion of their second semester of coursework. These credits must be taken along with an internship/co-op opportunity. Therefore, a letter from the specific employer must be provided on behalf of the student.

Electives
Career Specialization
These courses are to be chosen to give students career skills in teaching, entrepreneurship and/or health care policy.

Select one course from the following: 3
Teaching
HE 602 College Teaching
HE 704 The Scholarship of Teaching and Learning

Entrepreneurship
PUBP 781 Entrepreneurship and Economic Development

Health Care Policy
HAP 715 Health Economics
HAP 742 Health Policy Development and Analysis
HAP 762 Cost-Effectiveness for Health Care Management and Policy Decisions

Total Credits 3

Technical Specialization
These upper-level technical courses are to be chosen to give students technical depth in an area of their interest. The courses are to be selected under the guidance and with the approval of the student’s advisor. At least one of the two classes must be at the 700 level.

Select two of the following: 6
BENG 636 Advanced Biomedical Signal Processing
BENG 641 Advanced Nanotechnology in Health
BENG 699 Advanced Topics in Bioengineering
Bioengineering, MS (pending SCHEV approval)

BENG 725 Computational Motor Control
BENG 738 Advanced Medical Image Processing
BENG 745 Biomedical Systems and Microdevices
BENG 750 Modeling and Simulation of Human Movement
BINF 740 Introduction to Biophysics
BIOL 669 Pathogenic Microbiology
CHEM 641 Solid State Chemistry
CHEM 660 Protein Biochemistry
CHEM 728 Introduction to Solid Surfaces
CS 688 Pattern Recognition
CS 795 Advanced Topics in CS
CSI 720 Fluid Mechanics
CSI 742 The Mathematics of the Finite Element Method
CSI 780 Principles of Modeling and Simulation in Science
ECE 537 Introduction to Digital Image Processing (DIP)
ECE 738 Advanced Digital Signal Processing
ECE 754 Optimum Array Processing I
NANO 620 Computational Modeling in Nanoscience
NEUR 602 Cellular Neuroscience
NEUR 634 Neural Modeling
NEUR 701 Neurophysiology Laboratory
NEUR 734 Computational Neurobiology
NEUR 735 Computational Neuroscience Systems
NEUR 751 Applied Dynamics in Neuroscience
NEUR 752 Modern Instrumentation in Neuroscience
PHYS 612 Physics of Modern Imaging
PSYC 701 Cognitive Bases of Behavior
PSYC 757 Advanced Topics in Statistical Analysis
PSYC 768 Advanced Topics in Cognitive Science
RHBS 711 Applied Physiology II
RHBS 746 Movement Control and Learning
STAT 662 Multivariate Statistical Methods
STAT 760 Advanced Biostatistical Methods
SYST 664 Bayesian Inference and Decision Theory

Committee Selection
Each student must form a master's committee, comprising two or three individuals. In this case, the committee will help identify the goals of the internship and make sure that they are in line with the MS program's objectives. The committee will also be responsible to evaluate a final report and presentation to assess the successful completion of the internship. A minimum of one member of the committee must be tenured or tenure-track faculty in the Department of Bioengineering. The other two members must be representatives from the internship program.

Project Preparation and Presentation
During the internship, the candidate enrolls in BENG 798 Independent Reading and Research in Bioengineering (Internship/Co-op) and prepares the project report and presentation. The candidate can proceed to the final presentation of the project once it has been approved by the committee.

The presentation must be announced at least two weeks in advance. The report draft must be submitted to the library and made publicly available at least two weeks in advance of the defense. The entire committee must be present at the presentation. If the candidate fails to defend the project, the candidate may request a second attempt, following the same procedures as for the initial one. A candidate who fails a second attempt is terminated from the program.

Coursework Option
BENG 551 Translational Bioengineering 3

Total Credits 3

Electives Career Specialization
These courses are to be chosen to give students career skills in teaching, entrepreneurship and/or health care policy.

Select two from the following: 6

Teaching
HE 602 College Teaching
HE 704 The Scholarship of Teaching and Learning

Entrepreneurship
PUBP 781 Entrepreneurship and Economic Development

Health Care Policy
HAP 715 Health Economics
HAP 742 Health Policy Development and Analysis
HAP 762 Cost-Effectiveness for Health Care Management and Policy Decisions

Total Credits 6

Technical Specialization
These upper-level technical courses are to be chosen to give students technical depth in an area of their interest. The courses are to be selected under the guidance and with the approval of the student's advisor. At least two of the four classes must be at the 700 level.

Select from the following: 12

BENG 636 Advanced Biomedical Signal Processing
BENG 641 Advanced Nanotechnology in Health
BENG 699 Advanced Topics in Bioengineering
BENG 725 Computational Motor Control
BENG 738 Advanced Medical Image Processing
BENG 745 Biomedical Systems and Microdevices
BENG 750 Modeling and Simulation of Human Movement
BINF 740 Introduction to Biophysics
BIOL 669 Pathogenic Microbiology
CHEM 641 Solid State Chemistry
CHEM 660 Protein Biochemistry
CHEM 728 Introduction to Solid Surfaces
CS 688 Pattern Recognition
CS 795 Advanced Topics in CS
CSI 720 Fluid Mechanics
<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CSI 742</td>
<td>The Mathematics of the Finite Element Method</td>
</tr>
<tr>
<td>CSI 780</td>
<td>Principles of Modeling and Simulation in Science</td>
</tr>
<tr>
<td>ECE 537</td>
<td>Introduction to Digital Image Processing (DIP)</td>
</tr>
<tr>
<td>ECE 738</td>
<td>Advanced Digital Signal Processing</td>
</tr>
<tr>
<td>ECE 754</td>
<td>Optimum Array Processing I</td>
</tr>
<tr>
<td>NANO 620</td>
<td>Computational Modeling in Nanoscience</td>
</tr>
<tr>
<td>NEUR 602</td>
<td>Cellular Neuroscience</td>
</tr>
<tr>
<td>NEUR 634</td>
<td>Neural Modeling</td>
</tr>
<tr>
<td>NEUR 701</td>
<td>Neurophysiology Laboratory</td>
</tr>
<tr>
<td>NEUR 734</td>
<td>Computational Neurobiology</td>
</tr>
<tr>
<td>NEUR 735</td>
<td>Computational Neuroscience Systems</td>
</tr>
<tr>
<td>NEUR 751</td>
<td>Applied Dynamics in Neuroscience</td>
</tr>
<tr>
<td>NEUR 752</td>
<td>Modern Instrumentation in Neuroscience</td>
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<tr>
<td>PHYS 612</td>
<td>Physics of Modern Imaging</td>
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<tr>
<td>PSYC 701</td>
<td>Cognitive Bases of Behavior</td>
</tr>
<tr>
<td>PSYC 757</td>
<td>Advanced Topics in Statistical Analysis</td>
</tr>
<tr>
<td>PSYC 768</td>
<td>Advanced Topics in Cognitive Science</td>
</tr>
<tr>
<td>RHBS 711</td>
<td>Applied Physiology II</td>
</tr>
<tr>
<td>RHBS 746</td>
<td>Movement Control and Learning</td>
</tr>
<tr>
<td>STAT 662</td>
<td>Multivariate Statistical Methods</td>
</tr>
<tr>
<td>STAT 760</td>
<td>Advanced Biostatistical Methods</td>
</tr>
<tr>
<td>SYST 664</td>
<td>Bayesian Inference and Decision Theory</td>
</tr>
</tbody>
</table>

**Total Credits** 12

Note: Students who elect to the coursework option will complete a minimum of 33 credit hours.

**Additional Training Requirement**

**Bioengineering Seminar**

All MS students are required to attend a minimum of two departmental seminars per semester. Students will sign an attendance sheet available at the end of each seminar.