MASTER OF BIOENGINEERING (MBE) DEGREE

Program Learning Outcomes for the MBE Degree

Program Learning Outcomes for the Applied Bioengineering Area of Specialization

Upon completing the MBE degree, students pursuing the Applied Bioengineering area of specialization requirements will be able to:

1. Apply and integrate advanced knowledge of Bioengineering topics in at least one of the following areas: Biomaterials, Tissue Engineering, Mechanobiology and Biophysics; Biomedical Imaging, Optics and Diagnostics; Microfabrication, Microfluidics and Design; Synthetic Biology and Genome Engineering; Quantitative, Computational and Theoretical Bioengineering.
2. Apply knowledge from engineering and other disciplines to identify, formulate, and solve novel and complex problems that require advanced knowledge in bioengineering.
3. Select and apply quantitative analytic techniques to analyze bioengineering data.

Additionally, upon completing the MBE degree, students pursuing the Applied Bioengineering area of specialization requirements and the research component, will be able to:

1. Develop practical experience of designing and performing laboratory research, including the ability to summarize and assess research results in a written format, and present research results.

Program Learning Outcomes for the Global Medical Innovation Area of Specialization

Upon completing the MBE degree, students pursuing the Global Medical Innovation area of specialization requirements will be able to:

1. Apply knowledge of Bioengineering topics in at least one of the following areas: Biomaterials, Tissue Engineering, Mechanobiology and Biophysics; Biomedical Imaging, Optics and Diagnostics; Microfabrication, Microfluidics and Design; Synthetic Biology and Genome Engineering; Quantitative, Computational and Theoretical Bioengineering.
2. Develop effective medical products, from concept to commercialization, within a team environment.
3. Comprehend and navigate the global medical technology industry by leveraging an internship experience.

Requirements for the MBE Degree

The MBE degree is a non-thesis master's degree. For general university requirements, please see Non-Thesis Master's Degrees (https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-non-thesis-masters-degrees/). For additional requirements, regulations, and procedures for all graduate programs, please see All Graduate Students (https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/).

Students pursuing the MBE degree must complete:

• A minimum of 30 credit hours of graduate-level study (coursework at the 500-level or above).
• A minimum of 24 credit hours must be taken at Rice University.
• A minimum residency enrollment of one fall or spring semester of part-time graduate study at Rice University.
• The requirements for one area of specialization (see below for areas of specialization). The MBE degree program offers two areas of specialization:
  • Applied Bioengineering: (class-based) or Applied Bioengineering: (research-based): designed as a flexible degree for students who will pursue careers in research, medicine, or related fields, or
  • Global Medical Innovation: designed specifically for students who will pursue a career in the global medical technology industry. As the medical technology industry becomes increasingly global with an emphasis in cost-effective health care solutions and clinical outcomes, Rice University seeks to prepare engineers for this new and changing environment. This area of specialization of the MBE degree is designed to prepare engineers for careers in medical technology through education in innovation, emerging-market design projects and internships. The Rice MBE area of specialization in Global Medical Innovation program specifically targets students who have an undergraduate degree in engineering (mechanical, electrical, chemical, or bioengineering/medical) or a related field, and who are interested in pursuing a career in the private, public, or non-profit sectors of medical technology.

Both areas of specialization have the same prerequisites, though applicants will be evaluated considering the different purposes of each. More information about each of these areas of specialization can be found below. Curriculum must be approved by the Graduate Academic Affairs Committee and the Bioengineering Department. This is done on a case-by-case basis.

The Master of Bioengineering (MBE) degree is a professional non-thesis master’s degree. Students who have a BS or BA degree in an engineering or science discipline may apply. Depending on their background, some students may need to fulfill prerequisites or take remedial engineering courses to earn the MBE degree. For more information, see the department website.

The courses listed below satisfy the requirements for this degree program. In certain instances, courses not on this official list may be substituted upon approval of the program’s academic advisor, or where applicable, the department or program’s Director of Graduate Studies. Course substitutions must be formally applied and entered into Degree Works by the department or program’s Official Certifier (https://registrar.rice.edu/facstaff/degreeworks/officialcertifier/). Additionally, these must be approved by the Office of Graduate and Postdoctoral
Studies. Students and their academic advisors should identify and clearly document the courses to be taken.

**Summary**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Total Credit Hours Required for the MBE Degree</td>
<td>30-31</td>
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</table>

**Degree Requirements**

<table>
<thead>
<tr>
<th>Code</th>
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<td>Total Credit Hours</td>
<td>30-31</td>
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</table>

**Areas of Specialization**

**Area of Specialization: Applied Bioengineering (Class-Based)**

Students pursuing the Applied Bioengineering (class-based) area of specialization must complete:

- A minimum of 2 courses (3 credit hours) from the core requirements.
- A minimum of 9 courses (27 credit hours) taken at the 500-level or above from selected course offerings.
  - A minimum of 6 courses (18 credit hours) from approved departmental (BIOE) course offerings.
  - A minimum of 1 course (3 credit hours) as a professional development elective course.
  - A minimum of 1 course (3 credit hours) as a quantitative elective course.
  - A minimum of 1 course (3 credit hours) from approved departmental (BIOE) course offerings or another department.
- A minimum GPA of 3.00 or higher in all Rice coursework that satisfies requirements for the non-thesis master's degree with a minimum grade of a B- (2.67 grade points) in each course.

**Core Requirements**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>BIOE 627</td>
<td>MEDICAL INNOVATION INDUSTRY SEMINAR</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Select 1 course from the following:</td>
<td>1.5</td>
</tr>
<tr>
<td>BIOE 628</td>
<td>MEDICAL TECHNOLOGY DESIGN SEMINAR</td>
<td>2</td>
</tr>
<tr>
<td>BIOE 633 / MGMT 633</td>
<td>ROLES OF PHYSICIANS, SCIENTISTS, ENGINEERS AND MBA'S IN HIGH-TECH STARTUPS</td>
<td>2</td>
</tr>
</tbody>
</table>

**Elective Requirements**

- Elective Category: BIOE Departmental Electives
  - Select 6 courses from approved departmental (BIOE) course offerings at the 500-level or above
  - Select a minimum of 3 credit hours from the following:

**Footnotes and Additional Information**

1 Students may include up to 6 credit hours of BIOE 506 (Graduate Independent Research) within these 18 credit hours. Students choosing to complete the Applied Bioengineering Area of Specialization with a Research emphasis will take up to 9 credit hours of BIOE 507 and BIOE 607, which are more structured MBE research courses. For students taking BIOE 507 or BIOE 607, BIOE 506 may also be taken for additional research experience, but it will not be counted toward the 30 credit hours required for the MBE.

2 Students completing the Research emphasis will be required to take UNIV 594 and one of the technical writing courses (ENGI 501, ENGI 510, or ENGI 542).

**Area of Specialization: Applied Bioengineering (Research-Based)**

Students pursuing the Applied Bioengineering (research-based) area of specialization must complete:

- A minimum of 2 courses (3 credit hours) from the core requirements.
- A minimum of 2 courses (9 credit hours) from the research requirement.
- A minimum of 8 courses (22 credit hours) taken at the 500-level or above from selected course offerings.
  - A minimum of 5 courses (15 credit hours) from approved departmental (BIOE) course offerings.
  - A minimum of 1 course (1 credit hour) as an ethics course.
  - A minimum of 1 course (3 credit hours) as a technical writing course.
- A minimum GPA of 3.00 or higher in all Rice coursework that satisfies requirements for the non-thesis master's degree with a minimum grade of a B- (2.67 grade points) in each course.
### Core Requirements

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<td>MEDICAL INNOVATION INDUSTRY SEMINAR</td>
<td>1.5</td>
</tr>
<tr>
<td>Select 1 from the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOE 628</td>
<td>MEDICAL TECHNOLOGY DESIGN SEMINAR</td>
<td>2</td>
</tr>
<tr>
<td>BIOE 633 / MGMT 633</td>
<td>ROLES OF PHYSICIANS, SCIENTISTS, ENGINEERS AND MBA'S IN HIGH-TECH STARTUPS</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Research Requirement

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOE 507</td>
<td>GRADUATE RESEARCH COMPONENTS I</td>
<td>3</td>
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<tr>
<td>BIOE 607</td>
<td>RESEARCH CONCENTRATION – COMPONENT II</td>
<td>6</td>
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#### Elective Requirements

**Elective Category: BIOE Departmental Electives**

Select 5 courses from approved departmental (BIOE) course offerings at the 500-level or above  

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<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>ENGI 501</td>
<td>WORKPLACE COMMUNICATION FOR PROFESSIONAL MASTER'S STUDENTS IN ENGINEERING</td>
<td>3</td>
</tr>
<tr>
<td>ENGI 510</td>
<td>TECHNICAL AND MANAGERIAL COMMUNICATIONS</td>
<td></td>
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<tr>
<td>ENGI 542</td>
<td>PROFESSIONAL COMMUNICATION FOR ENGINEERING LEADERS</td>
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**Elective Category: Ethics**

Select 1 course from the following:

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>UNIV 594</td>
<td>RESPONSIBLE CONDUCT OF RESEARCH</td>
<td>1</td>
</tr>
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</table>

**Elective Category: Technical Writing**

Select 1 course from the following:

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>ENGI 501</td>
<td>WORKPLACE COMMUNICATION FOR PROFESSIONAL MASTER'S STUDENTS IN ENGINEERING</td>
<td>3</td>
</tr>
<tr>
<td>ENGI 510</td>
<td>TECHNICAL AND MANAGERIAL COMMUNICATIONS</td>
<td></td>
</tr>
<tr>
<td>ENGI 542</td>
<td>PROFESSIONAL COMMUNICATION FOR ENGINEERING LEADERS</td>
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</tbody>
</table>

**Elective Category: Quantitative Requirement**

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<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>BIOE 539</td>
<td>APPLIED STATISTICS FOR BIOENGINEERING AND BIOTECHNOLOGY</td>
<td>3</td>
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**Elective Category: BIOE General Elective**

Select 1 additional course from approved departmental (BIOE) course offerings (or another department) at the 500-level or above  

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<tr>
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<tbody>
<tr>
<td>BIOE 539</td>
<td>APPLIED STATISTICS FOR BIOENGINEERING AND BIOTECHNOLOGY</td>
<td>3</td>
</tr>
</tbody>
</table>

### Area of Specialization: Global Medical Innovation

Students pursuing the Global Medical Innovation area of specialization must complete:

- A minimum of 6 courses (15 credit hours) from the core requirements.
- An internship or independent study (6 credit hours).
- A minimum of 3 courses (9 credit hours) taken at the 500-level or above from selected course offerings:
  - A minimum of 1 course (3 credit hours) as a professional development elective course.
  - A minimum of 1 course (3 credit hours) as a quantitative elective course.
  - A minimum of 1 course (3 credit hours) from approved departmental (BIOE) course offerings or another department.
  - A minimum GPA of 3.20 or higher in all Rice coursework that satisfies requirements for the non-thesis master’s degree with a minimum grade of a B- (2.67 grade points) in each course.

### Footnotes and Additional Information

1. This will be considered on a case-by-case basis, and the student is responsible for obtaining and selecting an internship that best aligns with their career goals.
2. BIOE 539 or an alternative quantitative-based BIOE course, taken at the 400-level or above, with the advisor’s approval.
3. Students may complete a course offered by another department, but it must be relevant to the MBE degree.
Policies for the MBE Degree

Department of Bioengineering Graduate Program Handbook

The General Announcements (GA) is the official Rice curriculum. As an additional resource for students, the department of Bioengineering publishes a graduate program handbook, which can be found here: https://gradhandbooks.rice.edu/2020_21/Bioengineering_Graduate_Handbook.pdf

Enrollment Status Requirements

Students may enroll for the Applied Bioengineering area of specialization on a full-time or part-time basis. Students may only enroll on a full-time basis for the Global Medical Innovation area of specialization. University graduation requirements (including the minimum residency requirement for students in graduate degree programs) still apply.

Transfer Credit

For Rice University's policy regarding transfer credit, see Transfer Credit (https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/#transfer). Some departments and programs have additional restrictions on transfer credit. Students are encouraged to meet with their academic program's advisor when considering transfer credit possibilities.

Additional Information

For additional information, please see the Bioengineering website: https://bioengineering.rice.edu/

Opportunities for the MBE Degree

Fifth-Year Master's Degree Option for Rice Undergraduate Students

Rice students have an option to pursue the Master of Bioengineering (MBE) degree by adding an additional fifth year to their four undergraduate years of science and engineering studies.

Advanced Rice undergraduate students in good academic standing may apply to the MBE degree program during their junior or senior year. Upon acceptance, depending on course load, financial aid status, and other variables, they may then start taking some required courses of the master's degree program. A plan of study will need to be approved by the student's undergraduate advisor and the MBE program director.

As part of this option and opportunity, Rice undergraduate students:

- must complete the requirements for a bachelor's degree and the master's degree independently of each other (i.e. no course may be counted toward the fulfillment of both degrees).
- should be aware there could be financial aid implications if the conversion of undergraduate coursework to that of graduate level reduces their earned undergraduate credit for any semester below that of full-time status (12 credit hours).
- more information on this Undergraduate - Graduate Concurrent Enrollment opportunity, including specific information on the registration process can be found here (https://ga.rice.edu/undergraduate-students/academic-opportunities/undergraduate-graduate-concurrent-enrollment/).