MASTER OF BIOENGINEERING (MBE) DEGREE AND A MAJOR CONCENTRATION IN GLOBAL MEDICAL INNOVATION

Program Learning Outcomes for the MBE Degree and a Major Concentration in Global Medical Innovation

Upon completing the MBE degree and a major concentration in Global Medical Innovation, students will be able to:

- Apply and integrate advanced knowledge of Bioengineering topics in at least one of the following areas: Biomaterials, Biofabrication and Mechanobiology; Biomedical Imaging and Instrumentation; Cellular, Molecular, and Genome Engineering and Synthetic Biology; Computational and Theoretical Engineering and Biophysics.
- 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 <u>All Graduate Students (https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/)</u>. Students pursuing the MBE degree must complete:

- A minimum of 30-31 credit hours, depending on major concentration and course selection, to satisfy degree requirements.
- A minimum of 30 credit hours of graduate-level study (graduate semester credit hours, coursework at the 500-level or above).
- A minimum of 24 graduate semester credit hours must be taken at Rice University.
- A minimum of 24 graduate semester credit hours must be taken in standard or traditional courses (with a course type of lecture, seminar, laboratory, lecture/laboratory).
- A minimum residency enrollment of one fall or spring semester of part-time graduate study at Rice University.
- A maximum of 2 courses (6 graduate semester credit hours) from transfer credit. For additional departmental guidelines regarding transfer credit, see the *Policies* tab.
- A minimum of 4 courses (12 credit hours) must be taken in departmental (BIOE) courses at Rice with a course type of lecture or lecture/laboratory.
- The requirements for one major concentration. When students apply to the MBE degree program, they must identify and be admitted into one of two major concentrations, either in:
 - Applied Bioengineering (class-only) or Applied Bioengineering (research option): designed as a flexible program for students who will pursue careers in research, medicine, or related fields. This MBE degree major concentration is designed for students to transition to

medical school or a PhD program, or to advance their professional career in the biomedical industry, **or**

- Global Medical Innovation: designed specifically for students who will pursue a career in the global medical technology industry. This MBE degree major concentration is designed to prepare engineers for careers in medical technology through education in innovation, emergingmarket design projects and internships.
- · A minimum overall GPA of 2.67 or higher in all Rice coursework.
- A minimum program 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.

Both major concentrations have the same prerequisites, though applicants will be evaluated considering the different purposes of each. More information about each of these major concentrations can be found below. Curriculum must be approved by the Graduate Academic Affairs Committee and the Bioengineering Department. This is done on a caseby-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 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 <u>Official Certifier (https://registrar.rice.edu/facstaff/degreeworks/officialcertifier/)</u>. 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

| Code | Title | Credit Hours |
|--------------|---|-----------------|
| Total Credit | Hours Required for the MBE Degree and a Major | 30 |
| Concentratio | on in Global Medical Innovation | |

Degree Requirements

| Code | Title | Credit Hours |
|--|--|-----------------|
| Core Requireme | nts | |
| BIOE 627 | MEDICAL INNOVATION INDUSTRY SEMINAR | 1.5 |
| BIOE 628 | MEDICAL TECHNOLOGY DESIGN SEMINAR 2 | 1.5 |
| Major Concentra | ation | |
| Select 1 from the following Major Concentrations (see below for Major Concentration): | | |
| Applied Bioer | ngineering (class-only or research option) | |
| Global Medic | al Innovation | |
| Total Credit Hours | | |

1

RCEL 505

Major Concentration: Global Medical Innovation

Students pursuing the MBE degree with a Global Medical Innovation major concentration must complete:

| Code | Title | Credit Hours |
|--------------------------------------|---|-----------------|
| Core Requirement | ts | |
| Medical Technolo | gy Design | |
| BIOE 527 | HEALTHCARE INNOVATION AND ENTREPRENEURSHIP | 3 |
| BIOE 529 | HEALTHCARE INNOVATION AND ENTREPRENEURSHIP LAB | 3 |
| Medical Technolo | gy Implementation | |
| BIOE 528 | MEDICAL ENGINEERING AND DESIGN LAB | 3 |
| BIOE 530 | MEDICAL ENGINEERING & DESIGN LAB 2 | 3 |
| Internship or Inde | pendent Study ¹ | |
| Select 1 from the f | iollowing: | 6 |
| BIOE 506 | GRADUATE INDEPENDENT STUDY (2 semesters required) | |
| BIOE 600 | GRADUATE BIOENGINEERING INDUSTRY INTERNSHIP | |
| Elective Requirem | nents ² | |
| Elective Category | Quantitative Requirement | |
| Select a minimum | of 3 credit hours from the following: ³ | 3 |
| BIOE 502 / BIOS 505 / SSPB 501 | PHYSICAL BIOLOGY | |
| BIOE 539 | APPLIED STATISTICS FOR BIOENGINEERING AND BIOTECHNOLOGY ³ | |
| BIOE 541 | CELL AND MOLECULAR BIOLOGY FOR ENGINEERS | |
| BIOE 552 / SSPB 502 | INTRO COMPUTATIONAL SYSTEMS BIOLOGY: MODELING & DESIGN PRINCIPLES OF BIOCHEM NETWORKS | |
| BIOE 572 | BIOMECHANICS | |
| RCEL 506 | APPLIED STATISTICS AND DATA SCIENCE FOR ENGINEERING LEADERS | |
| Elective Category | Professional Development | |
| Select a minimum | of 3 credit hours from the following: | 3 |
| ENGI 501 | WORKPLACE COMMUNICATION FOR PROFESSIONAL MASTER'S STUDENTS IN ENGINEERING | |
| ENGI 510 | TECHNICAL AND MANAGERIAL COMMUNICATIONS | |
| ENGI 515 | LEADING TEAMS AND INNOVATION | |
| ENGI 529 / CEVE 529 | ETHICS AND ENGINEERING LEADERSHIP | |
| ENGI 555 | ENGINEERING PERSUASION: HOW TO DRIVE DECISIONS AND CHANGE | |
| ENGI 610 / NSCI 610 | MANAGEMENT FOR SCIENCE AND ENGINEERING | |
| ENGI 615 | LEADERSHIP COACHING FOR ENGINEERS | |
| RCEL 501 | ENGINEERING MANAGEMENT & LEADERSHIP THEORY AND APPLICATION | |
| RCEL 502 | ENGINEERING PROJECT MANAGEMENT | |

| RCEL 542 | PROFESSIONAL COMMUNICATION FOR ENGINEERING LEADERS | |
|--|--|--|
| UNIV 594 | RESPONSIBLE CONDUCT OF RESEARCH | |
| Elective Category | : BIOE General Elective | |
| Select 1 additional course offerings (d above ⁴ | l course from approved departmental (BIOE) or another department) at the 500-level or | 3 |
| Total Credit Hours | s | 27 |
| Footnotes and A This will be corresponsible for with their care Independent S hours total), or Industry International Provided and the McGovern fulfill MBE reading and the 500-lev approval. BIOE 539 or a at the 500-lev approval. Students may it must be releved and the source of the second second and the second se | Additional Information prosidered on a case-by-case basis, and the studen probtaining and selecting an internship that best a ser goals. Students typically take BIOE 506 Gradual tudy for 2 semesters (3 credit hours each for 6 credit r 1 semester of BIOE 600 Graduate Bioengineering iship for 6 credit hours. formally admitted into and specifically pursuing the 1 degrees program, up to 2 courses (6 credit hours) a Medical School at the UT Health Science Center puirements: BIOE 695 Transfer - Foundations of Medi 10E 696 Transfer - Doctoring 1: History and Physical n alternative quantitative-based BIOE course, take el or above, with the advisor/MBE Program Director examplete a course offered by another department evant to the MBE degree. Description of the MBE degree. Description of the MBE degree. Description of the MBE degree. Description of the MBE program handbook, which e: https://gradhandbooks.rice.edu/2023_24/ raduate_Handbook.pdf Tatus Requirements roll for the MBE Degree with a Major Concentration ineering (class-only or optional research experience art-time basis. For the MBE Degree with a Major | nt is aligns ate dit edit from can <i>lical</i> <i>Exam.</i> n or's at, but |
| Concentration in (on a full-time basi the minimum resi programs) all still | Global Medical Innovation, students may only enro is. University graduation requirements (including dency requirement for students in graduate degre apply. | e |
| Transfer Cred | it | |
| For Rice Universit (<u>https://ga.rice.ec</u> <u>regulations-proce</u> and programs hav are encouraged to considering trans | y's policy regarding transfer credit, see <u>Transfer C</u> <u>du/graduate-students/academic-policies-procedur</u> <u>dures-all-degrees/#transfer</u>). Some departments ve additional restrictions on transfer credit. Studer p meet with their academic program's advisor whe fer credit possibilities. | <u>redit</u> r <u>es/</u> nts n |

ENGINEERING ECONOMICS FOR

ENGINEERING LEADERS

Departmental Transfer Credit Guidelines

Students pursuing the MBE degree should be aware of the following departmental transfer credit guidelines:

- No more than 2 courses (6 credit hours) of transfer credit from U.S. or international universities of similar standing as Rice may apply towards the degree.
- Requests for transfer credit will be considered by the program director on an individual case-by-case basis.

Additional Information

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

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

In certain situations and with some terminal master's degree programs, Rice students have an option to pursue a master's degree by adding an additional fifth year to their four years of undergraduate studies.

Advanced Rice undergraduate students in good academic standing typically apply to the master's 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 major advisor and the master's degree 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 <u>here (https://ga.rice.edu/ undergraduate-students/academic-opportunities/undergraduategraduate-concurrent-enrollment/).</u>

Rice undergraduate students completing studies in science and engineering may have the option to pursue the Master of Bioengineering (MBE) degree. For additional information, students should contact their undergraduate major advisor and the MBE program director.

Additional Information

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