

B.S. IN BIOMEDICAL ENGINEERING

<http://www.miami.edu/bme> (<http://www.miami.edu/bme/>)

Dept. Code: BME

Introduction

Biomedical engineering is a multidisciplinary field that addresses problems at the interface of engineering, medicine, and the life sciences. Examples include the design of medical devices, implants and prostheses; the development of new biomaterials or drug delivery systems; the engineering of cells and tissues; the design of optical and laser systems for diagnostic and therapy; the development of medical imaging systems and algorithms for medical image processing; and the acquisition, interpretation and use of physiological signals to assess and control physiological function, such as the use of brain signals to control movement in brain computer interfaces. Biomedical engineering has an impact on virtually all fields of medicine.

The Department of Biomedical Engineering at the University of Miami was formally created in 1979 as a graduate program. The four-year undergraduate program leading to the B.S degree in BME was established approximately ten years later to address the need for professional biomedical engineers. The undergraduate BME program at the University of Miami was the first of its kind in Florida, with the first class of B.S.B.E. students graduating in 1993. It has been continuously accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board of Engineering and Technology (ABET) since 1997. The Department of Biomedical Engineering also offers graduate courses leading to the Master of Science and Doctor of Philosophy degrees and it includes a graduate program in Medical Physics. The PhD program in Biomedical Engineering is also a degree-granting program of the University's MD/PhD program. In addition, qualified undergraduate students may apply for the combined BS/MS program (details are provided following the curricula for the BS degrees).

Graduates of the biomedical engineering undergraduate program find employment in industry or continue their studies either in graduate school or in a professional school in medicine and other health-related disciplines (such as dentistry, optometry, orthotics), law or business.

Some special features of the program include the small class size and open-door policy of the faculty, which facilitates student-faculty interaction. The Department has very strong ties with the University of Miami Miller School of Medicine and with industry. Undergraduate students have a wide range of research and internship opportunities in some of the leading research laboratories in their respective field. The Department strongly encourages undergraduate student participation in research and professional activities.

Program Description

Curriculum

The two educational objectives of the Biomedical Engineering program are achieved via the implementation of a curriculum with four parallel concentrations which include a common core and concentration-specific courses. The core curriculum is designed to provide a broad foundation in the basic sciences and in engineering. Concentration-specific courses provide the depth required to be proficient engineers.

The four concentrations are:

- Biomaterials and Tissue (B)
- Electrical (E),
- Mechanical (M),
- Premedical (P)

The Biomaterials and Tissue concentration provides training in the fundamental aspects of cell and tissue biology, design of biomaterial scaffolds and implants, and the application of tissue engineered constructs toward repair, restoration, and regeneration of damaged cells, tissues and organs. The Electrical concentration provides training in the fundamental aspects of electronics and signal processing, design of instrumentation, sensors, imaging systems and neural interfaces, and the application of biomedical technology to the measurement, control and rehabilitation of tissue and organ function. The Mechanical concentration provides training in the fundamental aspects of solid, fluid, and computational mechanics, design and modeling of biomedical devices such as artificial implants, and prostheses and the application of biomechanical principles toward assessment and restoration of tissue and organ function. The Premedical concentration is designed for students who plan to seek admission to medical school. In addition to providing core training in biomedical engineering, the Premedical concentration ensures that students meet the general requirements for admission to medical school.

The curriculum is designed to provide all graduates with the analytical and design skills required to formulate and solve problems at the interface of engineering, medicine and the life sciences. Required courses in the humanities and social sciences provide students with an awareness of social, ethical and environmental issues related to their profession. The curriculum has been carefully designed with the prerequisite structure in mind so that students have to draw from previously acquired knowledge to complete the upper level course requirements successfully. The curriculum includes two or three technical electives selected by the student based on their individual professional interests. The curriculum places a special emphasis on written and oral communication skills. Many of the Biomedical Engineering courses, as well as the capstone design project, include a requirement for a written term paper and oral presentation on a course-related topic related to the class.

Advanced Writing and Communication Skills

Biomedical Engineering students satisfy the University's Advanced Writing and Communication Skills requirement by completing a set of classroom courses, laboratory courses and design courses where they learn effective oral, graphical and technical writing skills.

Design Experience

The biomedical engineering design experience is integrated in the curriculum throughout the four years of study, starting in the freshman year with the Introduction to Biomedical Engineering course. Each semester includes classroom or laboratory courses which place a heavy emphasis on theoretical and practical biomedical engineering design concepts. In the second semester of the junior year, students complete a 3 credit-hour course which covers the principles of biomedical engineering design, from problem identification and design conception to implementation and testing, including regulatory aspects. The design experience culminates in the senior year with a yearlong capstone Senior Design Project. The Senior Design Project is typically completed by teams of two to four students who build on their knowledge and previous design experience to solve one major design problem which integrates the various components of the curriculum.

Teaching and Design Laboratories

The Department of Biomedical Engineering houses several teaching laboratories which provide students hands-on experience in core areas of the curriculum, including cell and tissue engineering, tissue mechanics, medical instrumentation, measurements, and optics and physiology, among others. In particular, the Ben-Josef Cell and Tissue Laboratory provides undergraduate and graduate students a unique opportunity to gain hand-on experience in the field of cell and tissue engineering, biomaterials and tissue mechanics. The Department also houses a state-of-the art Scanning Electron Microscope and 3D printer which are used by students in their design and research projects. In addition, students have access to the College of Engineering's maker space and Johnson & Johnson 3D Printing Center of Excellence Collaborative Laboratory. The facility provides access to a wide variety of advanced 3-D printers and fabrication equipment, and has a full-time engineer/scientist available for training purposes. Students can use the facility for their design projects.

Undergraduate Research and Internships

Biomedical Engineering students are strongly encouraged to gain research or professional experience through internships. Most undergraduate students conduct research in laboratories at the Department of Biomedical Engineering and at the School of Medicine, or are hired as interns by the local biomedical industry.

Degree Programs

The department offers one degree program with four concentrations: Electrical, Mechanical, Biomaterials and Tissue, and Premed. A list of the core science and engineering courses common to all four concentrations is provided below, followed by a tabular listing of the course requirements for the degree Bachelor of Science in Biomedical Engineering for each concentration.

Dual Major

The College of Engineering offers a dual major in Biomedical Engineering for students that are majoring in another engineering Department. In order to obtain the dual major in Biomedical Engineering, the student will have to obtain, in parallel, a major in one of the fundamental engineering programs, plus 24 credit hours of course work, including 19 credit hours of required course work and 5 credit hours of elective course work from the lists given below. Of this total of 24 credit hours, at least 12 have to be at the level of 400 and above.

The required courses for the dual major are:

Code	Title	Credit Hours
BME 265	Medical Systems Physiology	3
BME 335	Biomaterials	3
BME 375	Fundamentals of Biomechanics	3
BME 440	Biomedical Measurements	4
BME 470	Biomedical Signal Analysis	3
BME 480	Biomedical Instrumentation	3
Total Credit Hours		19

The electives are to be chosen from the BME course list.

Curriculum Requirements

Biomaterials and Tissue Concentration

Students in the Biomaterials and Tissue concentration are required to complete the following courses:

Code	Title	Credit Hours
Engineering Courses		
BME 111	Introduction to Engineering I	3
BME 112	Introduction to Biomedical Engineering	2
BME 211	Introduction to Programming for Biomedical Engineers	3
BME 266	Human Physiology Laboratory	1
BME 302	Cellular Engineering	3
BME 303	Cell Engineering Lab	1
BME 310	Mathematical Analysis in Biomedical Engineering	3
BME 330	Foundations of Medical Imaging	3
BME 335	Biomaterials	3
BME 375	Fundamentals of Biomechanics	3
BME 401	Biomedical Design	3
BME 402	Senior Design I	2
BME 403	Senior Design II	1
BME 440	Biomedical Measurements	4
BME 450	Biomedical Transport Phenomena	3
BME 470	Biomedical Signal Analysis	3
BME 480	Biomedical Instrumentation	3
BME 512	Regulatory Control of Biomedical Devices	3
BME 535	Advanced Biomaterials	3
BME 565	Principles of Cellular and Tissue Engineering	3
BME 567	Tissue Engineering Lab	1
ECE 201	Electrical Circuit Theory	3
Technical Electives		6
Math and Science Courses		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
BME 265	Medical Systems Physiology	3
BME 312	Biomedical Statistics and Data Analysis	3
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
CHM 205	Chemical Dynamics Laboratory	1
CHM 221	Introduction to Structure and Dynamics	4
MTH 151	Calculus I for Engineers	5
MTH 162	Calculus II	4
MTH 311	Introduction to Ordinary Differential Equations	3
PHY 221	University Physics I	3
PHY 222	University Physics II	3
PHY 223	University Physics III	3
PHY 224	University Physics II Lab	1
PHY 225	University Physics III Lab	1
Additional Requirements		
ENG 105	English Composition I	3
ENG 107	English Composition II: Science and Technology	3
Arts and Humanities Cognate		9
People and Society Cognate		9
Total Credit Hours		131

Curriculum Requirements

Electrical Concentration

Students in the Electrical concentration are required to complete the following courses:

Code	Title	Credit Hours
Engineering Courses		
BME 111	Introduction to Engineering I	3
BME 112	Introduction to Biomedical Engineering	2
BME 211	Introduction to Programming for Biomedical Engineers	3
BME 266	Human Physiology Laboratory	1
BME 310	Mathematical Analysis in Biomedical Engineering	3
BME 330	Foundations of Medical Imaging	3
BME 335	Biomaterials	3
BME 375	Fundamentals of Biomechanics	3
BME 401	Biomedical Design	3
BME 402	Senior Design I	2
BME 403	Senior Design II	1
BME 440	Biomedical Measurements	4
BME 450	Biomedical Transport Phenomena	3
BME 470	Biomedical Signal Analysis	3
BME 480	Biomedical Instrumentation	3
BME 507	LabView Applications for Biomedical Engineering	1
BME 512	Regulatory Control of Biomedical Devices	3
BME 540	Microcomputer-Based Medical Instrumentation	3
BME 541	Medical Electronic Systems Laboratory	2
ECE 201	Electrical Circuit Theory	3
ECE 202	Electronics I	3
ECE 203	Electrical Circuits Laboratory	1
ECE 211	Logic Design	3
ECE 315	Digital Design Laboratory	1
Technical Electives		6
Technical Elective Lab		1
Math and Science Courses		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
BME 265	Medical Systems Physiology	3
BME 312	Biomedical Statistics and Data Analysis	3
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
MTH 151	Calculus I for Engineers	5
MTH 162	Calculus II	4
MTH 311	Introduction to Ordinary Differential Equations	3
PHY 221	University Physics I	3
PHY 222	University Physics II	3
PHY 223	University Physics III	3
PHY 224	University Physics II Lab	1
PHY 225	University Physics III Lab	1
Additional Requirements		
ENG 105	English Composition I	3
ENG 107	English Composition II: Science and Technology	3
Arts and Humanities Cognate		9

People and Society Cognate	9
Total Credit Hours	130

Curriculum Requirements

Mechanical Concentration

Students in the Mechanical concentration are required to complete the following courses:

Code	Title	Credit Hours
Engineering Courses		
BME 111	Introduction to Engineering I	3
BME 112	Introduction to Biomedical Engineering	2
BME 211	Introduction to Programming for Biomedical Engineers	3
BME 266	Human Physiology Laboratory	1
BME 303 or ECE 303	Cell Engineering Lab Electronics Laboratory	1
BME 310	Mathematical Analysis in Biomedical Engineering	3
BME 330	Foundations of Medical Imaging	3
BME 335	Biomaterials	3
BME 375	Fundamentals of Biomechanics	3
BME 401	Biomedical Design	3
BME 402	Senior Design I	2
BME 403	Senior Design II	1
BME 440	Biomedical Measurements	4
BME 450	Biomedical Transport Phenomena	3
BME 460	Introduction to Physiological Fluid Mechanics	3
BME 470	Biomedical Signal Analysis	3
BME 480	Biomedical Instrumentation	3
BME 506	Computer Aided Design in Biomedical Engineering	1
BME 512	Regulatory Control of Biomedical Devices	3
BME 575	Tissue Mechanics	3
ECE 201	Electrical Circuit Theory	3
CAE 210	Mechanics of Solids I	3
MAE 202	Dynamics	3
Technical Electives		6
Technical Elective Lab		1
Math and Science Courses		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
BME 265	Medical Systems Physiology	3
BME 312	Biomedical Statistics and Data Analysis	3
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
MTH 151	Calculus I for Engineers	5
MTH 162	Calculus II	4
MTH 311	Introduction to Ordinary Differential Equations	3
PHY 221	University Physics I	3
PHY 222	University Physics II	3
PHY 223	University Physics III	3
PHY 224	University Physics II Lab	1
PHY 225	University Physics III Lab	1
Additional Requirements		
ENG 105	English Composition I	3

ENG 107	English Composition II: Science and Technology	3
Arts and Humanities Cognate		9
People and Society Cognate		9
Total Credit Hours		130

Curriculum Requirements

Pre-Med Concentration

Students in the Pre-Med concentration are required to complete the following courses:

Code	Title	Credit Hours
Engineering Courses		
BME 111	Introduction to Engineering I	3
BME 112	Introduction to Biomedical Engineering	2
BME 211	Introduction to Programming for Biomedical Engineers	3
BME 266	Human Physiology Laboratory	1
BME 303	Cell Engineering Lab	1
BME 310	Mathematical Analysis in Biomedical Engineering	3
BME 330	Foundations of Medical Imaging	3
BME 335	Biomaterials	3
BME 375	Fundamentals of Biomechanics	3
BME 401	Biomedical Design	3
BME 402	Senior Design I	2
BME 403	Senior Design II	1
BME 440	Biomedical Measurements	4
BME 450	Biomedical Transport Phenomena	3
BME 470	Biomedical Signal Analysis	3
BME 480	Biomedical Instrumentation	3
BME 512	Regulatory Control of Biomedical Devices	3
ECE 201	Electrical Circuit Theory	3
Advanced Bioscience Elective		6
Technical Elective		3
Technical Elective Lab		1
Technical or Science Lab Elective		1
Math and Science Courses		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
BIL 160	Evolution and Biodiversity	4
BIL 161	Evolution and Biodiversity Laboratory	1
BME 265	Medical Systems Physiology	3
BME 312	Biomedical Statistics and Data Analysis	3
CHM 113	Chemistry Laboratory I	1
CHM 121	Principles of Chemistry	4
CHM 205	Chemical Dynamics Laboratory	1
CHM 221	Introduction to Structure and Dynamics	4
MTH 151	Calculus I for Engineers	5
MTH 162	Calculus II	4
MTH 311	Introduction to Ordinary Differential Equations	3
PHY 221	University Physics I	3
PHY 222	University Physics II	3
PHY 223	University Physics III	3
PHY 224	University Physics II Lab	1
PHY 225	University Physics III Lab	1

Additional Requirements		
ENG 105	English Composition I	3
ENG 107	English Composition II: Science and Technology	3
Arts and Humanities Cognate		9
People and Society Cognate		9
Total Credit Hours		133

Suggested Plan of Study

Biomaterials and Tissue Concentration

Freshman Year		
Fall		Credit Hours
BME 111	Introduction to Engineering I	3
ENG 105	English Composition I	3
MTH 151	Calculus I for Engineers	5
PHY 221	University Physics I	3
PS/HA Cognate ¹		3
Credit Hours		17
Spring		
BME 112	Introduction to Biomedical Engineering	2
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
ENG 107	English Composition II: Science and Technology	3
MTH 162	Calculus II	4
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
Credit Hours		18
Sophomore Year		
Fall		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
BME 302	Cellular Engineering	3
BME 303	Cell Engineering Lab	1
ECE 201	Electrical Circuit Theory	3
MTH 311	Introduction to Ordinary Differential Equations	3
PHY 223	University Physics III	3
Credit Hours		18
Spring		
BME 211	Introduction to Programming for Biomedical Engineers	3
BME 265	Medical Systems Physiology	3
BME 266	Human Physiology Laboratory	1
CHM 221	Introduction to Structure and Dynamics	4
CHM 205	Chemical Dynamics Laboratory	1
BME 310	Mathematical Analysis in Biomedical Engineering	3
PHY 225	University Physics III Lab	1
Credit Hours		16
Junior Year		
Fall		
BME 312	Biomedical Statistics and Data Analysis	3
BME 330	Foundations of Medical Imaging	3
BME 335	Biomaterials	3
BME 375	Fundamentals of Biomechanics	3

PS/HA Cognate ¹		3
	Credit Hours	15
Spring		
BME 401	Biomedical Design	3
BME 450	Biomedical Transport Phenomena	3
BME 470	Biomedical Signal Analysis	3
PS/HA Cognate ¹		6
	Credit Hours	15
Senior Year		
Fall		
BME 402	Senior Design I	2
BME 440	Biomedical Measurements	4
BME 565	Principles of Cellular and Tissue Engineering	3
BME 567	Tissue Engineering Lab	1
Technical Elective ²		3
PS/HA Cognate ¹		3
	Credit Hours	16
Spring		
BME 403	Senior Design II	1
BME 480	Biomedical Instrumentation	3
BME 512	Regulatory Control of Biomedical Devices	3
BME 535	Advanced Biomaterials	3
Technical Elective ²		3
PS/HA Cognate ¹		3
	Credit Hours	16
	Total Credit Hours	131

¹ PS/HA Cognate: Students must complete a minimum of 1 People & Society (PS) cognate and 1 Humanities & Arts (HA) cognate, to be selected from the list of available cognates (<https://cognates.miami.edu/>). Each cognate should be a minimum of 3 courses (9 credit hours).

² Technical Electives are chosen from the BME course offerings (300 level and above) with the approval of the advisor. Any other courses selected need to be approved by the advisor and the chairperson.

Suggested Plan of Study

Electrical Concentration

Freshman Year		
Fall		Credit Hours
BME 111	Introduction to Engineering I	3
ENG 105	English Composition I	3
MTH 151	Calculus I for Engineers	5
PHY 221	University Physics I	3
PS/HA Cognate ¹		3
	Credit Hours	17
Spring		
BME 112	Introduction to Biomedical Engineering	2
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
ENG 107	English Composition II: Science and Technology	3
MTH 162	Calculus II	4
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
	Credit Hours	18

Sophomore Year		
Fall		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
ECE 201	Electrical Circuit Theory	3
MTH 311	Introduction to Ordinary Differential Equations	3
PHY 223	University Physics III	3
PS/HA Cognate ¹		3
Credit Hours		17
Spring		
BME 211	Introduction to Programming for Biomedical Engineers	3
BME 265	Medical Systems Physiology	3
BME 266	Human Physiology Laboratory	1
BME 310	Mathematical Analysis in Biomedical Engineering	3
ECE 203	Electrical Circuits Laboratory	1
PHY 225	University Physics III Lab	1
PS/HA Cognate ¹		3
Credit Hours		15
Junior Year		
Fall		
BME 312	Biomedical Statistics and Data Analysis	3
BME 375	Fundamentals of Biomechanics	3
BME 450	Biomedical Transport Phenomena	3
ECE 202	Electronics I	3
ECE 211	Logic Design	3
Credit Hours		15
Spring		
BME 330	Foundations of Medical Imaging	3
BME 335	Biomaterials	3
BME 401	Biomedical Design	3
BME 440	Biomedical Measurements	4
ECE 315	Digital Design Laboratory	1
PS/HA Cognate ¹		3
Credit Hours		17
Senior Year		
Fall		
BME 402	Senior Design I	2
BME 470	Biomedical Signal Analysis	3
BME 507	LabView Applications for Biomedical Engineering	1
BME 512	Regulatory Control of Biomedical Devices	3
Technical Elective ²		3
PS/HA Cognate ¹		3
Credit Hours		15
Spring		
BME 403	Senior Design II	1
BME 480	Biomedical Instrumentation	3
BME 540	Microcomputer-Based Medical Instrumentation	3
BME 541	Medical Electronic Systems Laboratory	2
Technical Elective ²		3
Technical Elective Lab ³		1

PS/HA Cognate ¹	3
Credit Hours	16
Total Credit Hours	130

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² Technical Electives are chosen from BME course offerings (300 level & above) with the approval of the advisor. Any other course selected needs to be approved by the advisor and the department chairperson.

³ Technical Elective Lab is selected from BME 303, BME 495, OR BME 506.

Suggested Plan of Study

Mechanical Concentration

Freshman Year		Credit Hours
Fall		
BME 111	Introduction to Engineering I	3
ENG 105	English Composition I	3
MTH 151	Calculus I for Engineers	5
PHY 221	University Physics I	3
PS/HA Cognate ¹		3
Credit Hours		17
Spring		
BME 112	Introduction to Biomedical Engineering	2
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
ENG 107	English Composition II: Science and Technology	3
MTH 162	Calculus II	4
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
Credit Hours		18
Sophomore Year		
Fall		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
BME 211	Introduction to Programming for Biomedical Engineers	3
ECE 201	Electrical Circuit Theory	3
MTH 311	Introduction to Ordinary Differential Equations	3
PS/HA Cognate ¹		3
Credit Hours		17
Spring		
BME 265	Medical Systems Physiology	3
BME 266	Human Physiology Laboratory	1
CAE 210	Mechanics of Solids I	3
PHY 223	University Physics III	3
PHY 225	University Physics III Lab	1
ECE 203 or BME 303	Electrical Circuits Laboratory or Cell Engineering Lab	1
PS/HA Cognate ¹		3
Credit Hours		15
Junior Year		
Fall		
BME 310	Mathematical Analysis in Biomedical Engineering	3
BME 312	Biomedical Statistics and Data Analysis	3

BME 330	Foundations of Medical Imaging	3
BME 440	Biomedical Measurements	4
MAE 202	Dynamics	3
Credit Hours		16
Spring		
BME 335	Biomaterials	3
BME 375	Fundamentals of Biomechanics	3
BME 401	Biomedical Design	3
BME 460	Introduction to Physiological Fluid Mechanics	3
PS/HA Cognate ¹		3
Credit Hours		15
Senior Year		
Fall		
BME 402	Senior Design I	2
BME 480	Biomedical Instrumentation	3
BME 506	Computer Aided Design in Biomedical Engineering	1
BME 575	Tissue Mechanics	3
Technical Elective ²		3
Technical Elective Lab ³		1
PS/HA Cognate ¹		3
Credit Hours		16
Spring		
BME 403	Senior Design II	1
BME 450	Biomedical Transport Phenomena	3
BME 470	Biomedical Signal Analysis	3
BME 512	Regulatory Control of Biomedical Devices	3
Technical Elective ²		3
PS/HA Cognate ¹		3
Credit Hours		16
Total Credit Hours		130

¹ PS/HA Cognate: Students must complete a minimum of 1 People & Society (PS) cognate and 1 Humanities & Arts (HA) cognate, to be selected from the list of available cognates (<https://cognates.miami.edu/>). Each cognate should be a minimum of 3 courses (9 credit hours).

² Technical Electives are chosen from the BME course offerings (300 level and above) with the approval of the advisor. Any other courses selected need to be approved by the advisor and the department chairperson.

³ Technical Elective Lab is selected from BME 303, BME 495, BME 507 or BME 567.

Suggested Plan of Study

Pre-Med Concentration

Freshman Year		
Fall		Credit Hours
BME 111	Introduction to Engineering I	3
ENG 105	English Composition I	3
MTH 151	Calculus I for Engineers	5
PHY 221	University Physics I	3
PS/HA Cognate ¹		3
Credit Hours		17
Spring		
BME 112	Introduction to Biomedical Engineering	2
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
ENG 107	English Composition II: Science and Technology	3

MTH 162	Calculus II	4
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
Credit Hours		18
Sophomore Year		
Fall		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
BME 211	Introduction to Programming for Biomedical Engineers	3
ECE 201	Electrical Circuit Theory	3
MTH 311	Introduction to Ordinary Differential Equations	3
CHM 221	Introduction to Structure and Dynamics	4
Credit Hours		18
Spring		
BIL 160	Evolution and Biodiversity	4
BIL 161	Evolution and Biodiversity Laboratory	1
BME 265	Medical Systems Physiology	3
BME 266	Human Physiology Laboratory	1
PHY 223	University Physics III	3
CHM 205	Chemical Dynamics Laboratory	1
CHM 222	Organic Reactions and Synthesis ⁴	4
Credit Hours		17
Junior Year		
Fall		
BME 303	Cell Engineering Lab	1
BME 310	Mathematical Analysis in Biomedical Engineering	3
BME 335	Biomaterials	3
PHY 225	University Physics III Lab	1
CHM 206	Organic Reactions and Synthesis Laboratory ⁵	2
BMB 401	Biochemistry for the Biomedical Sciences ⁴	4
PS/HA Cognate ¹		3
Credit Hours		17
Spring		
BME 312	Biomedical Statistics and Data Analysis	3
BME 375	Fundamentals of Biomechanics	3
BME 401	Biomedical Design	3
BME 440	Biomedical Measurements	4
PS/HA Cognate ¹		3
Credit Hours		16
Senior Year		
Fall		
BME 330	Foundations of Medical Imaging	3
BME 402	Senior Design I	2
BME 470	Biomedical Signal Analysis	3
BME 512	Regulatory Control of Biomedical Devices	3
Technical Elective Lab ³		1
PS/HA Cognate ¹		3
Credit Hours		15
Spring		
BME 403	Senior Design II	1
BME 450	Biomedical Transport Phenomena	3
BME 480	Biomedical Instrumentation	3

Technical Elective ²	3
PS/HA Cognate ¹	6
Credit Hours	16
Total Credit Hours	134

- ¹ PS/HA Cognate: Students must complete a minimum of 1 People & Society (PS) cognate and 1 Humanities & Arts (HA) cognate, to be selected from the list of available cognates (<https://cognates.miami.edu/>). Each cognate should be a minimum of 3 courses (9 credit hours). Students in the Pre-Med concentration are highly encouraged to choose cognates that include PSY 110 and SOC 101.
- ² Technical Electives are chosen from BME course offerings (300 level & above) with the approval of the advisor. Any other course selected needs to be approved by the advisor and the department chairperson.
- ³ Technical Lab Elective is selected from BME 495, BME 506, BME 507, or BME 567.
- ⁴ Can be replaced with an Advanced Bioscience Elective chosen from BIL 250, BIL 255, BIL 268, CHM 222 or BMB 401. Note that CHM 222 is a pre-requisite for BMB 401. Students should verify admission requirements of their medical school of interest to verify Adv. Bioscience requirements, e.g. organic chemistry II, biochemistry, or both.
- ⁵ Can be replaced with a science lab that complements the Advanced Bioscience Elective, see footnote 4 (e.g., CHM or BIL lab).

Mission

The mission of the biomedical engineering program is to prepare future leaders in biomedical engineering who are motivated to create a positive impact on human health, medicine, and industry.

Program Educational Objectives

Within a few years after graduation, the graduates of the Department of Biomedical Engineering will be:

- Working as professionals in industry, research, entrepreneurship, and medicine with high ethical standards.
- Building careers across disciplinary boundaries while promoting a culture of inclusion.
- Engaging in their self-development through professional development activities or the pursuit of post-graduate education.

Student Learning Outcomes

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.