Biomedical Engineering- Bachelor of Science in Engineering

For information, contact the Department of Chemical, Paper and Biomedical Engineering, 64 Engineering Building, 513-529-0760.

This program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Biomedical engineering is the integration of life sciences with engineering to develop solutions for healthcare related problems. The program uses a multi-disciplinary approach, deriving its strength from biology, chemistry, physics, mathematics and engineering disciplines as well as computational sciences. Together, these enable the graduate to design, analyze, synthesize, and test products and processes in a variety of areas, such as medical equipment and instrumentation, pharmaceuticals, biotechnology, prosthetics and biomaterials. Graduates may also choose to pursue advanced study in graduate or professional degree programs.

The biomedical engineering program provides the student with a broad biomedical engineering education enhanced by liberal arts courses in life sciences, economics, humanities, social sciences, and global perspectives.

Within the biomedical engineering curriculum, students can specialize in Biomechanics, Biomedical Materials, Clinical Engineering and Bioinstrumentation, or Pre-Medicine. Organizations that employ biomedical engineers include manufacturers of medical devices, equipment and prosthetics, hospitals, clinical laboratories, pharmaceutical companies, biotechnology companies, and high-level consulting companies.

Program Educational Objectives

The undergraduate Biomedical Engineering program at Miami University focuses on the integration of interdisciplinary engineering sciences, biological sciences, engineering design and a global liberal education. Based on the needs of our constituents, we expect a graduate to attain the following within a few years of graduation:

1. The graduate will have interdisciplinary training in biomedical engineering that will allow them to have successful careers in industry, research and development, plant design and manufacturing, and in regulatory/governmental, academic, and clinical work.
2. The graduate will have the ability to work with individuals from diverse backgrounds to meet professional obligations and will contribute to an inclusive and equitable workplace.
3. The graduate will have independent critical thinking, problem solving, communication, organizations, and leadership skills that can be applied to support interdisciplinary teams that may include physicians, cell and molecular biologists, physiologists, geneticists, and other engineers.
4. The graduate will have life-long learning skills and awareness of ethical responsibilities that will allow successful adaptation to the rapidly changing field of biomedical engineering.
5. The graduate will have sound training in mathematics, the biological sciences, liberal arts, engineering and sciences that will facilitate successful pursuit of advanced degrees in medicine, law, business, and engineering or related fields.

Student Outcomes

These student outcomes prepare our graduates to attain the program educational objectives listed above, and should be attained by students by the time they graduate.

1. Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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. Ability to communicate effectively with a range of audiences.
4. 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. 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. Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Credit/No-credit Policy

All courses in chemistry, physics, biology, mathematics, statistics and those in the College of Engineering and Computing (CPB, CSE, ECE, EGM, MME, CEC) that are used to fulfill requirements of the major, must be taken for a grade.

Divisional Policy

DOUBLE MAJORS: Students with two majors in the College of Engineering and Computing must take a minimum of 15 different/additional credit hours in their second major beyond the requirements of their first major.

Grade Requirements

You must earn a grade of C or better in CPB 204.

Program Requirements

The Biomedical Engineering major requires the following courses. Additional hours to meet the Miami Plan for Liberal Education are also required.

Code	Title	Credit Hours
Physics		
PHY 181	General Physics I	4
PHY 182	General Physics II	4
Chemistry		
CHM 141 & CHM 144	College Chemistry and College Chemistry Laboratory	5

CHM 142 & CHM 145	College Chemistry and College Chemistry Laboratory	5
Mathematics and Statistics		
MTH 151	Calculus I	4
MTH 251	Calculus II	4-5
or MTH 249	Calculus II	
MTH 245	Differential Equations for Engineers	3-4
or MTH 246	Linear Algebra and Differential Equations for Engineers	
STA 301	Applied Statistics	3-4
or STA 261	Statistics	
Biological Sciences		
BIO/MBI 116	Biological Concepts: Structure, Function, Cellular, and Molecular Biology	4
BIO 203	Introduction to Cell Biology	3
BIO 305	Human Physiology	4
Advanced Writing		
ENG 313	Technical Writing	3
Core Biomedical Engineering Courses		
CSE 174	Fundamentals of Programming and Problem Solving	3
CEC 111	Imagination, Ingenuity and Impact I	2
CEC 112	Imagination, Ingenuity, and Impact II	2
CPB 219	Statics and Mechanics of Materials	3
CPB 204	Mass and Energy Balances I	2
CPB/MME 314	Engineering Thermodynamics	3
CPB 318	Transport Phenomena I	4
CPB 324	Chemical and Bio- Engineering Computation and Statistics	3
CPB/MME 341	Engineering Economics	3
CPB 328	Bioinstrumentation	3
CPB 419	Biomaterials	3
CPB 423	Biomechanics	3
CPB 417	Biomedical Engineering	3
CPB 421	Bioethics	1
CPB 471 & CPB 472	Engineering Design I and Engineering Design II	4
ECE 205	Electric Circuit Analysis I	4
Biomedical Engineering Electives		
Select two of the following:		6
CPB 416	Biochemical Engineering	
CPB 424	Musculoskeletal Biomechanics	
CPB 426	Fundamentals of Tissue Engineering	
CPB 428	Engineering Principles in Medical Device Design	
ECE 306	Signals and Systems	
ECE 426	Biomedical Signal Analysis and Machine Learning	
CPB 445	Hospital Instrumentation	
CPB 453	Medical Device Development and Regulatory Considerations	
Non-Biomedical Engineering Electives		
Select one of the following:		3-5
CPB 448	Hospital Rotation	
CPB 452	Introduction to FDA Regulations and Medical Device Laws	
CSE 456	Bioinformatic Principles	
KNH 381 & 381L	Biodynamics of Human Performance and Biodynamics of Human Performance Lab	
CHM 231	Fundamentals of Organic Chemistry	
CHM 241 & CHM 244	Organic Chemistry and Organic Chemistry Laboratory	
CHM 242 & CHM 245	Organic Chemistry and Organic Chemistry Laboratory	
CHM 332 & 332L	Outlines of Biochemistry and Outlines of Biochemistry Lab	
CHM 432	Fundamentals of Biochemistry	
Total Credit Hours		**101-106**