

BIOMEDICAL ENGINEERING

The biomedical engineering (BME) field has grown rapidly in the last 20 years. This growth was fueled by breakthroughs in molecular biology and many engineering technologies, symbolized by the Human Genome Project, arguably the greatest biomedical engineering accomplishment ever, and realized with creation of the National Institute of Biomedical Imaging and Bioengineering. BME now is clearly recognized as an integral part of the nation's and the world's efforts to deliver more effective and efficient medical care.

About this Program

- **College:** Herbert Wertheim College of Engineering
- **Degree:** Bachelor of Science in Biomedical Engineering
- **Credits for Degree:** 131
- **Additional Information**

To graduate with this major, students must complete all university, college, and major requirements.

A biomedical engineer uses traditional engineering expertise to analyze and solve problems in biology and medicine, providing an overall enhancement of health care. Students choose biomedical engineering to serve people, to work with living systems and to apply advanced technology to the complex problems of medical care. The biomedical engineer is called upon to design instruments, devices and software, to bring together knowledge from many technical sources to develop new procedures and to conduct the research needed to solve clinical problems.

Bioengineering integrates sciences and engineering for the study of biology, medicine, behavior or health. It advances fundamental concepts, creates knowledge for the molecular to the organ systems levels, and develops innovative biologics, materials, processes, implants and devices. Biomedical engineers create informatics approaches to prevent, diagnose and treat disease, applying systematic, quantitative and integrative thinking and solutions to problems important to biology, medical research and population studies.

BME typically is among the three most popular engineering majors and very often is the largest. The job market in biomedical engineering is the fastest growing of all engineering disciplines. It has become clear that the nation needs a variety of engineers with knowledge of biomedicine, including a cadre of exceptional people whose education thoroughly immerses them in engineering and biomedicine. The intellectual foundation of this limited-access undergraduate program is captured in this vision: Biomedicine comprises the science core while engineering provides the framework for inquiry. The curriculum incorporates exceptional rigor in both.

Educational Objectives

The program educational objectives of the J. Crayton Pruitt Family Department of Biomedical Engineering at the University of Florida are that:

1. Graduates will excel in top graduate programs of professional schools and will have successful careers in a multi-disciplinary, global industry.

2. Graduates will be active leaders in their profession, creating innovative, ethical and socially beneficial solutions to human health problems.

Department Vision Statement

The faculty, students, and alumni of the J. Crayton Pruitt Family Department of Biomedical Engineering will lead in the discovery and development of innovative biomedical solutions to improve healthcare in the State of Florida and worldwide. To achieve this vision, the department will leverage the unique co-localization of talent and resources in engineering, biology, medicine, veterinary science, dentistry, and technology commercialization at the University of Florida, thereby maximizing opportunities for interdisciplinary student education and clinical translation of technologies to improve human health.

Department Mission

The J. Crayton Pruitt Family Department of Biomedical Engineering at the University of Florida is dedicated to developing innovative and clinically translatable biomedical technologies, educating future generations of biomedical engineers, and cultivating leaders, by nurturing the integration of engineering, science, and healthcare in a collaborative and dynamic educational and research environment.

Admission Requirements

The biomedical engineering undergraduate major is a limited enrollment program. Students who enter the University of Florida as freshmen identify pre-BME as their major of choice and begin enrolling in the required critical tracking courses to prepare for upper division.

During the fall semester of sophomore year (semester 3), pre-BME majors apply for admission to the upper division major, which begins in the spring semester of sophomore year (semester 4).

Current UF students must meet the following minimum requirements to be considered for admission to the upper division program.

- Minimum 3.0 grade point average in critical tracking courses (best attempt)*
- No more than two attempts allowed for each critical tracking course (withdrawals included)
- Minimum grade of C in each critical tracking course
- Completion of the first three semesters of the Model Plan of Study by Fall semester of application
- BME Departmental online application

*Only the best attempt in each critical tracking course is considered for admission to the upper division program.

All application requirements and details are available on the department website.

Department Requirements

Minimum grades of C are required for BME 3508, BME 3053C, CHM 3217, COP 2271, COP 2271L, EEL 3003, and ENC 3246. The minimum C grade is part of the prerequisite requirement for several 3000/4000-level BME courses. The prerequisite course and subsequent course cannot be taken in the same term, even if the prerequisite is being repeated.

All BME Electives must be selected from an approved list. Students may petition to take courses not included in the approved list toward

this requirement. The BME Electives allow students to explore topic areas within their interests and are designed to build upon biomedical engineering foundation courses and laboratories.

A biomedical engineering student whose cumulative, upper-division or department grade point average falls below a 2.0 or whose critical tracking grades do not meet department requirements will be placed on academic probation and be required to complete a probation contract with a BME academic advisor. Students normally are allowed a maximum of two terms (consecutive or non-consecutive) on academic probation. Students who do not satisfy the conditions of the first term of probation may be dismissed from the department.

All graduating seniors must complete an exit interview with their advisor before graduating.

Critical Tracking

Critical Tracking records each student's progress in courses that are required for entry to each major. Please note the critical-tracking requirements below on a per-semester basis.

Equivalent critical-tracking courses as determined by the State of Florida Common Course Prerequisites may be used for transfer students.

Semester 1

- Complete 3 of 11 critical-tracking courses with minimum grades of C within two attempts: BSC 2010; CHM 2045 or CHM 2095; CHM 2046 or CHM 2096; MAC 2311, MAC 2312, MAC 2313, MAP 2302, PHY 2048; PHY 2049; BME 3060 and PCB 3713C
- 3.0 GPA required for all critical-tracking courses
- 3.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 2

- Complete 3 additional critical-tracking courses with minimum grades of C within two attempts
- 3.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 3

- Complete 2 additional critical-tracking courses with minimum grades of C within two attempts
- 3.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 4

- Complete all critical-tracking courses with minimum grades of C within two attempts
- 3.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Model Semester Plan

To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold. These courses must be completed by the terms as listed above in the Critical Tracking criteria.

This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student's

academic record and scheduling availability of courses. Prerequisites still apply.

This program is limited access and competitive. Students cannot register for courses in semesters 5-8 before they have been admitted to the biomedical engineering major.

Course	Title	Credits
Semester One		
BME 1008	Introduction to Biomedical Engineering	1
BSC 2010	Integrated Principles of Biology 1 (Critical Tracking ; Gen Ed Biological Sciences)	3
BSC 2010L	Integrated Principles of Biology Laboratory 1 (Gen Ed Biological and Physical Sciences)	1
Select one:		3
CHM 2045	General Chemistry 1 (Critical Tracking ; Gen Ed Physical Sciences)	
CHM 2095	Chemistry for Engineers 1 (Critical Tracking)	
CHM 2045L	General Chemistry 1 Laboratory (Gen Ed Physical Sciences)	1
IUF 1000	What is the Good Life (Gen Ed Humanities)	3
MAC 2311	Analytic Geometry and Calculus 1 (Critical Tracking ; Gen Ed Mathematics)	4
		Credits
		16
Semester Two		
Select one:		3
CHM 2046	General Chemistry 2 (Critical Tracking ; Gen Ed Physical Sciences)	
CHM 2096	Chemistry for Engineers 2 (Critical Tracking)	
CHM 2046L	General Chemistry 2 Laboratory (Gen Ed Physical Sciences)	1
ENC 1101	Expository and Argumentative Writing (State Core Gen Ed Composition; Writing Requirement: 6,000 words)	3
MAC 2312	Analytic Geometry and Calculus 2 (Critical Tracking ; State Core Gen Ed Mathematics)	4
PHY 2048	Physics with Calculus 1 (Critical Tracking ; State Core Gen Ed Physical Sciences)	3
PHY 2048L	Laboratory for Physics with Calculus 1 (Gen Ed Physical Sciences)	1
		Credits
		15
Semester Three		
CHM 3217	Organic Chemistry/Biochemistry 1 ¹	4
COP 2271	Computer Programming for Engineers ⁴	2
COP 2271L	Computer Programming for Engineers Laboratory ⁴	1
MAC 2313	Analytic Geometry and Calculus 3 (Critical Tracking ; Gen Ed Mathematics)	4
PHY 2049	Physics with Calculus 2 (Critical Tracking ; Gen Ed Physical Sciences)	3
PHY 2049L	Laboratory for Physics with Calculus 2 (Gen Ed Physical Sciences)	1
		Credits
		15
Semester Four		
BME 3053C	Computer Applications for BME	2
BME 3060	Biomedical Fundamentals (Critical Tracking)	3
EEL 3003	Elements of Electrical Engineering	3
ENC 3246	Professional Communication for Engineers (Gen Ed Composition; writing requirement)	3
MAP 2302	Elementary Differential Equations (Critical Tracking ; Gen Ed Mathematics)	3

PCB 3713C	Cellular and Systems Physiology (Critical Tracking)	4
	Credits	18
Semester Five		
BME 3101	Biomedical Materials	3
BME 3508	Biosignals and Systems	3
BME 4311	Molecular Biomedical Engineering	3
BME 4503	Biomedical Instrumentation	3
BME 4503L	Biomedical Instrumentation Laboratory	1
EGM 2511	Engineering Mechanics: Statics	3
	Credits	16
Semester Six		
BME 3012	Clinically-Inspired Engineering Design	3
BME 3323L	Cellular Engineering Laboratory	3
BME 4632	Biomedical Transport Phenomena	3
STA 3032	Engineering Statistics	3
Gen Ed Social and Behavioral Sciences with International; Writing Requirement: 6,000 words ³		3
BME elective ²		3
	Credits	18
Semester Seven		
BME 4409	Quantitative Physiology	3
BME 4621	Biomolecular Thermodynamics and Kinetics	3
BME 4882	Senior Design, Professionalism and Ethics 1	3
State Core Gen Ed Social and Behavioral Sciences ³		3
BME electives ²		6
	Credits	18
Semester Eight		
BME 4531	Medical Imaging	3
BME 4883	Senior Design, Professionalism and Ethics 2	3
State Core Gen Ed Humanities with Diversity ³		3
BME electives ²		6
	Credits	15
	Total Credits	131

¹ Can substitute CHM 2210 and CHM 2211.

² BME Electives: A total of 15 credits of 3000/4000-level courses (9 credits of engineering electives and 6 credits technical electives, both of which must be selected from an approved list).

³ Courses should cover 12,000 words.

⁴ Course and corresponding laboratory to be completed in same language (Matlab or C++).

Students are also expected to complete the general education international (GE-N) and diversity (GE-D) requirements. This is often done concurrently with another general education requirement (typically, GE-C, H or S).

Academic Learning Compact

Biomedical engineering blends traditional engineering techniques with biological sciences and medicine to improve the quality of human health and life. The discipline focuses on understanding complex living systems via experimental and analytical techniques and on development of devices, methods and algorithms that advance medical and biological knowledge while improving the effectiveness and delivery of clinical medicine.

Before Graduating Students Must

- Pass assessment by two or more faculty and/or industry practitioners of student performance on a major design experience.

- Pass assessment in two courses of individual assignments targeted to each learning outcome. Assessment will be provided by the instructor of the course according to department standards.
- Complete an exit interview in the final semester.
- Complete requirements for the baccalaureate degree, as determined by faculty.

Students in the Major Will Learn to Student Learning Outcomes (SLOs)

Content

1. Solve biomedical engineering problems by applying knowledge of mathematics, science and engineering principles.
2. Design and conduct biomedical engineering experiments and analyzing and interpreting the data.

Critical Thinking

3. Design a biomedical device, component, technology or process to meet identified clinical needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and regulatory constraints.

Communication

4. Communicate technical data and design information effectively in speech and in writing to other biomedical engineers.

Curriculum Map

I = Introduced; R = Reinforced; A = Assessed

Courses	SLO 1	SLO 2	SLO 3	SLO 4
BME 3060	A	I	I	I
BME 4409	A	I	I	R
BME 4503		R	I	R
BME 4503L		A	R	R
BME 4882			A	A
BME 4883			A	A

Assessment Types

- Assignments
- Exams
- Projects
- Reports
- Presentations