

BIOMEDICAL ENGINEERING

Not all courses are offered every semester. Refer to the schedule of courses for each term's specific offerings.

More Info (<https://one.ufl.edu/soc/>)

Unless otherwise indicated in the course description, all courses at the University of Florida are taught in English, with the exception of specific foreign language courses.

Department Information

The J. Crayton Pruitt Family Department of Biomedical Engineering (BME) is part of the Herbert Wertheim College of Engineering and is a prime resource for biomedical engineering education, training, research, and technology development. BME is an ever-evolving field that uses and applies engineering principles to the study of biology and medicine in order to improve health care.

Website (<https://www.bme.ufl.edu/>)

CONTACT

Email (undergrad@bme.ufl.edu) | 352.273.9222 (tel) | 352.273.9221 (fax)

P.O. BOX 116131

1275 Center Drive

BIOMEDICAL SCIENCES BUILDING JG56

GAINESVILLE FL 32611-6131

Map (<http://campusmap.ufl.edu/#/index/0213>)

Curriculum

- Biomedical Engineering
- Combination Degrees

Courses

BME 1008 Introduction to Biomedical Engineering 1 Credit

Grading Scheme: Letter Grade

Introduction to and overview of biomedical engineering. Lectures are given by faculty expert in an area of biomedical engineering. The goal is to give beginning students an appreciation for the breadth of the field and to guide them in making curriculum, major and career choices.

BME 1930 Special Topics in Biomedical Engineering 1-4 Credits

Grading Scheme: Letter Grade

Selected topics in biomedical engineering.

BME 2202 Engineering Statics and Dynamics in Biological Systems 3 Credits

Grading Scheme: Letter Grade

Principles of engineering statics and dynamics as they relate to biological systems. Topics include vector mathematics, summation of forces and moments in static equilibrium, equations of motion, dynamics of particles and rigid bodies, concepts of work, energy, and momentum, introduction to deformable bodies. All topics are discussed in the context of biological systems.

Prerequisite: PHY 2049, and MAC 2313.

BME 3012 Clinically-Inspired Engineering Design 3 Credits

Grading Scheme: Letter Grade

Through exposure to real clinical problems, learn to communicate with medical professionals in order to identify unmet needs, to develop prototypes and initial concepts for clinical problems, and to critically evaluate potential solutions for clinical problems.

Prerequisite: BME 3060 and PCB 3713C with minimum grades of C;

Corequisite: BME 3101 and EGM 2511.

BME 3053C Computer Applications for BME 2 Credits

Grading Scheme: Letter Grade

Computer programming lab and lecture utilizes Matlab to analyze biomedical measurements.

Prerequisite: COP 2271 and COP 2271L or equivalent and MAC 2312, with minimum grades of C.

Attributes: Artificial Intelligence

BME 3060 Biomedical Fundamentals 3 Credits**Grading Scheme:** Letter Grade

Working specifically within the framework of biomedical engineering applications, provides the engineering fundamentals of the conservation laws of mass, energy, charge, and momentum.

Prerequisite: (CHM 2046 or CHM 2096) and MAC 2313 with minimum grades of C.

Corequisite: PHY 2049, MAP 2302, and BME 1008.

BME 3101 Biomedical Materials 3 Credits**Grading Scheme:** Letter Grade

Restoration of physiological function by engineering biomaterials for biological environment, covering principles underlying use and design of medical implants and matrices/scaffolds. Strong emphasis on transition from engineering material to biological tissue, including molecular and cellular interactions with biomaterials, tissue and organ regeneration, and design of intact, biodegradable, and bioreplaceable materials.

Prerequisite: BME 3060 with minimum grade of C and (CHM 3217 or (CHM2210 and CHM2211) with minimum grades of C).

BME 3219 Engineering Analysis of Musculoskeletal Biomechanics 3 Credits**Grading Scheme:** Letter Grade

Introduction to musculoskeletal biomechanics and quantitative movement analysis with emphasis on engineering approaches. Students learn how to apply experimental and computational methods to evaluate the human body as a biomechanical system. Topics include rigidbody kinematics, dynamics, motion capture, external force measurement, electromyography, and mechanical properties of muscles and tendons.

Prerequisite: COP 2271 (or equivalent) & EGM 2511. Only Matlab or C++ programming languages will be accepted for COP 2271. Engineering majors only.

BME 3234 Mechanical Behavior of Biological Tissues and Systems 3 Credits**Grading Scheme:** Letter Grade

Focuses on understanding the mechanical behavior of biological tissues and systems by evaluating structure-function relationships, stress-strain relationships, and the mechanical complexity of biological systems; introduces the basics of viscoelastic behavior as it applies to biological tissues.

Prerequisite: BME 3060 with minimum grade of C and EGM 2511.

BME 3323L Cellular Engineering Laboratory 3 Credits**Grading Scheme:** Letter Grade

The cellular engineering laboratory teaches the fundamentals of cell culture for use in biomedical engineering investigations. Acquire skills in cell culture, quantitative analyses, notebook keeping, report writing, and oral presentation.

Prerequisite: PCB 3713C;

Corequisite: BME 4311 or instructor permission.

BME 3508 Biosignals and Systems 3 Credits**Grading Scheme:** Letter Grade

Basic theory and techniques of biosignals and systems. Topics include sampling, noise in biological signals, signal averaging of noisy biological signals, Fourier analysis and filtering.

Prerequisite: (EEL 3003 or EEL 3111C) and MAC 2313 with a minimum grade of C.

BME 3941 Internship Experience in Biomedical Engineering 0-3 Credits**Grading Scheme:** S/U

Engineering work experience under the supervision of an engineer.

Prerequisite: Biomedical Engineering major.

BME 4160 Magnetic Biomaterials 3 Credits**Grading Scheme:** Letter Grade

Fundamental concepts in magnetism and magnetic micro- and nano-materials and their applications in biomedicine. Participants present a critical review of recent literature in the field and lead a group discussion on a specific, recent paper.

Prerequisite: PHY 2048 and CHM 2046 or CHM 2096 with minimum grades of C.

BME 4311 Molecular Biomedical Engineering 3 Credits**Grading Scheme:** Letter Grade

Introduces the fundamentals of molecular biology for biomedical engineers. Designed for juniors or seniors majoring in biomedical engineering to learn the nomenclature and current state of knowledge of the eukaryotic cell and its related structures. Topics include protein structure and function, enzymes, the structure and nature of DNA and the cellular structure and function of various cellular organelles. Learn about energy and the function of mitochondria and chloroplast, cellular communication and the function of the extracellular matrix.

Prerequisite: BSC 2010 and (CHM 3217 or CHM 2210) and PCB 3713C with minimum grades of C.

BME 4361 Neural Engineering 3 Credits**Grading Scheme:** Letter Grade

Applying engineering to neuroscience; includes such diverse areas as neural tissue engineering, models of neural function, and neural interface technology. Focuses mainly in the context of neural interfaces and prosthetics, from basic neural physiology and models of neural mechanisms to advanced neural interfaces currently in development or produced commercially.

Prerequisite: BME 3508 or EEL 3135.

BME 4409 Quantitative Physiology 3 Credits**Grading Scheme:** Letter Grade

A junior/senior level physiology course. Quantitative modeling of organ system physiology of the nervous system, the cardiovascular system and the respiratory system are discussed and students work on quantitative problems.

Prerequisite: PCB 3713C, BME 3053C, BME 3060, and BME 3508 with minimum grades of C.

BME 4503 Biomedical Instrumentation 3 Credits**Grading Scheme:** Letter Grade

Provides engineering and clinical fundamentals involved in acquiring, measuring, and processing physiological signals. Covers operational amplifier (op-amp) circuits for signal conditioning, amplification, and spectral filtering, and study biosensors and bioelectrodes used in biomedical applications such as photoplethysmography (PPG), electrocardiography (EKG), electrophoresis, and TENS. Introduces digital systems and Boolean logic, to enable prototyping clinical devices.

Prerequisite: MAC 2313 and MAP 2302 and PHY 2049 and (EEL 3003 or EEL 3111C) with minimum grades of C.

Corequisite: BME 4503L.

BME 4503L Biomedical Instrumentation Laboratory 1 Credit**Grading Scheme:** Letter Grade

Laboratory for BME 4503.

Prerequisite: MAC 2313 and MAP 2302 and PHY 2049 and (EEL 3003 or EEL 3111C) with minimum grades of C;

Corequisite: BME 3508 and BME 4503.

BME 4531 Medical Imaging 3 Credits**Grading Scheme:** Letter Grade

Medical imaging technologies from a biomedical engineering perspective. The physics, mathematics, instrumentation and clinical applications of all common medical imaging modalities, including x-ray radiography, computed tomography (CT), ultrasound imaging, positron emission tomography (PET) and magnetic resonance imaging (MRI) are discussed. Emerging imaging modalities, including optical imaging, fluorescence imaging and photoacoustic imaging are also introduced.

Prerequisite: MAC 2313, MAP 2302, PHY 2049, BME 3053C, and BME 3508 with minimum grades of C.

BME 4621 Biomolecular Thermodynamics and Kinetics 3 Credits**Grading Scheme:** Letter Grade

Principles of thermodynamics and kinetics from a biomolecular perspective. The mathematics, analysis, and applications of classical thermodynamics, statistical thermodynamics, and reaction kinetics are introduced in the context of molecular interactions, binding equilibria, metabolism, and biomolecular transport common to living systems.

Prerequisite: CHM 3217 or (CHM 2210 and CHM 2211), with minimum grades of C, and BME 3060 and (BME 4311 or BCH 4024).

BME 4632 Biomedical Transport Phenomena 3 Credits**Grading Scheme:** Letter Grade

Introduces and applies the concepts of momentum, mass, and thermal energy transport in the context of problems of interest in biomedical sciences and engineering. Macroscopic and microscopic analysis of momentum, mass, and thermal energy transport problems in biomedical systems.

Prerequisite: BME 3060 with minimum grade of C.

BME 4648 Biomaterials for Drug Delivery 3 Credits**Grading Scheme:** Letter Grade

Focuses on the principles of engineering controlled release systems, and integrates topics in polymer chemistry, biomaterials, pharmacokinetics/pharmacodynamics, and mass transport phenomena.

Prerequisite: BME 3060 with a minimum grade of C.

Corequisite: BME 4632

BME 4760 Biomedical Data Science 3 Credits**Grading Scheme:** Letter Grade

Covers the biomedical applications of data science techniques, which include pre-processing techniques, machine learning data analysis, and data visualization techniques.

Prerequisite: BME 3053C and COP 2271 and COP 2271L and (STA 2023 or STA 3032).

Attributes: Artificial Intelligence

BME 4882 Senior Design, Professionalism and Ethics 1 3 Credits**Grading Scheme:** Letter Grade

Design of custom strategies to address real-life issues in the development of biocompatible and biomimetic devices for biotechnology or biomedical applications. Teams work with a client in the development of projects that incorporate various aspects of biomedical engineering including instrumentation, biomechanics, biotransport, tissue engineering and others. Emphasizes formal engineering design principles; overview of intellectual properties, engineering ethics, risk analysis, safety in design and FDA regulations are reviewed. Part 1 focuses on design.

Prerequisite: BME 3012 and senior standing.

BME 4883 Senior Design, Professionalism and Ethics 2 3 Credits

Grading Scheme: Letter Grade

Design of custom strategies to address real-life issues in the development of biocompatible and biomimetic devices for biotechnology or biomedical applications. Teams work with a client in the development of projects that incorporate various aspects of biomedical engineering including instrumentation, biomechanics, biotransport, tissue engineering and others. Emphasizes formal engineering design principles; overview of intellectual properties, engineering ethics, risk analysis, safety in design and FDA regulations are reviewed. Part 2 focuses on implementation and testing.

Prerequisite: BME 4882 and (ENC 3246 with minimum grade of C) and senior standing.

BME 4931 Special Topics in Biomedical Engineering 1-4 Credits

Grading Scheme: Letter Grade

Selected topics in biomedical engineering.

EGN 1935 Special Topics in Freshman Engineering 1-3 Credits

Grading Scheme: Letter Grade

Laboratory, lectures or conferences cover selected topics in engineering.

EGN 4912 Engineering Directed Independent Research 0-3 Credits

Grading Scheme: S/U

Provides firsthand, supervised research with a faculty advisor or postdoctoral or graduate student mentor. Projects may involve inquiry, design, investigation, scholarship, discovery, or application.

Prerequisite: Department permission.
