

School of Engineering offerings, with the exception of offerings that meet Liberal Learning requirements, are restricted to School of Engineering majors or to students with academic programs requiring specific School of Engineering offerings. Enrollment for non-majors interested in exploring School of Engineering offerings is by permission of the department chairperson.

BME 222 Introduction to Mechanics

(fall semester)

Prerequisites: MAT 127, PHY201

This course introduces the fundamentals of statics, force systems, and structural analysis. Topics include: equilibrium in particulate and rigid body systems, force systems, mechanics of deformation, and statically indeterminate systems. Applications in biology, medicine, and industry will be discussed.

BME 251/Fundamentals of Biomedical Engineering

1 course unit

(fall semester)

Prerequisites: PHY 202 with a C- or better; MAT 128 with a C- or better

Introduction to biomedical engineering through critical thought and analysis of unique engineering problems. The conservation laws of mass, energy, and momentum will be developed and applied to identify and define problem systems, formulate appropriate relationships, and solve problems found in the diverse field of biomedical engineering.

BME 311/Physiological Systems

1 course unit

(fall semester)

Prerequisites: BIO 185, CHE 202, BME 251

Control and integration of physiological function of the systems of the human body. Study of structure and function of systems, and homeostatic mechanisms in health and disease. Overview of sensory and biological control systems.

BME 313/Biomedical Instrumentation and Measurements Laboratory

.5 course unit

(laboratory)

(fall semester)

Prerequisites: CHE 202, ENG 212, BME 222

This laboratory is an introduction to mechanical, chemical and electrical measurements and instrumentation relative to biomedical engineering and physiological applications. Experimental design, data analysis techniques, statistical analysis and the interpretation of results are emphasized.

BME 323 Introduction to Biomaterials

1 course unit

(with design hour)

(spring semester)

Prerequisite: CHE 201 and BME 222 or MEC 251

Introduction to metal, polymeric, ceramic, and biological materials used in medical devices and surgical implants in humans. Topics are anticipated to include those highlighted below. This course includes a fourth 'design hour' that meets weekly. In this design hour, students are engaged in one or more intensive group experiences that require the extended mentoring and

contact time with the instructor. First, a degradable biomaterial will be analyzed to introduce analytical techniques and reporting methods. Second, a semester-long design project will synthesize course learnings into analysis, design, and evaluation of a single device.

BME 333/Physiological Systems Laboratory

.5 course unit

(laboratory)

(spring semester)

Prerequisite: BME 311 and BME 313

Analysis of physiological systems through measurement of human physiological signals. Reaction time, biological potentials (ECG, EMG) and cardiopulmonary responses will be explored as a function of appropriate variables, including body position, gender, and exercise. Communication through written and oral presentation using descriptive and inferential statistical analysis will be emphasized.

BME 343/Biomechanics

1 course unit

(same as MEC 343)

(with design hour)

(spring semester)

Prerequisite: BME 222 or MEC 251

Comprehensive study of structure, function, and mechanical properties of biological soft and hard tissues. Topics include joint and tissue mechanics, analysis of tissue remodeling, fatigue and fracture resistance, and mechanical properties of skeletal tissue.

BME 350/Biofluid Mechanics

1 course unit

(spring semester)

Prerequisites: ENG 342 and BME 251

Basic properties of fluids in motion. Lagrangian and Eulerian viewpoints, material derivative, streamlines. Continuity, energy, angular and linear momentum equations in integral and differential forms. Applications in biofluids and biomedical devices; Rheology of biological fluids.

BME 371/Physiological Systems II

1 course unit

(spring semester)

Prerequisite: BME 311

Continuation of BME 311, with an emphasis on integrative function within and between systems.

BME 391/Independent Study

.5-1 course unit

(occasionally)

Prerequisite: Permission of instructor and department

For advanced students wishing to pursue a special area of interest. Topic(s) developed in consultation with a faculty advisor.

BME 423/Introduction to Biomaterials

1 course unit

(same as MEC 423)

(with design hour)

(fall semester)

Prerequisite: CHE 201

Introduction to metal, polymeric, ceramic, and biological materials used as surgical implants in humans. Topics include acute and chronic biological response to implants, degradation of artificial materials, artificial organs, and medical devices. Consideration of ethical issues.

BME 433/Bioinstrumentation Laboratory

.5 course unit

(laboratory)

(fall semester)

Prerequisites: BME 333

Corequisite: BME 473

An advanced practical laboratory experience directed in the utilization of noninvasive physiological recording techniques, including electromyography and electrocardiography systems for human data. Experimental design and statistical analysis of recorded data will also be covered.

BME 450/Mass and Heat Biotransport Phenomena

1 course unit

(fall semester)

Prerequisites: BME 350 Biofluids

This course applies laws and methods of continuum mechanics to heat and mass transport in biological and physiological systems. Models of heat and mass flux will be used to investigate and understand biological transport phenomena over a range of size (molecules to organs) and time scales.

BME 470/Special Topics in Biomedical Engineering

1 course unit

(with design hour)

(occasionally)

Prerequisite: Permission of instructor and department

Study of advanced topics in biomedical engineering chosen by the instructor.

BME 473/Bioinstrumentation

1 course unit

(spring semester)

Prerequisites: ENG 212, ENG 214, BME 311

Theory and design of biomedical instruments used for measurements on humans and animals. Detailed coverage of sensors and transducers that quantify force, pressure, flow, sound, temperature, and displacement. Origin of biopotentials (ECG, EMG, EEG) and biological signal processing. Consideration of noise, interference, and electrical safety issues.

BME 480/Physiological Modeling

1 course unit

(spring semester)

Prerequisites: BME 371, ENG342

A multi-scale approach to the theory, design, and application of mathematical and computer-based physiological models, with a quantitative and data driven focus to build models that provide estimations of system behaviors.

BME 497 Mentored Research in Biomedical Engineering **.5 or 1 course unit**

Prerequisites: Department permission based on a successful application to the research track
This course is for the pursuit of an original biomedical engineering research project under the direction of a supervising professor. Students must be accepted to the research track and may enroll for 0.5 CU or 1.0 CU over 2-4 semesters consecutively. At the end of completion of 2 CU of mentored research, a final paper in the form of a manuscript and an oral presentation to faculty and students of the department are required. The paper must be archived by the Department of Biomedical engineering.

BME 495, 496/Senior Project I, II **.5, .5 course unit**

(BME 495 fall semester; BME 496 spring semester)

Prerequisites: Senior standing, BME 371

Senior project focuses students' previous experience upon a specific technical biomedical engineering project. Library research, preliminary design, evaluation of alternatives, project planning, cost and scheduling analysis, written reports, and oral presentation. Students work closely with a biomedical engineering faculty advisor.