BIOMEDICAL ENGINEERING (BME)

College of the Sciences and Mathematics

Courses

BME 110. Introduction to Biomedical Engineering. 3 Credits.
Introduction to the development of biomedical engineering or bioengineering using fundamental concepts and tools from physics, mechanical, chemical, electrical engineering and biology. Topics may include: biomaterials; biomechanics; bioinstrumentation; biotransport and artificial organs; cell and tissue engineering; systems and signals; biochemical engineering; biologic electric phenomenon; and biomaterials. Additional topics include developing engineering tools for use in advanced courses and problem-solving skills. Consent: Permission of the Department required to add. Typically offered in Fall.

BME 199. Transfer Credits. 1-10 Credits.
Transfer Credits. Repeatable for Credit.

BME 220. Statics. 3 Credits.
This course covers the applications of the principles of mechanics to engineering problems of equilibrium. Topics include resultants, equilibrium, friction, center of gravity, internal forces, analysis of structures, and motion of rigid bodies. Pre / Co requisites: BME 220 requires prerequisites of PHY 170 and MAT 162. Typically offered in Fall.

BME 230. Dynamics. 3 Credits.
This course is to present the fundamentals of particle and rigid body dynamics and to apply these fundamentals to the systematic solution of engineering problems. Topics include: work, energy, and momentum; kinetics and kinematics of a particle; planar and three-dimensional kinematics; and dynamics of rigid bodies. Pre / Co requisites: BME 230 requires a prerequisite of BME 220. Typically offered in Spring.

BME 301. Engineering Thermodynamics. 3 Credits.
This course introduces students to engineering thermodynamics. Topics include: basic concepts of pure substance; system parameters; atmospheric pressure, etc.; first law and second law of thermodynamics; ideal gas; and equation of the state, work, energy, exergy, entropy, and thermal refrigeration cycle. Pre / Co requisites: BME 310 requires prerequisites of PHY 170, CHE 104, and MAT 162. Typically offered in Fall.

BME 315. Biomedical Engineering Laboratory I. 2 Credits.
LEC (1), LAB (3)
This course introduces students to the modern computational tools used for engineering design and analysis. Topics include: the principles of SolidWorks, simple and advanced part modeling approaches, assembly modeling, drawing, configurations/design tables and surface modeling, the applications of SolidWorks in manufacturing processes, mechanical systems, and engineering analysis. Typically offered in Spring.

BME 325. Biomedical Engineering Laboratory II. 2 Credits.
LEC (1), LAB (3)
This course is the continuation of BME 315. Students will perform a series of laboratory experiments. A project will be conducted at the end of the semester. Pre / Co requisites: BME 325 requires prerequisites of BME 110, BME 315, and BIO 265. Typically offered in Spring.

BME 335. Biomaterials. 3 Credits.
This course provides an introduction to the interactions between cells and the surfaces of biomaterials. Topics include: materials commonly used in biomedical applications, chemical structure of biomaterials, physical and mechanical properties of biomaterials, the biocompatibility of those materials with the biological environment, and the immune response to biomaterials. Pre / Co requisites: BME 335 requires prerequisites of BIO 265 and CHE 104. Typically offered in Fall.

BME 345. Biotransport Phenomena. 4 Credits.
This course provides the fundamental biomedical applications of fluid mechanics, heat, and mass transfer. Topics include: the principles and applications of biotransport fundamentals; fluid mechanics, macroscopic biotransport, 1-D steady and unsteady state transport, and general multidimensional microscopic transport. Pre / Co requisites: BME 345 requires prerequisites of BIO 265, BME 310, and MAT 315. Typically offered in Spring.

BME 355. Biomedical Instrumentation. 3 Credits.
This course is to study the fundamentals of instrumentation in biomedical fields. Topics include: various types of medical instruments; basic analog and digital electronics; data acquisition signal processing; and applications of instrumentation in diagnoses, medical imaging, and laboratory. Regulation and medical safety will be discussed. Pre / Co requisites: BME 355 requires prerequisites of BIO 265, PHY 180, and MAT 315. Typically offered in Spring.

BME 365. Biomechanics for Engineers. 3 Credits.
In this course, students acquire the basic tools used to analyze the human body as a mechanical system with examples from the tissue level to the whole-body level. Relevant concepts introduced in previous mechanics courses (e.g., BME 230) will be advanced and applied in BME-specific contexts. Topics include the following: joint kinematics and kinetics; linked segment modeling; tissue stresses and strains; and biomechanics related to injury/disease as well as treatments. Emphasis will be placed on how to effectively find, read, interpret, and synthesize the information presented in scholarly research articles to write a literature review and propose a research study. Pre / Co requisites: BME 365 requires prerequisites of BIO 265 and BME 230. Gen Ed Attribute: Writing Emphasis. Distance education offering may be available. Typically offered in Spring & Summer.

BME 401. Senior Seminar I. 1 Credit.
This course is to provide students an opportunity to learn how to prepare and make formal presentations. Students will make several presentations during the semester with a chosen topic that they are interested in. Pre / Co requisites: BME 401 requires students to be senior-level. Typically offered in Fall.

BME 402. Senior Seminar II. 1 Credit.
This is the continuation of BME 401. Students will recognize and address bioethical questions through a group presentation and discussions. Topics include: security, confidentiality, privacy, and biomedical dilemmas. Pre / Co requisites: BME 402 requires students to be senior-level. Typically offered in Fall.

BME 410. Senior Design I. 3 Credits.
LEC (2), LAB (1)
This is a capstone design course. This course provides students the opportunity to work with real-world, open-ended, and/or interdisciplinary challenges proposed by faculty or industrial project sponsors. Students work as a small team supervised by a faculty member and/or industry advisor. Students team learn and apply principles of engineering, biology, chemistry, physics, and mathematics to solve biomedical engineering problems through the consideration of engineering solutions in global, economic, environmental, and societal contexts. The design process involves: defining functional requirements, conceptualization, design, development, construction, physical prototyping, measurement, analysis, and conclusion. An initial proposal and progress report are required at the beginning of the course as well as in the middle of these two semesters, respectively. A final report and post/oral presentations are required at the end of the second semester. Pre / Co requisites: BME 410 requires prerequisites of BME 325, BME 345, BME 355, BME 365 or permission of the instructor. Gen Ed Attribute: Speaking Emphasis. Typically offered in Fall.
BME 420. Senior Design II. 1 Credit.
This is the continuation of BME 410. This course provides students the opportunity to work with real-world, open-ended, and/or interdisciplinary challenges proposed by faculty or industrial project sponsors. Students work as a small team supervised by a faculty member and/or industry advisor. Students learn and apply principles of engineering, biology, chemistry, physics, and mathematics to solve biomedical engineering problems through the consideration of engineering solutions in global, economic, environmental, and societal contexts. The design process involves: defining functional requirements, conceptualization, design, development, construction, physical prototyping, measurement, analysis, and conclusion. An initial proposal and progress report are required at the beginning of the course and in the middle of the two semesters, respectively. A final report and post/oral presentations are required at the end of the second semester.
Pre / Co requisites: BME 420 requires students to be senior-level.
Typically offered in Fall & Spring.

BME 450. Regulatory and GMP. 3 Credits.
This course provides students knowledge of the processes in the manufacture or quality control of biotechnology products with current Good Manufacturing Practices (cGMP) guidelines and regulations. Topics include: introduction to the FDA and other regulatory agencies, current Good Manufacturing Practices (cGMP), process validation requirements and product life cycle quality management, and the application of the regulations to case studies.
Pre / Co requisites: BME 450 requires a prerequisite of BME 325 or permission of the instructor.
Typically offered in Fall.

BME 460. Introduction to Biomedical Device Design. 3 Credits.
This is an elective, project-based learning course for Biomedical Engineering (BME) majors. It introduces the engineering design process and related concepts, tools, and methodologies in the context of biomedical device design. Students will work in teams to redesign, modify, fabricate, and validate a current medical device. Topics include the engineering design process, rapid prototyping using 3D printing, finite-element analysis (FEA), and the use of standards in design evaluation (e.g., ASTM testing standards).
Pre / Co requisites: BME 460 requires prerequisites of BME 120 and BME 365.
Typically offered in Fall.