BME-Biomedical Engineering Courses

Courses

BME 011. Undergraduate Internship in BME. 0 Hours.
Engineering internship experience in preparation for the student's intended career. Students in a university recognized cooperative education experience should register for COP 011 or COP 012.

BME 210. Engineering in Biology. 3 Hours.
Application of engineering to the study of biology on the cellular and molecular level. Engineering solutions in genomics, proteomics, and nanotechnology to investigate cellular and molecular process.
Prerequisites: BY 123 [Min Grade: C]

BME 221. Clinical Innovation I. 3 Hours.
The goals of this class are to develop an understanding of the concept of clinical innovation and develop skills in written and oral communication of innovation in the context of a business proposal/presentation.

BME 289. Undergraduate Research in Biomedical Engineering I. 1 Hour.
Undergraduate research experiences in biomedical engineering. Must have sophomore standing.
Prerequisites: EGR 194 [Min Grade: C] or EGR 200 [Min Grade: C] or EGR 111 [Min Grade: C] or HC 111 [Min Grade: C] and (MA 125 [Min Grade: C] or MA 225 [Min Grade: C])

BME 310. Biomaterials. 3 Hours.
Introduction to wide range of materials used for biomedical applications. Physical, chemical and mechanical properties of biomaterials.
Prerequisites: MSE 280 [Min Grade: C] and BME 210 [Min Grade: C]

BME 311. Biomaterials for Non-Majors. 3 Hours.
Wide range of materials used for biomedical applications. Physical, chemical and mechanical properties of biomaterials.
Prerequisites: MSE 280 [Min Grade: C]

BME 312. Biocomputing. 3 Hours.
Introduction to computational techniques used in biomedical engineering.
Prerequisites: EGR 150 [Min Grade: C] and EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and MA 260 [Min Grade: C](Can be taken Concurrently)

BME 313. Bioinstrumentation. 3 Hours.
An introduction to instrumentation used to make biological and physiological measurements. Techniques include acquisition and analysis of bioelectric signals and instrument control.
Prerequisites: EE 312 [Min Grade: C] and (MA 227 [Min Grade: C] and MA 252 [Min Grade: C] or EGR 265 [Min Grade: C])

BME 333. Biomechanics of Solids. 3 Hours.
Application of mechanics of solids principles to biomedical engineering problems; stress-strain of bone, viscoelasticity and constitutive equations of tissues, mechanics of the cell, introduction to molecular mechanics.
Prerequisites: CE 210 [Min Grade: C] or EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and ME 215 [Min Grade: C](Can be taken Concurrently)

BME 350. Biological Transport Phenomena. 3 Hours.
Basic mechanisms and mathematical analysis of transport processes with biological and biomedical applications. Analysis of flow, transport and reaction processes for biological fluids and biological molecules with applications towards development of artificial organs, drug delivery systems and tissue engineering products.
Prerequisites: CE 210 [Min Grade: C] and EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and BME 210 [Min Grade: C] and BME 370 [Min Grade: C](Can be taken Concurrently) or BY 409 [Min Grade: C](Can be taken Concurrently) and ME 215 [Min Grade: C](Can be taken Concurrently)

BME 370. Integrated Physiology. 3 Hours.
Integrated Physiology will introduce undergraduate students to mathematical models of major physiological systems. Basic anatomy will be reviewed in pre-recorded videos to be watched prior to coming to synchronous lectures. Lectures will include discussions, derivations of relevant equations, and development of models to demonstrate understanding of biological systems. In-class activities will be used as means to provide interactive content that will be assessed via Assignments and Exams. The course will culminate in a final project where teams of students select a pathological condition and model it in Matlab, including comparing to normal conditions and with currently-available clinical interventions. Open to junior and senior level Biomedical Engineering students.
Prerequisites: EGR 150 [Min Grade: C] and BME 210 [Min Grade: C]

BME 389. Undergraduate Research in Biomedical Engineering II. 1-2 Hour.
Undergraduate research experiences in biomedical engineering.

BME 401. Undergraduate Biomedical Engineering Seminar. 1 Hour.
Undergraduate seminar.

BME 420. Implant-Tissue Interactions. 3 Hours.
An overview of implant biocompatibility including tissue histology, histopathology of implant response and the regulatory process for medical devices. Emphasis placed on ethical issues related to design, development, and implementation of biomedical implants. Ethics and Civic Responsibility are significant components of this course.
Prerequisites: BME 310 [Min Grade: C] or BME 311 [Min Grade: C]

BME 423. Living Systems Analysis and Biostatistics. 3 Hours.
Basic concepts and techniques of measurement processing and analysis of data from living systems. Statistics, analysis of variance and regression analysis. Emphasis is placed on data analysis and presentation of group projects.
Prerequisites: BME 312 [Min Grade: C]

BME 424. Current Topics in Stem Cell Engineering. 3 Hours.
Topics include stem cells, regenerative medicine, and tissue engineering using stem cells and stem cell derived cells. The role of stem cells in tissue growth and development, the theory behind the design and in vitro construction of tissue and organ replacements, and the applications of biomedical engineering principles to the treatment of tissue-specific diseases. Hands on experience on culturing and analyzing stem cells, stem cell differentiation, analysis of functional and physiological properties of differentiated cells, and fabricating basic engineered-tissues.
Prerequisites: BY 123 [Min Grade: C] and (BY 210 [Min Grade: C] or BY 212 [Min Grade: C] or BY 115 [Min Grade: C])

BME 435. Tissue Engineering. 3 Hours.
Principles underlying strategies for regenerative medicine such as stem-cell based therapy, scaffold design, proteins or genes delivery, roles of extracellular matrix, cell-materials interactions, angiogenesis, tissue transplantation, mechanical stimulus and nanotechnology.
Prerequisites: BME 310 [Min Grade: C] or BME 311 [Min Grade: C]

BME 443. Medical Image Processing. 3 Hours.
Fundamental topics of medical image processing to practical applications using conventional computer software.
Prerequisites: BME 312 [Min Grade: C](Can be taken Concurrently) and PH 222 [Min Grade: C]

BME 444. Machine Learning for Biomedical Engineering Applications. 3 Hours.
Introduction to the practical aspects of machine learning in simple biomedical engineering problems. The principle of machine learning 'thinking process' for the next machine learning – AI courses and more in-depth machine learning studies. Fundamental differences between Machine Learning and Data Mining. Fundamental theories in machine learning to be able to develop new machine learning techniques and research machine learning in biomedical engineering.
Prerequisites: EGR 150 [Min Grade: C]

BME 450. Computational Neuroscience. 3 Hours.
This course examines the computational principles used by the nervous system. Topics include: biophysics of axon and synapse, sensory coding (with an emphasis on vision and audition), planning and decision-making, and synthesis of motor responses. There will be an emphasis on systems approach throughout. Homework includes simulations.
Prerequisites: BME 312 [Min Grade: C]

BME 462. Cardiac Electrophysiology. 3 Hours.
Experimental and computational method associated with cardiac electrophysiology, ionic current, action potentials, electrical propagation, the electrocardiogram, electromechanical coupling, cardiac arrhythmias, effects of electric fields in cardiac tissue, defibrillation and ablation.
Prerequisites: BME 312 [Min Grade: C]

BME 465. Mechanobiology. 3 Hours.
The overall course objective is to develop understanding of mechanobiological processes in cells as they relate to both development and disease pathways, focusing on cancer and vascular biology. Students will learn molecular biology techniques for characterizing mechanobiology and cell phenotype, and describe biomechanical analysis protocols including micropipette aspiration, atomic force microscopy, traction force microscopy, and optical/magnetic tweezers. The course will include comprehensive literature reviews relevant to the subject area. Students will present formal presentations on articles discussing mechanobiology topics and prepare a written commentary article on a published journal article discussing a relevant mechanobiological project.

BME 471. Continuum Mechanics of Solids. 3 Hours.
Matrix and tensor mathematics, fundamentals of stress, momentum principles, Cauchy and Piola-Kirchoff stress tensors, static equilibrium, invariance, measures of strain, Lagrangian and Eulerian formulations, Green and Almansi strain, deformation gradient tensor, infinitesimal strain, constitutive equations, finite strain elasticity, strain energy methods, 2-D Elasticity, Airy Method, viscoelasticity, mechanical behavior of polymers.
Prerequisites: EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and (BME 333 [Min Grade: C] or CE 220 [Min Grade: C])

BME 489. Undergraduate Research in Biomedical Engineering III. 1-2 Hour.
Undergraduate research experiences in biomedical engineering. Must have senior standing.

BME 490. Special Topics in Biomedical Engineering. 1-3 Hour.
Special Topic in Biomedical Engineering.

BME 491. Individual Study in Biomedical Engineering. 1-6 Hour.
Individual Study in Biomedical Engineering.

BME 494. Honors Research I. 1-3 Hour.
Research experiences for undergraduates enrolled in the Biomedical Engineering Honors Program. The student will write a proposal and make an oral presentation to their thesis committee based on the proposal.
Prerequisites: EGR 301 [Min Grade: C] or STH 201 [Min Grade: C]

BME 495. Honors Research II. 1-3 Hour.
Research opportunities for undergraduate students in the Biomedical Engineering Honors Program. The student should write a thesis and make an oral presentation to their thesis committee defending the thesis.
Prerequisites: BME 494 [Min Grade: C]

BME 496. Biomedical Engineering Honors Seminar. 1 Hour.
Must be enrolled in an Honors Program.
Prerequisites: BY 123 [Min Grade: B] and BY 286 [Min Grade: B]

BME 498. Capstone Design I Product Development. 3 Hours.
Design and development of medical-products. Through experiential learning, students go through the early phases of engineering design innovation for medical products, starting with clinical immersion to determine a critical health-care need. Engineering students work in teams to develop design concepts, culminating in a written design proposal. Designs take into account client needs as well as legal, regulatory, and marketing requirements. Emphasis is placed on communication in both oral and written format to targeted audiences.
Prerequisites: (BME 310 [Min Grade: C] and BME 312 [Min Grade: C]) or (BME 310 [Min Grade: C] and BME 313 [Min Grade: C]) or (BME 310 [Min Grade: C] and BME 333 [Min Grade: C]) or (BME 310 [Min Grade: C] and BME 350 [Min Grade: C]) or (BME 312 [Min Grade: C] and BME 313 [Min Grade: C]) or (BME 312 [Min Grade: C] and BME 333 [Min Grade: C]) or (BME 312 [Min Grade: C] and BME 350 [Min Grade: C]) or (BME 313 [Min Grade: C] and BME 333 [Min Grade: C]) or (BME 313 [Min Grade: C] and BME 350 [Min Grade: C]) or (BME 333 [Min Grade: C] and BME 350 [Min Grade: C]) or BME 370 [Min Grade: C]

BME 499. Capstone Design II. 3 Hours.
Capstone design project; a continuation of BME 498. Through experiential learning, student teams complete the engineering design process for their client-based prototype incorporating engineering standards and realistic constraints. Student teams develop a functional prototype and a commercialization strategy based on a business model. Additional skills learned in this part of the design process include: project planning and scheduling, project execution and resource scheduling, communication of design, and interim and final design reviews. Emphasis is placed on communication of design and design justification in both an oral and written format to targeted audiences.
Prerequisites: BME 498 [Min Grade: C] and BME 310 [Min Grade: C] and BME 312 [Min Grade: C] and BME 313 [Min Grade: C] and BME 333 [Min Grade: C](Can be taken Concurrently) and BME 350 [Min Grade: C] (Can be taken Concurrently) and BME 423 [Min Grade: C](Can be taken Concurrently)