BIOMEDICAL ENGINEERING (BMD_ENG)

BMD_ENG 101-0 Introduction to Biomedical Engineering (0 Unit)
Information to 1) help students determine if BME is the right major for them and 2) learn how to make the most of their undergraduate experience. The field of biomedical engineering, career and research opportunities, ethics.

BMD_ENG 220-0 Introduction to Biomedical Statistics (1 Unit) Basic statistical concepts presented with emphasis on their relevance to biological and medical investigations.

BMD_ENG 250-0 Thermodynamics (1 Unit) Physical and chemical principles as applied to biological systems and medical devices. Topics include material balances, thermodynamics, solution chemistry, electrochemistry, surface chemistry, transport, and kinetics. Prerequisites: MATH 230-0; CHEM 132-0, CHEM 152-0, or CHEM 172-0.

BMD_ENG 270-0 Fluid Mechanics (1 Unit) Fundamentals of fluid mechanics and their applications to biological systems. Prerequisites: GEN_ENG 205-4; MATH 234-0.

BMD_ENG 271-0 Introduction to Biomechanics (1 Unit) Analysis of stresses and deformations in solids. Problems in biomechanics, with emphasis on assumptions appropriate to modeling biological materials including bone, skin, muscle, and cell membranes. Prerequisite: GEN_ENG 205-2.

BMD_ENG 301-0 Quantitative Systems Physiology (1 Unit) Functional/structural aspects of mammalian nervous system. Neural biophysics. Laboratory exercises. Prerequisite: PHYSICS 135-2; junior standing recommended.

BMD_ENG 302-0 Quantitative Systems Physiology (1 Unit) Rigorous overview of cardiovascular and respiratory anatomy, physiology, and pathophysiology. Case studies and a design team project. Prerequisite: MATH 230-0; junior standing recommended.

BMD_ENG 303-0 Quantitative Systems Physiology (1 Unit) Cellular mechanisms of and quantitative systems’ approach to human renal, digestive, endocrine, and metabolic physiology. Prerequisite: junior standing recommended.

BMD_ENG 305-0 Introduction to Biomedical Signals and Electrical Circuits (1 Unit) Time and frequency domain analysis: convolution representation, Fourier series, Fourier transforms, frequency response, filtering, sampling. Prerequisite: PHYSICS 135-2 or consent of instructor.

BMD_ENG 306-0 Biomedical Systems Analysis (1 Unit) Introduction to linear systems analysis. Time and frequency domain techniques for analyzing linear systems, emphasizing their applications to biomedical systems. MATLAB-based problem sets and lab illustrate topics covered in class. Prerequisites: BMD_ENG 305-0; BMD_ENG 220-0, IEMS 303-0, or MECH_ENG 359-0; GEN_ENG 205-4.

BMD_ENG 307-0 Quantitative Experimentation and Design (1 Unit) Laboratory and associated lecture concerning quantitative physiology, physiological measurement techniques, instrument design, and statistical design of experiments. Prerequisites: BMD_ENG 305-0; BMD_ENG 306-0; BMD_ENG 220-0, IEMS 303-0 or MECH_ENG 359-0.

BMD_ENG 314-0 Models in Biochemistry & Molecular Biology (1 Unit) Mathematical modeling of biochemical and molecular biological problems, such as allosteric enzymes, bacterial transduction, X-ray diffraction, study of DNA. Prerequisites: BIOL_SCI 215-0; BIOL_SCI 219-0; junior standing recommended.

BMD_ENG 315-0 Application of Genetic Engineering to Immunocochemistry (1 Unit) Recent developments in genetic engineering as applied to the rapidly developing field of immunocochemistry for antibodies and related proteins. Prerequisite: junior standing recommended.

BMD_ENG 316-0 Engineering Design of Therapeutic Antibodies (1 Unit) In-depth study of the development of therapeutic antibodies through protein engineering-the process of selectively modifying the activities of existing proteins and enzymes to improve their function. Prerequisites: BIOL_SCI 215-0; BIOL_SCI 219-0

BMD_ENG 317-0 Biochemical Sensors (1 Unit) Theory, design, and applications of chemical sensors used in medical diagnosis and patient monitoring. Electrochemical and optical sensors. Prerequisites: BIOL_SCI 215-0; BIOL_SCI 219-0; CHEM 210-1; PHYSICS 135-2; PHYSICS 135-3.


BMD_ENG 325-0 Introduction to Medical Imaging (1 Unit) Diagnostic X-rays; X-ray film and radiographic image; computed tomography; ultrasound. Prerequisite: PHYSICS 135-3 or equivalent.

BMD_ENG 327-0 Magnetic Resonance Imaging (1 Unit) Nuclear magnetic resonance; two-dimensional Fourier transform, spin echo and gradient echo imaging; gradient and RF hardware. Prerequisite: PHYSICS 135-3.

BMD_ENG 333-0 Modern Optical Microscopy & Imaging (1 Unit) Rigorous introduction to principles, current trends, emerging technologies, and biomedical applications of modern optical microscopy. Prerequisites: PHYSICS 135-2; MATH 220-0; MATH 230-0; GEN_ENG 205-4.

BMD_ENG 343-0 Biomaterials and Medical Devices (1 Unit) Structure-property relationships for biomaterials. Metal, ceramic, and polymeric implant materials and their implant applications. Interactions of materials with the body. Taught with MAT_SCI 370-0; may not receive credit for both courses. Prerequisites: BIOL_SCI 215-0; BIOL_SCI 219-0; MAT_SCI 201-0 or MAT_SCI 301-0; senior standing.

BMD_ENG 344-0 Biological Performance of Materials (1 Unit) Structure-property relationships of materials, physical chemistry of surfaces and interfaces, materials-tissue interactions, applications to the selection and design of materials for medical implants and devices. Prerequisites: BIOL_SCI 215-0; BIOL_SCI 219-0; MAT_SCI 201-0.

BMD_ENG 346-0 Tissue Engineering (1 Unit) In vivo molecular, cellular, and organ engineering, with emphasis on the foundations, techniques, experiments, and clinical applications of tissue engineering. Prerequisites: BIOL_SCI 215-0; BIOL_SCI 219-0.

BMD_ENG 349-1 Regenerative Engineering Principles and Technologies (1 Unit) Foundations, principles, and technologies of molecular, cellular,
and tissue regenerative engineering. Prerequisites: BIOL_SCI 215-0; BIOL_SCI 219-0.

**BMD_ENG 349-2 Regenerative Engineering Applications (1 Unit)** Fundamentals of human disorders; engineering aspects of regenerative medicine; application of regenerative engineering to human disease. Prerequisite: BMD_ENG 349-1.

**BMD_ENG 365-0 Control of Human Limbs and Their Artificial Replacements (1 Unit)** Human movement, biomechanics, skeletal and muscular anatomy, comparative anatomy, muscle physiology, and locomotion. Engineering design of artificial limbs. Prerequisite: senior standing with engineering or physical science background.

**BMD_ENG 366-0 Biomechanics of Movement (1 Unit)** Engineering mechanics applied to analyze human movement, including models of muscle and tendon, kinematics of joints, and dynamics of multi-joint movement. Applications in sports, rehabilitation, and orthopedics. Prerequisite: BMD_ENG 271-0.

**BMD_ENG 371-0 Mechanics of Biological Tissue (1 Unit)** Stress and strain for small and large deformations. Nonlinear elastic, viscoelastic, pseudo-elastic, and biphasic models. Prerequisites: BMD_ENG 271-0; GEN_ENG 205-3; GEN_ENG 205-4.

**BMD_ENG 377-0 Intermediate Fluid Mechanics (1 Unit)** Fundamental concepts of fluid dynamics. Kinematics, mass and momentum balances, constitutive relations. Navier-Stokes equations and methods of solution. Sealing techniques. Prerequisite: BMD_ENG 270-0 or consent of instructor.

**BMD_ENG 378-0 Transport Fundamentals (1 Unit)** Fundamental and biomedical applications of diffusive and convective heat and mass transfer. Prerequisites: BMD_ENG 270-0; MATH 230-0; BMD_ENG 377-0 recommended.

**BMD_ENG 380-0 Medical Devices, Disease & Global Health (1 Unit)** Health systems and technologies to address health problems of the world’s underserved populations, with special emphasis on developing countries.

**BMD_ENG 388-SA Healthcare Technology in Resource Poor Environments (1 Unit)** Consent of instructor.

**BMD_ENG 389-SA Healthcare Assessment and Planning (1 Unit)** Consent of instructor.

**BMD_ENG 390-1 Biomedical Engineering Design (1 Unit)** Open-ended team-designed projects in the medical devices arena. Systems approach requiring design strategy and concepts, including reliability, safety, ethics, economic analysis, marketing, FDA regulations, and patents. Written and oral reports. Prerequisite: BMD_ENG 307-0.

**BMD_ENG 390-2 Biomedical Engineering Design (1 Unit)** Development of a design project initiated during the previous quarter. Prerequisite: BMD_ENG 390-1.

**BMD_ENG 390-3 Biomedical Engineering Design (1 Unit)** Continuation of a design project; independent study. May not be repeated for credit. Prerequisites: BMD_ENG 390-1 or BMD_ENG 390-2; consent of instructor.

**BMD_ENG 391-SA Healthcare Technology Innovation and Design (1 Unit)**

**BMD_ENG 395-0 Topics in Biomedical Engineering (1 Unit)** Special Topics in Biomedical Engineering, Laboratory emphasis.

**BMD_ENG 397-0 Special Topics in Biomedical Engineering (0.5-1 Unit)** Special Topics in Biomedical Engineering, Laboratory emphasis.

**BMD_ENG 398-0 Special Topics in Biomedical Engineering (0.34 Unit)** Special Topics in Biomedical Engineering, Laboratory emphasis.

**BMD_ENG 399-0 Projects (1 Unit)** SEE DEPT FOR SECTION AND PERMISSION NUMBERS.

**BMD_ENG 396-0 Special Topics (0.5 Unit)** Special Topics in Biomedical Engineering, Laboratory emphasis.

**BMD_ENG 399-0 Projects (1 Unit)** SEE DEPT FOR SECTION AND PERMISSION NUMBERS.