

BIOMEDICAL ENGINEERING (BME)

Courses

BME 001. Intro to Biomedical Eng Design. 0 or 2 Credits.

Introduction to the biomedical engineering profession. Hands-on experiences that emphasize interdisciplinary teamwork, technical communications, and project design methodologies. Co-requisite: ENGR 002.

BME 010. BME Design 0. 0 or 2 Credits.

Introduction to the biodesign methodology. Hands-on design experiences that emphasize inter-disciplinary teamwork, technical communication, and engineering ethics.

BME 011. Core 1: Biomechanics & Sensing. 0 or 6 Credits.

Studio-style course that fuses lecture with project-based learning and laboratory exercises. Covers force and torque vectors, systems in equilibrium, physical properties of human body segments and biological systems, kinematics and kinetics of particles and rigid bodies, stress and strain of solid materials, circuits and instrumentation. Prerequisites: C- or better in MATH 022, and PHYS 031.

BME 012. Core 2: Materials & Transport. 0 or 6 Credits.

Studio-style course that fuses lecture with project-based learning and laboratory exercises. Covers materials related to medical devices, the biological reaction to implanted medical devices, and associated failure mechanisms. Diffusive and convective mass transport in biochemical interactions, oxygen transport, cell adhesion/signaling, drug and macromolecule transport. Prerequisites: BME 011, BHSC 034.

BME 013. BME Design 1. 0 or 1 Credits.

Introduction to ISO standards, FDA, quality control, and regulatory processes. Case studies of BME Capstone Design I teams. Prerequisite: BME 001 or BME 010 or equivalent.

BME 014. BME Design 2. 0 or 1 Credits.

Introduction to verification/validation testing. Case studies of BME Capstone Design II teams. Prerequisite: BME 013.

BME 081. Biomedical Eng Lab I. 0 or 2 Credits.

Laboratory experiments pertaining to biomedical instrumentation and biomechanics. Computer-based modeling of biological networks.

BME 090. Internship. 1-3 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

BME 092. Independent Study. 1-18 Credits.

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 096. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

BME 111. Core 3: Systems & Signals. 0 or 6 Credits.

Studio-style course that fuses lecture with project-based learning and laboratory exercises. Covers linear modeling of biological systems with mechanical, electrical, fluidic, and thermal elements, continuous/discrete-time descriptions of signals and linear systems, fourier and Laplace analysis and feedback systems, collection and processing of signals and images. Prerequisite: BME 012. Pre/Co-requisite: MATH 271.

BME 112. BME Design 3. 0 or 2 Credits.

Industry-standard biodesign and project management processes. Application of principles to small-scale team-based design projects in collaboration with existing BME Capstone Design teams and to identify future Capstone projects. Shop training. Prerequisite: BME 014.

BME 151. Fall BME Workshop. 0 or 1 Credits.

Seminars and lab tours to provide biomedical context to concurrently taken engineering courses. Professional development including guidance and review of resume, cover letter, and personal statement.

BME 152. Spring BME Workshop. 0 or 1 Credits.

Guest speakers and seminars to provide biomedical design examples, ethics, and insight to the biomedical engineering design process including regulatory processes.

BME 181. Biomedical Eng Lab II. 0 or 2 Credits.

Laboratory experiments including those related to biomedical sensing and instrumentation, biomechanics, tissue engineering, and/or computer-based modeling of biological networks. Prerequisite: BME 081.

BME 185. BME Capstone Design I. 0 or 3 Credits.

Teams apply industry-standard biodesign and project management processes to design, build, and test a functional prototype that meets their client's requirements. Prerequisite: BME 112.

BME 186. BME Capstone Design II. 0 or 3 Credits.

Teams refine their functional prototype from BME Capstone Design I and explore approaches for manufacturing at scale, regulatory strategy, clinical strategy, IP strategy, health-economics and reimbursement. Prerequisite: BME 185.

BME 187. Capstone Design I. 3 Credits.

Project-based course. Multidisciplinary teams apply their knowledge to design, analyze, build and test a functional prototype that meets client's requirements and solves unique problems. Teams follow engineering design and project management processes such as periodic reports, presentations, meetings, reviews and demonstrations using standard industry tools. Prerequisite: EE 120 or EE 171, and EE 184 or Instructor permission; or Senior standing in Mechanical or Biomedical Engineering. Cross-listed with: EE 187, ME 185.

BME 188. Capstone Design II. 3 Credits.

Project-based course. Multidisciplinary teams apply their knowledge to design, analyze, build and test a functional prototype that meets client's requirements and solves their problems. Teams follow engineering design and project management processes such as periodic reports, presentations, meetings, reviews and demonstrations using standard industry tools. Prerequisite: Senior standing. Cross-listed with: EE 188, ME 186.

BME 190. Internship. 1-18 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

BME 192. Independent Study. 1-18 Credits.

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 193. College Honors. 3-6 Credits.

Honors studies leading to a thesis. Prerequisite: CEMS 101.

BME 194. College Honors. 3-6 Credits.

Honors studies leading to a thesis. Prerequisite: BME 193.

BME 196. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

BME 197. Teaching Assistantship. 1-3 Credits.

Undergraduate student service as a teaching assistant, usually in an introductory-level course in the discipline, for which credit is awarded. Offered at department discretion.

BME 198. Undergraduate Research. 1-18 Credits.

Undergraduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 201. Biomaterials Engineering. 3 Credits.

A materials science and engineering approach is used to explore the structure-function relationships of natural and bio-inspired materials for various engineering applications. The emphasis is on mechanical design and function. The medical applications of biomaterials will be discussed. Prerequisites: ME 101 or BME 112. Cross-listed with: ME 201.

BME 204. Biothermodynamics. 3 Credits.

Inter-disciplinary; guides the student through the thermodynamics of living organisms, comprised of the study of energy transformation in the life sciences. Designed for students from the STEM disciplines. Covers Gibbs free energy, statistical thermodynamics, binding equilibria, and reaction kinetics. Prerequisites: ME 123, ME 124, or BME 112. Cross-listed with: ME 204.

BME 206. Biomechanics of Human Motion. 3 Credits.

Biomechanics of Human Motion will describe the typical processes-from small scale protein interactions to large scale joint torques-that result in human locomotion. Clinical problems and athletic performance will be discussed. Students will learn about musculoskeletal tissues related to force generation/transmission and will perform kinematic/kinetic analyses. Prerequisite: BME 011 or ME 012. Pre/Co-requisites: ME 101, ME 111, or BME 111. Cross-listed with: ME 206.

BME 208. Biomechanics: Tissue Engr. 3 Credits.

Solid biomechanics including structure, function and mechanical properties of biological tissues. Tissue engineering involving cell mechanics, scaffold materials, and signaling. Current literature topics are covered. Prerequisites: ME 101 or BME 112. Cross-listed with: ME 208.

BME 227. Biomedical Instrumentation. 3 Credits.

Measurement techniques for biomedical engineering research and industry, and health care institutions. Integrated biomedical monitoring, diagnostic, and therapeutic instrumentation. Prerequisite: EE 100 or EE 004 or EE 075 or EE 021. Co-requisite: EE 120, ANPS 020, or Instructor permission. Cross-listed with: EE 227.

BME 229. Biosignal Decoding. 3 Credits.

Overview of biomedical measurement techniques; development of Python software to visualize, denoise, and decode biomedical signals. Prerequisites: CS 021; (BME 111 or EE 171) or (ME 111 and EE 101) or Instructor permission. Pre/Co-requisites: Beginner knowledge of Python programming is strongly suggested. Cross-listed with: EE 229.

BME 240. Wearable Sensing. 3 Credits.

Covers current state-of-the-art in wearable sensors and the biomechanical and physiological phenomena they are being used to measure. Emphasis will be given to applications related to human health and medicine. Prerequisite: ME 111 or EE 171 or equivalent with Instructor permission.

BME 241. Biomedical Signal Processing. 3 Credits.

Covers several important physiological signals often monitored in biomedical contexts (e.g. EMG, ECG, PPG). Content will include the physiology that generates the signals as well as the signal processing techniques (e.g., LTI filters, empirical mode and wavelet decomposition) and algorithms used for analysis. Prerequisite: ME 111 or EE 171 or equivalent with Instructor permission.

BME 250. Nanobiomaterials. 3 Credits.

Covers the classes of nanomaterials used biomedically, the biological response, and material testing. Content includes applications of nanomaterials in drug delivery, nano-topography of surfaces, sensors, and imaging as well as the topic of nanotoxicity. Pre/Co-requisites: ME 101, BME 111, or equivalent with Instructor permission.

BME 290. Internship. 1-18 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

BME 292. Independent Study. 1-18 Credits.

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BME 296. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

BME 297. Teaching Assistantship. 1-3 Credits.

Undergraduate student service as a teaching assistant, usually in an introductory-level course in the discipline, for which credit is awarded. Offered at department discretion.

BME 298. Undergraduate Research. 1-18 Credits.

Undergraduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.