

BIOMEDICAL ENGINEERING (B M E)

Courses primarily for undergraduates:

B M E 220: Introduction to Biomedical Engineering

(Cross-listed with CH E). (3-0) Cr. 3. S.

Prereq: BIOL 212, ENGR 160 or equiv, MATH 166, CHEM 167 or CHEM 178, PHYS 222

Engineering analysis of basic biology and engineering problems associated with living systems and health care delivery. The course will illustrate biomedical engineering applications in such areas as: biotechnology, biomechanics, biomaterials and tissue engineering, and biosignal and image processing, and will introduce the basic life sciences and engineering concepts associated with these topics.

B M E 341: BioMEMs and Nanotechnology

(3-0) Cr. 3.

Prereq: B M E 220

Overview of Micro-Electro-Mechanical-System (MEMS) technologies for bioengineering, fundamentals of microfluidic device design, fabrication, and characterization, survey of microfluidic functional building blocks for lab-on-a-chip applications including mixers, valves, channels, and chambers. Topics of nanotechnology in bioengineering, nanoscale building block technologies for bioengineering including self-assembling, surface chemical treatment, nano-imprinting, nano-particles, nano-tubes, nano-wires, and stimuli-responsive biomaterials.

B M E 341L: BioMEMS and Nanotechnology Laboratory

(0-3) Cr. 1.

Prereq: B M E 220, concurrent enrollment in B M E 341

Introductory laboratory course accompanying B M E 341. Design, fabrication, and characterization of BioMEMS lab-on-a-chip devices and nanoscale techniques for bioengineering. Student group projects.

B M E 352: Molecular, Cellular and Tissue Biomechanics

(3-0) Cr. 3.

Prereq: B M E 220, E M 324, MAT E 273

Introduction to the anatomy of the musculoskeletal system and connective tissue. Range of movement, joint dislocation, bone deformity and fracture. Application of continuum mechanics to both living and non-living systems. Laws of motion, free-body diagrams and simple force analysis of musculoskeletal system. Biomechanical response of soft and hard tissues with emphasis on microstructure and mechanical properties. Applications to bioengineering design.

B M E 428: Image Processing with Biomedical Applications

(3-0) Cr. 3.

Prereq: E E 324

Review of signal processing, linear algebra, probability. Image sampling and quantization. Image transforms, image enhancement, image denoising/restoration. Tomographic reconstruction, segmentation and registration, recognition and shape analysis and applications in Computer Aided disease Detection (CAD).

B M E 440: Biomedical Applications of Chemical Engineering

(Cross-listed with CH E). (3-0) Cr. 3.

Prereq: CH E 210, MATH 266 or MATH 267, PHYS 222

Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

B M E 450: Biosensing

(Cross-listed with E E). (3-0) Cr. 3.

Prereq: B M E 220

Overview of biosensors and bioanalytical challenges; designing for performance including various analytical problems, ion-selective membranes, characteristics of enzymes and basics of bioaffinity sensing; fundamentals of bioselective layers including depositing films and membranes, surfaces for immobilization and bioselective agents; survey of different biosensing technologies including electroanalytical, biomembrane, optical, and acoustic-wave based sensors.

B M E 450L: Biosensing Laboratory

(Cross-listed with E E). (0-3) Cr. 1.

Prereq: B M E 220, concurrent enrollment in B M E 450

Laboratory course accompanying B M E 450. Design, fabrication, and characterization of various electrical, chemical, polymer, optical and acoustic sensors.

B M E 456: Biomaterials

(Cross-listed with MAT E). (3-0) Cr. 3. F.

Prereq: CHEM 178 and MAT E 216 or MAT E 273 or MAT E 392

Presentation of the basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses.

B M E 466: Multidisciplinary Engineering Design

(Cross-listed with A B E, AER E, CPR E, E E, ENGR, I E, M E, MAT E). (1-4)

Cr. 3. Repeatable. F.S.

Prereq: Student must be within two semesters of graduation; permission of instructor.

Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

B M E 490: Independent Study

Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.

Prereq: permission of chair for the bioengineering minor

Investigation of biomedical engineering topics of special interest to student and supervising faculty member with a final written report.