Biomedical Engineering (BME)

Courses

BME 1. Introduction to Biomedical Engineering. 3 Units.
Introduction to the central topics of biomedical engineering. Offers a perspective on bioengineering as a discipline in a seminar format. Principles of problem solving, design, engineering inventiveness, entrepreneurship, information access, communication, ethics, teamwork, and social responsibility are emphasized.

(Design units: 1)

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment.

BME 3. Engineering Innovations in Treating Diabetes. 4 Units.
Innovations in diabetes treatment from the 1800s until the present: purification of insulin, measuring and control of blood glucose, recombinant DNA, clinical trials, and ethics. Solving optimization problems in engineering with Excel.

(II and VA).

BME 50A. Cell and Molecular Engineering. 4 Units.
Molecular, structural, genetic, biophysical, and cellular principles of life and bioengineering. Introduction to molecular bioengineering, genetic engineering, synthetic biology, and cell biology. Applications to genetic and biomolecular design.

(Design units: 1)

Prerequisite or corequisite: BME 1 and (CHEM 1C or CHEM H2C)

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Chemical Engineering Majors have first consideration for enrollment. Materials Science and Engr Majors have first consideration for enrollment.

BME 50B. Cell and Molecular Engineering. 4 Units.
Physiological function from a cellular, molecular, and biophysical perspective. Introduction to genetics, neuronal signaling, and cell cycle control.

(Design units: 1)

Prerequisite: BME 50A

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Chemical Engineering Majors have first consideration for enrollment.

BME 60A. Engineering Analysis/Design: Data Acquisition. 4 Units.
Fundamentals of LabVIEW programming, basics of computer-based experimentation, establishing interface between computer and data acquisition instrumentation, signal conditioning basics. Materials fee.

(Design units: 2)

Prerequisite: PHYS 7D

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment.

BME 60B. Engineering Analysis/Design: Data Analysis. 4 Units.
Overview of MATLAB; numeric, cell, and structure arrays; file management; plotting and model building; solving linear algebraic equations; signal and image processing. Materials fee.

(Design units: 1)

Prerequisite or corequisite: MATH 3A

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment.

BME 60C. Engineering Analysis/Design: Computer-Aided Design. 4 Units.
Introduction to SolidWorks and Computer-Aided Design software; design; analysis; rapid prototyping; visualization and presentation; manufacturing planning. Materials fee.

(Design units: 2)

Prerequisite or corequisite: BME 1

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment.

BME 60D. Engineering Analysis/Design: Finite-Element Simulation. 4 Units.
Introduction to finite-element simulation; fundamentals of Multiphysics simulation;.

(Design units: 2)

Prerequisite: BME 60B and BME 60C

BME 110A. Biomechanics I. 4 Units.
Introduction to statics and dynamics. Topics include rigid bodies, analysis of structures, forces in beams, moments of inertia, friction, kinetics, work, and energy.

(Design units: 1)

Prerequisite: PHYS 7C and MATH 3A and MATH 3D and BME 60B and BME 60C

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment. Materials Science and Engr Majors have first consideration for enrollment.

BME 110B. Biomechanics II. 4 Units.
Introduction to biomechanics from subcellular to tissue levels. Introduction to stress, strain, and constitutive laws of cells and tissues. Emphasis is placed on biosolids. Introduction to elastic and viscoelastic behaviors with emphasis on the standard linear model of viscoelasticity.

(Design units: 1)

Prerequisite: BME 110A

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment. Materials Science and Engr Majors have first consideration for enrollment.

BME 110C. Biomechanics III. 4 Units.
Introduction to human biomechanics with emphasis on cardiovascular biomechanics and biofluid mechanics.

(Design units: 0)

Prerequisite: BME 110B

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

BME 111. Design of Biomaterials. 4 Units.
Natural and synthetic polymeric materials. Metal and ceramics implant materials. Mechanical properties, degradation, surface characterization, and design of materials. Wound repair, blood clotting, foreign body response, biocompatibility of material. Artificial organs and medical devices. Government regulations.

(Design units: 3)

Prerequisite or corequisite: (BME 50B or BIOL 99) and CHEM 1C

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment. Materials Science and Engr Majors have first consideration for enrollment.

BME 114. Genetic Engineering and Synthetic Biology. 4 Units.
Exploring how biological function can be engineered and "synthesized" from the DNA level up.

(Design units: 0)

Prerequisite: (CHEM 1C or CHEM H2C) and MATH 3D and BME 50A and BME 50B

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

BME 120. Sensory Motor Systems. 4 Units.
A quantitative and systems approach to understanding physiological systems. Systems covered include the nervous and musculoskeletal systems.

(Design units: 2)

Prerequisite: (BME 60B or EECS 10 or EECS 12 or CEE 20 or MAE 10) and MATH 3D and PHYS 7D

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment. Materials Science and Engr Majors have first consideration for enrollment.

Concurrent with BME 220.

BME 121. Quantitative Physiology: Organ Transport Systems. 4 Units.
A quantitative and systems approach to understanding physiological systems. Systems covered include the cardiopulmonary, circulatory, and renal systems.

(Design units: 1)

Prerequisite: (BME 60B or EECS 10 or EECS 12 or CEE 20 or MAE 10) and MATH 3D

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment. Chemical Engineering Majors have first consideration for enrollment.

BME 130. Biomedical Signals and Systems. 4 Units.
Analysis of analog and digital biomedical signals; Fourier Series expansions; difference and differential equations; convolutions. System models: discrete-time and continuous-time linear time-invariant systems; Laplace and Fourier transforms. Analysis of signals and systems using computer programs.

(Design units: 1)

Prerequisite or corequisite: BME 60B and (MATH 3A or ICS 6N) and MATH 3D. Recommended: STAT 8.

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment.

BME 132. Introduction to Computational Biology. 4 Units.
The use of theories and methods based on computer science, mathematics, and physics in molecular biology and biochemistry. Basics in biomolecular modeling. Analysis of sequence and structural data of biomolecules. Analysis of biomolecular functions.

Prerequisite: MATH 2D or MATH 3A or STAT 7 or STAT 8

Same as BIOL M123, CS 183.

Concurrent with MBB 223 and BME 232.

BME 135. Photomedicine. 4 Units.
Studies the use of optical and engineering-based systems (laser-based) for diagnosis, treating diseases, manipulation of cells and cell function. Physical, optical, and electro-optical principles are explored regarding molecular, cellular, organ, and organism applications.

(Design units: 0)

Prerequisite: PHYS 3C or PHYS 7D

Same as BIOL D130.

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

BME 136. Engineering Medical Optics. 4 Units.
Principles of optics and photonics, integration of optical components into systems and devices, and analysis of physiological signals obtained from Biophotonics measurements.

(Design units: 3)

Prerequisite: BME 130 and (BME 135 or BIOL D130)

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

Concurrent with BME 251.

BME 137. Introduction to Biomedical Imaging. 4 Units.
Introduction to imaging modalities widely used in medicine and biology, including X-ray, computed tomography (CT), nuclear medicine (PET and SPET), ultrasonic imaging, magnetic resonance imaging (MRI), optical tomography, imaging contrast, imaging processing, and complementary nature of the imaging modalities.

(Design units: 1)

Prerequisite: BME 130 or EECS 50 or EECS 150

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

BME 138. Spectroscopy and Imaging of Biological Systems. 4 Units.
Principles of spectroscopy; absorption; molecular orbitals; multiphoton transitions; Jablonski diagram; fluorescence anisotropy; fluorescence decay; quenching; FRET; excited state reactions; solvent relaxations; instruments; microscopy: wide field, LSM, TPE; fluorescent probes, fluctuations spectroscopy; optical resolution and super-resolution; CARS and SHG microscopy.

(Design units: 1)

Prerequisite: (MATH 3A or ICS 6N) and MATH 3D. Recommended: STAT 8.

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment.

Concurrent with BME 238.

BME 140. Design of Biomedical Electronics. 4 Units.
Analog and digital circuits in bioinstrumentation. AC and DC circuit analysis, design and construction of filter and amplifiers using operational amplifier, digitization of signals and data acquisition, bioelectrical signals, design and construction of ECG instrument, bioelectrical signal measurement and analysis. Materials fee.

(Design units: 3)

Prerequisite: BME 60A and BME 130

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

BME 142. Microfabrication. 4 Units.
Essentials of photolithography, soft-lithography, microfabrication, Microelectromechanical Systems (MEMS), BioMEMS; applications in biomedical engineering.

(Design units: 2)

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

BME 147. Microfluidics and Lab-on-a-Chip. 4 Units.
Introduction to principles of microfluidics and state-of-the-art micro Total Analysis Systems (uTAS). Lab-on-a-Chip for bimolecular assays with device design principles for microscale sample preparation, flow transport, bimolecular manipulation, separation and detection, and the technologies for integrating these devices into microsystems.

(Design units: 1)

Prerequisite: BME 110C

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

Concurrent with BME 260.

BME 148. Microimplants. 4 Units.
Essential concepts of biomedical implants at the micro scale. Design, fabrication, and applications of several microimplantable devices including cochlear, retinal, neural, and muscular implants.

(Design units: 1)

Prerequisite: BME 111

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

Concurrent with BME 262.

BME 150. Biotransport Phenomena. 4 Units.
Fundamentals of heat and mass transfer, similarities in the respective rate equations. Emphasis on practical application of fundamental principles.

(Design units: 0)

Prerequisite: (BME 60B or CEE 20) and (MATH 3A or ICS 6N) and MATH 3D

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment.

BME 160. Tissue Engineering. 4 Units.
Quantitative analysis of cell and tissue functions. Emerging developments in stem cell technology, biodegradable scaffolds, growth factors, and others important in developing clinical products. Applications of bioengineering.

(Design units: 2)

Prerequisite: (BME 50B or BIOL 99) and BME 111 and BME 121 and BME 150

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment. Chemical Engineering Majors have first consideration for enrollment.

BME 170. Biomedical Engineering Laboratory. 4 Units.
Measurement and analysis of biological systems using engineering tools and techniques. Laboratory experiments involve living systems with the emphasis on measuring physiological parameters. Materials fee.

(Design units: 1)

Prerequisite: BME 50B and BME 120 and BME 130

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

BME 171. Cell and Tissue Engineering Laboratory. 4 Units.
Techniques in molecular, cellular, and tissue engineering. Topics include bacterial and mammalian cell culture, DNA cloning and gene transfer, fabrication of biomaterial scaffolds, and immunassays and microscopy techniques for cell-based assays.

(Design units: 0)

Prerequisite: BME 160

Restriction: Biomedical Engineering Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment.

BME 180A. Biomedical Engineering Design. 3 Units.
Design strategies, techniques, tools, and protocols commonly encountered in biomedical engineering; industrial design experience in group projects; ethics, economic analysis, and FDA product approval. Materials fee.

(Design units: 3)

Prerequisite: (BME 60B or MAE 10 or EECS 10) and (BME 60C or MAE 52 or EECS 31L) and (BME 140 or MAE 106 or EECS 170B). BME 180A, BME 180B, and BME 180C must be taken in the same academic year.

Grading Option: In progress only.

Restriction: Seniors only. Biomedical Engineering Majors only.

BME 180B. Biomedical Engineering Design. 3 Units.
Design strategies, techniques, tools, and protocols commonly encountered in biomedical engineering; industrial design experience in group projects; ethics, economic analysis, and FDA product approval. Materials fee.

(Design units: 3)

Prerequisite: BME 180A. BME 180A, BME 180B, and BME 180C must be taken in the same academic year.

Grading Option: In progress only.

Restriction: Seniors only. Biomedical Engineering Majors only.

BME 180C. Biomedical Engineering Design. 3 Units.
Design strategies, techniques, tools, and protocols commonly encountered in biomedical engineering; industrial design experience in group projects; ethics, economic analysis, and FDA product approval. Materials fee.

(Design units: 3)

Prerequisite: BME 180B. BME 180A, BME 180B, and BME 180C must be taken in the same academic year.

Restriction: Seniors only. Biomedical Engineering Majors only.

BME 195. Special Topics in Biomedical Engineering. 1-4 Units.
Studies in selected areas of Biomedical Engineering. Topics addressed vary each quarter.

(Design units: 1-4)

Prerequisite: Prerequisites vary.

Repeatability: Unlimited as topics vary.

BME 197. Seminars in Biomedical Engineering. 2 Units.
Presentation of advanced topics and reports of current research efforts in Biomedical Engineering.

(Design units: 1-2)

Restriction: Seniors only. Biomedical Engineering Majors have first consideration for enrollment.

Concurrent with BME 298.

BME 199. Individual Study. 1-4 Units.
Independent research conducted in the lab of a biomedical engineering core faculty member. A formal written report of the research conducted is required at the conclusion of the quarter.

(Design units: 1-4)

Repeatability: May be taken for credit for 8 units.

BME 199P. Individual Study. 1-4 Units.
Supervised independent reading, research, or design for undergraduate Engineering majors. Students taking individual study for design credit are to submit a written paper to the instructor and to the Undergraduate Student Affairs Office in the School of Engineering.

(Design units: 1-4)

Grading Option: Pass/no pass only.

Repeatability: May be repeated for credit unlimited times.

BME 201P. Biomedical Big Data. 4 Units.
Analysis and visualization of large biomedical datasets. Topics covered include cloud computing, learning Structured Query Language (SQL), database normalization and joins, using Google's BigQuery, using the statistical analysis package R, machine learning algorithms, application of machine learning for classification problems.

Restriction: Master of Engineering students only. Graduate students only.

BME 202P. Biomedical Imaging and Biophotonics. 4 Units.
Designed as a subfield of optical imaging and biophotonics as it applies to their applications to basic lifesciences and in vivo imaging to diagnose disease. Topics span all of of the areas of biophotonics and techniques.

Restriction: Master of Engineering students only. Graduate students only.

BME 203P. Digital Health. 4 Units.
Digital health is the convergence of genomics and technology to radically change the way health and medicine is practiced. Explores the history of healthcare in the U.S., its current status, and the future of digital health.

Restriction: Master of Engineering students only. Graduate students only.

BME 210. Molecular and Cellular Engineering. 4 Units.
Engineering of physiological function at the genetic, cellular, and tissue scales. Topics include cloning and genetic engineering, extracellular matrix biomaterials, principles of regenerative medicine and tissue engineering, and experimental design.

Restriction: Graduate students only.

BME 210P. Molecular and Cellular Engineering. 4 Units.
Engineering of physiological function at the genetic, cellular, and tissue scales. Topics include cloning and genetic engineering, extracellular matrix biomaterials, principles of regenerative medicine and tissue engineering, and experimental design.

Restriction: Master of Engineering students only. Graduate students only.

BME 211. Microscale Tissue Engineering. 4 Units.
Engineering of physiological function at the scale of individual cells. Topics include cell micropatterning, microfluidic tissue culture, engineering the cellular microenvironment, and microphysiological systems.

Restriction: Graduate students only.

BME 211P. Microscale Tissue Engineering. 4 Units.
Engineering of physiological function at the scale of individual cells. Topics include cell micropatterning, microfluidic tissue culture, engineering the cellular microenvironment, and microphysiological systems.

Restriction: Master of Engineering students only. Graduate students only.

BME 212. Cardiovascular Mechanobiology. 4 Units.
Advanced topics in cellular engineering and mechanobiology, with focus on the cardiovascular system. Tools and techniques used to manipulate and measure mechanical forces at the molecular, cellular, tissue, and organ levels, and their applications in cardiovascular devices and tissue engineering.

Restriction: Graduate students only.

BME 212P. Cardiovascular Mechanobiology. 4 Units.
Advanced topics in cellular engineering and mechanobiology, with focus on the cardiovascular system. Tools and techniques used to manipulate and measure mechanical forces at the molecular, cellular, tissue, and organ levels, and their applications in cardiovascular devices and tissue engineering.

Restriction: Master of Engineering students only. Graduate students only.

BME 213. Systems Cell and Developmental Biology. 4 Units.
Introduces concepts needed to understand cell and developmental biology at the systems level, i.e., how the parts (molecules) work together to create a complex output. Emphasis on using mathematical/computational modeling to expand/modify insights provided by intuition.

Same as DEVB 232.

Restriction: Graduate students only.

BME 215. Linking Modeling and Experiments in Bioengineering. 4 Units.
Overview of modeling based on experimental techniques in bioengineering. Construct and evaluate models of varying complexity and to relate them to experimental data.

Prerequisite: BME 220 and BME 221

Restriction: Graduate students only.

BME 220. Sensory Motor Systems. 4 Units.
A quantitative and systems approach to understanding physiological systems. Systems covered include the nervous and musculoskeletal systems.

Restriction: Graduate students only.

Concurrent with BME 120.

BME 220P. Sensory Motor Systems. 4 Units.
A quantitative and systems approach to understanding physiological systems. Systems covered include the nervous and musculoskeletal systems.

Restriction: Master of Engineering students only. Graduate students only.

BME 221. Organ Transport Systems. 4 Units.
A quantitative and systems approach to understanding physiological systems. Systems covered include the cardiopulmonary, circulatory, and renal systems.

Restriction: Graduate students only.

BME 221P. Organ Transport Systems. 4 Units.
Applies engineering models and mathematics to understand human physiology in order to understand the physiology. Covers the pulmonary, cardiac, and cardiovascular systems focusing on transport phenomena.

Restriction: Master of Engineering students only. Graduate students only.

BME 222. Biofluid Mechanics . 4 Units.
Introduces principles of biofluid mechanics in a research oriented scheme and approaches a wide spectrum of biofluid related problems in human body and solutions that involves engineering concepts.

Restriction: Graduate students only.

BME 224. Molecular and Cellular Biophotonics. 4 Units.
Principles underlying the application of photonic technologies to biomolecular and cellular systems. Sample technologies Optical Tweezers, Linear and Nonlinear Optical Microscopy and Fluorescence Lifetime and Correlation Methods, and their use to investigate emergent problems in Molecular, Cellular, and Developmental Biology.

Same as CHEM 224.

Restriction: Graduate students only.

BME 225. Tissue and Organ Biophotonics. 4 Units.
Principles underlying the application of photonic technologies to tissues, organs, organisms. Sample technologies include Optical Coherence Tomography, Optical Speckle Imaging, Optoacoustic Imaging, Wide-Field Spectroscopic Imaging, Diffuse Optical Spectroscopy. Addressing the use of these technologies to detect/monitor disease and physiological processes.

BME 230A. Applied Engineering Mathematics I. 4 Units.
Analytical techniques applied to engineering problems in transport phenomena, process dynamics and control, and thermodynamics.

BME 230B. Applied Engineering Mathematics II. 4 Units.
Focuses on biomedical system identification. Includes fundamental techniques of model building and testing such as formulation, solution of governing equations, sensitivity theory, identifiability theory, and uncertainty analysis.

Restriction: Graduate students only.

BME 232. Introduction to Computational Biology. 4 Units.
The use of theories and methods based on computer science, mathematics, and physics in molecular biology and biochemistry. Basics in biomolecular modeling. Analysis of sequence and structural data of biomolecules. Analysis of biomolecular functions.

Same as MBB 223.

Restriction: Graduate students only.

Concurrent with BIOL M123 and CS 183 and BME 132.

BME 233. Dynamic Systems in Biology and Medicine. 4 Units.
Introduces principles of system theory to analyze biological, biochemical, physiological, and bioengineering systems. Analytical and computational tools are used to model and analyze dynamic systems such as population, neuronal and heart dynamics, biochemical and physiological systems, oxygen diffusion and similar.

Restriction: Graduate students only.

BME 233P. Dynamic Systems in Biology and Medicine. 4 Units.
Introduces the elements of system theory, and applies these principles to analyze biomedical, chemical, social, and engineering systems. Using analytical and computational tools to model and analyze various dynamic systems.

Restriction: Master of Engineering students only. Graduate students only.

BME 234. Neuroimaging Data Analysis. 4 Units.
Knowledge and understanding of recent techniques for the analysis of healthy and pathological structure and function in neuroimaging data.

Restriction: Graduate students only.

BME 234P. Neuroimaging Data Analysis. 4 Units.
Knowledge and understanding of recent techniques for the analysis of healthy and pathological structure and function in neuroimaging data.

Restriction: Master of Engineering students only. Graduate students only.

BME 238. Spectroscopy and Imaging of Biological Systems. 4 Units.
Principles of spectroscopy; absorption; molecular orbitals; multiphoton transitions; Jablonski diagram; fluorescence anisotropy; fluorescence decay; quenching; FRET; excited state reactions; solvent relaxations; instruments; microscopy: wide field, LSM, TPE; fluorescent probes, fluctuations spectroscopy; optical resolution and super-resolution; CARS and SHG microscopy.

Restriction: Graduate students only.

Concurrent with BME 138.

BME 238P. Spectroscopy and Imaging of Biological Systems. 4 Units.
Principles of spectroscopy; absorption; molecular orbitals; multiphoton transitions; Jablonski diagram; fluorescence anisotropy; fluorescence decay; quenching; FRET; excited state reactions; solvent relaxations; instruments; microscopy: wide field, LSM, TPE; fluorescent probes, fluctuations spectroscopy; optical resolution and super-resolution; CARS and SHG microscopy.

Restriction: Master of Engineering students only. Graduate students only.

BME 240. Introduction to Clinical Medicine for Biomedical Engineering. 4 Units.
An introduction to clinical medicine for graduate students in biomedical engineering. Lectures and rotations through nephology, gastroenterology, pulmonary, and critical care cardiology.

Restriction: Graduate students only. Biomedical Engineering Majors only.

BME 240P. Introduction to Clinical Medicine for Biomedical Engineering. 4 Units.
An introduction to clinical medicine for graduate students in biomedical engineering. Lectures and rotations through nephology, gastroenterology, pulmonary, and critical care cardiology.

Restriction: Master of Engineering students only. Graduate students only.

BME 251. Engineering Medical Optics. 4 Units.
Principles of optics and photonics, integration of optical components into systems and devices, and analysis of physiologic signals obtained from Biophotonics measurements.

Restriction: Graduate students only.

Concurrent with BME 136.

BME 251P. Engineering Medical Optics. 4 Units.
Principles of optics and photonics, integration of optical components into systems and devices, and analysis of physiologic signals obtained from Biophotonics measurements.

Restriction: Master of Engineering students only. Graduate students only.

BME 252. Critical Thinking in Biophotonics. 2 Units.
Critical thematic review of current research papers in the field of Biophotonics.

Prerequisite: BME 224 or BME 225

Repeatability: May be taken for credit 2 times.

Restriction: Graduate students only.

BME 260. Microfluids and Lab-On-A-Chip. 4 Units.
Introduction to microfluidics and state-of-the-art micro Total Analysis Systems (uTAS). Lab-on-a-Chip for biomolecular assays with device design principles for microscale sample preparation, flow transport, biolmolecular manipulation, separation and detection, and the technologies for integrating these devices into microsystems.

Restriction: Graduate students only.

Concurrent with BME 147.

BME 260P. Microfluids and Lab-on-a-Chip. 4 Units.
Introduction to microfluidics and state-of-the-art micro Total Analysis Systems (uTAS). Lab-on-a-Chip for biomolecular assays with device design principles for microscale sample preparation, flow transport, biolmolecular manipulation, separation and detection, and the technologies for integrating these devices into microsystems.

Restriction: Master of Engineering students only. Graduate students only.

BME 262. Microimplants. 4 Units.
Essential concepts of biomedical implants at the micro scale. Design, fabrication, and applications of several microimplantable devices including cochlear, retinal, neural, and muscular implants.

Restriction: Graduate students only.

Concurrent with BME 148.

BME 262P. Microimplants. 4 Units.
Essential concepts of biomedical implants at the micro scale. Design, fabrication, and applications of several microimplantable devices including cochlear, retinal, neural, and muscular implants.

Restriction: Master of Engineering students only. Graduate students only.

BME 290. Critical Thinking and Writing. 4 Units.
Critical thinking and writing are essential ingredients for success in scientific research. Examines examples from the scientific literature to extract principles of good scientific reasoning, experimental design, and writing.

Restriction: Graduate students only.

BME 295. Special Topics in Biomedical Engineering. 1-4 Units.
Studies in selected areas of Biomedical Engineering. Topics addressed vary each quarter.

Prerequisite: Prerequisites vary.

Repeatability: Unlimited as topics vary.

BME 295P. Special Topics in Biomedical Engineering. 4 Units.
Studies in selected areas of Biomedical Engineering. Topics addressed vary each quarter.

Prerequisite: Prerequisites vary.

Repeatability: Unlimited as topics vary.

Restriction: Master of Engineering students only. Graduate students only.

BME 296. Master of Science Thesis Research. 1-16 Units.
Individual research or investigation conducted in the pursuit of preparing and completing the thesis required for the M.S. in Engineering.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

BME 297. Doctor of Philosophy Dissertation Research. 1-16 Units.
Individual research or investigation conducted in the pursuit of preparing and completing the dissertation required for the Ph.D. in Engineering.

Repeatability: May be repeated for credit unlimited times.

BME 298. Seminars in Biomedical Engineering. 2 Units.
Presentation of advanced topics and reports of current research efforts in biomedical engineering. Designed for graduate students in the Biomedical Engineering program.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Concurrent with BME 197.

BME 299. Individual Research. 1-16 Units.
Individual research or investigation under the direction of an individual faculty.

Repeatability: May be repeated for credit unlimited times.