BME

Biomedical Engineering

BME 100 Introduction to Biomedical Engineering
An introduction to and overview of biomedical engineering and selected topics review state-of-the-art bioengineering developments in solving medical problems as well as the identification of clinical and health problems and their engineering solutions. Includes the role of biotechnology and biomedical engineers in supporting global human well-being.
3 credits

BME 201-H Biomedical Engineering and Society
How engineers interact with others in the development of solutions to societal problems, with emphasis on engineering problems arising in the biological realm. In-depth evaluations of both successful and unsuccessful technological initiatives illuminate the role of biomedical engineers in supporting the well-being of urban and rural populations throughout the world, through developments in medical engineering, biotechnology, environmental engineering, and ergonomic design. Not for credit in addition to BME 100.
Prerequisite: One D.E.C. category E course

BME 212 Biomedical Engineering Research Fundamentals
Introduction to data collection and analysis in the context of biophysical measurements commonly used by biomedical engineers. Statistical measures, hypothesis testing, linear regression, and analysis of variance are introduced in an application-oriented manner. Data collection methods using various instruments, A/D boards, and PCs as well as LabView, a powerful data collection computer package. Not for credit in addition to the discontinued BME 309.
Prerequisites: BME 100 and MEC 260
Pre-or Corequisite: BIO 202 or 203
3 credits

BME 300 Writing in Biomedical Engineering
See requirements for the major in Biomedical Engineering, upper-division writing requirement.
Prerequisites: WRT 102; U3 or U4 standing; BME major
Corequisites: Any 300-level BME course
S/U grading

BME 301 Bioelectricity
Theoretical concepts and experimental approaches used to characterize electric phenomena that arise in live cells and tissues. Topics include excitable membranes and action potential generation, cable theory, equivalent dipoles and volume conductor fields, bioelectric measurements, electrodes and electric stimulation of cells and tissues.
Prerequisites: ESE 271; ESG 111 (or CSE 130 or ESE 124 or MEC 111 or MEC 112); BIO 202 or 203, BME 212
3 credits

BME 303 Biomechanics
Illuminates the principles of mechanics and dynamics that apply to living organisms, from cells to humans to sequoia trees. The behavior of organisms is examined to observe how they are constrained by the physical properties of biological materials. Locomotion strategies (or the lack thereof) are investigated for the forces and range of motions required and energy expenditures. Includes the relationship between form and function to illustrate how form dominates behavior. Presents the physiological effects of mechanical stresses on organs, pathologies that develop from abnormal stress, and how biological growth and adaptation arise as a natural response to the mechanics of living.
Prerequisites: MEC 260; BIO 202 or 203; ESG 111 (or CSE 130 or ESE 124 or MEC 111 or MEC 112); BME 212
3 credits

BME 304-H Genetic Engineering
An introduction to the realm of molecular bioengineering with a focus on genetic engineering. Includes the structure and function of DNA, the flow of genetic information in a cell, genetic mechanisms, the methodology involved in recombinant DNA technology, and its application in society in terms of cloning and genetic modification of plants and animals (transgenics), biotechnology (pharmaceutics, genomics), bio-processing (production and process engineering focusing on the production of genetically engineered products), and gene therapy. Production factors such as time, rate, cost, efficiency, safety, and desired product quality are also covered. Considers societal issues involving ethical and moral considerations, consequences of regulation, as well as risks and benefits of genetic engineering.
Prerequisites: BME 100; BIO 202 or 203
3 credits

BME 305 Biofluids
The fundamentals of heat transfer, mass transfer, and fluid mechanics in the context of physiological systems. Techniques for formulating and solving biofluid and mass transfer problems with emphasis on the special features and the different scales encountered in physiological systems, from the organ and the tissue level down to the molecular transport level.
Prerequisites: AMS 361 and MEC 262
Pre-or Corequisite: BIO 202 or 203
3 credits

BME 313 Biostatistics
Basic concepts of biomedical instrumentation and medical devices with a focus on the virtual instrument in biomedical engineering using the latest computer technology. Topics include basic sensors in biomedical engineering, biological signal measurements, conditioning, digitizing, and analysis. Advanced applications of LabView, a graphics programming tool for virtual instrumentation. Helps students develop skills to build virtual instrumentation for laboratory research and prototyping medical devices.
Prerequisite: BME 212
3 credits

BME 353 Biomaterials: Manufacture, Properties, and Applications
The engineering characteristics of materials, including metals, ceramics, polymers, composites, coatings, and adhesives, that are used in the human body. Emphasizes the need of materials that are considered for implants to meet the material requirements specified for the device application (e.g., strength, modulus, fatigue and corrosion resistance, conductivity) and to be compatible with the biological environment (e.g., non-toxic, nonimmunogenic, resistant to blood clotting if in the cardiovascular system). This course is offered as both ESM 353 and BME 353.
Prerequisite: ESG 332
3 credits

BME 381 Nanofabrication in Biomedical Applications
Theory and applications of nanofabrication. Reviews aspects of nanomachines in nature with special attention to the role of self-assembly, intracellular or interstitial viscosity, and protein-guided adhesion. Discusses current nanofabricated machines to perform the same tasks and considers the problems of lubrication, compliance, and adhesion. Self-assembly mechanisms of nanofabrication with emphasis on cutting-edge discovery to overcome current challenges associated with nanofabricated machines.
Prerequisites: CHE 132 and BME 305
Pre-or Corequisite: BIO 202 or 203
3 credits

BME 404 Essentials of Tissue Engineering
Topics covered are developmental biology (nature’s tissue engineering), mechanisms of cell and cell-matrix interactions, biomaterial formulation, characterization of biomaterial properties, evaluation of cell interactions with biomaterials, principles of designing an engineered tissue. Considers manufacturing parameters such as time, rate, cost, efficiency, safety, and desired product quality as well as regulatory issues.
Prerequisites: BIO 202 or 203; CHE 132
Advisory prerequisites: CHE 321 and 322
3 credits

BME 420 Computational Biomechanics
Introduces the concepts of skeletal biology; mechanics of bone, ligament, and tendon; and linear and non-linear properties of biological tissues. Principles of finite differences method (FDM) and finite elements method (FEM) to solve biological problems. Both FDM and FEM are applied to solve equations and problems in solid and porous media. Requires knowledge of Fortran or C programming.
Prerequisites: BME 363; BME 305; MEC 363
3 credits

BME 430 Engineering Approaches to Drug and Gene Delivery
Introduction to the application of engineering principles and biological considerations in designing drug delivery systems for medical uses. The concept of biocompatibility and its implications in formulating controlled release devices are illustrated. Emphasis on the use of biodegradable materials to design drug delivery systems for site-specific applications.
Prerequisites: AMS 161 or MAT 132 or 142; BIO 202 or 203; BME 304
3 credits

BME 440 Biomedical Engineering Design
Introduction to product development from the perspective of solving biomedical, biotechnological, environmental, and ergonomic problems. Teamwork in design, establishing customer needs, writing specifications, and legal and financial issues are covered in the context of design as a decision-based process. A semester-long team design project follows and provides the opportunity to apply concepts covered in class.
Prerequisites: BME major; U4 standing; BME 301 and 305
3 credits

BME 441 Senior Design Project in Biomedical Engineering
Formulation of optimal design problems in biomedical and physiological settings. Introduces optimization techniques for engineering design and modeling for compact and rapid optimization of realistic biomedical engineering problems. Necessary conditions for constrained local optimum with special consideration for the constraints in which the product designed should function in terms of the settings (corporeal, ex-corpus, biological, etc.) and the safety considerations involved which are unique to biomedical engineering. Students carry out the detailed design of projects chosen early in the semester. A final design report is required.
Prerequisite: BME 440
3 credits

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Spring 2006: updates since Spring 2005 are in red
BME 461 Biosystems Analysis
Fundamentals of the linear time series analyses framework for modeling and mining biological data. Applications range from cardiorespiratory; renal blood pressure, flow, and sequence; to gene expression data. Tools of data analysis include Laplace and Z transforms, convolution, correlation, Fourier transform, transfer function, coherence function, various filtering techniques, and time-invariant and time-varying spectral techniques. 
*Prerequisites:* BME 212 and 301
3 credits

BME 475 Undergraduate Teaching Practicum
Students assist the faculty in teaching by conducting recitation or laboratory sections that supplement a lecture course. The student receives regularly scheduled supervision by the faculty instructor. May be used as an open elective and repeated once.
*Prerequisites:* BME major; U4 standing; a minimum g.p.a. of 3.00 in all Stony Brook courses and a grade of B or better in the course in which the student is to assist; or permission of the department
3 credits

BME 481 Biosensors
A comprehensive introduction to the basic features of biosensors. Discusses types of most common biological agents (e.g. chromophores, fluorescence dyes) and the ways in which they can be connected to a variety of transducers to create complete biosensors for biomedical applications. Focus on optical biosensors and systems (e.g. fluorescence spectroscopy, microscopy), and fiber-optically based biosensing techniques. New technologies such as molecular beacons, Q-dots, bioMEMs, confocal microscopy and multiphoton microscopy, and OCT will be referenced.
*Prerequisites:* BIO 202 or 203; ESE 271
3 credits

BME 499 Research in Biomedical Engineering
An independent research project with faculty supervision.
*Prerequisites:* B average in all science courses; permission of instructor and department
0-3 credits