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 (transgenic, biotechnology, biotechnology (pharmaceuticals, 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. Consider societal issues involving ethical and moral considerations, consequences of regulation, as well as risks and benefits of genetic engineering.

Prerequisites: BME 106; 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 Bioinstrumentation
Basic concepts of biomedical instrumentation and medical devices with a focus on the virtual instrumentation in biomedical engineering using the latest computer technology. Topics include basic sensors in biomedical engineering, biological signal measurement, 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 as specified for the device application (e.g., strength, modulus, fatigue and corrosion resistance, conductivity) and to be compatible with the biological environment (e.g., nontoxic, noncarcinogenic, resistant to blood clots 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-lubrication, 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
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. Considerations 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
3 credits

BME 420 Computational Biomechanics
Introduces the concepts of skeletal biology; mechanics of bone, ligament, and tendon; and linear and nonlinear properties of biological tissues. Principles of finite differences method (FDM) and finite elements method (FEM) to solve biomechanical 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 303; 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 bio-compatibility and its implications in formulating controlled release devices are illustrated. Emphasis on the use of biodegradable materials to design drug delivery devices for specific applications.

Prerequisites: AMS 161 or MAT 132 or 142 or 171; 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 models 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 (corporal, ex-corpo- ral, 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

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 252 or 205; ESE 271
3 credits

BME 488 Biomedical Engineering Internship
Participation in off-campus biomedical engineering practice. Students are required to submit a proposal to the undergraduate program director at the time of registration that includes the location, immediate supervisor, nature of the project, and hours per week for the project. One mid-semester report and one end-of-semester report are required. May be repeated up to a limit of 12 credits.
Prerequisites: EME 212 and permission of undergraduate program director
3-6 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