Biomedical Engineering MS Program

University of Bridgeport

Practical Student Guide
DEGREE REQUIREMENTS

To receive the MS in BME every student must earn 33 credits. Six credits are earned by completing a team based publishable graduate level research project. That means minimum 27 credits are earned by taking classes. Students will be advised for their classes from the broad range of course available as shown below.

The first six classes you should concentrate on taking BME 412 Intro to Biomedical Engineering and Biotechnology, BME 520 Physiology, BME 530 Instrumentation and Laboratory Experience, BME 540 Advanced Cellular and Molecular Biology, BME 560 Advanced Tissue Engineering BME 571 Advanced Biomedical Materials and Engineering

COURSE DESCRIPTIONS

BME/EE 412 Introduction to Biomedical Engineering
This course will be offered by the EE department in the fall 2009. This course is designed to introduce engineers to life science applications of traditional engineering and to introduce life scientists to engineering theory. BME 412 is a course providing a broad overview of the field.

BME/BIO 520 Physiology
The Physiological and Biochemical principles that control the function of the human body will be covered. Laboratory work will introduce the student to basic physiologic experimentation, interpretation and presentation of results.

BME 530 Instrumentation and Laboratory Experience
This course can be taken in any semester. The student who wishes to take the course should fill out the sheet included with this packet. On that sheet the student will identify laboratory techniques he/she is interested in learning, and the lab or labs on campus where he/she can get that experience. Working with the program director, engineering or life science, the students will get permission to enter the relevant lab and formulate an experimental plan with the faculty supervisor of that lab. At the end of the lab experience the student will present their lab notebook for inspection to the lab supervisors and the program director. Grades will be issued by the program director in consultation with the lab supervisors.

BME/BIO 540 Advanced Cell and Molecular Biology
The general biological principles that govern all living organisms will be discussed. The structure and function of cells with emphasis on gene activity at the molecular level, DNA replication and repair, transcription, translation, recombination, translocation and mutations. Techniques and experiments leading to important discoveries on DNA will be covered.
ME/ BME 560 Advanced Tissue Engineering
Graduate level course that deals with specific elements of tissue engineering design and analysis. Approaches to the regeneration of three tissue systems will be analyzed utilizing engineering design. Concepts ranging from tissue development and dynamic growth conditions to ultimate tissue properties will be addressed. Students will be required to acquire understanding and expertise from analysis of primary literature and will complete group presentations on directed approaches to tissue design and engineering in three tissue systems. To ensure in-depth understanding of different aspects of tissue engineering the groups will be required to focus on one or two key aspects in each mini design module; for example, use of stem cells, mechanical influence of the materials or dynamic growth conditions may be chosen as a focal point of the design process.

ME/BME 569 Advanced Biomedical Materials and Engineering
This course will cover the advanced level understanding on the different types of biomaterials using in medical purposes and their design. Examples include implants, stents, catheters, smart polymer gels, bone grafts, tissue scaffold and so on. Modern biology in biomedical engineering such as but not limited to protein absorption, immuno isolation, regenerative medicine etc will be covered. Ethical issues in biomedical engineering will be discussed. Current cutting edge research on nanobiotechnology that extends to biosensors, 3D biomatrix, advanced diagnostics, dental composites, sealants, adhesives will be covered. Device fabrication aspect of biomedical engineering especially that are at the interface of nanotechnology and biomaterials will be thoroughly discussed.

BME 571 Ethical Issues in Biomedical Research
This course will be offered as one hour discussion with the group of students in instructor’s office keeping in mind the ethical issues dealing with Biomedical Engineering. Health concern on handling nanobiomaterials, laws and bylaws associated with human subjects. Food and Drug administration’s requirement and hence creating ethical awareness associated with Biomedical Engineering study will be covered.

ME/BME 511 Designs and Development of Biomedical Instrument
This course offers the information to understand and design biomedical instruments. Biomedical Instruments contains imaging & monitoring the environment, simulation & modeling, instrument testing, bio-sensors & diagnostics, instrument design & development, therapeutic devices, next generation instrument technology, clinical & regulatory, and etc. The in-depth descriptions of design methods for biomedical instrument will be included in this course.

ME/BME 508 Biomechanics
Biomechanics is the application of mechanical principles to living organisms that includes bioengineering, research and analysis of mechanism in living organisms, and application of engineering principles to and from biological systems. This course can be carried forth on from the molecular level including collagen and elastin, all the way up to the tissue and organ level. Some simple applications of Newtonian mechanics can supply approximations on each level, but precise details demand the use of continuum mechanics.
ME/BME 506 Transport Phenomena in Biological Systems

This course provides understanding of the physical, chemical and biological processes governing the movement of mass and transmission of forces throughout an organism, which are important to biomedical engineers in the design and operation of biomedical devices. Engineering fundamentals of transport phenomena (fluid flow, heat transfer, and mass transfer) will be discussed in biological applications. Mathematical modeling will be used to analyze the biological transport and biochemical interactions in physiological systems, such as cardiovascular and respiratory systems. Numerical modeling will also be introduced to simulate some biological processes to enhance mathematical understanding.

EE/BME 546 - Bio-Signal Processing

This is an introductory course in Bio-Signal Processing (DSP) for graduate Electrical and Computer Engineering students. Sometime will be spent initially reviewing major concepts in signals and systems. Major topics to be covered in ELEG 546 include: Concepts of signal and image processing, wavelets, classification and clustering, and applications of these concepts to EEG, ECG, EMG, MRI and CT Scans.

BME 507 Algorithms in Bioinformatics

This course is tailored for students both in biomedical engineering dept. and computer science and engineering dept desiring to understand the issues concerning representing and analyzing genomes, sequence of proteins etc. The course is about applying the techniques (computational methods and systems) developed in computer science to solve problems in molecular biology such as DNA or protein sequences alignment problem, genome rearrangement problem, protein folding problems and so on. The problems in molecular biology may be solved by trivial algorithm - “given a string of letters, return a copy” for DNA replication or may be complex if intelligence has to be introduced into the algorithm to match the complicated behavior such as “material foraging before DNA replication” displayed by even a single celled organism. Hidden Markov Models (HMM), Bayesian Model, clustering, decision trees are some of the examples of machine learning methods that will be covered in the course.

BME-451: Introduction to BioMEMS

This course will introduce to students the fundamentals of BioMEMS, the application of MEMS (Microelectromechanical Systems) for biological applications. The topics include microfabrication, microfluidics, bio-sensors, actuators, micro/nano drug delivery systems, micro total analysis systems and lab-on-a-chip devices, and detection and measurement systems. The main focus is to understand the fundamental challenges and limitations involved in designing and fabricating various BioMEMS and BioNEMS devices.

BME/ME 440 Ergonomic Factors in Design

This course introduces the student to the concepts of ergonomics. Ergonomics is the study of fitting the workplace and devices to the capabilities of the human worker. Students will have an understanding of the beginnings and evolution of the field of ergonomics. They will learn to recognize risk factors associated with repetitive stress disorders (e.g., carpal tunnel syndrome) and potential sprain/strain injuries as well as be familiar with the body areas affected. This course covers principles of physiology and biomechanics and how they apply to workstation and tool design.
TCMG/BME 541: Foundations of Biotechnology and Bioentrepreneurship

This course defines biotechnology as the application of molecular biology for useful purposes. The biotechnology industry is shaped by scientific, legal, regulatory, social, economic, technological, political, financial and commercial factors. Understanding the dynamics and linked contributions of the interdisciplinary array of factors affecting the commercialization of biotechnology is essential to operate in the biotechnology industry. In this course we are dissecting the biotechnology industry to isolate the key drivers and study their interactions. Discoveries in science and fast developments in technology combined with financial availabilities offer many entrepreneurial opportunities. Bioentrepreneurship is a dynamic and social process, where researchers, physicians, computer scientists, business scholars and practitioners, financiers, attorneys, and other contributors individually or in interdisciplinary collaboration, identify or create opportunities and make something out of them to realize ideas of practical value. The ability to manipulate the genetic codes of organisms has set off an industrial convergence: farmers, physicians, drug makers, chemical processors, computer and communications companies, energy companies and many other commercial enterprises will converge into the largest global integrated and interdependent industry. Knowledge, its elucidation, creation, transformation, dissemination and utilization is the unlimited key resource that drives and permanently sustains the diverse businesses.

BME 620 Team Based Research Project

This must be taken in your last semester of course work or later. This is a team based project. You should form a multi-disciplinary team. Teams with members from both the life sciences and the quantitative sciences are strongly encouraged. Your team may include members of industry or visiting scholar or Ph.D. students from computer science department. Non-multidisciplinary teams or individual projects will not usually be approved. Your team also needs a faculty advisor. You may have more than one advisor, but one faculty member needs to be identified as the primary advisor. Your capstone project may be based on a single project or multiple projects. Each project, however, must be experimental or simulation in nature and be interdisciplinary. The project results should be publishable in peer reviewed journals.

Your team should submit a written project proposal to the BME program director. The proposal should be for 3 to 5 pages in length. It should describe the project with emphasis on the multi-disciplinary aspects. The relevant expertise of the various team members should be included, and a clear project outcome should be identified.

The program director (or directors) will evaluate all projects and make a recommendation to the program coordinating committee. In the event the program directors plan not to recommend approval for a project, the students and faculty advisor will be notified in advance so they can address the concerns of the program directors prior to a vote by the coordinating committee. All projects must be approved by the UB BME program committee prior to student enrollment in the BME 620 course.

Proposal for BME 530

Each student will need to have a faculty advisor or a team of participating faculties.

Student must identify (with the help of faculty advisor) the laboratory skills and techniques the student wish to explore and the location where the work will be performed.