CORE REQUIREMENTS
BME 140: INTRODUCTION TO BIOMEDICAL ENGINEERING

Total credits: 3 (3 engineering topics credits), 42 contact hours.

Instructor: Prof. Frank Yin, Whitaker 190A

Textbooks:
Michael Domach, Introduction to Biomedical Engineering, Pearson/Prentice Hall, 2nd ed. 2010 (Optional)

Catalog Description: An introduction to the vast and diverse field of biomedical engineering (BME), this very challenging course has two main purposes. One is to teach students -- via lectures, reading assignments, homework and exams -- to think on their own, to solve problems and how engineering principles are applied to areas of bioelectricity, biomechanics, biomolecules, biotechnology and bioimaging. The second is to introduce students -- via guest lectures by school of medicine and engineering faculty -- to some of the fascinating and challenging ongoing research in these areas. The course is challenging because students at this early stage, by and large, lack the knowledge base to understand either the engineering/biological aspects of the topical areas or the research being presented. Nevertheless, because future success depends on such, emphasis throughout is placed on developing self-learning as well as quantitative and analytical problem-solving skills, but at an appropriate level. By the end of the course it is hoped that students will have begun to acquire the skills and approaches necessary to succeed in the engineering curriculum as well as a much more in-depth and informed perspective of BME. The primary outcomes being addressed in this course are: A, E, F, G, H, I, J, K.

Prerequisites: None


Course Status: Required __x__ Elective _____ Selected elective _____ (select one)

HOMEWORK
All homework is due at the beginning of class one week after it is assigned -- unless otherwise specified. All homework is to be written, typed or printed on one side only of 8.5 x 11 inch paper. Multiple pages must be stapled (not clipped) together (as we will not accept responsibility for loose sheets). Hand in homework folded lengthwise with the text inside and with your name and assignment number on the inside and your name on the outside. Because of the tight schedule, no late homeworks will be accepted. In the final tabulation, your lowest homework grade will be dropped and not counted.

GRADING
Your final grade will be based on the following proportions:
• Homework 10%
• Exam #1 - 30%
• Exam #2 - 30%
• Final exam - 30%

The top 5% of the composite scores will earn a grade of A+. The remaining students will get grades based on 5% decrements from the lowest of the top 5% group. For example, if the lowest grade of the top 5% of the class is 88 points, those with grades of >83.6 (95% of 88) will earn A; those between 79.2 and 83.5 will earn A-, and so on.

ACADEMIC INTEGRITY

Students are expected to uphold the highest levels of academic integrity. This means doing your own work on exams, lab reports, papers and homework -- except when explicitly told by the instructor that it is acceptable to do otherwise. Academic integrity also means NO PLAGIARISM. Plagiarism is deliberately and willfully using someone else's work (figures, graphs, etc.) or words without proper attribution. For example, copying word-for-word, or essentially the same words in a part of a sentence or more and claiming that work to be your own is plagiarism. If you want to quote someone else's work, properly acknowledge it, e.g. put the text in quotes, or refer to a footnote. Violations of academic integrity will not be tolerated. The first violation will cost you an F for that exercise, the second violation will cost you an F for the course !!!

Topics covered:

Bioelectrical Systems Module
• Overview of Bioelectricity
• Ion channels
• Action potentials
• Nerve propagation
• Sensory systems
• Auditory signal processing
• Sensory systems
• Olfactory signal processing
• Neural networks
• Ventricular fibrillation
• Brain computation and motor learning
• Brain-computer interfaces
• Atrial fibrillation

Biomechanics Module
• Overview of biomechanics
• Cardiovascular biomechanics
• Cell and subcellular biomechanics
• Orthopedic mechanics – tendons
• Orthopedic mechanics – bones
• Mechanics of brain injury

Proteins and Biotechnology Module
• Nanotechnology
• Protein structure and function
• Protein thermodynamics
• Manipulating proteins
• Tissue engineering
• Biomaterials
• High throughput technology
• Biostatistics

Imaging Module
• Optical imaging
• Image processing
• Photoacoustic imaging
• MRI imaging