BME 301 - Electrical Fundamentals of Biomedical Engineering

3 credits, 4 Contact hours
Instructor: Raquel Perez-Castillejos, Ph.D.
Course Coordinator: Mesut Sahin, Ph.D.

Textbook(s)/Materials Required:
Basic Electricity, Schaum Outline, 2nd Edition, 2010, McGraw-Hill, ISBN: 9780071635288

Description:
Course lectures and laboratories will address important issues for biomedical engineers at the introductory level; covering the origins of bio-electric signals and the instrumentation involved in collection of biopotentials from the electrodes to processing of the signals on the computer. Some other topics included are the transducers/sensors and modern engineering software used in bio-instrumentation. Laboratory work will provide hands-on experience in all of these topics. The course will also address practical issues in design of medical devices such as noise, resolution, linearity, and saturation. This course is offered in Studio format that involves the integration of lectures and labs into one highly participatory structure.

Prerequisites:
Grade of C or higher in Phys 121 & Math 112, or Math 133

This is a required course for all Biomedical Engineering Majors.

Course Learning Outcomes:
1. Understand the basic current and voltage waveforms in RC circuits under DC and AC conditions
2. Learn the basic Op-Amp circuits and their usage for amplification and filtering of biological signals
3. Learn basic sensors for collection of physiological signals from living systems
4. Learn the bioelectrical phenomena (action potential generation, propagation, etc.)
5. Learn the origins of biopotentials and their characteristics in time and frequency domain
6. Learn the characteristics and electrical models of electrodes-electrode interface
7. Apply modern engineering tools (DAQ Board, MATLAB) to collect, analyze and interpret biological signals
8. Work in groups on lab exercises and develop written communication skills (lab reports)

Student Outcomes:

Student outcome A - An ability to apply foundations of math, science, and engineering to biomedical engineering problems
Related CLO – 2,3,5,6

Student outcome E - Ability to identify, formulate and solve biomedical engineering problems
Related CLO – 4,5

Course Topics:
General Anatomy and Physiology, Electrical Fundamentals, Capacitance in DC circuits, Concept of frequency and capacitance in AC circuits, Amplification and filtering, Analog to digital conversion and Matlab, Bioelectric Phenomena (Nernst potential, action potential), Biological Signals, Electrodes, Sensors and Transducers.