NJIT | DEPARTMENT OF BIOMEDICAL ENGINEERING

BME 301 Electrical Fundamentals of Biomedical Engineering

3 credits, 4 Contact hours
Instructor: Mesut Sahin, Ph.D.
Course Coordinator: Mesut Sahin, Ph.D.

Textbook(s)/Materials Required:

Milton Gussow, Schaum's Outline of Theory and Problems of Basic Electricity, McGraw-Hill, ISBN: 0-07-025240-8.

Description:

Course lectures and laboratory exercises will address fundamental concepts on the origin of bioelectric signals, and the basic electrical circuits and sensors for their collection into a computer. The first half of the course covers fundamentals of resistor circuits in DC, including Kirchhoff's voltage and current laws, capacitors in AC and phasors. Operational amplifiers, Low-Pass and High-Pass filtering, and the concept of Transfer Function will be introduced. In the second half, characteristics of various biopotentials (e.g. EEG, EOG, EMG) and the electrodes for their collection will be discussed in lectures and practiced in labs. Laboratory exercises will provide hands-on experience both on electrical circuits and the bioelectrical aspect of the course.

Prerequisites:

Grade of C or higher in Phys 121 & Math 112

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 1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Related CLO – 1,2,3,5,6,7

Course Topics: Series and Parallel Resistor Circuits, Charging and Discharging of Capacitor, Capacitors in AC circuits, Phasors in Capacitive Circuits, Low-Pass and High-Pass Filters, Transfer Function, Basic Op-Amp Circuits, Analog to Digital conversion, Basic Functions in MATLAB, Bioelectric Phenomena (Nernst potential, Action potential), Biopotential Signals, Electrodes, Sensors and Transducers.