BME 489 Medical Instrumentation

3 Credits,
3 Contact hours
Instructor: Tara Alvarez, Ph.D.
Course Coordinator: Tara Alvarez, Ph.D.

Textbook(s)/Materials Required:
Introduction to Biomedical Equipment Technology 4th Edition by Joseph Carr and John Brown
ISBN: 0130104922

Description:

The hardware and instrumentation needed to measure variables from different physiological systems. Electrodes, sensors and transducers. Bioelectric amplifiers. Hardware for measurement of the ECG, EEG, EMG, respiratory system, nervous system . Clinical laboratory instruments. Electrical safety. Computers in biomedical instrumentation. Students will have lectures and interactive laboratory exercises.

Prerequisites by topic:

BME 372 and BME 310

This is a required course for the Instrumentation and Signal Processing Track.

Course Learning Outcomes (CLO):

1. Biomedical Signals and Instrumentation Sensors: Learn several signals that can be measured from the human body. Specific examples include temperature, electrical, and pressure signals. Understand how noise from the environment, instruments and other physiologic systems can create artifacts in instrumentation. Understand the theory of how several sensors operate and use these sensors in laboratory sessions. Specific examples include thermistors and electrodes.
2. Instrumentation Design: Understand theory and design on Wheatstone bridge; inverting, noninverting, differential and instrumentation amplifiers. Design filters necessary to condition and isolate a signal. Understand how signals are digitized and stored in a computer or presented on an output display.
3. Instrumentation Application: Review the cardiac, respiratory and neural physiological systems. Study the designs of several instruments used to acquire signals from living

systems. Examples of instruments studied include ECG, blood pressure monitors, spirometers, EEG, MRI, and ultrasound. Integrate information learned about biomedical signals, sensors and instrumentation design to create a design of your own.

4. Work in Multi-disciplinary Teams: Learn written and oral communication skills necessary to present information learned from laboratory sessions. Learn how to work in a group to attain a common goal.

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

Student outcome 2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of **public health, safety, and welfare, as well as global, cultural, social,environmental, and economic factors**

Related CLO – 2,3

Student outcome 4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Related CLO - 3

Student Outcome 5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Related CLO – 4

Student outcome 6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and **use engineering judgment to draw conclusions**

Related CLO – 2, 3

Program Specific Criteria

A - an understanding of biology and physiology

Related CLO – 1

D - the ability to make measurements on and interpret data from living systems

Related CLO – 1,2,3

Course Topics: The following topics are discussed within this course: Theories of measurement; signals and noise, electrodes, sensors, transducer, Wheatstone bridge, Amplifiers, Heart and Circulatory System, Electrocardiographs, physiological pressure, sphygmomanometer, spirometers, electroencephalogram, imaging.