

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:

BME 373, BME 310 and ECE 251.

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 A: an ability to apply knowledge of mathematics, science, and engineering

Related CLO -1,2,3

Student outcome B: an ability to design and conduct experiments, as well as to analyze and interpret data

Related CLO – 2, 3

Student Outcome D: an ability to function on multi-disciplinary teams

Related CLO – 4

Student Outcome E: an ability to identify, formulate, and solve engineering problems

Related CLO – 1,2,3

Student outcome H - Broad education to understand effect of engineering solutions in a global, economic, environmental, and societal context.

Related CLO - 3

Student outcome J - Knowledge of contemporary issues.

Related CLO – 23

Student outcome L - Apply bio/physio insight for BME application

Related CLO – 1

Student Outcome N - an 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.

BME 495 – Capstone Design I

3 Credits, 5 Contact hours

Instructor: Joel Schesser, Ph.D.

Textbook(s)/Materials Required:

Class lecture notes

Description:

To provide students with the guidance to choose a capstone design topic and advisor and to prepare the design proposal. The course introduces the student to the definition of design as well

as introducing issues of intellectual property, bioethics and safety, and professional societies. This portion of the project includes library research, time and cost planning, oral and written reports, as well as construction, troubleshooting and demonstration of a working prototype.

Prerequisites: BME 372 or BME 420 or BME 351, senior standing, and permission of instructor
Co requisite: none

Objectives:

1. Project Implementation: Define the development of a biomedical engineering technology-based project. Develop engineering documentation for the selected project.
2. Use effective research and critical thinking skills while developing an understanding of ethical issues in research and design.
3. Perform multi-disciplinary teamwork, including written and verbal communication skills, while monitoring project progress using planning and milestone management.

Topics:

Industry Standard Product Development
Identifying Customer Needs
Market and Technical Product research
Teamwork Skills
Design Evaluation
Establishing Product Requirements
Project management and Microsoft Project
Intellectual Property
Animal and human subject testing
Budget and risk analysis

Professional Component: Biomedical Engineering Core Topics