BME 384 – Biomechanical Engineering Laboratory

3 Credits, 4 Contact hours
Instructor: Sergei Adamovich, Ph.D.
Course Coordinator: Sergei Adamovich, Ph.D.

Textbook(s)/Materials Required:

There are no required books, but as this class will be utilizing MATLAB extensively, we HIGHLY recommend purchasing a MATLAB textbook. Below are 2 good ones you can find online**:**

1. **Mastering MATLAB** by Duane C. Hanselman and Bruce L. Littlefield. Published October 8, 2011, ISBN-10: 0136013309 (or any earlier edition)
2. **Essential MATLAB for scientists & Engineers** by Brian Hahn & Dan Valentine. Published November 17, 2016. ISBN-10: 0081008775 (6th edition or earlier)

Description:

This laboratory course will expose students to a wide range of quantitative techniques for movement analysis. Students will learn how to use Matlab for data acquisition and analysis. Kinematic analysis will be performed using state of the art equipment with optoelectronic and electromagnetic motion sensors. Movement kinematics will be correlated with the electromyographic activity of the muscles. Analysis of movement kinetics will be performed using strain gauges and force sensors, including force plates for balance control studies.

Throughout the course, students will be given the opportunity to observe and ask questions about movement then analyze and evaluate the movement to answer their questions. This process will require the application and integration of anatomical and mechanical concepts to a wide variety of activities. At the conclusion of the course, students will demonstrate basic competence in a systematic approach to the observation, analysis, and evaluation of human movement in clinical, educational, and industrial environments.

Prerequisites:

BME 302, MECH 236, MECH 320 or BME 321, CS 101, and MATH 279 or MATH 333.

This is a required course for the Biomechanics Track.

Course Learning Outcomes (CLO):

1. Be able to identify the experimental problem in engineering terms, and then state the problem in a hypothesis.

2. Be able to apply the appropriate engineering tools and scientific knowledge to design and conduct an experiment to test the hypothesis
3. Be able to apply appropriate math/engineering analytical methods to present their data and to test the validity of their hypothesis.
4. Be capable of drawing appropriate conclusions from their data analysis.
5. Use the techniques, skills, and modern engineering tools necessary for engineering practice.
6. Be able to apply appropriate statistical tools for describing experimental data and testing hypotheses.
7. Be capable of making measurements on and interpret data from living systems.
8. Be able to address problems associated with the interaction between living and non-living materials and systems.

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, 3 , 4, 6

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, 5, 7

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 – 8

Course Topics:

The biomechanics of human motion; motion capture: optoelectronic cameras, electromagnetic sensors, force plates; basic muscle physiology: action potential, motor unit and electromyography; Matlab programming: scripting, functions, plotting and animation; signal processing: digital filtering and integration; hypotheses testing.