BME 451 – Biomechanics

3 Credits, 3 Contact hours
Instructor: Maxine Kwan, Ph.D.
Course Coordinator: Maxine Kwan, Ph.D.

Textbook(s)/Materials Required:
Research Methods in Biomechanics / Robertson et al. / Human Kinetics (2004) / ISBN-13: 978-0736039666

Description:
Biomechanics is an interdisciplinary field of engineering mechanics and biology. While the study of biomechanics relies on a solid foundation of classical mechanics, the complexity of biological systems often requires representation through empiral methods. Therefore, biomedical engineers specializing in biomechanics should be familiar with the theoretical and experimental aspects of analyzing the mechanics of biological systems. This course emphasizes the aspects of biomechanics involved in the study of human movement: classical mechanics, anatomical considerations, and instrumentation systems. Students will learn to critically analyze biomechanical problems and their applications, preparing them for both industry and academic research. Students will also be introduced to factors involved in experimental design and analysis when developing their own research projects.

Prerequisites:
Mech 320, BME 351

This is a required course for the Biomechanics Track.

Course Learning Outcomes (CLO):
1. Gain broad knowledge about the mechanics of moving systems and familiarity with human anatomy to competently analyze gross movement of the human body.
2. Be able to computionally analyze the dynamics of human movement from the most commonly used measurement devices in the field, such as motion capture and force platform systems.
3. Be capable of reading, comprehending and communicating the content of contemporary technical articles on biomechanical research and applications.
4. Use knowledge gained to competently interpret the current understanding of human movement and present recommendations for further study.

Student Outcomes:

Student outcome A - Ability to apply foundations of mathematics, science, and engineering
Related CLO - 1

Student outcome B - Ability to design and conduct experiments, and analyze
Related CLO - 2, 4

Student outcome C - Ability to design a system, component, or process to meet needs with realistic constraints
Related CLO -

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

Student outcome G - Ability to communicate effectively
Related CLO - 4

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

Student outcome K - Ability to use the techniques, skills, and modern engineering tools needed for engineering practice
Related CLO - 2

Student outcome J - Knowledge of contemporary issues.
Related CLO – 3

Student outcome L - Apply bio/physiological insight for BME application
Related CLO – 1, 2, 4

(M-1) ability to model bio- & physiological systems
(M-2) ability to statistically analyze and interpret bio- & physiological data
(N) ability to collect and analyze data from living systems

Course Topics: Rigid body and multi-body dynamics: linear and angular kinematics, force and torque, impulse and momentum, basic anatomical terms applicable to human movement analysis, anthropometry, motion capture, force platforms, coordinate transformation, Cardan angles, computational analysis using Matlab, numerical and statistical methods in data processing