ENME 477
Biomechanics
Fall 2016

INSTRUCTOR: Dr. Topoleski, ECS 225C, x3302, topoleski@umbc.edu

TIME AND ROOM: Monday/Wednesday, 4:00PM – 5:15PM, Phys 201

TEXT: no required textbook.

REQUIRED READINGS: Readings will be assigned appropriately related to the topics discussed in class (listed below). Readings will consist of provided reference materials, including scientific journal papers, sections from textbooks, testing standards, and/or government documents (e.g. FDA guidance documents); other readings will include publically available materials researched by the students.

COURSE DESCRIPTION: Biomechanics is the application of mechanics and mechanical engineering to a biological or living system. In this course, we will focus on understanding the natural human mechanical systems, as well as artificial mechanical systems used to treat human diseases. Examples are: joint mechanics, blood flow, soft tissue (muscle, lung, etc.) mechanics, artificial blood vessels, artificial joints, limb lengthening, et al. Since biomechanics and biomechanical engineering are active areas of research in the Mechanical Engineering Department at UMBC, we may also have the opportunity to engage in topics of current research as they become available. Finally, we will have the potential to examine topics or details of topics according to student experience and interest.

GRADING: Course grading will be based on homework assignments, one mid-term and one cumulative final exam, and a final project.

Mid-term exam (20%)
Final Exam (20%)
Homework (30%)
Final Project (30%)

Homework: Homework will consist of problem solving, critical reviews of readings, and research assignments. Each homework assignment will consist of a specific set of deliverables and presentation format. Homework assignments will be assessed based on the extent to which the student met the specified requirements (deliverables).

Final Project: There will be a medium length (~15 page) research paper/design project on topics to be discussed during the course. The project may also include an oral project presentation.

STATEMENT OF ACADEMIC INTEGRITY:

By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC policies section of the UMBC Directory.

COURSE OUTLINE

Topics (approximately one each week of class)

1. Introduction – What is biomechanics? Why would a Mech E study biomechanics?
2. The human body as machine.
3. Fun with bugs! The exoskeleton vs. the endoskeleton.
4. Approaches to and methods for studying human and animal biomechanics.
5. Application of statics to complex biomechanical systems.
6. Review of fundamental strength of materials concepts and introduction to advanced strength of materials for biomechanical analysis.
7. Learning by case study: how did the bone break?
8. Just in time learning: bone and joint mechanics as an archetypical biomechanics field.
9. Experimental methods for properties of biological tissue.
10. Design of medical implants & devices: how they differ from traditional systems, design criteria, failure analysis, ethics.
11. Materials considerations for medical implants.
12. Intro to biofluid mechanics: how our blood flows.
13. Intro to bioheat transfer: how we stay warm.
14. Engineers interacting with the medical world – contributing to human health.