University of Wisconsin - Madison
College of Engineering [EGR]
Last Offered: 2015 Spring [1154]
Direct Link to this Syllabus :
http://aefis.engr.wisc.edu/index.cfm/page/CourseAdmin.ViewABET?coursecatalogid=241&pdf=True

1. **B M E 315, Biomechanics**
2. **Credits :** 3 **Contact Hours :** 4.7
3. **Textbook and Materials :** Basic Biomechanics of the Musculoskeletal System; Nordin; 4th; 2012
4. **Specific Course Information :**

a. **Brief description of the content of the course (Course Catalog Description) :** This course will provide an introduction to the mechanical behavior of biological tissues and systems. Specific topics include: structure and function of biological tissues, mechanical properties of biological tissues, and analysis of specific tissues (i.e. bone, muscle, and soft connective tissues).
b. **Pre-requisites or Co-requisites :** Math 234; Physics 202 or Physics 208; EMA 303 or ME 306. Open only to students in the BME program or consent of instructor
c. **This is a Required course.**

- **Specific Goals for the Course :**

a. **Course Outcomes :**

1. Apply mechanical equilibrium analyses to compute forces acting on tissues, organs and structures within the human body.
2. Examine mechanical stress and deformation associated with the loading of biological tissues.
3. Analyze, interpret and present data collected during experiments in biomechanics.
4. Describe the relevance of mechanics for investigating biological systems at scales ranging from cellular to the whole body.

- **ABET Student Learning Outcomes :**

(a) Ability to apply mathematics, science and engineering principles.
(b) Ability to design and conduct experiments, analyze and interpret data.
(e) Ability to identify, formulate and solve engineering problems.
(g) Ability to communicate effectively.
(k) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

- **Program Specific Student Outcomes :** (1) Understanding of biology and physiology as related to biomedical engineering needs.
(2) Ability to apply knowledge of advanced mathematics (including differential equations and statistics), sciences, and engineering to solve problems at the interface of engineering and biology and to model biological systems
(3) Ability to design and conduct experiments, including making measurements and interpreting experimental data from living systems and addressing the problems associated with the interaction between living systems and non-living materials and systems

- **Brief List of Topics to be Covered :**

  Topics covered

  - Static force systems in the body.
  - Stress and strain.
  - Tension, compression, and bending.
  - Tissue material properties.
  - Adaptation of tissue.
  - Scaling: effect of body size in mammals.
  - Dynamics: force, acceleration.
  - Energy, work, and power.
- **Additional Information :**

  This course will provide an introduction to the mechanical behavior of biological tissues and systems. The influence of material properties on the structure and function of organisms will provide the students with an appreciation for the mechanical complexity of biological systems. Methods for the analysis of both rigid body and deformational mechanics will be introduced as they apply to biological tissues including bone, muscle, and connective tissues. Students will be expected to develop an understanding of the important issues regarding the application of engineering tools in the study of biological tissue mechanics. Problem solving skills will be emphasized through weekly homework assignments and a project which will require students to focus on the analysis of a specific tissue using one of the approaches discussed in class. Specific topics include: structure and function of biological tissues, mechanical properties of biological tissues, and analysis of specific tissues (i.e. bone, muscle, and soft connective tissues). Students will acquire laboratory data during single axis testing of various tissues.

  Class/laboratory schedule

  - Two lectures each week
  - One laboratory every other week