

**BME 473 Applied Biomechanics
Every Spring Semester**

2004-2005 Catalog Data: BME 473 Applied Biomechanics

Description: Application of biomechanics to the industrial and orthopaedic area. Design of orthopaedic implant devices; biomechanics of Injury and Protection. Prereq: ME 321, Coreq. BME 310, MSE 474

Textbook: Phillips, C. A., Human Factors Engineering, John Wiley & Sons, Inc, .

Coordinator: Jack Wasserman, Professor

Prerequisite by topic:

1. Static
2. Dynamics
3. Mechanics of materials

Course Objectives:

- Objective 1: Graduates will understand the types of human response to vibration and to consider how to reduce the exposure from certain situation
- Objective 2: Graduates will be able to understand the concepts of using physiologic test to develop human control of motion and the development of MATLAB models.
- Objective 3: Graduates will have an understanding of orthopaedic devices and the current methods of analysis that provide the information on analysis.

Topics:

1. Characteristics and Modeling of biological materials
2. Biomechanics of cortical and trabecular bone: implications for assessment of fracture risk
3. Modeling of muscular control based on biological testing
3. Vibration Fundamentals
4. Whole Body Vibration
5. Hand-Arm Vibration
6. Human Vibration Standards and protecting of workers
7. Orthopaedic Devices
8. Dynamic modeling for evaluation
4. Structure and function of articular cartilage and meniscus

Selected Additional Topics (Instructor's options)

5. Biomechanics of fracture fixation
6. Biomechanics of the human spine
7. Biomechanics of artificial joints: the hip
8. Biomechanical principles of total knee replacement design

Evaluation:

1. Exams
2. Homework
3. Reports/Team project/oral presentations

Performance criteria:

(Numbers in the brackets refer to the evaluation methods used to assess student performance.)

Objective 1

Performance criteria:

- 1.1 Students will understand the concepts of vibration and vibration response
- 1.2 Students will demonstrate an understanding of the consequences of vibration Exposure. [1, 3]
- 1.3 Students will work on the redesign of a tool to reduce the worker risk factors

Objective 2

Performance criteria:

- 2.1 Students will apply principles of statics, dynamics, and mechanics of materials to problems associated with the musculoskeletal system as indicated under "Topics" and in their team projects. [1, 2, 3]
- 2.2 Students will demonstrate an understanding of the anatomy and physiology needed to understand the problem being discussed. [1, 3]

Objective 3

Performance criteria:

- 3.1 Students will demonstrate an understanding and knowledge of the background of the problem being studied (literature review). [3]
- 3.2 Students will apply concepts of analysis and synthesis to the problem, evaluate information obtained and present their results in a report and orally. [3]

Relation of course to program objectives:

The course covers the following outcomes:

- (a) An ability to apply knowledge of mathematics, science and engineering
- (c) An ability to design a system, component, or process to meet desired needs
- (d) An ability to function on multidisciplinary teams;
- (e) An ability to identify, formulate, and solve engineering problems
- (g) An ability to communicate effectively
- (i) A recognition of the need for, and an ability to engage in life-long learning
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for successful engineering practice
- (l) Knowledge of the applications of engineering methods to biomedical systems