

Course alpha, number, title ME 495 Tissue Mechanics

Required or elective Elective

Course (catalog) description Application of solid mechanics to understanding mechanical responses of biological tissues. Microstructure and biological function for soft and hard connective tissues and muscle.

Prerequisite(s) (ME 222)

Textbook(s) and/or other required material Mow & Hayes, Basic Orthopaedic Biomechanics

Class/Lab schedule: Total Credits: 3 *Lecture/Laboratory/Discussion Hours: 3/0/0*

Topics covered

- (a) Muscle/Force Systems
- (b) Tendon/Ligament Models
- (c) Cartilage Mechanics
- (d) Physical Regulation of Soft Tissues
- (e) Bone Biomechanics
- (f) Mechanics of Fracture Fixation
- (g) Mechanics of Artificial Joints

Course learning objectives The student shall be able to:

- (1) Develop statically determinate and indeterminate systems of forces representing a body joint and compute muscle forces,
- (2) Be able to compute risks of injury to bones from simplified loading conditions and integrate effects of age, sex, etc.,
- (3) Compute some basic properties of joint cartilage using a poroelastic approach,
- (4) Determine the viscoelastic responses of ligaments and tendons using simple phenomenological models and hereditary integral formulations,
- (5) Understand basic mechanical principles of bone fracture fixation techniques,
- (6) Learn the basic technique of strain-adaptive-remodeling used in FEA models of bone remodeling around implants

Relationship of course to ME program outcomes The following measurement standard is used to evaluate the relationship between the course outcomes and the educational-program outcomes:
3 = Strong Emphasis, 2 = Some Emphasis, 1 = Little or No Emphasis.

- (a) an ability to apply knowledge of mathematics, science, and engineering—3
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data—1
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability—1
- (d) an ability to function on multidisciplinary teams—1
- (e) an ability to identify, formulate, and solve engineering problems—3
- (f) an understanding of professional and ethical responsibility—1
- (g) an ability to communicate effectively—1
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context —2
- (i) a recognition of the need for and the ability to engage in life-long learning—1
- (j) a knowledge of contemporary issues—1
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice—2
- (l) application of advanced mathematics—2
- (m) design, build, and test in mechanical systems area—1
- (n) design, build, and test in thermal/fluids area—1
- (o) capstone design experience—1

Contribution to professional component: Engineering Science 50% Basic Math & Science 50%

Person(s) who prepared this description Roger C. Haut

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