

UC Riverside
BIOENGINEERING 110
Biomechanics of the Human Body
Fall 2016

Course Time: Lecture: TR 12:40 PM-2:00 PM, Olmstead Hall (OLMH) 1208
Discussion Section 021: W 8:10 AM-9:00 AM, Winston Chung Hall (WCH)143
Discussion Section 022: F 11:10 AM-12:00 PM, Olmstead Hall 421

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Teaching Assistants: Jack Tang <jtang014@ucr.edu>
Office Hours & Location: To Be Announced

Course Objectives:

- (1) Develop an understanding of fundamental biomechanical properties of biological materials;
- (2) Acquire analytical skills and physiological understanding in a unified way to develop mechanical models of biological systems; and
- (3) Develop written communication skills through written assignments and a project related to hard or soft tissue, or cellular biomechanics.

Tentative Course Schedule

<u>Week of</u>	<u>Topic</u>
Sept. 19	Introductions
Sept. 26	Muscle Types & Structure
Oct. 3	Muscle Contraction Mechanisms and Models
Oct. 10	Deformations and Strains, Stresses
Oct. 17	Mechanical Properties, Elastic Solids, Viscoelasticity
Oct. 24	Maxwell, Voigt, Kelvin models
Oct. 31	<u>Midterm</u>
Nov. 7	Complex Modulus
Nov. 14	Measurement Methods, Strain Gauges
Nov. 21	Optical Tweezers, Cochlear Mechanics
Nov. 28	Mechanobiology: Membrane Mechanics and Cytoskeletal Interactions

Final Examination: Friday, December 9, 11:30 AM-2:30 PM

Grading Policy:

Quizzes & Assignments	30%
Midterm Examination	25%
Final Examination	25%
Project Presentation	10%
Project Report	10%

Quizzes & Assignments Policy:

Expect a quiz during the class time for about 15 minutes. If you are absent from class and miss a quiz, you will receive a zero grade for the missed quiz. Only **documented** emergency situations will be considered to determine if a make up quiz can be provided.

Assignments are intended to provide you with the opportunity to gain an understanding of various concepts through critical thinking and carrying out analytical and computational tasks. While you are allowed to work on assignment problems together, each student is required to provide an independently prepared submission. **All submissions must be: (1) typed unless (otherwise noted) and submitted on iLearn with hardcopies turned in on the due date; (2) presented in a clear and understandable manner to describe the approach and solution methodologies; and (3) turned in on time. No credit will be given for late submissions. Only emergencies with appropriate documentations will be considered.**

Project Guidelines, Policy & Requirements:

You will work in groups on a biomechanics project. Projects related to cardiovascular fluid mechanics are not allowed since there is a separate Bioengineering course (BIEN 105) on this topic. The intention of the project is to provide you with the opportunity to explore and critically analyze a topic, or develop a design idea that is especially interesting to you. One useful resource to get familiar with various areas of biomechanics is the *Journal of Biomechanics*: <http://www.jbiomech.com/content/aims>

Each member of your group is responsible towards making specific contributions towards the project. The group is collectively responsible in preparing the project presentation and the written report. It is strongly recommended that each group holds regular meetings during the quarter (e.g., on weekly basis) to plan the various activities associated with the project and monitor progress. Successful completion of the project consists of: (1) oral presentation of the project; and (2) submitting a written final report. All members of the group will receive the same grade for both the oral presentation and the written report. Therefore, it is important that all members work together collectively and effectively.

The project must address your topic of interest by either **quantitative analysis (e.g., mathematical modeling), biomechanical design,** or a proposed **experimental approach** for measurement of specific mechanical properties or parameters.

Oral presentation of the project should be a summary of your project and presented by all group members. You are allowed 5 minutes to present your project. Therefore, it is important that you capture the highlights of your project and present them effectively during this allowable short limit. Your presentation must remain within the allowable time limit. Points will be deducted if the presentations are longer than the allowable time.

Written project report must be typed and should not exceed 7 single-sided, double-spaced pages with 1" margins in all directions. Font must be Arial and size 11. Points will be deducted for not following these format requirements. The 7-page limit excludes: (i) the cover page that will have the names of the group members and the title of project; (ii) list of references; and (iii) any possible appendix material.

Project report must include the following sections: (1) Introduction to provide background information on the specific biomechanics topic and its physiological significance; (2) Prior methods in **quantitative** description of the particular biomechanics concept, the **design** of a biomechanical device, apparatus, implant, etc., or **experimental** technique; (3) Specific approach taken by you to **quantitatively** analyze the problem and your

solution methodology, your **design** approach, or your **experimental** approach in sufficient details; (4) Results and discussion of your analysis, design, or proposed experiment; (5) A section entitled "Respective Contributions" where the specific contributions of each group member to the project must clearly be provided (6) References; and (7) Optional Appendix materials such as computer codes or similar information.