

MECH 435/535
Orthopaedic Biomechanics

3 credits, January-April 2016
T & Th 11:00-12:30 – Ch & Bio Eng 103
First class: January 5, 2016

Contact Information

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Class Format

Two 1.5 hour classes each week. Three labs / field trips will be optional.

Learning Objectives

By the end of the course, we expect that students will be able to:

- Describe the structure and function of the major components of the musculoskeletal system;
- Integrate engineering concepts in statics, dynamics, materials, and structural analysis to examine the mechanical behaviour of the skeletal system;
- Identify and analyse problems of the musculoskeletal system where mechanical engineers can make a significant contribution;

Prerequisites

Registration in the fourth or higher year of the mechanical engineering program. Otherwise, approval of the instructor is required. We will draw from material covered in courses such as MECH 260 and MECH 265.

Textbook

There is no required text for the course. The following reference books are on reserve at Woodward Library:

Carter DR, Beaupre GS. Skeletal Function and Form. 2001
Fung YC. Biomechanics - Mechanical Properties of Living Tissues. 1981
Mow VC, Huiskes R. Basic Orthopaedic Biomechanics. Third Edition. 2005
Nordin M, Frankel V. Basic Biomechanics of the Musculoskeletal System. 2001

Classes

Our perspective is that the best learning is achieved through active participation and thus, it is recommended that all students attend class with an openness and willingness to discuss the subject material and take part in class activities. In general, the classes will be structured for active student participation in the learning process. We will have some guest speakers coming to the class, including orthopaedic surgeons from the Vancouver General Hospital to provide a clinical perspective on the material.

Problem Sets

Four problem sets will be distributed throughout the term to allow application of the subject matter. It is strongly recommended that they be completed in a timely fashion. Problem sets will not be graded but they will form the core of the material examined at mid-term and at the end of term.

Labs

Two to three informal labs / field trips will be arranged during the term. These include a visit to the UBC Anatomy lab, the Gait Lab at UBC Hospital, and possibly the Orthopaedic and Injury Biomechanics Lab at Vancouver General Hospital. In the past, students have attended at least one surgery at UBC Hospital and we hope for this to continue. None of these events are mandatory, but they do represent a unique opportunity to see application of the subject matter and are therefore, highly recommended.

Project Requirements

MECH 435 Projects

Groups of 3-4 MECH 435 students will conduct an analysis of the human body (Part A) and a simple experiment (Part B) that will test one of the concepts learned in class. Part A will be presented as a report (end Feb) and Part B as an in-class presentation (end March).

MECH 535 Projects

Groups of 2 MECH 535 students will conduct an analysis of the human body (Part A) and a simple experiment (Part B) that will test one of the concepts learned in class. They will also present a literature review on a related, relevant topic. Part A will be presented as a report (end Feb), Part B as an in-class presentation (end March), and Part C as a report (early April).

Course Grading

<i>Activity</i>	<i>MECH 435</i>	<i>MECH 535</i>
Mid-term exam	25%	25%
Final exam	45%	45%
Project	30%	30%

Week	Lecture Topic	Instructor	Lab	Project Deadlines
Jan 5	Introduction/terminology/anatomy Muscle and joint loads – static	TRO TRO		
Jan 12	Indeterminate problem & OrthoLoad MSK loads - dynamic & bone-bone	TRO TRO	Anatomy Lab (Jan 12, 2pm)	
Jan 19	Muscle mechanics Gait analysis/Instrumentation	TRO TRO/MM	Gait Lab (Jan 21, 2pm)	
Jan 26	Bone - anatomy & mechanics AC - anatomy & mechanics	TRO DRW		Proposal due January 28th to Dr. Oxland
Feb 2	MSK Modelling Viscoelasticity	MM/TRO TRO		
Feb 9	T&L - anatomy & mechanics Mid-Term Exam (Feb 11)	TRO		
Feb 16	UBC CLOSED-BREAK			
Feb 23	Biomaterials Implant mechanics	Wang TRO		Part A of Project due Feb. 25th
Mar 1	Trauma/ Fracture fixation Fracture healing - mechanics	Guy TRO		
Mar 8	Joint replacement – clinical OA mechanics/research approaches	Masri DRW		
Mar 15	SCI mechanics Spine biomechanics	TRO TRO	Biomechanics Lab	
Mar 22	Project Presentations	TRO/MM		Part B Presentations begin
Mar 29	spinal cord Project Presentations	Kwon TRO/MM		
April 5	Review (one class)	TRO		Part C reports due April 7th