

MECH 435/535 Orthopaedic Biomechanics

3 credits, January-April 2014
T & Th 11:00-12:30 – Ch & Bio Eng 103
First class: January 7, 2014

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, and 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 a simple experimental project that will test one of the concepts learned in class. The project must outline a conceptual problem, evaluate it analytically, and test the analysis using a simple experiment.

MECH 535 Projects

MECH 535 students will work individually or in pairs on a larger design or analysis project. A relevant laboratory experiment could be a component of the project or it could involve a relevant mathematical model.

Course Grading

<i>Activity</i>	<i>MECH 435</i>	<i>MECH 535</i>
Mid-term exam	25%	25%
Final exam	50%	45%
Project	25%	30%

Week	Lecture Topic	Instructor	Lab	Assignments
Jan 7	Introduction/terminology/anatomy Muscle and joint loads – static	TRO TRO		Problem set 1 assigned
Jan 14	Indeterminate problem MSK loads - dynamic	TRO TRO	Anatomy Lab (Jan 15th, 1-3pm)	Problem set 2 assigned
Jan 21	Instrumentation – body kinematics and kinetics Gait analysis	Amiri Black	Gait Lab (Jan 21st, 2-3pm)	Problem set 3 assigned
Jan 28	Bone - anatomy & mechanics AC - anatomy & mechanics (include OA?)	TRO DRW		Problem set 4 assigned
Feb 4	Viscoelasticity T&L - anatomy & mechanics	TRO TRO	Biomechanics Lab	
Feb 11	Muscle mechanics Mid-Term Exam (Feb 13)	TRO		
Feb 18	UBC CLOSED-BREAK			
Feb 25	Biomaterials Mechanobiology - a glimpse	Wang TRO		
Mar 4	Joint replacement – mechanics Joint replacement - clinical	Amiri Masri		
Mar 11	SCI Trauma/ Fracture fixation	Kwon Guy		
Mar 18	no class Spine/SCI research	TRO		
Mar 25	OA - mechanics research OA - clinical & Olympics	DRW McCormack		
Apr 1	Project Presentations	TRO/DRW		
April 8	Review (one class)	TRO/DRW		Project reports due