MECH 435/535
Orthopaedic Biomechanics

3 credits, January-April 2011
T & Th 11:00-12:30 – Ch & Bio Eng 103
First class: January 4, 2011

Contact Information

Dr. Thomas Oxland
Orthopaedics & Mechanical Engineering
Blusson Pavilion, room 564
604-675-8834
toxland@interchange.ubc.ca

Dr. David Wilson
Orthopaedics
VGH Research Pavilion, room 577
875-4428
dawilson@interchange.ubc.ca

Class Format

Two 1.5 hour classes each week. Three labs / field trips will be optional. Students registered in MECH 535 must also attend a weekly seminar.

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:

Bartel D, Davy DT, Keaveny TM. Orthopaedic Biomechanics. 2006
Carter DR, Beaupre GS. Skeletal Function and Form. 2001
Mow VC, Huiskes R. Basic Orthopaedic Biomechanics. Third Edition. 2002
Nordin M, Frankel V. Basic Biomechanics of the Musculoskeletal System. 2001
Winter DA. Biomechanics and Motor Control of Human Movement. 1999

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 and submitted 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

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 Hospital. In the past, students have attended at least one surgery at Vancouver General 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 finite element analysis.

Graduate Student Seminars

The graduate student seminars will focus on extensions of the topics covered in class and will be led by the students. We will provide some suggested papers for the various topics, but encourage students to pursue topics of special interest.

Course Grading

Activity	*MECH 435*	*MECH 535*
Seminar	–	10%
Mid-term exam	25%	25%
Final exam	50%	40%
Project	25%	25%

Week	Lecture Topic	Instructor	Lab	Assignments
Jan 4	Introduction/terminology/anatomy	OXLAND		
Jan 11	Muscle and joint loads - static - dynamic	OXLAND	Anatomy Lab	-Problem set 1 assigned
Jan 18	Gait analysis Indeterminate problem	Black OXLAND		-Problem set 2 assigned
Jan 25	Skeletal Tissue Morphology & Mechanical Behaviour	OXLAND		-Problem set 3 assigned
Feb 3/5	Skeletal Tissue Mechanics - viscoelasticity; - two-phase models;	WILSON OXLAND		-Problem set 4 assigned
Feb 10/12	Mid-Term Exam (Feb 10) Continuum stress-strain representation	OXLAND		
Feb 17/19	UBC CLOSED-BREAK			
Feb 24/26	Cartilage & Bone Development	OXLAND	Biomechanics Lab	
Mar 3/5	Skeletal Tissue Regeneration Joint Replacement	OXLAND Masri		
Mar 10/12	Spine	Kwon OXLAND		
Mar 17/19	Osteoarthritis	WILSON McCormack		
Mar 24/26	Bone-Implant Systems or ???	OXLAND		
Mar 31/ Apr 2	Project Presentations	OXLAND WILSON		
Apr 7	Review	OXLAND		-Projects due