Kinesiology 351: Mechanical Properties of Tissues

Summary

The objective of this course is to provide the opportunity to explore the mechanics of muscular contraction and to examine how the mechanical properties of the muscle work synergistically with tendons, bones and ligaments. Practical applications (training & clinical) of key concepts will be discussed in class.

Lectures: Tuesday and Thursday, 14h – 15h, WOOD-6
Tutorials: Tuesday and Thursday, 15h – 15h30, WOOD-6

Tuesday 16h15 – 17h45 and Thursday 11h45 – 13h15, Osborne Gym G (KIN Teaching Lab)

Instructor: Dr. Jean-Sébastien Blouin
Teaching Assistants: Emma Nielsen and Anthony Chen

Prerequisites:

School of Kinesiology Core and third-year standing.

Required Reading

Review of biomechanical definitions provided on the web site (Connect)
Readings: Lecture notes provided on the web site (Connect).
On-line reading material provided on the web site (Connect). The on-line reading material includes excerpt from:


Optional Readings available at the Library

Title: Skeletal Muscle Structure, Function & Plasticity
Author: Richard Lieber

Title: Neuromechanical Basis of Kinesiology
Author: Roger Enoka

Title: Low Back Disorders - Evidence-Based Prevention and Rehabilitation
Author: Stuart M McGill

Title: Basic Biomechanics of the Skeletal System
Authors: Margareta Nordin and Victor Frankel
Course Learning Objectives

1. Demonstrate a conceptual understanding of the elements of the human musculoskeletal system and how their properties interact during human movement.
2. Be able to use the concepts of force-length, force-velocity, hysteresis, compression, tension, shear, stress, strain, Young's Modulus to explain musculoskeletal adaptation.
3. Apply knowledge of anatomy to describe human movement in both anatomical and mechanical terms.
4. Become familiar with the interaction of the mechanical properties of the musculoskeletal system as they affect human movement and relate these properties to real-world applications.
5. Become familiar with the conceptual framework for analysis of human movement and understand the physiological and biomechanical basis for recording electrical potentials from skeletal muscles using surface electrodes.
6. Demonstrate an understanding of basic computer programming concepts.
7. Have demonstrated personal and social responsibility towards class and tutorial participation.
8. Be able to facilitate active learning, critical thinking, and problem solving skills in the analysis of human musculoskeletal system.

Course Content

Week 1 (Jan 7 & 9): Introduction, Definition of biomechanical concepts / Introduction to computer programming

Week 2 (Jan 14 & 16): Mechanical properties of bone and muscle & Wearable sensors for motion sensing – Invited Speaker

Week 3 (Jan 21 & 23): Introduction to muscle structure and function & Electromyography


Week 5 (Feb 4 & 6): Current topics on muscle mechanics
Week 6 (Feb 11 & 13): Review/Tutorial & Midterm (Feb 13)

Week 7: Reading Week

Week 8 (Feb 25 & 27): Muscle length- joint geometry & Muscle moment arm & joint geometry

Week 9 (March 3 & 5): Muscle moment arm & joint geometry & Lumbar spine: muscle anatomy and physiology


Week 11 (Mar 17 & 19): Introducing the tendon: Structure and function & Electromechanical delay
Week 12 (Mar 24 & 26): Biomechanics of biarticular muscles and muscle force measurement & Biomechanical concepts for vestibular encoding and processing of motion  

Week 13 (March 31 & April 2): Biomechanical concepts for vestibular encoding and processing of motion & Invited Speaker

Week 14 (April 7): Review/Tutorial

Course Structure

The *lecture component* will be two 60-minute seminars. The seminars will include lecturing, invited speakers and discussions around pre-assigned topics. Students will be requested to prepare for these discussions with readings posted on Connect before the beginning of the course.

- Each Tuesday lecture will be followed by *tutorials*. The tutorials will include brief presentations on computer programming concepts. Students are invited to perform the computer programming activities during the tutorials and encouraged to ask questions about these activities or the lecture material.
- Each Thursday lecture will be followed by a participation quiz. Students will answer a question about the material covered that they will submit for participation marks. All quizzes will contribute to the participation mark. If you miss a participation quiz for a valid reason, please contact an instructor with proper justification material so we can correct your participation mark. A guided discussion about the question will follow.

We will also offer guided *tutorials* every week on Tuesday 16h15 – 17h45 and Thursday 11h45 – 13h15. This will provide an opportunity to address questions, perform targeted activities related to lecture material and provide support for the programming activities. Students are encouraged to attend all tutorials and ask questions about any material.

Programming activities. There will be five computer programming activities throughout the term. The objective of these activities is to introduce students to computer programming. The data analysis concepts will be applicable to any type of data and emphasize certain theoretical concepts discussed in the lectures. To obtain full marks for the programming activities (10), students are required to submit two (2) programming activities during the term prior to March 31st @ 16h.

WITHDRAWAL DATES

Last day to withdraw without a W standing : January 17, 2020

Last day to withdraw with a W standing  
(course cannot be dropped after this date) : February 14, 2020
Course Participation: personal and social responsibility

As there are tutorials and group discussions in this course, students are expected to participate actively in these activities and demonstrate leadership, critical contribution, interpersonal skills, support activities, punctual attendance, on-time completion of class activities, positive attitude and effort according to the following schedule.

Evaluation Profile

<table>
<thead>
<tr>
<th>Learning objective</th>
<th>Methods (all required)</th>
<th>Value</th>
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<tbody>
<tr>
<td>1, 2, 3, 4, 7</td>
<td>Written examinations (2)</td>
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<tr>
<td></td>
<td><em>Mid-term (Feb 13)</em></td>
<td>30</td>
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<td></td>
<td><em>Final</em></td>
<td>50</td>
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<tr>
<td>5, 6, 7, 8</td>
<td>Tutorials and programming</td>
<td></td>
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<tr>
<td></td>
<td><em>In class participation quizzes</em></td>
<td>10</td>
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<tr>
<td></td>
<td><em>Programming activities (2)</em></td>
<td>10</td>
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<td></td>
<td>Total</td>
<td>100 marks</td>
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Important Notes: If you miss the Mid-term for a valid reason, the marks will be transferred to the Final exam.

Attendance: Regular attendance is expected of students in all their classes (including lectures, tutorials, seminars, etc.). Students who neglect their academic work and assignments may be excluded from the final examinations. Students who are unavoidably absent because of illness or disability should report to their instructors on return to classes.

The University accommodates students with disabilities who have registered with the Disability Resource Centre. The University accommodates students whose religious obligations conflict with attendance, submitting assignments, or completing scheduled tests and examinations. A list of religious holidays involving fasting, abstention from work or study, or participation in all-day or fixed-time activities is available at http://students.ubc.ca/publications/multifaith/. Please let your instructor know in advance, preferably in the first week of class, if you will require any accommodation on these grounds. Students who plan to be absent for varsity athletics, family obligations, or other similar authorized commitments, cannot assume they will be accommodated, and should discuss their commitments with the instructor before the drop date.

Academic Dishonesty: Please review the UBC Calendar “Academic regulations” for the university policy on cheating, plagiarism and other forms of academic dishonesty. Also visit www.arts.ubc.ca and go to the students’ section for useful information on avoiding plagiarism and on correct documentation.

Students should retain a copy of all submitted assignments (in case of loss) and should also retain all their marked assignments in case they wish to apply for a Review of Assigned Standing. Students have the right to view their marked examinations with their instructors, providing they apply to do so within a month of receiving their final grades. This review is for pedagogic purposes. The examination remains the property of the university.