HK*4070 Clinical Biomechanics

Winter 2018
Section(s): C01

Department of Human Health and Nutritional Sciences
Credit Weight: 0.50
Version 1.00 - January 03, 2018

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1 Course Details

1.1 Calendar Description

This course covers functional anatomy, neurophysiology and mechanical characteristics of humans at the tissues and whole-body levels. Pathomechanics of human movement resultant from disease, abuse or trauma will be examined. Special emphasis will be placed on etiology, testing and correction of functional disorders with special reference to balance, gait and orthopaedic biomechanics.

Pre-Requisite(s): ENGG*2660 or (HK*2270, HK*3600)

1.2 Course Description

This course is designed to explore the theoretical basis of clinical biomechanics and expose students to the skills necessary to work in the area. Special emphasis will be in the areas of: Posture and Balance, Gait, and Orthopedic Biomechanics. Lectures will cover the theory underlying normal musculoskeletal system function using physics and engineering concepts. Clinical and pathological examples will be discussed to highlight differences from the healthy state, and explore how these differences arise.

***Note**:* The prerequisites of HK*2270 and HK*3600 may be waived for Biological/Biomedical Engineering students at the discretion of the course instructor.

1.3 Timetable

- Lectures: Tuesday/Thursday 1:00 PM - 2:20 PM MCKN 029
- Labs:
  - Section 101 Monday 10:30 AM - 12:20 PM JTP 208B
  - Section 102 Wednesday 10:30 AM - 12:20 PM JTP 208B
  - Section 103 Thursday 2:30 PM - 4:20 PM JTP 208B

1.4 Final Exam

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

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2 Instructional Support

2.1 Instructor(s)

Dr. Lori Ann Vallis
Email: lvallis@uoguelph.ca
Telephone: +1-519-824-4120 x54589
Office: ANNU 343
Office Hours: Tuesday @ 10 am - 12 pm or by appointment

2.2 Teaching Assistant(s)

Teaching Assistant: David Shulman
Email: dshulman@uoguelph.ca
Office Hours: By appointment.

Teaching Assistant: Lukas Linde
Email: llinde@uoguelph.ca
Office Hours: By appointment.

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3 Learning Resources

3.1 Required Resources(s)

Lecture Notes (Notes)
Lecture notes are the required reading for the course.

Lecture Slides (Notes)
Selected summary slides from the lectures will be posted on Courselink http://courselink.uoguelph.ca at the END of each WEEK (~ Friday evenings).

Journal Articles (Article)
We will also be focusing on Critical Reading skills this term; as such I will assign 1 journal article ~ every 2 weeks, which we will review together. It is the students' responsibility to have read this article prior to class time so that we can discuss it in detail, in class.

3.2 Additional Resources(s)

Anatomy, Biomechanics and Control (Textbook)

- Winter, D.A. A.B.C. (Anatomy, Biomechanics and Control) of Balance During Standing and Walking. Waterloo Biomechanics, 1995. May be helpful as a reference on occasion.

Clinically Oriented Anatomy (Textbook)

- Moore, K.L. and Dalley, A.F. Clinically oriented anatomy (5^{th} edition). Lippincott Williams and Wilkins, 2006. May be helpful as a reference on occasion.

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4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. By the end of this course you will have,

    1. Gained increased knowledge about the role of the *sensory systems* in balance and mobility control, through literature review and case studies of healthy and special populations
    2. Gained increased knowledge about the impact of *different heath conditions and pathologies* on balance and mobility through literature review and case studies presented in lecture and laboratory experiences
    3. Gained experience with performing *critical reviews of published scientific findings*; this will be assessed through your preparation two conference abstracts requiring the comparison of laboratory results to previous findings from the literature
    4. Gained *knowledge and practice performing different clinical tests* designed for the assessment of posture and mobility at different stages of lifespan development and/or for different health conditions.
    5. Obtained a brief *hands on training experience* performing a small research study OR working with a clinical population, including identification of important clinical assessment tools to identify altered movement patterns (e.g. gait, posture, upper body motions)
    6. Gain greater understanding and experience with *preparing a manuscript or clinical case report* using the scientific method and preparing an oral presentation that disseminates your research/clinical observations to your peers

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5 Teaching and Learning Activities

5.1 Summary of Laboratories

- The purpose of the labs is to expose the students to a variety of Clinical Biomechanics instrumentation, and demonstrate collection, analysis, reduction and interpretation of clinical data.
- Lab Topics: lab topics include: Computer tutorial in Excel spread sheet basics, balance, gait kinematics, gait electromyography. You must attend your appropriate lab section/week
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    - The First (MS Excel) laboratory write up will be based directly on the material presented in the laboratory and should be handed in 48 hours following conclusion of the lab.
    - For all remaining laboratory sessions: A minimum of 2 abstract write-ups is required.
    - Students can submit abstracts for all remaining lab sessions however, ONLY THE TOP 2 MARKS will be used for final grade calculation.
    - Write-ups for Labs 2 to 5 must be in conference abstract form**.** A maximum of 2

pages is permitted including references & figures; 2 marks will be deducted for *each* page exceeding this limit. Samples of a lab write up in conference abstract form will be posted on the *Courselink* Lab Evaluation: Students MUST hand in a laboratory write up for the first EXCEL laboratory and brief abstract write-ups for two of the remaining laboratory sessions. Important details:

- Abstracts are due at the start of the lab time exactly one week following the completion of lab; *late abstracts will not be graded by TAs or the course instructor.*

5.2 Clinical Case Report

The small-group case report represents a large evaluation component of the course. Students are asked to get into groups of 4 to 5 individuals (no groups will be allowed to be larger or smaller than this). If at all possible, you should be with people who are in the same HK*4070 laboratory section.

There are two options for this report:

1. **Replicate a published research study**. Suggested topics include balance or gait. The purpose of this project format is to provide a hands-on laboratory experience tailored to the interests of the group. Group members must pick a research study to replicate that must be, 1) based within Clinical Biomechanics, 2) must involve collecting and analyzing data, and 3) must use available equipment and software found in JTP 208B (i.e. force plate, LabView software). Your Project Proposal is due to the course instructor by Thursday January 25, 2018 and is worth 4%; it will include the names and signatures of each group member, citation for the published paper to be replicated, a list of required equipment and a general timeline/plan for your lab data collection, analyses and write up. Your group will play the role of a Research Assistant being hired by a Professor at a University to conduct a small pilot research project involving ~3-4 participants. The final report is in the form of a manuscript based on the data collected for the group project. It will be similar to the article that you are replicating, but not necessarily the *exact* same focus. It should include additional current, pertinent references, and the discussion should be tailored to your particular project and interests.
2. **In field clinical assessment.** You will be expected to go out into the Guelph area and find a setting that is willing to let your group come into their environment and perform a clinical assessment, similar to what we will be learning about in lectures. Your Project Proposal is due to the course instructor by Thursday January 25, 2018 and is worth 4%; it will include the names and signatures of each group member, the name and contact for your Clinical Case partner, and an outline of the clinical case you will study (brief literature review, clinical tests you hope to observe/perform) to ensure it is appropriate for the project. Try to find a community partner, which has welcomed student volunteers from the University of Guelph in the past, or businesses where Kinesiologists, Occupational Therapists or Physiotherapists are on staff and are willing to work with your group as a practical training exercise. This may include the following organizations in Guelph:
    1. St. Joseph’s Health Center (older adults, individuals recovering from Stroke, traumatic brain injuries)
    2. KidsAbility (children with special needs, e.g. Cerebral Palsy, Down’s Syndrome, Autism spectrum)

3. Kids Therapy Network Associates (occupational therapy assessment, treatment and consultation)
4. Guelph Community Health center (health programs & services to improve health and well-being)

- Your group will play the role of a Kinesiologist being hired by a company to perform a clinical biomechanics assessment of posture, balance, gait and/or mobility. Each group will submit one "Clinical Case Study Report" to summarize their findings. This report is expected to be professional and it is mandatory that a second hard copy be submitted to the community organization you worked with. The students must ADDITIONALLY submit an electronic copy of their final report to the professor.
- Students are encouraged to use any of the assessment tools discussed in this course to strengthen their report. In addition, the group will present their project in lecture during Week 12 (March 26 - 29, 2017).
- Note: everyone in a group will normally receive the same mark for the project. However, the instructor reserves the right to assign a higher or lower mark to individuals who have done much more or much less than their share of the allotted work, by consensus of their group.
- Report Format: Please follow the format outlined for traditional Case Report in the journal *Physical Therapy*. https://academic.oup.com/ptj/pages/Author_Guidelines#What%20is%20Your%20Article%20Type
- Sample case reports can be found on the journal website as well as on the course D2L site.

5.3 Class Schedule

Material presented in class and laboratories may vary slightly from that depicted here.

Week	Lecture Topics	Laboratory
	Week 1:	
Jan 8-11	• Introduction; Project Organization • *Biomechanics review*: Kinetics, kinematics; anatomy review. *Focus on posture & locomotion* • Center of pressure, center of gravity and center of mass; Strategies for maintaining postural control	NO LABS THIS WEEK
	Week 2:	Lab 1: Excel Laboratory
Jan 15-18	• Common perturbations to posture & locomotion	*In SCIE 1306: this week only!*

Jan 22-25	Week 3: • Sensory contributions to balance • Kinematic data smoothing techniques	Lab 2: Dynamic Balance (Kinetics) + Clinical Balance Assessment *(JTP 208B)*
Jan 29-Feb 1	Week 4: • Initiation of gait & Termination of gait • Development & postural control	NO LABS THIS WEEK
Feb 5-8	Week 5: • Degeneration & postural control • Pathological differences in balance	Lab 3 Dynamic Balance *(Kinetics+Kinematics)* (*JTP 208B)*
Feb 12-15	Week 6: • Balance Control Case Studies & Review for mid-term examination	NO LABS THIS WEEK
Feb 19-23	Week 7: • No class - Reading week	No Labs - Reading week
Feb 26-Mar 1	Week 8: • Tuesday February 27 MID-TERM EXAM ◦ Content: Weeks 1-6; Case studies; Critical Reviews • Thursday March 1 ◦ Overview: Biomechanics of Gait ◦ Sensory contributions to gait: Proprioception	NO LABS THIS WEEK
March 5-8	Week 9: • Gait: Case study w. ACL injury	Lab 4: Gait Initiation /Termination + Clinical Gait Assessment *(JTP 208B)*

	Week 10:	
March 12-15	• Navigation during gait: Role of Sensory Input • Sensory contributions to gait: Visual and Vestibular deficits	NO LABS THIS WEEK
	Week 11:	
March 19-22	• Development & Locomotion • Degeneration & Locomotion	Lab 5: Electromyography assessment of Gait (*JTP 208B*)
	Week 12:	
March 26-29	• Small-Group Presentations (in lecture)	NO LABS THIS WEEK
	Week 13:	
April 2-5	• Locomotion in special populations • Case Studies & Review • Case reports due Thurs April 5	NO LABS THIS WEEK

5.4 Note

Friday March 9th is the last day to drop a class

Final Exam: TBA

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6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Lab 1: Write Up	3.00
Lab 2-5: Conference Abstracts (2 in total)	12.00
Clinical Case - Proposal	4.00
Clinical Case - Written Report	15.00
Clinical Case - Group Oral Presentation	8.00
Midterm Exam	25.00
Final Examination	33.00
Total	100.00

6.2 Assessment Details

Lab 1: Write Up (3.00%)
Due: Due 48 hours after end of Lab 1
Done in MS Excel

Lab 2-5: Conference Abstracts (2 in total) (10.00%)
Due: Due 1 week after lab time @ start of lab

- Top 2 marks recorded
- 5% each = 10% in total

Clinical Case - Proposal (4.00%)
Due: Thu, Jan 25

Clinical Case - Written Report (15.00%)
Due: Fri, Apr 6

Clinical Case - Group Oral Presentation (8.00%)
Date: March 28 & 30In lecture

Midterm Exam (25.00%)
Date: Wed, Feb 28, 8:30AM - , 9:50AM

Final Examination (35.00%)
Date: Fri, Apr 13

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7 Course Statements

7.1 Course Rule

ALL laboratory sessions and examinations are **mandatory**. Please inform the instructors of potential time conflicts with scheduled evaluations by **Tuesday January 23, 2018**. If any scheduled evaluations are missed due to documented illness or compassionate circumstances, you must inform an instructor within 5 days of the missed evaluation. Negligence to do so may result in failure of the missed component. Accommodations following these circumstances will be made at the discretion of the course instructor. If a student has any objections or concerns regarding the way a quiz or examination has been graded, they may resubmit their quiz/exam paper for re-marking; the risk, however, is that this re-evaluation will remain the final one, whether higher or lower in score than the original.

7.2 Grading

Indicate all course policies regarding in-semester tests and assignment submissions, including time and place for submission of assignments and explicit penalties for late submissions.

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8 Department of Human Health and Nutritional Sciences Statements

8.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. B.Sc. Academic Advising or Program Counsellors

8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. http://www.learningcommons.uoguelph.ca/
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help and http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help

8.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. https://www.uoguelph.ca/counselling/
- Student Health Services is located on campus and is available to provide medical attention. https://www.uoguelph.ca/studenthealthservices/clinic
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. http://www.uoguelph.ca/~ksomers/

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9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The regulations and procedures for Academic Consideration are detailed in the Undergraduate Calendar.

9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester.

The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: www.uoguelph.ca/sas

9.6 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

9.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma

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