



# HK\*2270 Principles of Human Biomechanics

Fall 2020

Section(s): C01

Department of Human Health and Nutritional Sciences

Credit Weight: 0.50

Version 2.00 - September 21, 2020

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## 1 Course Details

### 1.1 Calendar Description

This course will address the application of mechanical principles to the study of human movement. Topics will include: motion analysis techniques, anthropometrics, biological tissue tolerance, muscle force generation, static and dynamic equilibrium, work/energy and impulse/momentum as they apply to the description of motion, injury of musculoskeletal tissues and optimization of human performance.

**Pre-Requisites:** 4.00 credits including BIOL\*1090, PHYS\*1080

### 1.2 Course Description

This is an introductory course to human biomechanics which is a prerequisite for HK\*3600 Applied Human Kinetics I. We will apply key mechanical principles from physics (e.g. Newton's Laws of Motion; static and dynamic equilibrium; free body diagrams) to guide our understanding of the human biological system (e.g. anatomy, physiology, and injury mechanics) and movement of the human body.

### 1.3 Timetable

Lectures will be pre-recorded (using power point with video capture) and will be posted each week (Tuesdays at 10 am EST and Thursdays at 10 am EST). These can be reviewed when your schedule permits however students are encouraged to set aside time each week to make sure they keep up with lecture material.

Tutorial/seminar sessions will run synchronously (real time) in your scheduled Tutorial/Seminar time period (Sections 101-106) using ZOOM links that will be provided each week; PLEASE ATTEND YOUR SECTION and come prepared to interact with your peers! These sessions will be used on occasion for students to complete online quizzes (using Respondus + Lockdown Browser), small group activities, discussion groups to

facilitate assignment writing, take up questions from the problem sets and so on.

Office hours (for the Professor and the Teaching Assistants) will be regularly scheduled and students are encouraged to use the Discussion board to post any questions about course material from lectures and/or tutorial seminar sessions.

## 1.4 Final Exam

December 17 at 7-9 pm EST; using Respondus with Lockdown Browser

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## 2 Instructional Support

### 2.1 Instructional Support Team

<b>Instructor:</b>	Lori Ann Vallis
<b>Email:</b>	lvallis@uoguelph.ca
<b>Telephone:</b>	+1-519-824-4120 x54589
<b>Office:</b>	ANNU 343
<b>Office Hours:</b>	Weekly Office hours; held via Zoom (Links posted on CourseLink). Tuesdays 11:30 am - 1 pm EST

#### **Teaching Assistants:**

#### **TA office hours: Fridays 1-2 pm EST using "Virtual Classroom" on CourseLink**

Becky Breau [rbreau@uoguelph.ca]; Office Hours will be held during the week, via Zoom; Details to come.

Hannah Coyle-Asbil [hcoyleas@uoguelph.ca]; Office Hours will be held during the week, via Zoom

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## 3 Learning Resources

### 3.1 Required Resources

#### **CourseLink (Website)**

<https://courselink.uoguelph.ca>

Lecture notes are the required reading for the course. *Partially completed* lecture slides will be posted on CourseLink website prior to the next week's lectures. These notes will assist in lecture note taking and problem solving examples carried out in lecture.

Please familiarize yourself with the Rights and Responsibilities of all users prior to using CourseLink.

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## 4 Learning Outcomes

### 4.1 Course Learning Outcomes

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

1. Describe the fundamental mechanical static and dynamic principles underlying human movement.
  2. Interpret human movement characteristics using basic descriptive qualitative techniques and quantitative assessment methods to compute forces and moments which generate human movement.
  3. Demonstrate knowledge of anthropometrics and biological tissue tolerance as it pertains to injury of musculoskeletal tissues.
  4. Apply the concepts of work/energy and impulse/momentum and compute these variables to describe motion and the optimization of human performance.
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## 5 Teaching and Learning Activities

### 5.1 Lecture

Tue, Sep 8 - Thu, Dec 3

Topics:

**Teaching format/delivery method:**

**Lectures** will be posted at the same time each week. These will consist of power point slide presentations recorded using lecture capture software.

**Tutorials** will include weekly meetings using the ZOOM conference platform; these will occur at the same time each week in your tutorial time slot. These meetings will be facilitated by a Teaching Assistant and will involve other students registered in your tutorial section. Interactive discussions, break out learning sessions will be scheduled during these tutorial times. Zoom Links will be emailed directly to your [@uoguelph](mailto:@uoguelph) email account.

Section 101- Wednesday 9:30 am - 10:20 am  
EST: Hannah and Dennis

Section 102- Wednesday 12:30 pm - 1:20 pm  
EST: Hannah and Dennis

Section 103- Wednesday 2:30 pm - 3:20 pm  
EST: Becky and Hannah

Section 104- Wednesday 3:30 pm - 4:20 pm  
EST: Becky and Dennis

Section 105- Thursday 1:30 pm - 2:20 pm  
EST: Becky and Hannah

Section 106- Thursday 2:30 pm - 3:20 pm  
EST: Becky and Dennis

**Is there a face-to-face component that is required to be successful in the course?:** No

**A computer with a webcam will be required for weekly tutorial sessions. The Respondus Software with LockDown Browser will be required for all Quizzes, Midterm and Final examinations.**

## 5.2 Course Content

# Introduction

- Definitions, relevance and applications of biomechanics

# Review of Physics

- Force and moments, work, energy, momentum, power
- Vector vs. scalar, sine/cosine functions, essential math functions

## **The Human Biological System**

- Strength of human tissues
- Skeletal muscle mechanics
- Anthropometry and body segment data: methods of estimation, use in kinematic and kinetic calculations,

## **Statics**

- static equilibrium
- free body diagrams
- bone-on-bone forces (compression, shear, etc.)

## **Kinematics (motion that results from forces)**

- vector representations
- linear vs. angular motion: displacement-velocity-acceleration equations
- quantifying segment motion
- absolute vs. relative motion

## **Kinetics (forces that cause motion)**

- muscle mechanics revisited
- impulse/momentum approach
- linear vs. rotation momentum
- conservation of momentum
- work/energy approach

- efficiency, power calculations
- $F = ma$  approach
  - dynamic equilibrium
  - inverse vs. forward solutions
  - free body diagrams and bone-on-bone forces revisited

## 5.3 Course Structure

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# 6 Assessments

## 6.1 Assessment Details

### Tutorial Online Quizzes - 4 in total (18%)

**Date:** during scheduled seminar time slot; using Respondus/Lockdown Browser

**Learning Outcome:** 1, 2

2 online Quizzes pre-midterm; **#1 worth 3% on Sept 30 or Oct 1**; **#2 worth 5% on Oct 14 or 15**

2 online Quizzes post-midterm; **#3 worth 4% on Nov 18 or 19**; **#4 worth 6% on Dec 2 or 3**

- learning outcomes 1,2,3,4

### Mini Assignments- 4 in total (24%)

**Date:** due by 4 pm on dates indicated below, using DropBox

2 Assignments must be submitted online before the midterm; **#1 worth 3% due Sept 25**; **#2 worth 5% due Oct 9**

2 Assignments must be submitted online after the midterm; **#3 worth 7% due Nov 13**; **#2 worth 9% due Nov 27**

-learning outcomes 1,2,3,4

### Midterm Exam- Oct 27 (22%)

**Date:** Tue, Oct 27, 10:00 AM - 11:20 AM, Via Respondus Software with LockDown Browser

**Learning Outcome:** 1, 2

Mid-term Examination- learning outcomes 1,2,3

### Final Exam - Cumulative (36%)

**Date:** Thu, Dec 17, 7:00 PM - 9:00 PM, Via Respondus Software with LockDown Browser

**Learning Outcome:** 1, 2, 3

Final Examination - learning outcomes 1,2,3,4

## 6.2 Description of Assessments

ALL quizzes, assignments, mid-term and final examinations are *mandatory*. Please inform the instructor of potential time conflicts with scheduled evaluations by *Thursday September 17, 2020*. All evaluation methods will count toward the calculation of your final grade in the course. 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 course component has been graded, they may resubmit this component 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.

**Please note** that all announcements, problem sets and course updates will be posted on the CourseLink site.

Practice Problems are assigned on a weekly basis. It is expected that students will attempt all problems prior to attending weekly tutorial sessions.

Tutorial sessions will be held at the same time each week (synchronous teaching in real time) and used throughout the semester to take up questions from assigned problem sets, tackle new problems in break-out groups (Small Group Activities). As stated above, it is expected that students will have attempted questions from the assigned problem sets prior to each weekly tutorial session.

Four Quizzes will be administered (via CourseLink, Respondus with Lock Down Browser) during tutorial/seminar time periods (see dates above). These quizzes will test concepts taught in lecture and in assigned problem sets and *must be completed in the tutorial session for which you are registered*; a zero mark will be recorded for any Tutorial Quiz not completed.

Four Assignments will be given throughout the term; tutorial sessions will be used to review the assignment instructions and concepts covered by these assignments.

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## 7 Course Statements

### 7.1 Office Hours

Office hours will be held each week with Dr. Vallis using the ZOOM software platform.

Tuesday 11:30 am - 2 pm EST

Teaching Assistants will also hold regular office hours for students and will monitor the Discussion board on a regular basis.

## 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.selfregulationskills.ca/>



## 8.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) <http://www.e-laws.gov.on.ca/index.html>. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar.  
(<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml>)

## 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 grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration  
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions  
<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

### 9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

## 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.

For Guelph students, information can be found on the SAS website

<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website

<https://www.ridgetownc.com/services/accessibilityservices.cfm>

## 9.6 Academic Integrity

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 encourages academic integrity. 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.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, 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 that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

## 9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

## 9.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

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