



# ENGG\*3150 Engineering Biomechanics

01

Fall 2023

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - September 07, 2023

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## 1 Course Details

### 1.1 Calendar Description

The following topics related to biomechanics are covered in this course: kinematic and kinetic analysis techniques; electromyography; current techniques in laboratory instrumentation and biomedical applications.

**Pre-Requisites:**

4.00 ENGG credits, including ENGG\*1210

**Restrictions:**

Non-BENG students may take a maximum of 4.00 ENGG credits.

### 1.2 Course Description

The following topics related to biomechanics are covered in this course: kinematic and kinetic analysis techniques; electromyography; current techniques in laboratory instrumentation and biomedical applications.

### 1.3 Timetable

**Lectures:**

Monday, Wednesday, Friday 9:30-10:20 AM ROZH 102

**Laboratory:**

Experiments: THRN 2135

## Computer Lab: THRN 2336

\*Lab sessions will alternate between the Computer and Experiment labs. Refer to Courselink for more details and announcements.

<b>Day</b>	<b>Section</b>	<b>Time</b>	<b>GTA</b>
Thursday	0101	11:30-1:20 PM	
Wednesday	0102	12:30-2:20 PM	
Friday	0104	2:30-4:20 PM	
Tuesday	0105	3:30-5:20 PM	

## 1.4 Final Exam

There is no final exam

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## 2 Instructional Support

### 2.1 Instructional Support Team

**Instructor:** Michele Oliver Ph.D., P.Eng.  
**Email:** moliver@uoguelph.ca  
**Telephone:** +1-519-824-4120 x52117  
**Office:** THRN 1335  
**Office Hours:** Friday 10:30-11:30 AM

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**Office Hours:**

**Lab Technician:** TBA TBA  
**Email:** TBA@uoguelph.ca  
**Telephone:** +1-519-824-4120 x  
**Office:** TBA

## 2.2 Teaching Assistants

**Teaching Assistant (GTA):** Eliza Cazzola  
**Email:** eliza@uoguelph.ca  
**Office Hours:** By appointment

**Teaching Assistant (GTA):** Celina Kuczynski  
**Email:** ckuczyns@uoguelph.ca  
**Office Hours:** By appointment

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## 3 Learning Resources

### 3.1 Required Resources

#### Course Website (Website)

<http://courselink.uoguelph.ca>

Course material, news, announcements, and grades will be regularly posted to the ENGG\*3150 CourseLink site. You are responsible for checking the site regularly.

### 3.2 Recommended Resources

**D.G.E. Robertson et al. Research Methods in Biomechanics – 2nd Edition. Human Kinetics, 2014. (Textbook)**

#### Matlab Tutorials (Website)

Go to: mathworks.com; Create an account; Click on the Explore Matlab button; Click on the 'Getting Started' button near the top of the page; Scroll down to the Matlab Onramp tile and click Launch

### 3.3 Additional Resources

#### Lecture Information (Notes)

Selected lecture notes will be posted on CourseLink.

#### Lab Information (Notes)

The handouts/manual for all the lab sessions will be posted on CourseLink.

#### Miscellaneous Information (Other)

Other information related to Engineering Biomechanics will be posted on CourseLink.

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## 4 Learning Outcomes

This course is an introductory course in engineering biomechanics. The main goals of the course are to (1) introduce students to the language and instrumentation of biomechanics and (2) give them the knowledge and tools to intelligently assess biomechanical problem/questions and then (3) to select the most appropriate techniques and instrumentation to use in order to solve these problems/questions. To consolidate course knowledge, students are exposed to an open ended problem/project of their own choosing in which they have to choose a biomechanical problem, choose what parameters they should measure, and with the available resources, choose the most appropriate measurement and analysis techniques to use.

### 4.1 Course Learning Outcomes

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

1. The breadth and depth of the field of biomechanics
2. Selected data collection, processing and analysis techniques for biomechanics data
3. How to critically assess the published biomechanics literature

### 4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	2
1.4	Recall, describe and apply program-specific engineering principles and concepts	2
3	Investigation	1, 2
3.1	Propose a working hypothesis	1, 2
3.2	Design and apply an experimental plan/investigative approach (for example, to characterize, test or troubleshoot a system)	1, 2
3.3	Analyze and interpret experimental data	1, 2
3.4	Assess validity of conclusions within limitations of data and methodologies	1, 2
5	Use of Engineering Tools	1, 2
5.1	Select appropriate engineering tools from various alternatives	1, 2
5.2	Demonstrate proficiency in the application of selected engineering tools	1, 2

#	Outcome	Learning Outcome
5.3	Recognize limitations of selected engineering tools	1, 2
7	Communication Skills	2
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	2
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	2
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	2
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	2
10	Ethics & Equity	2
10.1	Summarize ethical theories and equity, diversity, and inclusivity principles	2
10.2	Determine an ethical course of action by applying ethical theories and the PEO Code of Ethics	2
10.3	Demonstrate values consistent with good ethical practice, including equity, diversity, and inclusivity	2

## 5 Teaching and Learning Activities

### 5.1 Lecture

Topics:

Week of	Approximate General Lecture Topics for week
Sept. 4	Course Introduction; Human Research Ethics
Sept. 11	Introduction to Biomechanics; Sensor Calibration

<b>Week of</b>	<b>Approximate General Lecture Topics for week</b>
Sept. 18	Kinetic Measurements; Research in Biomechanics
Sept. 25	Signal Processing
Oct. 2	Kinematics Measurements & Analysis
Oct. 9	Kinematics & Clinical Applications
Oct. 16	Biomechanical Case Studies, Waveform Analysis
Oct. 23	Electromyography and muscle mechanics
Oct. 30	Clinical EMG, Kinetics revisited
Nov. 6	Inverse Dynamics
Nov. 13	Inverse Dynamics
Nov. 20	Modeling in Biomechanics
Nov. 27	Biomechanics & Society: Special Topics

## 5.2 Lab

Topics:

Laboratory Schedule

**Week  
of      Lab**

Sept 4	No Labs
Sept 11	MATLAB refresher, Lab Safety, Equipment Demonstration
Sept 18	Lab 1 - Data Collection (GRF + IMU)
Sept 25	Lab 1 - Data Analysis + Writing
Oct 2	Lab 2 - Data Collection (Motion Capture); Project Coaching
Oct 9	No Labs
Oct 16	Lab 3 - Data Collection; Lab 2 - Data Analysis + Writing
Oct 23	Project "Early-Bird" Collection, Lab 3 - Data Analysis + Writing
Oct 30	Project Data Collection
Nov 6	Project Data Collection
Nov 13	Project Help - Analysis + Writing
Nov 20	Project Help - Analysis + Writing
Nov 27	Final Presentations (Group Projects)

### 5.3 Other Important Dates

Friday, September 8th: First day of class

Monday and Tuesday, October 9th and 10th : Fall Study Break

Friday December 1st: Last day of class (Classes rescheduled from Monday, October 9th)

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## 6 Assessments

In this course, your instructor will be using Turnitin, integrated with the CourseLink Dropbox tool, to detect possible plagiarism, unauthorized collaboration or copying as part of the ongoing efforts to maintain academic integrity at the University of Guelph.

All submitted work with the exception of the CORE completion certificate, Consent Forms, the Project Experiment Checklist, Distribution of Effort Forms and the Peer Presentation Evaluation Sheets will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Usage Policy posted on the Turnitin.com site.

A major benefit of using Turnitin is that students will be able to educate and empower themselves in preventing academic misconduct. In this course, you may screen your own assignments through Turnitin as many times as you wish before the due date. You will be able to view and print reports that show you exactly where you have properly and improperly referenced the outside sources and materials in your assignment.

## 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
CORE Human Ethics Online Course Completion	1
Consent Form Completion	1
MATLAB Refresher & Goniometer Calibration	7
Lab 1: One Page Write-Up	7
Group Project One Page Description & Distribution of Effort Form	5
Lab 2: One Page Write-up	12
Group Project Experiment Check-List & Distribution of Effort Form	2
Lab 3: Two Page Write-Up	15
Group Project Presentation & Distribution of Effort Form	10
Project Write-Up	40
Total	100

## 6.2 Assessment Details

### **CORE Human Ethics Online Course Completion (1%)**

**Due:** Prior to your scheduled lab period during the week beginning September 18

**Learning Outcome:** 1, 2

Upload Certificate of Completion to Courselink DropBox

Please note that you must complete the CORE prior to being allowed to participate in the course labs and project. If you have previously completed the CORE, you do not need to repeat it and will receive 1.25% towards your course grade. However, to receive the 1.25%, you must submit the CORE Certificate of Completion in the Courselink DropBox prior to the due date and time.

### **Consent Form Completion (1%)**

**Due:** Prior to your scheduled lab period during the week beginning September 18

**Learning Outcome:** 1, 2



It is your choice whether or not you wish to participate as a human subject in the laboratory experiments for this course. Choosing to participate, or not, will not affect your grade. However, to receive the 1.25%, you must submit EITHER a "Consent" form indicating your willingness to participate OR a "Do Not Consent" form indicating your desire not to participate as a human subject. The form must be uploaded to the Courselink DropBox prior to the due date and time.

**MATLAB Refresher & Goniometer Calibration (7%)**

**Due:** Prior to your scheduled lab period during the week beginning September 25

**Learning Outcome:** 1, 2

Upload to GradeScope

**Lab 1: One Page Write-Up (7%)**

**Due:** Prior to your scheduled lab period during the week beginning October 2nd

**Learning Outcome:** 1, 2

Ground Reaction Force and Tibial Acceleration

Upload to GradeScope

**Group Project One Page Description & Distribution of Effort Form (5%)**

**Due:** Week of October 9th; Due prior to scheduled lab period + 2 days (due to study break)

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

**One Page Project Description (Group)**

One person from each group should upload your project description to GradeScope.

**Distribution of Effort Form (Individual)**

Additionally, **each student** must submit a distribution of effort evaluation (format TBD) in order to receive a grade for the group assignment.

**Lab 2: One Page Write-up (12%)**

**Due:** Prior to your scheduled lab period during the week beginning October 23rd

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

VICON and Visual 3D

Upload to GradeScope

**Group Project Experiment Check-List & Distribution of Effort Form (2%)**

**Due:** , Prior to your scheduled lab period during the week beginning October 23rd

**Learning Outcome:** 2

**Experiment Checklist (Group)**

One person from each group should submit your experiment checklist to GradeScope

### **Distribution of Effort (Individual)**

Additionally, **each student** must submit a distribution of effort evaluation (format TBD) in order to receive a grade for the group assignment.

### **Lab 3: Two Page Write-Up (15%)**

**Date:** Prior to your scheduled lab period during the week beginning October 30th

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

Upload to GradeScope

### **Group Project Presentation & Distribution of Effort Form (10%)**

**Due:** Prior to your scheduled seminar/tutorial period during the week beginning November 28th

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

### **Presentation (Group)**

One member from each group must upload an electronic copy of the presentation slides to Courselink Dropbox. Each presentation will be approximately 10 minutes in duration, followed by a brief question period

### **Distribution of Effort Form (Individual)**

Additionally, **each student** must submit a distribution of effort evaluation (format TBD) in order to receive a grade for the group assignment.

### **Project Write-Up (40%)**

**Date:** Thu, Dec 8, 11:59 PM

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

Upload to GradeScope

## **6.3 Note:**

Failure to submit a distribution of effort (DOE) form for any group work assessments will result in an incomplete grade for the corresponding group work assessment. Individual grades in a group will only be adjusted by the course instructor if substantial differences in effort are documented in the DOE evaluation AND there is evidence of the meaningful steps taken to address the uneven effort. These steps may include, but are not limited to, a group discussion in the presence of the course instructor. It is unacceptable to expect grade

adjustment if there is a perception that one or more group members worked harder than someone else. There must be explicit evidence to support the claim.

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## 7 Course Statements

### 7.1 Course Grading Policies

**Missed Assessments:** If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

**Accommodation of Religious Obligations:** If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

**Missed Labs and Assessments:** Lab attendance is required; a lab submission will not be graded if the student did not attend the lab. If you miss, or are unable to submit, a laboratory and/or assignment due to grounds for granting academic consideration or religious accommodation, appropriate documentation must be obtained and provided to the course instructor. If academic consideration is granted, and if the lab can be completed and handed in prior to labs being handed back, the student may complete and hand in the lab. If, however, the lab has been handed back, the course grade weighting for that component will be added to the project write-up.

**Late Reports:** Late submissions of lab reports/assignments/project write-ups and presentations will not be accepted unless academic consideration has been granted.

**CORE Human Ethics Online Course:** It is mandatory to complete this course prior to attending or participating in a laboratory session. Students will not be able to participate in, or receive grades for, any lab or project activities until their CORE certificates are submitted.

## 8 School of Engineering Statements

### 8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes.

Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

## 8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

## 8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

# 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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

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 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

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