



# ENGG\*2340 Kinematics and Dynamics

01

Winter 2021

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - January 11, 2021

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## 1 Course Details

### 1.1 Calendar Description

The course will cover kinematic and dynamic analysis including graphical and analytical methods for kinematic analysis of space, mechanisms and elementary body motion in space, static and dynamic force analyses of mechanisms, gyroscopic forces, dynamics of reciprocating and rotating machinery, cam and gear mechanisms and specifications.

**Pre-Requisites:** ENGG\*1210

**Restrictions:** This is a Priority Access Course. Enrolment may be restricted to the MECH specialization in the BENG and BENG:C programs. See department for more information.

### 1.2 Timetable

**Lectures:**

Day	Time	Location
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Monday	12:30AM – 2:30PM	Virtual ( <a href="https://uoguelph.webex.com/meet/abardelc">https://uoguelph.webex.com/meet/abardelc</a> )
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**Labs:**

Day	Time	Location	Section(s)
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Wednesday	3:30PM – 5:20PM	Virtual	01
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Monday 3:30PM – 5:20PM Virtual 02

Thursday 3:30PM – 5:20PM Virtual 03

### 1.3 Final Exam

Monday April 19, 8:30AM - 10:30PM, Virtual.

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## 2 Instructional Support

### 2.1 Instructional Support Team

**Instructor:** Alexander Bardelcik MASC, PhD, PEng  
**Email:** abardelc@uoguelph.ca  
**Telephone:** +1-519-824-4120 x53228  
**Office:** THRN 2501  
**Office Hours:** Tuesday 10:00AM - 11:00AM  
 Thursday 10:00AM - 11:00AM

### 2.2 Teaching Assistants

**Teaching Assistant:** Andrei Buin  
**Email:** abuin@uoguelph.ca  
**Teaching Assistant:** Mayada Elkhailifa  
**Email:** elkhailim@uoguelph.ca  
**Teaching Assistant:** Siyu Wu  
**Email:** swu09@uoguelph.ca  
**Teaching Assistant:** Raj Dahal  
**Email:** rdahal@uoguelph.ca

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## 3 Learning Resources

### 3.1 Required Resources

**Course Website (Website)**  
<https://courselink.uoguelph.ca>

Course material, news, announcements, and grades will be regularly posted to the **ENGG\*2340** Courselink site. You are responsible for checking the site regularly.

#### **Mechanics of Machines (Textbook)**

W. L. Cleghorn (2014, 2nd ed) . ***Mechanics of Machines***; OXFORD UNIVERSITY PRESS; New York;

#### **Geometry Kit (Other)**

A simple geometry kit (2 triangles, protractor, ruler and compass) is required for this course. It will be used for the graphical kinematic and dynamic components of the course. Always have the kit on hand for the lectures, labs, midterms and final exam.

### **3.2 Recommended Resources**

#### **Theory of Machines and Mechanisms (Textbook)**

John J. Uicker, JR., Gordon R. Pennock, and Joseph E., Shigley (2010). ***Theory of Machines and Mechanisms***, 4ed, OXFORD UNIVERSITY PRESS, New York.

### **3.3 Additional Resources**

#### **Lecture Notes (Other)**

The entirety of the course will be delivered in a virtual manner. The lectures will be uploaded to the CoureLink website and made available for download by the students. The format of the virtual lectures will be voiced-over and annotated PowerPoint slides. The PowerPoint lectures are the property of Dr. A. Bardelcik and cannot be distributed by the students. Failure to do so will be considered an act of academic misconduct.

**Weekly Lecture Format:** I will use the weekly lecture time slot to hold a live virtual session and briefly introduce the lecture material for that week. This time will also be used by me to relay any important course information and answer student questions. Once we are finished with the live session, you will be asked to download that weeks lecture on PowerPoint and go through the material on your own time.

Lectures are the main source of material which includes important discussions and worked examples that might not be found elsewhere. Partially completed lecture notes (PDF format) with worked examples will be posted on CourseLink and these lecture notes will be completed in the weekly PowerPoint lectures.

#### **Lab Problems (Other)**

The labs will be used to virtually complete worked examples related to the course content. PDF versions of the problems will be posed on CourseLink.

#### **Assignments (Other)**

The assignments will be posted on CourseLink. Solutions to the assignments will be made available on CourseLink after the due date. Assignments are to be completed individually, not in groups. The TA's will be checking for plagiarism.

## 4 Learning Outcomes

The course is aimed at introducing students to the fundamentals of kinematics and dynamics analysis of mechanisms.

### 4.1 Course Learning Outcomes

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

1. Understand motion generated by different types of mechanisms.
2. Construct displacement, velocity and acceleration vector diagrams and solve them graphically and analytically.
3. Apply the concepts of displacement, velocity, and acceleration to solve mechanical problems.
4. Analyse both static and dynamic forces on kinematic machine components.
5. Understand the fundamentals of gears and gear trains.

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

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2, 4, 5
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1, 2, 4
1.2	Recall, describe and apply fundamental principles and concepts in natural science	1, 2, 4
1.3	Recall, describe and apply fundamental engineering principles and concepts	4, 5
1.4	Recall, describe and apply program-specific engineering principles and concepts	2, 4, 5
2	Problem Analysis	2, 3, 4, 5
2.2	Identify, organize and justify appropriate information, including assumptions	2, 4, 5
2.3	Construct a conceptual framework and select an appropriate solution approach	2, 3, 4, 5
2.4	Execute an engineering solution	3

## 4.3 Relationships with other Courses & Labs

### Previous and/or Current Courses:

**ENGG\*1210 (Engineering Mechanics I):** The fundamental principles of Newtonian mechanics covered in ENGG\*1210 are the basis for the various topics to be covered in ENGG\*2340

### Follow-on Courses:

**ENGG\*3280 (Machine Design):** The design of various mechanical elements requires the knowledge of the kinematics and dynamics of the mechanisms in which these mechanical elements are used.

## 5 Teaching and Learning Activities

### 5.1 Lecture

<b>Topics:</b>	Introduction
<b>References:</b>	Chapter 1
<b>Learning Outcome:</b>	1
<b>Topics:</b>	Mechanics of Rigid Bodies & Planar Mechanisms
<b>References:</b>	Chapter 2
<b>Learning Outcome:</b>	1, 3
<b>Topics:</b>	Graphical Kinematic Analysis of Planar Mechanisms
<b>References:</b>	Chapter 3
<b>Learning Outcome:</b>	1, 2, 3
<b>Topics:</b>	Analytical Kinematic Analysis of Planar Mechanisms
<b>References:</b>	Chapter 4
<b>Learning Outcome:</b>	1, 2, 3

**Topics:** Gears, Gear Trains & Cams

**References:** Chapter 5,6,7

**Learning Outcome:** 1, 5

**Topics:** Force Analysis of Planar Mechanisms

**References:** Chapter 8,9

**Learning Outcome:** 4

## 5.2 Lab

**Topics:** Weekly labs will be used to solve chapter specific problems. The problems will be uploaded to courselink prior to the lab sessions for review.

## 5.3 Other Important Dates

**Monday, January 11:** Classes commence

**Monday, February 15 – Friday, February 19:** WINTER BREAK

**Friday, April 12:** Last day of classes.

# 6 Assessments

## 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Assignments	20
Midterm	40
Final Exam	40
Total	100

## 6.2 Assessment Details

**Assignments 1-4 (20%)**

Four assignments will be given and uploaded to CourseLink during the semester. A softcopy (PDF) of the completed assignment must be uploaded to the CourseLink Dropbox for each assignment. You are responsible for uploading a clearly legible solution that will be graded by the TA. A select number of problems will be graded from each assignment. Each of the four assignments is worth 5% of your overall grade.

**Midterm (40%)**

**Date:** Mon, Feb 8, Virtual (during lecture time)

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

**Final Exam (40%)**

**Date:** Mon, Apr 19, 8:30 AM - , 10:30 AM, Virtual

**Learning Outcome:** 4, 5

## 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>

**Passing grade:** Students must obtain a grade of 50% to pass this course.

**Missed Midterm tests:** If you miss a Midterm test due to grounds for granting academic consideration or religious accommodation, the weight of the missed Midterm will be added to the final exam. There will be **no** makeup for missed midterm if academic consideration is granted.

**Missed Assignments:** Late submissions of assignments to the CourseLink Dropbox will not be accepted and a grade of **zero** will be given for that assignment. If you miss an assignment submission due to grounds for granting academic consideration or religious accommodation, the weight of the missed assignment will be added to the final exam.

## 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 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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