ENGG*2340 Kinematics and Dynamics

01

Winter 2023
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - January 08, 2023

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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
M/W/F	1:30 PM - 2:20 PM	RICH 2520

Labs:

Section	Day	Time	Location
01	Friday	08:30 AM - 10:20 AM	THRN 1319
02	Friday	11:30 AM - 01:20 PM	THRN 1319

03	Monday	11:30 AM - 01:20 PM	THRN 1319
04	Wednesday	08:30 AM - 10:20 AM	THRN 1319

1.3 Final Exam

08:30 AM - 10:20 AM (2023/04/24) Room TBA

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Defersha Fantahun Defersha, Fantahun
Email: fdefersh@uoguelph.ca
Office: THRN 2403
Office Hours: Monday and Wednesday 2:30 PM - 3:30 PM

2.2 Teaching Assistants

Teaching Assistant (GTA): Siyu Wu
Email: swu09@uoguelph.ca

Teaching Assistant (GTA): Leonardo Gadelha Tumajan Costa de Melo
Email: lgadelha@uoguelph.ca

Teaching Assistant (GTA): Sohang Rakeshbhai Patel
Email: sohangra@uoguelph.ca

Teaching Assistant (GTA): Randall Vandyk
Email: rvandyk@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;

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 lectures will be uploaded to the CoureLink website and made available for download by the students.

The lecture is the primary source of information for the course and certain topics will be more elaborated than presented in the textbook. Discussion and Examples that may not be available from the textbook will also be presented during the lecture time to help you further understand the subject matter of the various topics. As such it is highly recommended that you attend the lectures. The lecture time will also be used to relay any important course information.

Lab Problems (Other)

The laboratory sections are intended to introduce students to computer tools for graphical and analytical kinematics and dynamics analysis of mechanisms. Students are required to submit their laboratory work using designated dropbox.

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.

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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. Analyze the Design of cams
6. Understand the fundamentals of gears and gear trains.
7. Use CAD software, MATLAB and Working Model 2D for kinematics and dynamics analysis of mechanisms.

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, 6
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, 6
1.4	Recall, describe and apply program-specific engineering principles and concepts	2, 4, 5, 6
2	Problem Analysis	2, 3, 4, 6
2.2	Identify, organize and justify appropriate information, including assumptions	2, 4, 6
2.3	Construct a conceptual framework and select an appropriate solution approach	2, 3, 4, 6
2.4	Execute an engineering solution	3
4	Design	5
4.1	Describe design process used to develop design solution	5
5	Use of Engineering Tools	7
5.2	Demonstrate proficiency in the application of selected engineering tools	7

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.

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5 Teaching and Learning Activities

5.1 Lecture

Topics:	Revision of kinematics of rigid bodies ENGG*1210
References:	Lecture Slide
Learning Outcome:	1, 1, 2, 3
Topics:	Graphical and Vector Analysis of Relative Velocity
References:	Chapter 2, Chapter 3, Lecture Note
Learning Outcome:	1, 1, 2, 3, 3
Topics:	Graphical and Vector Analysis of Relative Acceleration
Learning Outcome:	1, 1, 2, 2, 3, 3
Topics:	Complex Vector Analysis of planar mechanism
References:	Chapter 4
Learning Outcome:	1, 1, 2, 2, 3, 3
Topics:	Dynamic Force Analysis
References:	Lecture note
Learning Outcome:	1, 4, 6
Topics:	Cam Analysis and Design

References: Chapter 7 and Lecture note

Learning Outcome: 4, 5

Topics: Gears and gear trains

References: Chapter 6 and 7

Learning Outcome: 6

5.2 Lab

Topics: Graphical Position and Velocity Analysis using AutoCAD

Learning Outcome: 1, 2, 3, 7

Topics: Graphical Acceleration Analysis using AutoCAD

Learning Outcome: 1, 2, 3, 7

Topics: Position and Velocity Analysis using MATLAB

Learning Outcome: 1, 2, 3, 7

Topics: Solving problem with Coriolis components of acceleration both graphically (AutoCAD) and analytically (MATLAB)

Learning Outcome: 1, 2, 3, 7

Topics: Introduction to Working Model 2D

Learning Outcome: 1, 2, 3, 7

Topics: Exercise on Working Model 2D

Learning Outcome: 1, 2, 3, 7

5.3 Other Important Dates

Please refer to winter schedule at:

https://calendar.uoguelph.ca/undergraduate-calendar/schedule-dates/winter-semester/

6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Assignments	15
Lab	10
Quizzes	20
Mid-term	25
Final-Exam	30
Total	100

6.2 Assessment Details

Assignments 1-4 (15%)

Learning Outcome: 1, 2, 3, 4, 5, 6, 7

Four assignments will be given and uploaded to CourseLink during the semester. A single PDF file of the completed assignment must be submitted via Dropbox. You are responsible for submitting a legible solution report. An assessment problem solution that is difficult to read will be considered incorrect. You are required to attempt all the problems in a given assignment. However, only a few randomly selected problems will be checked for the correctness of detailed solution steps and numerical values. Your completeness (attempting all problems), neatness, and assignment report organization will be given considerable weight in grading your assignment.

- Assignment-1 (Due January 30, 2023 Dropbox)
- Assignment-2 (Due February 27, 2023 Dropbox)
- Assignment-3 (Due March 13, 2023, Dropbox)
- Assignment-4 (Due March 27, 2023, Dropbox).

Labs 1-8 (10%)

Learning Outcome: 1, 2, 3, 7

Weekly labs will be conducted in the computer room (THRN 1319) where the TA will assist you in solving selected problems using graphical (using AutoCAD) and analytical methods (MATLAB). You will also be introduced to WorkinModel2D for kinematics and dynamic analysis of rigid-body mechanisms. Your successful completion of the lab exercise will be marked at the end of each lab.

The first lab will be in the week of January 23, 2022.

Quiz 1-4 (20%)

There are a total of four in-class quizzes aimed at testing your understanding of basic

concepts. Each quiz will be conducted during the lecture and will take 10 to 12 minutes. Quizzes are designed to increase student's engagement with the material and the lecture. Detail verbal instructions may also be given during a quiz. For this reason, quizzes cannot be attempted outside class. There will be no makeups for missed quizzes. The weights of the missed quizzes will be transferred to that of the final examination.

- Quiz-1 (February 3, 2023, in class)
- Quiz-2 (February 17, 2023, in class)
- Quiz-3 (March 17, 2023, in class)
- Quiz-4 (March 31, 2023, in class)

Midterm (25%)
Date: Sun, Mar 5 - Mon, Mar 6, Take-home-exam (within 12 to 18 hours duration)
Learning Outcome: 1, 2, 3, 7
The mid-term is a take-home exam. You are required to solve problems with hand calculation and using computers.

The problems will be posted on Sunday, March 05, 2023, and the complete solutions will be submitted in class on Monday, March 06, 2023.

Final Exam (30%)
Date: Mon, Apr 24, 8:30 AM - 10:30 AM, TBA
Learning Outcome: 1, 2, 3, 4, 5, 6

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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

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

Missed Quiz and Midterm: If you miss a Quiz or a Midterm test due to grounds for granting academic consideration or religious accommodation, the weight of the missed Quiz or Midterm will be added to the final exam. There will be ***no*** makeup for missed quizzes and midterms. A grade of zero will be given to missed test if academic consideration is not granted.

Missed Labs and Assignments: Not attending lab or late submissions of assignments will not be accepted and a grade of ***zero*** will be given for missed lab or assignment. If you do not attend a lab or miss assignment submission due to grounds for granting academic consideration or religious accommodation, the weights of the missed lab and 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 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 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. 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

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).

9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
