

MME 3381a - Kinematics and Dynamics of Machines

COURSE OUTLINE – 2021-2022

CALENDAR DESCRIPTION: Displacement, velocity and acceleration analysis of linkages; static and dynamic force analysis of mechanisms; balancing of reciprocating and rotating masses; special-purpose joints and mechanisms.

COURSE INFORMATION:

Instructor: Professor Remus Tutunea-Fatan
Office: SEB 3002
Email: rtutunea@eng.uwo.ca

Lectures: M 11:30 am – 12:20 pm (SEB 2100)
W 1:30 pm – 2:20 pm (SEB 2100)
Th 11:30 am – 12:20 pm (FNB 1250)

Tutorials: W 4:30 pm – 6:20 pm (WSC 55)

Labs: M 8:30 am – 11:20 am (SEB 3101)
M 2:30 pm – 5:20 pm (SEB 3101)
Tu 9:30 am – 12:20 pm (SEB 3101)
W 6:30 pm – 9:20 pm (SEB 3101)
Th 1:30 pm – 4:20 pm (SEB 3101)

COVID CONTINGENCY: In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (*i.e.*, at the times indicated in the timetable) or asynchronously (*e.g.*, posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online at the discretion of the course instructor.

PREREQUISITES: MME 2213a/b, NMM 2270a/b or the former AM 2270a/b
ANTIREQUISITE: MSE 3381 a/b

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

CONSULTATION HOURS: By advance notice via email or drop in.

ACCREDITATION UNITS: Engineering Science = 75%, Engineering Design = 25%

TOPICS:

- Fundamentals of mechanisms and machines
- Techniques in geometric constraint programming
- Planar linkage design

- Graphical position, velocity, and acceleration analysis
- Design and analysis of cam-based mechanisms
- Static and dynamic force analysis of mechanisms
- Dynamic force analysis
- Balancing of rotating and reciprocating machines

**LEARNING
OUTCOMES:**

Upon successful completion of this course, students will:

- Understand and assess the functionality of a mechanism
- Select or design a mechanism for a specific purpose
- Analyze the position, velocity and acceleration of a linkage using graphical, analytical, and computer-based methods
- Model and analyze a mechanism using motion simulation software
- Use hand calculations, computer simulation, and experiments in designing and analyzing machines
- Verify, compare, and interpret differences between the results obtained through different means of analysis
- Evaluate the implications of an incorrect mechanism design
- Manage and apply the principles of effective team interaction: organization, management, and motivation

CONTACT HOURS: 3 lecture hours, 2 tutorial hours, 0.5 laboratory hours, half course

**RECOMMENDED
TEXTBOOKS:**

Waldron K.J., Kinzel G.L., Agrawal S.K., *Kinematics, Dynamics, and Design of Machinery*, 3rd Edition, Wiley, 2016

EVALUATION:

The final course grade will be determined according to the following weighting scheme:

Eight in-tutorial assignments (open book)	15%
SolidWorks motion analysis tutorials (pre-project)	5%
Project	15%
Laboratory session	5%
Two quizzes (closed book)	20%
Final examination (closed book)	40%

Quizzes, projects and laboratories will be carried out according to the following *tentative* schedule:

Evaluation Format	Weight	Effort Type	Assigned	Due
Pre-project	5%	Team	Week of Sep. 19	Week of Oct. 3
Project	15%	Team	Week of Oct. 10	Week of Dec. 5
Quiz 1	10%	Individual	Oct. 13	Oct. 13
Quiz 2	10	Individual	Nov. 17	Oct. 17
Lab	5%	Team	Week of Nov. 21	Week of Nov. 21

Evaluation Format	Weight	Effort Type	Assigned	Due
Eight in-tutorial assignments	15% (1.875% each)	Team	Weekly except Sep. 8, Sep. 15, Oct. 13, Nov. 17, and Dec. 8	End of tutorial hour in which is assigned

COURSE POLICIES

The following course-specific policies will be strictly enforced throughout the course:

Laboratory sessions

- Each student has to attend the laboratory session to which they signed up.
- Failure to pass the laboratory component of the course will attract automatic course failure.
- Passing of the laboratory component is equivalent with obtaining more than 50% on the laboratory component of the course.
- A maximum of **one** make-up session will be offered to students who have missed a laboratory session with academic consideration.
- All approved make-up laboratory sessions will be offered in the final week of the term.
- Missing of a laboratory session **without** academic consideration will translate into a zero mark for that laboratory session.
- When academic consideration has been obtained for a particular laboratory session, it is student's responsibility to contact *timely* (*i.e.*, within maximum three days after consideration has been obtained) the instructor of the course in order to seek alternate arrangements for the missed laboratory session.
- The default assumption is that everyone contributes equally to the lab team effort and hence everyone should receive the same mark for the common team submission.
- Please note that whenever individual contributions to the team effort are not equitably shared by the team members, individual adjustments of the marks might occur at the discretion of the instructional team of the course (*i.e.*, course instructor and teaching assistants).
- Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

Quizzes

- The quizzes will take place during the scheduled tutorial sessions.
- Quizzes will be closed book.
- Each quiz will be approximately 1.5 hours long with the remainder of tutorial time used to discuss the quiz solution.
- Missing a quiz **without** academic consideration will translate into a zero mark for that quiz.
- **No make-up quiz** will be offered to those who miss it with academic consideration. The weighting of the quizzes missed with

consideration will be shifted automatically to the final exam. There will be no exceptions!

- Academic consideration for quizzes (greater than or equal 10% weight) can be obtained from Engineering Undergraduate Services.
- Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

Project

- Project teams will be formed in the first week of classes via OWL sign-up.
- The maximum team size will be three students, while the minimum team size will be two students.
- The same project team will also work on the eight in-tutorial assignments scheduled throughout the term.
- Once team formation deadline has passed, team membership cannot be changed.
- SolidWorks will be used for the kinematic analysis of the mechanism generated for project purposes.
- The default assumption is that everyone contributes equally to the project team effort and hence everyone should receive the same mark for the common team submission.
- Please note that whenever individual contributions to the team effort are not equitably shared by the team members, individual adjustments of the marks might occur at the discretion of the instructional team of the course (*i.e.*, course instructor and teaching assistants).
- Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

In-Tutorial Assignments

- **In-tutorial assignments will take place during the second hour of the tutorials.**
- The assignments will consist of problems to be solved by the same team formed for project-solving purposes.
- The instructor of the course will solve problems during the first tutorial hour. Problems similar to them will constitute the subject of the in-tutorial assignment for the following week.
- Teams will receive problem solving assistance from TA and instructor who will be in the tutorial room. However, prior knowledge on problems assigned (similar to the ones solved by the instructor in the preceding week) will be highly beneficial.
- No make-up sessions will be offered for those missing the in-tutorial assignment (irrespective of the reason).
- If the in-tutorial assignment is missed **with** academic consideration, then the 15% allotted to in-tutorial assignments will be calculated as the average of the remaining assignments.

- If the in-tutorial assignment is missed **without** academic consideration, then the mark for the missed assignment will be zero.
- Academic consideration for in-tutorial assignments (under 5% individual weight) can be obtained from the MME Undergraduate Coordinator.
- The default assumption is that everyone contributes equally to the in-tutorial assignment team effort and hence everyone should receive the same mark for the common team submission.
- Please note that whenever individual contributions to the team effort are not equitably shared by the team members, individual adjustments of the marks might occur at the discretion of the instructional team of the course (*i.e.*, course instructor and teaching assistants).
- Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

Term work

- If a minimum of 50% is not obtained on the term work (*i.e.*, quizzes, pre-project, project, and laboratory sessions), the student will fail the course regardless of the mark obtained on the final examination.
- Please note that whenever possible, due warning on this topic will be given. However, since the term project (15% weight) is due in the final day of classes, it is possible that accurate calculations will not be possible until final grades are calculated.
- No appeals on this topic will be accepted, such that students are strongly encouraged to self-monitor their academic progress in the course throughout the term.

Final examination

- Only non-programmable calculators will be allowed during the final examination.
- If a minimum of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.

Submissions

- In-tutorial assignments are due at the end of the tutorial hour in which they were assigned. No late submissions will be accepted.
- Lab reports will be due at the end of the lab session in which data was provided and was processed. No late submissions will be accepted.
- Late submissions of the pre-project will be penalized with 20% per day.
- Late submissions of the project will be penalized with 20% per day.
- The final examination will have a total duration of three hours.
- Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

- UNITS:** Metric and US customary.
- ENGLISH:** In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for the improper use of English. Additionally, poorly written work with the exception of final examinations may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.
- CLASSROOM DEMEANOR:** The instructor is committed to providing a respectful learning environment for all students involved in this course. This is a collective responsibility of the instructor and students, and therefore students partaking in this course agree to abide by this criterion. This includes arriving at lectures on time, and acting in a professional manner during class.
- ATTENDANCE:** Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.
- CHEATING:** University policy states that cheating, including plagiarism, is a scholastic offense. The commission of a scholastic offence is attended by academic penalties which might include expulsion from the program. If you are caught cheating, there will be no second warning (see Scholastic Offence Policy in the Western Calendar).
- SSD:** Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.
- NOTE:** Students who have failed an Engineering course (i.e. < 50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

NEW: Requests for Academic Consideration using the Self-Reported Absence Form

If you experience an unexpected illness or injury or an extenuating circumstance (48 hours or less) that is sufficiently severe to temporarily render you unable to meet academic requirements (e.g., attending lectures or labs, writing tests or midterm exams, completing and submitting assignments, participating in presentations) you should self-declare using the online Self-Reported Absence portal. This option should be used in situations where you expect to resume academic responsibilities within 48 hours or less.

Each student will be allowed a maximum of two self-reported absences between September and April and one self-reported absence between May and August. Self-reporting may not be used for final exams or assessments (e.g. midterm exams, tests, reports, presentations, or essays) worth more than 30% of any given course.

For full instructions about the Self-Reporting System refer to the Academic Calendar link [here](#).

A. GENERAL REGULATIONS & PROCEDURES (other than self-reported absences)

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination that is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If your course work is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

B. TERM/MIDTERM TESTS (other than self-reported absences)

1. If you are in first year and you are unable to write a midterm/term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a midterm/term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief.
3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair or the Undergraduate Services Office is required when rescheduling midterm/term tests.

C. FINAL EXAMINATIONS (cannot be self-reported)

1. If you are unable to write a final examination, contact the Undergraduate Services Office **PRIOR TO THE SCHEDULED EXAMINATION TIME** to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department **and** the Associate Dean and in order to apply you must sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

D. LATE ASSIGNMENTS

1. Advise the instructor if you are having problems completing the assignment on time (**prior** to the due date of the assignment).
2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).
3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4.
 - i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.
 - ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

E. SHORT ABSENCES

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

F. EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You are strongly encouraged to seek advice from your Academic Counsellor in the Undergraduate Services Office.

G. DOCUMENTATION

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, **you must provide the doctor with a Student Medical Certificate** to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.**

In Case of Serious Illness of a Family Member: Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).
2. **You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.**
3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your Academic Counsellor.

Calendar References: Check these regulations in your 2021 Western Academic Calendar available at www.westerncalendar.uwo.ca.

[Self-Reporting Absences](#)
[Absences Due to Illness](#)
[Academic Accommodations for Students with Disabilities](#)
[Academic Accommodations for Religious or Holy Days](#)
[Course Withdrawals](#)
[Examinations](#)
[Scheduling of Term Assignments](#)
[Scholastic Offences](#)
[Student Medical Certificate](#)
[Engineering Academic Regulations](#)

Note: These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

<u>Add Deadlines:</u>	First term half course (i.e. “A” or “F”)	September 16, 2021
	Full courses and full-year half course (i.e. “E”, “Y” or no suffix)	September 16, 2021
	Second term half course (i.e. “B” or “G”)	January 11, 2022

<u>Drop Deadlines:</u>	First term half course (i.e. “A” or “F”)	November 12, 2021
	Full courses and full-year half courses (i.e. “E”, “Y” or no suffix)	November 30, 2021
	Second term half or second term full course (i.e. “B” or “G”)	March 7, 2022

Contact Information:

Undergraduate Services Office	SEB 2097 Phone: 519-661-2130	E-mail: engugrad@uwo.ca
Chemical & Green Process Engineering	TEB 477 Phone: 519-661-2131	E-mail: cbeugrad@uwo.ca
Civil Engineering:	SEB 3005 Phone: 519-661-2139	E-mail: civil@uwo.ca
Computer, Electrical, Mechatronic Systems & Software Engineering	TEB 279 Phone: 519-661-3758	E-mail: eceugrad@uwo.ca
Integrated Engineering	ACEB 2410 Phone: 519-661-6725	E-mail: engceli@uwo.ca
Mechanical Engineering	SEB 3002 Phone: 519-661-4122	E-mail: mmeundergraduate@uwo.ca

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