Western University
Department of Mechanical & Materials Engineering

MME 3381a - "Kinematics and Dynamics of Machines"

COURSE OUTLINE – 2025-2026

CALENDAR DESCRIPTION:

Displacement, velocity and acceleration analysis of linkage mechanisms; inertia force analysis of mechanisms; balancing of reciprocating and rotating masses

COURSE INFORMATION:

Instructor: R. Tutunea-Fatan, PhD, PEng
Office: ACEB 3462
Email: rtutunea@eng.uwo.ca

Schedule: See timetable

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 if you are dropped from a course for failing to have the necessary prerequisites.

CONSULTATION HOURS:

By advance notice via email or drop in anytime.

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
- Design and analysis of gear-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 (KB3)
- Select or design a mechanism for a specific purpose (DE1, DE2)
- Analyze the position, velocity and acceleration of a linkage using graphical, analytical and computer-based methods (KB3, PA1, PA2, ET2)
- Model and analyze a mechanism using motion simulation software (PA1, PA2, ET1, ET2)
- Use hand calculations, computer simulation, and experiments in designing and analyzing machines (IN1, IN2, PA1, PA2, ET1, ET2)

- Verify, compare and interpret differences between the results obtained through different means of analysis (IN3, PA3, ET1, ET2, CS3)
- Evaluate the implications of an incorrect mechanism design (PA3)

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)	10%
One take home assignment	5%
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**
Eight in-tutorial assignments	10% (Average of best seven)	Team[a]	Weekly **except for** the first two Thursdays of the term, Fall Reading Week, and days of the two quizzes.	End of tutorial hour[e]
Pre-project	5%	Team[a]	Week of Sep. 15	Oct. 3[d]
Quiz 1	10%	Individual	Oct. 16[c]	
Project	15%	Team[a]	Week of Oct. 6	Week of Dec. 1[d]
Assignment (peer-graded, includes Part 1 and Part 2)	5%	Team[a]	Week of Oct. 13	Week of Nov. 24[d]
Quiz 2	10%	Individual	Nov. 13[c] (Designated Assessment)	
Lab	5%	Group[b]	Week of Nov. 17	Week of Nov. 24
			Makeup offered in the last week of the term	
Final exam	40%	Individual	TBA (Dec. examination period)	

[a] Team is student-formed (same team throughout the entire course).
[b] Group is instructor-formed (applies just to the lab session).

[c] These dates are tentative and might shift to avoid conflicts with other term tests. Final dates will be announced after the start of classes.

[d] Deliverable with a flexible deadline; self-attestations are not accepted for them.

[e] Flexible assignment (average of best seven in-tutorial assignments) but not flexible submission deadline; self-attestations are not accepted for in-tutorial assignments.

Note that the dates listed above are **tentative** and may be adjusted if needed. Marks will be assigned based on the analysis method, correctness, presentation, clarity and neatness.

COURSE POLICIES

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

Academic Considerations

- Please note that for academic relief to be granted for being absent in a laboratory session, for failing to submit a course deliverable (assignment, project report) on time or for writing the final exam in April according to the official schedule issued by the Office of Registrar, students must obtain approved academic considerations.
- Academic considerations are of two main types: accompanied by supporting documentation (”old” or “traditional” type) and unaccompanied by supporting documentation. Those in the latter category are also called self-attestations (“new” type, introduced in September 2024).
- Please note that - according to approved policies - academic considerations for self-attestations/undocumented absences can be granted *up to one per term and per course*.
- For more information on this topic (including on the process of requesting academic relief via academic considerations), please review the general policies appended at the end of this outline and/or posted on relevant faculty/university webpages.

Deliverable Deadlines

- As shown in the tentative course schedule, some course deliverables have a flexible submission deadline (pre-project, project, peer-graded assignment). In this course, the flexible submission deadline is constituted by a 72-hour window immediately (immediately following the original deadline of the deliverable) in which the deliverable can be submitted without late penalties. This submission deadline flexibility implies that self-attestations will not be accepted for any of these course deliverables.
- Once the 72 hour no-late-penalty window has passed, late penalties of 20% per day will be applied to late submissions.
- Self-attestations will also not be accepted for flexible assessments that are not included in the calculation of the final grade (in-tutorial assignments).

Laboratory sessions

- Students must attend the laboratory session for which they have signed up.
- 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. This make up session will be scheduled in the last week of the term.
- All approved make-up laboratory sessions will be offered in the final week of the term.
- Missing the laboratory session **without** academic consideration will translate into a zero mark for the laboratory session.
- Failure to pass the laboratory component of the course will result in automatic course failure.
- 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 timetabled tutorial sessions.
- Quizzes will be closed book.
- Quiz 2 is the designated assessment and as such will require medical documentation to receive academic consideration.
- Each quiz will be approximately 1.5 hours long with the reminder 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 academic 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.

Pre-project/Project

- Project teams will be formed in the first week of classes via OWL sign-up.
- Failure to pass the project component of the course will result in automatic course failure.
- 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 the 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 pre-project/project purposes.
- The instructor of the course will solve problems during the first tutorial hour. Problems like them will constitute the subject of the in-tutorial assignment assigned in the second hour of the tutorial.
- Teams will receive problem solving assistance from TAs and instructor who will be in the tutorial room. However, prior knowledge on problems assigned (like 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 its weight will be equally distributed over the completed assignments.
- If the in-tutorial assignment is missed **without** academic consideration, then its mark 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.
- Attendance will be taken during the first hour of the tutorial and those absent will be penalized with 80% of their in-tutorial assignment mark.
- 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.

Peer-Graded Assignment

- The assignment will consist of two separate, but interconnected parts: Part 1 will require the team to work together and complete the required deliverable(s) whereas Part 2 will require each team member to review and grade/rank the deliverables submitted by all other teams in the class.
- Part 1 will be graded by the rest of the class ("peer-graded assignment").
- Part 2 will not receive any marks, but those who will not submit timely their ranking of Part 1 submissions will incur individual late penalties of 20% per day for the peer-graded assignment (even if Part 1 was submitted on time by the team).
- 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.

Term work

- If a minimum of 50% is not obtained on the term work (assignments, 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 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

- 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.

USE OF AI: The use of generative artificial intelligence is not officially prohibited in this course, however if it is used in the production of any materials submitted for marks in the context of this course, its use must be disclosed in full. This includes, for example, the use of AI tools for text generation, editing, and/or refinement.

STATEMENT ON GENDER-BASED AND SEXUAL VIOLENCE: Western is committed to working to end gender-based and sexual violence on campus and in our community and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts, here: https://www.uwo.ca/health/gbsv/support/get-help.html. To connect with a case manager or set up an appointment, please contact support@uwo.ca.