Western University
Department of Mechanical & Materials Engineering

MME 3381a - "Kinematics and Dynamics of Machines"

COURSE OUTLINE – 2020-2021

CALENDAR DESCRIPTION:

Displacement, velocity and acceleration analysis of linkage mechanisms; inertia force analysis of mechanisms; balancing of reciprocating and rotating masses; free and harmonic vibrations of single degree of freedom systems.

COURSE INFORMATION:

Instructor:	Professor Remus Tutunea-Fatan Office: ACEB 3462 Email: rtutunea@eng.uwo.ca
Lectures:	M 11:30 pm – 12:20 pm (online, Zoom) W 1:30 pm – 2:20 pm (online, Zoom) Th 11:30 am – 12:20 pm (online, Zoom)
Tutorials:	Th 4:30 pm – 6:20 pm (online, Zoom)
Labs:	M 8:30 am – 11:20 am (online, Zoom) M 2:30 pm – 5:20 pm (online, Zoom) Tu 9:30 am – 12:20 pm (online, Zoom) W 8:30 am – 11:20 am (online, Zoom) Th 1:30 pm – 4:20 pm (online, Zoom)

PREREQUISITES: MME 2213a/b, 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 mechanical vibrations
- 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 the fundamental principles of the vibratory motion
- 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

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

Beer F., Johnston E.R., Mazurek D.F., Cornwell P., Self B., *Vector Mechanics for Engineers: Statics and Dynamics*, 12th Edition, McGrawHill, 2019

EVALUATION:

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

Weekly in-tutorial assignments (8)	10%
SolidWorks motion analysis tutorials (pre-project)	5%
Project	15%
Laboratory sessions	10%
Quiz 1 (closed book, Proctortrack)	10%
Quiz 2 (closed book, Proctortrack)	10%
Final examination (closed book, Proctortrack)	40%

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

Evaluation Format	**Weight**	**Effort Type**	**Assigned**	**Due**
Quiz 1	10%	Individual	Oct. 8	Oct. 8
Lab 1	5%	Team	Week of Sep. 28	Week of Sep. 28
Pre-project	5%	Team	Week of Sep. 21	Week of Oct. 5
Project	15%	Team	Week of Oct. 12th	Week of Dec. 7th
Lab 2	5%	Team	Week of Nov. 23rd	Week of Nov. 23rd
Quiz 2	10%	Individual	Nov. 12th	Nov. 12th
In-tutorial assignment	1.25%	Team	Weekly except Sep. 10, Sep. 17, Oct. 8 and Nov. 12	End of tutorial hour in which is assigned

COURSE POLICIES

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

Computer Requirements

- All students are to ensure that they have a functional camera and microphone connected to their computer (irrespective of Windows or Mac-based). These two accessories will be required for all term tests, final exam as well as when asking questions during synchronous/live sessions or when working on in-tutorial assignments.
- The complete hardware specifications for Proctortrack-monitored tests are listed here: https://www.proctortrack.com/tech-requirements/

Remote Proctoring

- The primary intent is to use Proctortrack as the sole remote proctoring solution throughout the course. However, if certain temporary difficulties will prevent the use of Proctortrack, Zoom might be used as an alternative term test/exam invigilation tool.
- If Zoom will be used for term test/exam invigilation, you will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session using Zoom will not be recorded.
- Proctortrack will require you to provide personal information (including some biometric data). The session will be recorded. By taking this course, you are consenting to the use of this software. More information about remote proctoring is available in the Online Proctoring Guidelines at the following link: https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf
- Completion of this course will require you to have a reliable internet connection and a device that meets the system and technical requirements for both Zoom and Proctortrack. Information about the system and technical requirements are available at the following links: https://www.proctortrack.com/tech-requirements https://support.zoom.us/hc/en-us

Online Class Demeanor/Netiquette

Some components of this course will involve online interactions. To ensure the best experience for both yourself and your classmates, please abide the following rules:

- All live sessions will take place via Zoom meetings. The links to be accessed for each class will be posted in the OWL calendar of the course.
- You will be required to authenticate in the Zoom meeting with your Western credentials **only** (SSO authentication on the westernuniversity.zoom.us domain). In the event you attempt to

authenticate in the Zoom meeting with different credentials, you will be removed from the online session without any warning.

- Please ensure that your Zoom participant name matches the one from the official class roster. Failure to do so will mean that you will be removed from the online session without any warning.
- Please connect to the Zoom sessions on time.
- Please use a Windows or Mac computer to connect to the Zoom meeting as opposed to a mobile device (*i.e.*, cell phone or tablet).
- Please ensure that you are in a private location to protect the confidentiality of the class discussions (if applicable).
- To minimize the background noise, please mute your microphone for the duration of class.
- Please unmute your microphone only if invited to speak. Failure to do so might result in your immediate removal from the meeting.
- Please do not share your screen during the meeting unless asked by the instructor.

The course instructor will act a moderator of the online live session and will attempt to answer the questions received from Zoom meeting participants. In this regard, please consider the following:

- If you wish to speak during the live meeting, please use the "raise hand" feature in Zoom and wait for the instructor to nominate you to speak.
- Zoom keeps track of the order in which the "raise hand" feature was activated by each participant. Meeting participants will be asked to speak in the Zoom indicated order.
- Please remember to unmute your microphone and turn on your video camera (if turned off) before speaking.
- Please self-identify yourself at the beginning of your comment.
- Please remember to mute your microphone after speaking (unless directed otherwise).
- Please put down off your "virtual hand" after speaking.

Some general considerations pertaining to "netiquette":

- Please be mindful of the possibly different cultural and linguistic background of Zoom meeting participants.
- Be courteous with all Zoom meeting participants.
- Be respectful of the diversity of viewpoints that you will encounter in the class since the exchange of diverse ideas and opinions is an essential component of the academic environment. However, please keep in mind that practices such as "flaming" are an inacceptable behavior.
- Be professional in all online postings and questions.
- Please note that disruptive behavior of any type to occur during online classes (including inappropriate use of the chat function) is unacceptable.

- Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures covered by the Code of Student Conduct.

Course Content

- Lecture notes and online lecture videos are copyrighted to the instructor and hence they are legally protected.
- As such, the unauthorized posting and sharing of the copyrighted course content could be subjected to legal actions.
- Along the same lines, the recording of the live/synchronous sessions of the course is strictly prohibited.

Laboratory sessions

- All students are to attend the laboratory session to which they signed up.
- Online laboratory sessions will take place during two preannounced weeks of the term.
- Laboratory sessions will be held via scheduled Zoom sessions.
- 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 mark of zero for that laboratory session.
- When academic consideration has been obtained for a particular laboratory session, it is the student's responsibility to contact the instructor of the course in a *timely* fashion in order to seek alternate arrangements for the missed laboratory session (*i.e.*, within maximum three days after consideration has been obtained from the Engineering Undergraduate Services Office).
- 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

- Each of the two quizzes will take place during the preannounced tutorial session.
- Quizzes will be closed book, administrated in OWL and proctored via Proctortrack.
- Each of the two quizzes will be two hours long.
- Missing of a quiz **without** academic consideration will translate into a mark of zero for that quiz.
- Quizzes will be proctored by means of the remote proctoring solution adopted by Western (*i.e.* Proctortrack).

- **One** make-up quiz will be offered to students who have missed one of the scheduled quizzes **with** academic consideration.
- When academic consideration has been obtained for a particular quiz, it is the student's responsibility to contact the instructor of the course in a *timely* fashion in order to seek alternate arrangements for the missed laboratory session (*i.e.*, within maximum three days after consideration has been obtained from the Engineering Undergraduate Services Office).
- If technical issues will prevent a student from successfully completing and submitting the quiz, the weight of the quiz will be automatically shifted to the final exam. No make-up quiz will be offered in this case.
- If cheating during the quiz is suspected, the student will be required to participate in a one-on-one oral examination with the instructor. The mark obtained in the oral examination will supersede the one obtained during the written quiz. If the student refuses his/her participation in the oral examination, the quiz will be automatically graded with zero and further academic penalties for scholastic offences will be applied.
- 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.
- Students who do not choose a team will be assigned to one.
- 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 team effort (*i.e.*, project and labs) 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 eight tutorials (dates specified above) where the first hour will consist of problem solving conducted by the course instructor.
- The assignments will consist of problems to be solved by the same team formed for project-solving purposes. For this purpose,

the class will be split in Zoom breakout rooms, each of the rooms enclosing one team only.

- 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 10% allotted to in-tutorial assignments will be calculated as the average of the rest of in-tutorial assignments.
- If the in-tutorial assignment is missed **without** academic consideration, then the mark for the missed assignment will be zero.
- Unlike quizzes or final exams that require the approval of the Engineering Undergraduate Services, for in-tutorial assignments academic consideration should be obtained from the MME Undergraduate Coordinator.
- 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 term work (quizzes, pre-project, project, in-tutorial assignments, and laboratory sessions), the student will fail the course irrespective of the mark obtained in the final examination.

Final examination

- The exam will take place during the December examination period. Its timing will be announced in advance.
- The exam will be closed book, delivered via OWL and proctored via Proctortrack.
- The length of the final exam will be three hours.
- If a minimum of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.
- If technical issues will prevent a student from successfully completing and submitting the final examination, the official guidelines from Associate Dean's Office, Undergraduate Affairs will be followed. Options to be considered will include but without being limited to oral examination or make-up examination in the special examination period.
- If cheating during the final examination is suspected, the student will be required to participate in a one-on-one oral examination with the instructor. The mark obtained in the oral examination will supersede the one obtained during the written exam. If the student refuses his/her participation in the oral examination, the final exam will be automatically graded with zero and further academic penalties for scholastic offences will be applied.
- 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.

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 tutorials will be penalized with 20% per day.
- Late submissions of the project will be penalized with 20% per day.
- 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.