

Western Kentucky University
School of Engineering and Applied Sciences
Course Number: ME 497 Course Title: Kinematics of Machinery
Winter 2021

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Pre-requisites/Co-requisites: **EM 313**

Credit: 3 credit hours

COURSE MEETING TIMES: This course meets during Winter term, which starts on December 14, 2020.

This is a three-credit course meeting online in a hybrid fashion. We will have a Zoom meeting on class days beginning at 6:00 PM, lasting for 1.5 hours, it will be recorded and shared. After that, I will be available for at least 45 minutes of "studio time" for help with your projects if needed. That last 45 minutes will only be used if people need help. Of course, you can always reach out anytime, my contact information is on the syllabus.

Per University policy, we will be meeting on the following days (no Fridays, no days close to holidays):

December: 14-17, 21-23, 28-30

January: 4-7, 11-13

You will be needing the latest Solidworks version installed, the installation sheet is available if you need it. You will also need the free WKU download of Matlab, I'll help you with that in class. You will also be given downloads of GearTRAX and CamTRAX, each of those costs \$2000 non-educational, \$100 each for education, I'll cover them both for you. You should have no out of pocket expenses. Just make sure your Solidworks is working. A big monitor or dual monitors will make this much easier...

COURSE DESCRIPTION: This course emphasizes the role of analysis in system modeling. Analytical modeling techniques and commercial software will be used to reinforce and validate models for system kinematics. The student will build upon the basics of dynamics to model and analyze four-bar and crank-slider mechanisms, gears and gear trains, and cams.

COURSE OBJECTIVES:

1. Introduce the modeling and analysis of mechanisms.
2. Apply graphical methods in kinematic analysis.
3. Validate graphical analysis methods with commercial digital tools.
4. Analyze gear train geometry.
5. Analyze cam/follower system geometry.

COURSE OUTCOMES:

By the end of the semester, students will be able to:

- Calculate the number of degrees of freedom for planar linkages.
- Analyze four-bar and crank-slider linkages.
- Conduct position, velocity, and acceleration analyses of linkages using graphical and analytic tools.
- Determine the gear ratios for gear trains (including planetary gear trains).
- Apply the fundamental law of gearing.
- Develop a cam profile to satisfy design criteria.

COURSE DISTRIBUTION:

Analysis of mechanical systems: 80%
Selection of appropriate geometries: 20%

REQUIRED MATERIALS (e.g. textbooks, calculators, readings, etc):

- No textbook is required, just your laptop with Solidworks, plus an engineering calculator with trig functions.
- You must have MATLAB installed on your laptop, and it must run!
- YOU MUST HAVE A WORKING LAPTOP WITH SOLIDWORKS, WE WILL BE USING MOTION STUDIES AND IT HAS TO RUN. YOU WILL BE PROVIDED DIGITAL GEAR AND CAM DESIGN SOFTWARE AT NO COST, MARKET VALUE \$4000. THEY ALSO RUN IN SOLIDWORKS.

INTRANET SITE:

There will be a Blackboard site for the course.

COURSE GRADE:

The grade distribution will be as follows:

Six individual analysis projects, with values of 100, 100, 200, 200, 200, and 200 points.

Scores for work will be based on the following rubric:

Letter Grade	Numeric Equivalent	Qualitative Description (Typical)
A	> 90%	Exemplar; no to minor mistakes.
B	> 80%	Proficient; several minor mistakes; almost no conceptual mistakes.
C	> 70%	Apprentice; several mistakes, some major; conceptual mistakes.
D	> 60%	Novice; many significant mistakes and conceptual errors.
F	< 60%	Non-response or completely incorrect response.

ASSIGNMENTS AND PROJECTS:

Assignments will be assigned in class most days. Assignments are due in class at the beginning of class or as stated otherwise with the assignment. Late work may not be accepted.

A grade of zero will be given for all unexcused absences from quizzes and exams and for projects not turned in on time. If you have a legitimate excuse, let me know in advance via e-mail or phone. No make-up work will be given except as required by University Policy. See the instructor prior to any anticipated absence or problems. If you miss an exam with a legitimate approved excuse with prior notice, the LOWER of either the other exam or the final exam (on a pro-rated percent basis) will be used to substitute. THERE IS NO MAKE UP AVAILABLE FOR THE FINAL EXAM.

PROFESSIONAL CONDUCT:

It is expected that all students be present in each lesson, will be courteous of others' ideas, and otherwise will conduct themselves in a professional manner in accordance with the WKU Student Handbook. Conduct determined to be unacceptable may result in the loss of points. **Notify the instructor in advance of any absence for in- or out-of-class activities.** Use of any form of tobacco or alcohol in the classroom is considered inappropriate for this classroom. Cell phones and other devices should be turned off or otherwise left at home.

If you need to answer your phone during class, you need to leave the room; re-admittance may or may not be permitted. Other activity that diminishes the professional quality of the class-room will not be tolerated.

CLASSROOM CONDUCT POLICY:

In an effort to create and foster a better learning environment in the classroom, the following policies have been adopted. **Failure to comply with the policies and procedures above and below may result in a FIVE (5) point deduction from the student's final grade in the course.**

1. All cell phones are to be turned off during class.
2. All unnecessary classroom disturbances are prohibited.
3. Use of computers during class is strictly limited to course related activities.
4. Activities that diminish the professional quality of the classroom will not be tolerated.

ACADEMIC DISHONESTY:

As an engineering student at WKU, you are expected to refrain from any form of academic dishonesty or deception such as cheating, stealing, plagiarism or lying on assignments, homework, quizzes, tests or exams. Furthermore, you understand and accept the potential consequences of punishable behavior, as stated in the WKU Catalog. Failing grades on exams, assignments, and the entire course are included as potential scenarios for academic dishonesty.

Title IX Misconduct/Assault Statement

Western Kentucky University (WKU) is committed to supporting faculty, staff and students by upholding WKU's Title IX Sexual Misconduct/Assault Policy (#0.2070) at

<https://wku.edu/eoo/documents/titleix/wkutitleixpolicyandgrievanceprocedure.pdf> and

Discrimination and Harassment Policy (#0.2040) at

https://wku.edu/policies/hr_policies/2040_discrimination_harassment_policy.pdf.

Under these policies, discrimination, harassment and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment and/or sexual misconduct, you are encouraged to report it to the Title IX Coordinator, Andrea Anderson, 270-745-5398 or Title IX Investigators, Michael Crowe, 270-745-5429 or Joshua Hayes, 270-745-5121.

*Please note that while you may report an incident of sex/gender based discrimination, harassment and/or sexual misconduct to a faculty member, WKU faculty are "Responsible Employees" of the University and **MUST** report what you share to WKU's Title IX Coordinator or Title IX Investigator. If you would like to speak with someone who may be able to afford you confidentiality, you may contact WKU's Counseling and Testing Center at 270-745-3159.*

WKU Covid-19 Mask Statement

Out of respect for the health and safety of the WKU community and in adherence with the CDC guidelines, the University requires that a cloth face covering (reusable or disposable) that covers both the nose and mouth must be worn at all times when in public areas within all buildings. Students must properly wear masks face coverings while in class regardless of the room size or the nature of the classroom activities. Students who fail to wear a face covering mask as required will be in violation of the WKU Student Code of Conduct and will be asked to comply or will face disciplinary action, including possible dismissal from the University. Accommodations to masks face coverings must be determined by the Student Accessibility Resource Center and documented before a student may attend class.

Ogden Student Course Attendance Statement

The faculty and staff of Ogden College of Science and Engineering are committed to providing you with learning experiences and opportunities. You must assume ownership of your education and be an active participant in the classroom and laboratory to take advantage of these opportunities. **Active participation requires you to attend.** Scientific studies have shown that attendance during scheduled classroom and laboratory meetings is directly correlated to your performance on assignments and exams and the potential to earn higher grades. Additionally, if you do not regularly attend class, you are missing important information about course topics, due dates, and assignment details that are crucial to your success in the course. Therefore, as a student enrolled in an Ogden course, you are expected to attend every class meeting and to inform your instructor regarding the reasons for any absences as soon as practical. **Your instructor may incorporate class attendance/participation as part of the grading criteria.**

ADA Accommodation Statement

In compliance with University policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, 1074. SARC can be reached by phone number at 270-745-5004 [270-745-3030 TTY] or via email at sarc.connect@wku.edu. Please do not request accommodations directly from the professor or instructor without a faculty notification letter (FNL) from The Student Accessibility Resource Center.