Syllabus and Course Introduction

Course Description: Graphical, analytical, and numerical techniques are developed for position, velocity, acceleration, and force analysis of various mechanisms including four-bar linkages, crank-slider linkages, cam-driven linkages, and gear trains.

Course Objectives: 1. An improved background in the fundamentals of kinematics and kinetics  
2. Competence and confidence in analytical and software analysis  
3. The ability to identify, specify, and analyze various mechanisms including linkages, cams, and gear trains

Course Instructor: Zachary D. Asher, PhD - Assistant Professor of Mech. & Aero. Eng.  
Office: https://wmich.webex.com/meet/zach.asher  
Email: zach.asher@wmich.edu  
Office Hours: Mondays 4:00-5:00pm

Co-Instructor: Hamzeh Alzubi, PhD  
Office: https://wmich.webex.com/meet/hamzeh.alzubi  
Email: hamzeh.alzubi@wmich.edu  
Office Hours: Monday 6:00-7:00pm

Instructional Assistant: Max Brummel  
Office: https://wmich.webex.com/meet/maximilian.h.brummel  
Email: maximilian.h.brummel@wmich.edu  
Office Hours: Wednesdays 11:00am-12:00pm

Lectures: Lectures will be asynchronous online and available through Elearning (https://elearning.wmich.edu/). Lecture notes are provided and organized into Chapters 1-9.

Required Software/Hardware:  
1. Solidworks (available at https://wmich.edu/labs/remotelabs)  
2. Adams (available at https://wmich.edu/labs/remotelabs)
4. A webcam & WebEx (available at [https://wmich.edu/webex](https://wmich.edu/webex))

**Optional Textbook:**  

**Optional Software/Hardware**
1. ELEGOO UNO Project Super Starter Kit with Tutorial and UNO R3 Compatible with Arduino IDE (teaches you programmable electronics, available on Amazon for $37)
2. Matlab (available at [https://wmich.edu/labs/remotelabs](https://wmich.edu/labs/remotelabs))

**Homework:**  
Homework assignments are posted in Elearning and submitted to the Elearning dropboxes. All homework must be professionally written and turned in by the deadline shown on it’s associated Elearning dropbox. Late submissions are not accepted.

**Course Project:**  
Each group (4-5 students per group) will design, develop, and prototype a useful mechanism of their choice. Projects are documented in a report and presented via WebEx. Details will be provided in a separate handout.

**Grading:**  
All grading disputes must be addressed with the instructor no later than one week after a grade is received. No individual extra credit will be allowed.

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<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>$92 % \leq$</td>
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<tr>
<td>AB</td>
<td>$88 % \leq$</td>
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<tr>
<td>D</td>
<td>$60 % \leq$</td>
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<tr>
<td>E</td>
<td>$&lt; 60 %$</td>
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**Homework - 25%**  
**Midterm Exam - 25%**  
**Final Exam - 25%**  
**Project - 25%**

**Exams**  
Exams will be a combination of multiple choice and word problems based on concepts from the lectures and homeworks. Analytical analysis, numerical analysis, and use of software will be required to complete exam questions. Lecture notes, textbooks, calculators, software, and the internet is allowed during exams.

Exams will be posted on Elearning and are turned in through the associated Elearning dropbox. During the exam you are required to join WebEx at [https://wmich.webex.com/meet/zach.asher](https://wmich.webex.com/meet/zach.asher) with your video on. You will be monitored to ensure you work alone and the video feed will be recorded.

No makeup tests will be given. If you are not able to comply with these conditions for any reason (other than a verifiable tragedy) an exam grade of zero will be given.
WMU Policies: You are responsible for making yourself aware of and understanding the policies and procedures at Western Michigan University that pertain to academic honesty and integrity. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. The academic policies addressing Student Rights and Responsibilities can be found here:

- Undergraduate Catalog: catalog.wmich.edu/content.php?catoid=24&navoid=974
- Graduate Catalog: catalog.wmich.edu/content.php?catoid=25&navoid=1030.

If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s) and if you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.

Code of Conduct: I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, abilities, and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every member of the class.

Students and instructors are responsible for making themselves aware of and abiding by the Western Michigan University Sexual and Gender-Based Harassment and Violence, Intimate Partner Violence, and Stalking Policy and Procedures related to prohibited sexual misconduct under Title IX, the Clery Act and the Violence Against Women Act (VAWA) and Campus Safety. Under this policy, responsible employees (including instructors) are required to report claims of sexual misconduct to the Title IX Coordinator or designee (located in the Office of Institutional Equity). Responsible employees are not confidential resources. For a complete list of resources and more information about the policy see www.wmich.edu/sexualmisconduct. In addition, students are encouraged to access the Code of Conduct, as well as resources and general academic policies on such issues as diversity, religious observance, and student disabilities:

- Office of Student Conduct: https://wmich.edu/conduct
- Division of Student Affairs: https://wmich.edu/students/diversity
- Registrar's Office: https://wmich.edu/registrar/calendars/interfaith
- Disability Services for Students: https://wmich.edu/disabilityservices
<table>
<thead>
<tr>
<th>Week 1</th>
<th>Chapter 1 - Course Introduction</th>
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| Week 2  | *Labor Day Recess*  
|         | Chapter 2 - Intro to Kinematics (1 of 2) |
| Week 3  | Chapter 2 - Intro to Kinematics (2 of 2)  
|         | Chapter 3 - Position Analysis (1 of 3) |
| Week 4  | Chapter 3 - Position Analysis (2 of 3)  
|         | Chapter 3 - Position Analysis (3 of 3) |
| Week 5  | Chapter 4 - Output Constraints (1 of 2)  
|         | Chapter 4 - Output Constraints (2 of 2) |
| Week 6  | Chapter 5- Velocity Analysis (1 of 4)  
|         | Chapter 5- Velocity Analysis (2 of 4) |
| Week 7  | Chapter 5- Velocity Analysis (3 of 4) & Midterm Prep  
|         | Midterm Exam: 3:00 - 5:00 pm |
| Week 8  | Chapter 5- Velocity Analysis (4 of 4) & Midterm Review  
|         | *Fall Break* |
| Week 9  | Chapter 6- Acceleration Analysis (1 of 4)  
|         | Chapter 6 - Acceleration Analysis (2 of 4) |
| Week 10 | Chapter 6- Acceleration Analysis (3 of 4)  
|         | Chapter 6: Acceleration Analysis (4 of 4) |
| Week 11 | Chapter 7: Cam Follower Mechanisms (1 of 3)  
|         | Chapter 7: Cam Follower Mechanisms (2 of 3) |
| Week 12 | Chapter 7: Cam Follower Mechanisms (3 of 3)  
|         | Chapter 8: Geartrain Analysis (1 of 3) |
| Week 13 | Chapter 8: Geartrain Analysis (2 of 3)  
|         | *Thanksgiving Break* |
| Week 14 | Chapter 8: Geartrain Analysis (3 of 3)  
|         | Chapter 9: Force/Torque Analysis and Industry Applications |
| Week 15 | Watch Project Presentation Videos (Section A) & Final Exam Prep  
|         | Watch Project Presentation Videos (Section B) & Course Reviews |
| Week 16 | **Final Exam: Wednesday 3:00 - 5:00 pm** |