MCT3410
Kinematics and Dynamics of Machines

Course Description:
Velocity and acceleration of moving parts in machine elements and mechanisms; cam, gear, and gear train design; static and inertial forces, balancing, gyroscopic effects, and critical speeds.

Credit Hours: 3

Class Schedule:
Monday and Wednesday, 7:30 ~ 9:20 PM, Room ETB 2018.

Prerequisites: ET2140, ET3050

Co requisites:

Textbook and Other Required Materials:

Topic Covered:
1. Introduction D. O. F. of mechanism
2. Geometry of motion
3. Position analysis of linkage mechanisms
4. Instant Centers
5. Circle diagram method for instant centers
6. Velocities analysis
7. Velocities analysis by instant centers
8. Relative velocities method
9. Mechanical analysis and mechanical advantage
10. Accelerations in mechanisms
11. Cam types, Cam profile
12. Supr gear
13. Other gears
14. Gear trains and Drive trains
15. Static forces analysis in mechanisms
16. Static forces analysis in mechanisms
17. Inertia forces in machines
18. Dynamic forces analysis in mechanisms
Laboratory Experiments:

MSC/Adams simulation software

Course Learning Objectives:

Upon completion of this course, students should be able to:

1. Perform mathematical analysis of displacement, velocity, and acceleration of mechanisms [SOa, SOb, SOd, M1]

2. Define degree-of-freedom, instant centers, and mechanical advantage in various types of mechanisms [SOb, SOd, M1]

3. Design and analyze cam, gear, and gear train systems [SOb, SOd, SOf, M1]

4. Perform kinematic synthesis and analysis of mechanisms [SOb, SOd, SOf, M1]

5. Evaluate and calculate loads on mechanisms [SOb, SOd, SOf, M1]

6. Analyze dynamics of machines [SOa, SOb, SOd, SOf, M1]

7. Design counter-mass systems for rotational machines [SOb, SOd, SOf, M1]

8. Apply computer aided mechanism design software, such as MSC/Adams, to design and analyze mechanisms [SOa, SOb, SOd, M1]

9. Communicate effectively in oral and written formats [SOg]

Grading Policy:

1. 3 sets of homework @ 10 points each, total 30 %
2. Midterm exam 20 %
3. Lab project 25 % (Written report 20%, Report presentation 5%)
4. Final exam 25 %
5. A= 100 to 90%; B= 89 to 80%; C= 79 to 70%; D= 69 to 60%
6. No late homework will be accepted, as solution will be handed out on the day the homework is due.
7. A written report will be required for the lab project
8. All exams are open-books and notes
9. Exam dates can be moved forward or back on meeting day by class vote

Contact Information:

Office: ETB 1158, Monday and Wednesday (4:00 ~ 5:20 PM).
Phone: (313) 577-8078 (leave voice-mail message with number and time you can be reached)
e-mail: liao@eng.wayne.edu Fax: (313) 577-1781
## Contributions to MCT Program Student Outcomes:

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<thead>
<tr>
<th>Level</th>
<th>BSMCT Program Student Outcomes</th>
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<tr>
<td>3</td>
<td>a. an ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined engineering technology activities</td>
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<tr>
<td>2</td>
<td>b. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies</td>
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<td>c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes</td>
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<td>3</td>
<td>d. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives</td>
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<td>e. an ability to function effectively as a member or leader on a technical team</td>
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<td>2</td>
<td>f. an ability to identify, analyze, and solve broadly-defined engineering technology problems</td>
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<td>g. an ability to communicate effectively regarding broadly-defined engineering technology activities</td>
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<td>h. an understanding of the need for and an ability to engage in self-directed continuing professional development</td>
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<td>i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity</td>
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<td>j. a knowledge of the impact of engineering technology solutions in a societal and global context</td>
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<td>k. a commitment to quality, timeliness, and continuous improvement</td>
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### M1 – MCT Design Track:
Students in this track will demonstrate the ability to apply principles of materials and mechanics to the design and analysis of mechanical components and mechanisms.

### M2 – MCT Energy Track:
Students in this track will demonstrate the ability to apply principles of thermo-fluid sciences to the design and analysis of energy systems.

### M3 – MCT Manufacturing Track:
Students in this track will demonstrate the ability to apply principles of materials and production techniques to the planning, implementation, and control of manufacturing processes.

## University / Division Policies:

- **Academic Misconduct**: [http://www.et.eng.wayne.edu/et/academicmisconduct/academicmisconduct.html](http://www.et.eng.wayne.edu/et/academicmisconduct/academicmisconduct.html)
- **Withdrawal from Engineering Tech class**: [http://www.et.eng.wayne.edu/withdraw/withdraw.html](http://www.et.eng.wayne.edu/withdraw/withdraw.html)
- **Deferred Grades**: [http://www.et.eng.wayne.edu/et/deferredgrade/deferredgrade.html](http://www.et.eng.wayne.edu/et/deferredgrade/deferredgrade.html)

## Code of Ethics for Engineers:

- [http://cems.alfred.edu/courses/ces120/ethics/abet.html](http://cems.alfred.edu/courses/ces120/ethics/abet.html)
- [http://cems.alfred.edu/courses/ces120/ethics/ieee.html](http://cems.alfred.edu/courses/ces120/ethics/ieee.html)
- [http://onlineethics.org/codes/](http://onlineethics.org/codes/)
- [http://www.iit.edu/departments/csep/codes/coe/abet-a.html](http://www.iit.edu/departments/csep/codes/coe/abet-a.html)

**Prepared by:** Gene Liao