UNIVERSITY OF CALIFORNIA
Mechanical Engineering Department

ME 130 - Design of Planar Machinery **Fall 2014**

Instructor:	Prof. Ken Youssefi	**Office: 5106 Etcheverry Hall**
Class room:	155 Donner Lab	**Office hrs : TuTh 9:00 - 10:45**
Class time:	Lecture - TuTh 11:00 - 12:30	**phone: (510) 642-4483**
	Discussion/Lab – M 9-10 and W 2-3 (Etch. 2107)	***email: kyoussefi@aol.com***
Control #	55577	**Course website**: **bspace/bcourse**
		GSI: Louis Malito

Final Exam: Group 11 – Wednesday Dec. 17, 8:00 – 11:00 am

COURSE OBJECTIVE:
Introduction to Mechanisms design and analysis. Graphical and analytical synthesis of mechanisms, path, motion, and function generation mechanisms. Complex polar notation and closed loop vector equations to analyze mechanisms. Position, velocity, acceleration and force analyses, cam design, static and dynamic balancing of mechanisms. The course will include a term project that involves the design, fabrication and prototype demonstration of a mechanical device.

Required Text: R. L. Norton, "Design of Machinery; an Introduction to Synthesis and Analysis of Mechanisms and Machines", 5th edition (2012), 4th, McGraw-Hill Inc.

Group Design Project: there will be a group design project. Refer to the design project handout for details.

Homework: homework problems will be assigned a week before the due date. Homework is due at the start of the lecture. Late homework will not be accepted. All graphical synthesis homework must be done using CAD.

Grading: Homework 10%, Project 25%, Two Midterm Exams 20% each, Final Exam 25%

References:

1. Journal of Mechanical Design, Transaction of ASME

2. G.H. Martin, Kinematics and Dynamics of Machine, McGraw-Hill

3. Shigley and Uicker, Theory of Machines and Mechanisms, McGraw-Hill

4. A.G. Erdman and G.N. Sander, Mechanism Design; Analysis and Synthesis, Prentice-Hall, V1,

5. A.H. Soni, Mechanism Synthesis and Analysis, McGraw-Hill

6. B. Paul, Kinematics and Dynamics of Planar Machinery, Prentice Hall

7. Beggs, J. S., Mechanism, McGraw-Hill, 1955, TJ175.B34 (WLN)

8. Hrones, J. A., Analysis of the Four-Bar Linkage; Its Application to Synthesis of Mechanism, MIT Technology, Press and J. Wiley, NY, 1951, TJ183.H7 (2 vol., WLN)

COURSE SCHEDULE

Week	Date	Subject	Reading Assign.(ch.)	Homework Assign.
1	8/28	Introduction, Enrollment, Course organization, Design project discussion Introduction to mechanisms, Linkages.	(1)	Homework problems are due on Th. of the week indicated
2	9/2	Degree of freedom, Kinematics pairs	(2)	
	9/4	Design process - Synthesis vs. Analysis, Four-Bar mechanism, Mechanism classification, Transmission angle.		Design group formation
3	9/9	Mechanical advantage, Toggle positions	(3)	Homework #1 due Th 9/11
	9/11	Graphical synthesis; Motion generation mechanism (two & three positions) Adding a Dyad to a mechanism (Grashof mechanism) Synthesis with fixed pivots.		
4	9/16	Path generation mechanism (three positions),	(3)	
	9/18	Path generation mechanism synthesis with prescribed timing, Synthesis of a Quick-return mechanism, Design project discussion.		Homework #2 due Th 9/18
5	9/23	Analytical synthesis; Complex polar notation, Closed loop vector equation,		
	9/25	Motion generation mechanisms (two to five position), Design project discussion.	(4,5)	Homework #3 due Th 9/25
6	9/30	Analytical synthesis; Function & path generation mechanisms,	(5)	**1st Design Review**
	10/2	Precision points, Chebychev spacing		
7	10/7	Example problems, Exam review (discussion period)		
	10/9	***Exam 1, Thursday October 9***		
8	10/14	Analytical analysis; Position, Velocity and Acceleration.		Homework #4 due Th 10/16
	10/16	Position analysis-complex polar notation, Velocity analysis; Relative velocity, Graphical methods (velocity polygon, instant center), Analytical methods (complex polar notation).	(4) (6)	
9	10/21	Acceleration analysis; Relative acceleration,	(7)	
	10/23	Graphical methods (acceleration polygon),		Homework #5 due Th 10/23
10	10/28	Kinematics of gears an gear trains	(9 and lecture slides)	
	10/30	Example problems, design project discussion.		Homework #6 due Th 10/30
11	11/4	Dynamic & static forces on mechanisms; Matrix method,	(11)	**Final Design Review**
	11/6	Graphical method, Torque requirements, Example problems.		
12	**11/11**	**Holiday (Tu) – Veteran's Day**		
	11/13	Cam design; Cam and follower type, Displacement diagram velocity and acceleration profiles	(8)	Homework #7 due Th 11/13
13	11/18	High speed cam design (example problem), Exam review		
	11/20	***Exam 2, Thursday Nov. 21***		
14	**11/25**	Balancing; Static and dynamic, four-bar mechanism	(12)	
	11/27	***Holiday – Thanksgiving***		
15	12/2	Design project presentations and prototype demonstration, groups 1 – 4		
	12/4	Design project presentations and prototype demonstration, groups 5 – 9		
16	12/9	Design project presentations and prototype demonstration, groups 10 – 14		RRR week
	12/11	***Mechanism Expo - Thursday December 11, 11:00 – 1:00 room 3110 Etcheverry***		

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