UNIVERSITY OF CALIFORNIA
Mechanical Engineering Department

ME 130 - Design of Planar Machinery **Fall 2019**

Instructor: Dr. Ken Youssefi **Office: 5106 Etcheverry Hall**
Class room: 106 Stanely Hall **Office hrs : TuTh 11:15 - 1:00**
Class time: Lecture - TuTh 9:30 - 11:00 **phone: (510) 642-4483**
Discussion/Lab – W 11-12 (sect. 101, 3111 Etcheverry) ***email:*** ***kyoussefi@aol.com***
F 9 -10 (sect. 102, 140 Barrows)

Control # 27936 **Course website**: **bCourse**

Final Exam: Tu. Dec. 17, 3:00 – 6:00 pm, exam location TBD **GSI:**
email:

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), McGraw-Hill Inc.

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

Homework: The homework problems and the due dates are posted on bCourse. Turn in a hard copy of the homework solution at the start of the lecture. Late homework will not be accepted. All graphical synthesis homework must be done using CAD (Solidworks or Autocad).

Grading: Homework (15%), Project (25%), Exam 1 (30%), Exam 2 (30%)

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	8/29	Introduction, Enrollment, Course organization, Design project discussion Introduction to mechanisms, Linkages.	(1)	Homework problems are due on Th. of the week indicated
2	9/3	Degree of freedom, Kinematics pairs	(2)	
	9/5	Design process - Synthesis vs. Analysis, Four-Bar mechanism, Mechanism classification, Transmission angle.		Design project groups
3	9/10	Mechanical advantage, Toggle positions	(3)	Homework #1 due Th 9/12
	9/12	Graphical synthesis; Motion generation mechanism (two & three positions) Adding a Dyad to a mechanism (Grashof mechanism) Synthesis with fixed pivots. Animation using SolidWorks		
4	9/17	Path generation mechanism (three positions),	(3)	**Project proposal due 9/19**
	9/19	Path generation mechanism synthesis with prescribed timing, Synthesis of a Quick-return mechanism, Design project discussion.		Homework #2 due Th 9/19 Graphical Synthesis (motion)
5	9/24	Analytical synthesis; Complex polar notation, Closed loop vector equation,		
	9/26	Motion generation mechanisms (two to five position), Design project discussion.	(4,5)	Homework #3 due Th 9/26 Graphical Synthesis (path)
6	10/1	Analytical synthesis; Function & path generation mechanisms.	(5)	**Design Review**
	10/3	Precision points, Chebychev spacing		
7	10/8	Example problems, Exam review (discussion period)		
	10/10	***Exam 1, Thursday October 10***		
8	10/15	Analytical analysis; Position, Velocity and Acceleration.		**Project specification due 10/17**
	10/17	Position analysis-complex polar notation,	(4)	Homework #4 due Th. 10/17
		Velocity analysis; Relative velocity, Graphical methods (velocity polygon, instant center), Analytical methods (complex polar notation) Motion analysis using SolidWorks	(6)	Analytical synthesis (motion)
9	10/22	Acceleration analysis; Relative acceleration,	(7)	Homework #5 due Th. 10/24
	10/24	Graphical methods (acceleration polygon),		Analytical analysis
10	10/29	Kinematics of gears and gear trains	(9 and lecture slides)	Homework #6 due Th. 10/31
	10/31	Example problems, design project discussion.		Graphical analysis
11	11/5	Dynamic & static forces on mechanisms; Matrix method,	(11)	**Design Review**
	11/7	Graphical method, Torque requirements, Example problems.		
12	11/12	Cam design; Cam and follower type, Displacement diagram	(8)	Homework #7 due Th. 11/14
	11/14	Velocity and acceleration profiles		Force analysis
13	11/19	High speed cam design (example problem), Exam review		
	11/21	***Exam 2, Thursday Nov. 21***		
14	11/26	Balancing; Static and dynamic, four-bar mechanism	(12)	
	11/28	***Holiday – Thanksgiving***		
15	12/3	Design project presentations and prototype demonstration, groups		1 – 5
	11/5	Design project presentations and prototype demonstration, groups		6 – 10
16	12/10	No class, work on the project	RRR week	
	12/12	***Mechanism Expo - Thursday December 12, 3:00 – 5:00 room 3110 Etcheverry*** **Final project report is due at the Expo**		

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