ME 4640(5640) Dynamics of Machinery II

2007 Catalog Data: ME 4640(5640). Dynamics of Machinery II. Lec. 3. Credit 3.
Prerequisites: ME 3610. Graphical and analytical synthesis of linkage mechanisms for function generation, motion generation, and path generation. Kinetostatic analysis of linkage mechanisms, engine dynamics, balancing; rigid-body dynamics, time response analysis. [Elective Course]

Prerequisites by Topic:
1. Introductory geometric synthesis of linkages
2. Mobility analysis of mechanisms
3. Kinematics of machines
4. Design of cam-follower mechanisms
5. Analysis and synthesis of gear trains
6. Calculus and vector algebra
7. Computer programming ability

Textbook and Resources:
Design of Machinery, R. L. Norton, 2007, 4th Ed. McGraw Hill
Mechanism Design: Analysis and Synthesis, Erdman and Sandor, 1997, Vol. I, 3rd, Ed., Prentice Hall
Mechanisms and Dynamics of Machinery ,Mabie and Reinholtz, 1987, 4th Ed., Wiley
Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, Norton, R. L., 1992, McGraw-Hill
Theory of Machines and Mechanisms, Shigley and Uicker, Jr., 1995, 2nd Ed., McGraw-Hill
Computer Aided Kinematics and Dynamics of Mechanical Systems, Haug, 1989, Vol..I, Allyn and Bacon
Kinematics and Dynamics of Machines, Martin, 1982, 2nd Ed., McGraw-Hill

Course Objectives: This course expands on the mechanical engineering student's background in kinematic synthesis and analysis by providing significant skills and experience in creating and modeling mechanisms. This course adds significant analytical skills in the mechanism synthesis process that will result in computational algorithms to automate the motion design process. This course also provides the tools necessary for kinematic and dynamic analysis of mechanisms and machines, and the skills necessary to consider the role of dynamics in the design of machines. This course will provide multiple exposures of computer analysis in the mechanism synthesis and design process.

Course Topics:

T1.	Analytical synthesis of mechanisms, exact and optimal synthesis methods	(28%)
T2.	Mechanism modeling	(8%)
T3.	Kinetostatic force analysis of mechanisms	(31%)
T4.	Engine dynamics, flywheel design, gyroscopic forces	(15%)
T5.	Static and dynamic balancing of mechanisms	(10%)
T6.	Time response of mechanisms	(8%)

Class/Lab Schedule: Minimum student contact time – 2200 minutes

Course Outcomes: Upon completion of this class, the student will be able to:
C1. Identify and distinguish basic and advanced mechanisms in the study and control of motion [e,h]
C2. Identify the design parameters inherent in basic mechanism types [c,e]
C3. Describe the analytical techniques for basic linkage synthesis, including optimal synthesis. [a,c,k]
C4. Synthesize mechanisms analytically for a variety of tasks under a variety of constraints [c,e,k]
C5. Evaluate the forces and torques in mechanisms and machines in operation [e,k]
C6. Describe the fundamentals of engine dynamics and correlation to other machines [a,k,l]
C7. Perform static and dynamic balance of simple mechanism [a,e,k]

And have gained experience with and/or exposure to:
C8. The kinematic synthesis process through implementation [c,e,g,l]

C9. Application of mechanisms and machines, and new fields of research in motion control. [h,I,j,l]

Professional Component: This course is required of Mechanical Engineering students taking the mechanical systems Areas of Concentration (AOC). It provides advanced skills in the creating mechanisms for motion control, as well as skills in performing dynamic force analysis of machinery

Contribution of Course to Meeting the Professional Component:

Math and Basic Science:
General Education:
Engineering: 3 credit hours
Other:

Relation to Program Outcomes: This course provides advanced analytical skills in synthesizing and analyzing kinematic systems. In addition, it introduces the role of dynamics in the analysis and design of machinery and provides the skills necessary to carry out these procedures. The course reinforces these skills by providing experience implementing the techniques in generating computer algorithms for synthesis and dynamic analysis of machines. It also provides significant experience in observing and implementing mechanisms in motion control systems. As a consequence, students who successfully complete this class will have the advanced skills and practical experience necessary in analyzing, designing, and selecting components for machinery.

5000-Level Credit: Students registered for 5000-level credit will be given additional assignments commensurate with a graduate-level course. The exact nature of these assignments will be specified by the instructor in the Course Policy for that semester.

Course Coordinator: Undergraduate Program Committee

Prepared by: Stephen L. Canfield **Date:** 1-15-08