

MECHANICAL ENGINEERING PROGRAM
ABET COURSE SYLLABUS

ME 442 Design of Machinery (4 Units) Technical Elective

Course Description:
(2019-20 Catalog) Graphical synthesis and analysis of mechanisms and machines. Analytical fundamentals for study of displacements, velocities, accelerations, and static and dynamic forces necessary for design of planar linkages and gearing systems. Creative design projects using software simulation tools.

3 lectures, 1 laboratory.

Prerequisite Courses: ME 212.

Prerequisites by Topic: The student is expected to have a working knowledge of dynamics.

Textbook:
(and/or other required material) Design of Machinery, 6th edition, An introduction to Synthesis and Analysis of Mechanisms and Machines by Robert L. Norton.

Laboratory Manual

References: None

Course Coordinator/Instructor: Xi Wu, Professor of Mechanical Engineering

Course Learning Outcomes:
On completion of this course students will be able to:

1. Apply newly learned skills of mechanism/machine synthesis and analysis to designing creative solution to real-world engineering problems using CAD and ADAMS software.
2. Get familiar with design process of the mechanisms starting from recognition of functional requirements.
3. Synthesize four-bar mechanisms using graphical and analytical methods for given motions or functional generation tasks.
4. Do kinematics analysis of mechanism to determine position, velocity, and acceleration of all members.
5. Do kinetics analysis of machine to determine the forces on all joints and/or the torque required to drive the system.
6. Accomplish term project by designing, synthesizing and analyzing mechanisms based on specific functional needs. Write short technical reports in a professional manner.

Relationship of Course to Mechanical Engineering Student Outcomes:

SO 1: M
 SO 2: M
 SO 3: M
 SO 4:
 SO 5:
 SO 6:
 SO 7:

Topics Covered:

Introduce and define kinematics, kinetics, mechanism and machine
 Kinematics Fundamentals
 4-bar Linkage Synthesis with two design positions
 4-bar Linkage Synthesis with three design positions and fixed pivots
 Synthesize quick-return mechanisms with specified time ratio
 Synthesize four-bar and six-bar quick-return linkages
 Synthesize dwell mechanisms using coupler curves
 Vector position analysis for four-bar linkages
 Analytical linkage synthesis with two design positions
 Design using Freudenstein’s Eq. and Chebyshev spacing
 Cam-follower design
 Four-bar linkage velocity analysis
 Four-bar linkage acceleration analysis
 Four-bar linkage dynamic force analysis

Laboratory Projects:

Power hacksaw Analysis using ADAMS
 Slider-Crank Mechanism Design for Washing Machine
 Conveyor Feed Mechanism Design and Analysis
 Whitworth Quick-Return Mechanism Design and Analysis
 Design a Six-link Dwell Mechanism Using a Coupler Curve
 Windshield Wiper Design and Analysis
 3-week individual term project
 tackle specific engineering design challenges
 integrate design and analytical skills from ME442 into projects

Class/Lab Schedule: Three 50-minute lectures per week; One 170-minute lab per week

Contribution of Course to Meeting the Professional Component:

(a) College-level mathematics and basic sciences:	0 credits
(b) Engineering Topics:	3 credits
Design	1 credit
(c) General Education:	0 credits

Prepared by: Xi Wu **Date:** 07/23/2020
