COURSE NUMBER	**ME 231**
COURSE TITLE	**Kinematics of Machinery**
COURSE STRUCTURE	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR	Dr. Ian S. Fischer
COURSE DESCRIPTION	Design, selection, and evaluation of mechanisms for various applications. Topics include displacement, velocity, and acceleration analysis of planar linkages, synthesis of function generators and motion generators, design of cams, gear-tooth geometry, and analysis of gear trains
PREREQUISITE(S)	CIS 101 computer programming, Mech 234 statics
COREQUISITE(S)	None
REQUIRED, ELECTIVE OR SELECTIVE ELECTIVE	Required
REQUIRED MATERIALS	Robert L. Norton *Design of Machinery* McGraw-Hill, 5th ed., ISBN 978-0-07-742171-7.
OTHER SUPPLEMENTAL MATERIALS (NOT REQUIRED)	none
COMPUTER USAGE	Matlab demonstrations
COURSE LEARNING OUTCOMES[1]	By the end of the course students should be able to: 1. Calculate the degree of freedom of a mechanism (a, c). 2. Identify the mobility of a four-bar mechanism (a, c). 3. Calculate the extremes of the transmission angle in a crank-and-rocker mechanism (a, c) 4. Calculate the displacements of a planar mechanism (a, c, e, k, n). 5. Apply Freudenstein's Equation in the analysis of a four-bar mechanism (a, c, e, k, n). 6. Synthesize a four-bar mechanism motion generator for two or three positions of a moving plane (a, c, e, k, n). 7. Synthesize a four-bar mechanism function generator for three precision points using Freudenstein's equation (a, c, e, k, n) 8. Calculate the velocities of planar mechanism (a, c, e, k, l, n). 9. Calculate the accelerations of planar mechanism (a, c, e, k, l, n). 10. Design a cam for a specified follower motion (a, c, e, k, l, n). 11. Design a gear train for a desired speed ratio (a, c, e, l) 12. Calculate the speed ratio of a planetary gear train (a, c, e, k, m)
CLASS TOPICS	1. Mechanisms and Machines – degrees of freedom, Grashof's rule, transmission angle, limiting positions (4 hours) 2. Displacement analysis (6 hours) 3. Linkage synthesis (6 hours) 4. Velocity analysis (5 hours) 5. Acceleration analysis (4 hours) 6. Cams – displacement, velocity, acceleration and jerk analysis of cam follower motion, polynomial cams (4 hours) 7. Spur gears, gear terminology, speed ratios (3 hours)

	8. Involutometry (3 hours) 9. Planetary gear trains (1 hour) 10. Exams (6 hours)
RELATED STUDENT OUTCOMES	The Course Learning Outcomes support the achievement of the following ME Student Outcomes of ABET Criterion 3 requirements **Outcome a** - An ability to apply knowledge of mathematics, science and engineering. **Related CLO** – 1-12 **Outcome c -** An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. **Related CLO** – 1-12 **Outcome e -** An ability to identify, formulate, and solve engineering problems **Related CLO** – 4-12 **Outcome k -** An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice **Related CLO –** 4-10, 12 **Outcome l -** Knowledge of chemistry and calculus-based physics with depth in at least one **Related CLO –** 8, 9, 10 (physics only) **Outcome m -** An ability to apply advanced mathematics through multivariate calculus and differential equations **Related CLO –** 12 (graph theory)

[1] Lower case letters in parenthesis refer to ABET Criterion 3: student outcomes (a-k)