

ME 3224 – Analysis and Design of Mechanisms

Credits and Contact Hours: 3 Credits. Three 50 minute or two 75 minute lectures per week.

Instructors: Horea Ilies, Ikjin Lee

Textbook: *Mechanism Design*, Vol. 1, 4th Edition by A. Erdman, G. Sandor, S. Kota

Specific Course Information:

- a. Catalog Description: Application of kinematics in the analysis and synthesis of mechanisms. Type and dimensional design of linkages, cams and gears based on motion requirements and kinetostatic force transmission, in contrast to the strength requirements. Graphical, analytical and computer methods in analysis and design of mechanisms. Design considerations in mechanism synthesis. Design project.
- b. Prerequisites: MATH 2110, MATH 2410, and CE 2110
- c. Required, Elective or Selected Elective: Elective

Specific Goals:

a. Course Outcomes:

After completing ME 3224 students should be able to:

- 1) Identify the basic relative kinematics relations of two moving point
- 2) Identify individual links
- 3) Identify and categorize the type of the connection of the links (joints)
- 4) Develop analytical equations describing the relative position, velocity and acceleration of all moving links
- 5) Identify all reaction and inertia forces on the links
- 6) Apply the fundamentals of part I to specific link and joint combinations such as cams and gear systems,
- 7) Demonstrate familiarity with standards in gear and cam machine components,
- 8) Analyze and design two dimensional (otherwise complex) cam and gear system.

b. Relationship of Course Outcomes to Criterion 3 Student Outcomes:

- a) an ability to apply knowledge of mathematics, science, and engineering:
This course builds upon the foundations in kinematics and dynamics with application to machine design activities. Knowledge in basic engineering science is applied to analysis and design of machine systems.
- b) an ability to design and conduct experiments, as well as analyze and interpret data: *not applicable*
- c) an ability to design a system, component, or process to meet desired needs:
Design projects and homework sets provide the students with experience in the design of mechanisms and machine systems.
- d) an ability to function on multi-disciplinary teams: *not applicable*
- e) an ability to identify, formulate, and solve engineering problems:

Through projects and homework, students identify engineering problems and formulate methods for their solution.

- f) an understanding of professional and ethical responsibility: *not applicable*
- g) an ability to communicate effectively: *not applicable*
- h) the broad education necessary to understand the impact of engineering solutions in a global and societal context: *not applicable*
- i) a recognition of the need for, and an ability to engage in life-long learning: *not applicable*
- j) a knowledge of contemporary issues: *not applicable*
- k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice:

Students complete their projects using computational tools and software, including programming in their language of choice and use of Working Model software and other appropriate software.

Topics Covered:

- ♦ Basic kinematics concepts and definitions
- ♦ Type analysis
- ♦ Position analysis
- ♦ Velocity analysis
- ♦ Acceleration analysis
- ♦ Cam analysis and design
- ♦ Gears (spur, bevel, helical, worm, rack)
- ♦ Gear Trains