Course number/name: MECH 2335 Kinematics and Dynamics of Machines

Credits/contact hours: 3 credits, 2 class hours, and 2 lab hours.

Instructor/coordinator: Malek Brahimi, Assistant Professor of Mechanical Engineering Technology


Specific course information
Catalog description: Introduce students to the concepts of planar mechanisms such as linkages and cams. Students learn the basics of velocity, acceleration, and force analysis of mechanisms using analytical, experimental, and computer methods. They learn Newton’s laws, work, energy, impulse, momentum, conservative force fields and impact. Rotation and plane motion of rigid bodies is introduced.

Pre/Corequisites: MECH 1222, MECH 1233, MECH 1240 / MAT 1375

Required/elective/selected elective: Required for Mechanical Engineering Technology

Course learning objectives:
1. To understand planar mechanisms and their degrees of freedom.
2. Ability to analyze and perform basic design of a four-bar mechanism and a slider-crank mechanism.
3. Ability to use computer to draw different type of planar mechanisms, and analyze the position of links.
4. Ability to calculate the instantaneous and average velocity of a point on a mechanism.
5. Ability to determine the angular velocity of a link and the relative velocity.
6. Ability to use graphical methods for design and analysis of mechanisms.
7. Ability to analyze the slider-crank, and the four-bar linkages.
8. To understand the normal, tangential and acceleration of a point on a rotating link.
9. Ability to draw, and use the acceleration polygon.
10. Ability to identify force, torque, couples, and draw free-body diagrams.
11. Ability to use graphical force analysis of the slider-crank mechanism and the four-bar linkages.
12. Ability to analyze linkage by the method of virtual work.
13. Ability to understand kinematics and dynamics of planar mechanism, Newton’s law, and impulse-momentum principles.
14. Ability to formulate and solve problems in the kinematics and dynamics of machinery using MATLAB and AutoCAD.
15. Ability to understand the implications of computed results in kinematics and dynamics to improve the design of a mechanism.
Course addresses ABET student outcomes: 3a, 3b, 3c, 3e, 3f, and PC-1

Brief list of topics to be covered:

- Introduction, system of units, terminology and definitions, degrees of freedom, classifications of closed planar four-bar linkages, transmission angle.
- Motion, vectors, displacement analysis, analysis of a four-bar linkages, position analysis using computers
- Basic concepts, relative velocity, graphical analysis of linkages, motion of slider-crank mechanism, velocity polygon, cam and cam followers.
- Basic concepts, analysis of a four-bar linkage, the acceleration polygon, graphical analysis, cam and cam followers, analyzing combination of basic linkage.
- Introduction, graphical cam design, cam system applications, disc cam design
- Basic considerations, gear types, pressure angle, line of action, force on gear teeth
- Introduction, Newton’s law of motion, dynamic analysis of a four-bar linkage and a slider crank mechanism, dynamic motion analysis for torque input.
- Work and kinetic energy, impulse and momentum.