

KINEMATICS OF MACHINERY

Course Code	20ME3401	Year	II	Semester	II
Course Category	Professional Core	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Mechanics
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

CO	Statement	Skill	BTL	Units
CO1	Understand the kinematic link, different types of kinematic pairs, mechanisms and their inversions, velocity, and acceleration of the mechanism, straight-line motion, steering mechanism, and the terminology related to cam, followers, gear, and gear trains	Understand	L2	1,2,3,4,5
CO2	Apply graphical and Instantaneous center methods for determining the velocity and acceleration of different mechanisms.	Apply	L3	2
CO3	Analyze the straight-line motion mechanisms, steering gear mechanisms, and velocity ratio of hook joints	Analyze	L4	3
CO4	Analyze the cam-follower mechanism for different motions of followers and generate cam profiles.	Analyze	L4	4
CO5	Analyze the gear and gear trains	Analyze	L4	5

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High : 3, Medium :2, Low :1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3												3	
CO2	3	3	2		2					1			3	
CO3	3												3	
CO4	3	2	2		2					1			3	
CO5	3	2	2		2					1			3	

Syllabus		
Unit	Contents	COs
I	Introduction: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Machines: Mechanism and machines – classification of mechanisms – kinematic chain – inversion of mechanism – inversions of quadric cycle chain – single and double slider crank chains.	CO1
II	Kinematics: Velocity – Motion of link in machine – Determination of Velocity diagrams – Graphical method –	CO1, CO2

	<p>Application of relative velocity method four bar chain. Analysis of slider crank chain for displacement, velocity.</p> <p>Acceleration Analysis: Angular acceleration of Links, Acceleration of Intermediate and offset points- Four Link Mechanism- Slider Crank Mechanism, Coriolis component of acceleration.</p> <p>Plane Motion of Body: Instantaneous center of rotation, Three centres in line theorem – Graphical determination of instantaneous centre for Four Bar Mechanism.</p>	
III	<p>Straight Line Motion Mechanisms: Exact and approximate copiers and generated types –Peaucellier, Hart and Scott Russel – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and Straight-line motion, Pantograph.</p> <p>Steering Mechanisms: Conditions for correct steering – Davis Steering gear, Ackermans steering gear. HOOKE’S JOINT: Single and double Hooke’s joint – velocity ratio –application – simple problems.</p>	CO1, CO3
IV	<p>Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.</p>	CO1, CO4
V	<p>Gears: Introduction, Classification of gear terminology, Law of Gearing, Velocity of Sliding, Forms of Teeth, Cycloidal Profile Teeth, Involute Profile Teeth, Path of contact, Arc of contact, Number of pairs of Teeth in contact, Interference in Involute Gears.</p> <p>Gear trains: Introduction, simple Gear Train, Compound Gear Train, Reverted Gear train, Planetary or Epicyclic Gear Train, Analysis of Epicyclic Gear Train, Torques in Epicyclic Trains. Tabular Method.</p>	CO1, CO4

Learning Resources

Text Book(s)

1. Theory of Machines, (3rd Edition) by S.S.Rattan, Tata Mc-Graw Hill, New Delhi, 2012.
2. Theory of machine and Mechanisms, 2nd Edition by J.E. Shigley, Mc-Graw Hill, New Delhi, 1994.

References

1. Theory of Mechanisms and Machines, (I st Edition) by C S Sharma and Kamlesh Purohit, Prentice Hall of India Pvt. Ltd., New Delhi, 2006.
2. Theory of Machines, (3rd edition), by Ballaney, P.L, Khanna Publishers, New Delhi 2002.
3. Theory of Mechanisms and Machines, (2 nd Edition), by A. Ghosh and ak Mallik, East-West Press (P) Ltd., New Delhi, 1988.

E Resources

1. <https://nptel.ac.in/courses/112/104/112104121/>