Course Code	18ME42	Course Title	Kinematics of Machines	Semester	IV
Credits	4	L – T – P –TL*	4 – 1 – 0 – 5	Teaching Hrs	56
Total Marks	100	CIE*	40	SEE*	60

***NOTE: L – Lecture; T – Tutorial; P – Practical; TL – Total;**
CIE – Continuous Internal Evaluation; SEE – Semester End Examination

	Teaching Hr
Course Learning Objectives: This course will enable students to; • To teach the students to gain the Knowledge of Mechanisms, and their mobility. • To analyze velocity and acceleration for different mechanisms • To understand the fundamentals of gear teeth, types of gear, gear mesh and its arrangements. • To teach the kinematic analysis of cam- follower motion.	
Module-1 **Definitions:** Introduction to Link, Kinematic Pairs, Degrees of freedom. Kinematic chain, Mechanism, Inversion, Machine, Grubler's criterion, mobility of mechanism, Groshoff's criteria, inversions of Grashoff's chain. Four bar chain and its inversions, Single slider chain and its inversions, Double slider chain and its inversions, Kinematic chain with three lower pairs, Quick return motion mechanisms, Straight line mechanisms, Pantograph, Intermittent motion mechanisms, Toggle mechanism, Ackerman steering gear mechanism, Hooke's Joint	**12**
Module-2 **Velocity and Acceleration Analysis of Mechanisms (Graphical Method):** Velocity and acceleration analysis of four bar mechanism, slider crank mechanism. Mechanism illustrating Corioli's component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing. **Velocity and Acceleration Analysis of Mechanisms (Analytical Method):** Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra method	**12**
Module-3 **Spur Gears:** Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. Interference in involute gears, methods of avoiding interference, condition and expressions for minimum number of teeth to avoid interference., Back lash, comparison of involute & cycloidal teeth. Problems on Gears, **Gear Trains:** Simple gear trains, compound gear trains. Epicyclic gear trains: Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, torque calculation in epicyclic gear trains.	**12**
Module-4 **Belt Drives**: Friction and Belt Drives: Definitions: Types of friction: laws of friction, Friction in pivot and collar bearings. Belt drives: Flat belt drives. Ratio of belt tensions, centrifugal tension, power transmitted **Chain drives**: Classification, construction of roller chain and silent chain. Advantages and disadvantages.	**10**

Module-5 **Cams:** Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and cycloidal motion. **Analysis of Cams:** Analysis of arc cam with flat faced follower. Circular arc cam operating flat faced and roller followers. Undercutting in Cams. .	**10**
Course outcomes: By the end of the course the student shall be able to CO1: Differentiate between a machine and mechanism, its degrees of freedom, possible inversions and classify mechanism with lower pair based on applications. CO2: Determine the velocity and acceleration of simple mechanisms. CO3: Analyze various types of gears and gear arrangements CO4: Draw various types of cams and follower based on motion	
Question paper pattern: • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub- questions) from each module. • Each full question will have sub- question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module.	
TEXT BOOKS: 1. Thomas Bevan., Theory of Machines, C.B.S Publishers, 2005. ISBN-8123908741. 2. Rattan S.S., Theory of Machines, TMH , Third Edition, 2011. ISBN-13:978-0-07-0144774. **REFERENCE BOOKS:** 1. Shigley. J. V. and Uickers, J. Theory of Machines & Mechanisms TMH, 6th Edition, 2003. ISBN-04718-0237-9, ISBN-019515598X. 2. Theory of Machines by Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd. 2nd edition 2007. 3. Mechanism and Machine Theory, A.G.Ambekar, PHI, 2007	