

**Subject Code: 01ME0304**
**Subject Name: Kinematics of Machines**
**B.Tech. II Year (Sem-III) Mechanical & Automobile Engineering.**
**Type of course:** Engineering Science

**Prerequisite:** NIL

**Rationale:** Kinematics of machines is intended to impart the fundamental knowledge of mechanism and machines so as to understand their functional aspects and perform the kinematic analysis of machine elements like linkages, gears and cams.

**Teaching and Examination Scheme:**

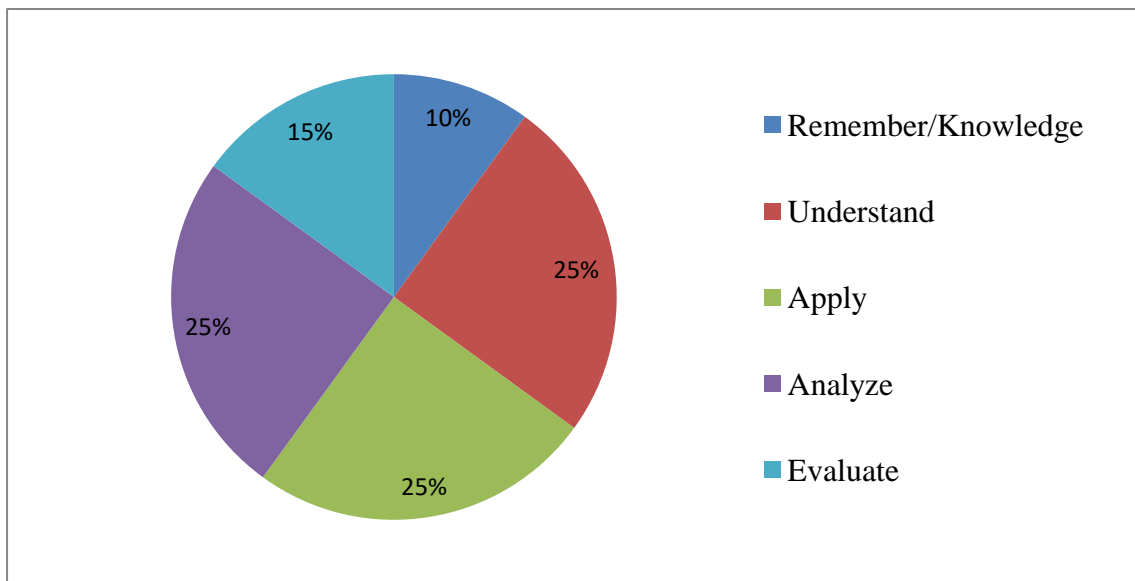
Teaching Scheme (Hours)			Credits	Evaluation Scheme					Total Marks
Theory	Tutorial	Practical		Theory Marks			Tutorial/Practical Marks		
				ESE (E)	IA	CSE	Viva (V)	Term Work (TW)	
4	2	0	5	50	30	20	25	25	150

**Content:**

Sr. No.	Content	Total Hrs	% Weight - age
1	<b>Mechanisms and Machines:</b> Introduction, Mechanism and machine, Rigid and resistant body, Link, Kinematic pair, Types of motion, Degrees of freedom (mobility) - Kutzbach and Grubler's criterion , Classification of kinematic pairs, Kinematic chain, Linkage, Mechanisms, Kinematic inversion, Inversions of slider crank chain, Double slider-crank chain, Four bar chain	6	10%

<p><b>2</b></p>	<p><b>Synthesis and Analysis of Mechanisms:</b></p> <p><b>Dimensional Synthesis:</b> Definitions of Type, Number and Dimensional Synthesis, synthesis, Definitions of Motion, Path and Function generation, precision position, Chebychev spacing, structural error, Freudenstein's equation, two and three position synthesis (function generation only) of four bar and slider crank mechanisms by graphical and analytical methods</p>	<p><b>8</b></p>	<p><b>40%</b></p>
	<p><b>Velocity and Acceleration Analysis:</b> Velocity diagrams, Relative velocity method, Instantaneous centre method, rubbing velocity Relative acceleration diagram, Klien's construction, Corioli's component of acceleration.</p> <p><b>Special mechanisms :</b> Straight line mechanism, Indicator diagrams, Hooke's Joint, Steering Mechanisms</p>	<p><b>8</b></p> <p><b>6</b></p>	
<p><b>3</b></p>	<p><b>Gears and Gear Trains:</b></p> <p><b>Gears:</b> Introduction, Classification of gears, Gear terminology, Law of gearing, Velocity of sliding, Forms of teeth, Cycloidal profile teeth, Involute profile Teeth , Comparison of cycloidal and involute tooth forms, Arc of contact, number of pairs of teeth in contact, Interference in involute gears, Minimum number of teeth, Interference between rack and pinion, Undercutting. Introduction to Helical, Spiral, Worm and Bevel gears.</p> <p><b>Gear Trains:</b> Synthesis of Simple, compound &amp; reverted gear trains, Analysis of epicyclic gear trains.</p>	<p><b>8</b></p> <p><b>6</b></p>	<p><b>25%</b></p>

<b>4</b>	<b>Cams and Followers:</b> Introduction, Types of cams, Types of followers, Cam terminology, Displacement diagrams of follower motion, Determination of basic dimensions and synthesis of cam profile using Graphical methods	<b>10</b>	<b>25%</b>
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### References:

1. Theory of Machines and Mechanisms (3/e 2009, 2013 Impression) Uicker J J Jr., Pennock G R, Shigley J E, Oxford Press.
2. Kinematics and Dynamics of Machinery (1/e 2009, 2013 Reprint) Norton R L, McGraw-Hill
3. Mechanism and Machine Theory (2013 Reprint), Ambekar, A G, Prentice Hall
4. Theory of Machines, Singh Sadhu, Pearson Education
5. Theory of Machines, Rattan S S, Tata McGraw-Hill

### Web Resources

<http://kmoddl.library.cornell.edu/>

**Course Outcomes:**

- Identify the functional characteristics of various machine elements
- Synthesize and analysis the motion parameters of mechanisms
- Understand the functional characteristics of various gears
- Analyse the motion of gear trains
- Analyse the motion of cam and follower

**List of Open Source Software/learning website:**

1. <http://nptel.iitm.ac.in>,
2. <http://vlab.co.in/>