Subject Code: 01ME2302
Subject Name: Kinematics of Machines
B. Tech. Year - II (Semester - 3)

Type of course : Under Graduate

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.

Course Outcome:
After completion of this course, student will be able to

1. Identify the functional characteristics of various machine elements.
2. Construct specified motion profiles for cam and follower.
3. Analyze and synthesize planar mechanisms for the motion parameters.
4. Evaluate gear tooth geometry and analyze the motion of gear trains.

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks			Practical Marks		
THEORY	TUTORIAL	PRACTICAL	C	ESE(E)	IA	CSE	Viva (V)	Term Work (TW)	
3	0	2	4	50	30	20	25	25	150

Content :

Sr. No.	Content	Total Hrs.
1	**Mechanisms & Machines** Introduction: Various mechanisms & machines, Various types of links, kinematic pairs & kinematic chain, Types of motion, mobility of a mechanism - Kutzbach and Grubler's criterion Classification: Classification of Mechanisms Inversion: Concept of inversion, Kinematic inversion of four bar, single slider, & double slider crank chain	05
2	**Synthesis & Analysis of mechanisms** Introduction: Concept of synthesis & its classification, Various types of synthesis problems	07

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	Graphical synthesis & analysis: Accuracy points for function generation, Analysis of four bar mechanism using Freudenstein's equation, synthesis of four bar & slider crank chain mechanism using graphical techniques	
3	**Kinematic Analysis** Velocity analysis: Analysis of Velocity diagrams, Relative velocity method, Instantaneous centre method, rubbing velocity Acceleration analysis: Analysis of acceleration diagram, Klien's construction, Coriolis component of acceleration.	**06**
4	**Special Mechanisms:** Functional aspects: Various types of lower pair mechanisms such as Straight line mechanism, Indicator diagrams, universal Joint, Steering gear Mechanism	**06**
5	**Gears:** Introduction: Introduction & various types of toothed wheels, Terminology of gear, fundamental condition for constant velocity ratio, sliding velocity Forms of gears teeth: Cycloidal profile teeth, Involute profile teeth, Relative benefits and drawbacks of cycloidal and involute tooth forms Interference: Contact ratio, Interference & undercutting in involute gears, Minimum number of teeth to avoid interference Functional aspects: Basic concepts of Worm, Bevel, helical & spiral gears	**07**
6	**Gear Trains:** Introduction: Basic concepts of Simple, compound & reverted gear trains Analysis: Motion Analysis of Epicyclic gear trains by different methods	**05**
7	**Cam & Follower:** Introduction: Introduction to various classification of cam & follower, terminology of cam, various types of displacement, velocity & acceleration diagrams for various follower motions Cam profile construction: Determination of basic dimensions of profile of cam and its construction using Graphical techniques	**08**
8	**Kinematics of Mechanisms and Machines: (In Self Study from Swayam)** Introduction to Mechanisms, Mobility Analysis, Mobility Analysis, Displacement Analysis, Displacement Analysis, Velocity Analysis, Velocity Analysis, Velocity Analysis, Acceleration Analysis, Force Analysis, Introduction to geared transmission, Analysis of gear trains.	**--**

Distribution of Theory Marks

R Level	**U** Level	**A** Level	**N** Level	**E`** Level	**C** Level
20	**30**	**25**	**15**	**10**	**--**

Legends: R: Remember**; U:** Understand**; A:** Apply**; N:** Analyze**; E:** Evaluate**; C**: Create

List of Tutorials :

1. Mechanisms & machines
2. Steering gear mechanism

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3. Velocity ratio of gears

4. Cam and follower

5. Kinematic Analysis

6. Special Mechanisms

7. Gears

8. Gear Trains

9. Cam profile

10. Working model of Cam & follower

11. Virtual Lab

Reference books :

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:

1. **http://kmoddl.library.cornell.edu/**

Open Ended Project:

1. Make model of any mechanism.

List of Open Base Software / learning website:

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

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