INSTITUTE	**FACULTY OF ENGINEERING AND TECHNOLOGY**
PROGRAM	**BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING - ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)**
SEMESTER	**3**
COURSE TITLE	**KINEMATICS OF MACHINES**
COURSE CODE	**01ME3302**
COURSE CREDITS	**4**

Objective:

1 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 Outcomes: After completion of this course, student will be able to:

1 Apply kinematic principles to classify and analyze links, pairs, and chains.
2 Evaluate the performance and utility of special mechanisms.
3 Construct motion diagrams and develop cam profiles graphically.
4 Analyze simple, compound, reverted, and epicyclic gear trains.
5 Analyze velocity ratio, contact, and motion characteristics of gears.
6 Evaluate gear tooth geometry for interference, undercutting, and contact ratio.

Pre-requisite of course:N.A.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	1	0	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
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, Kinematic inversion of single slider, & double slider crank chain	7
2	**Special Mechanisms** Functional aspects, Various types of lower pair mechanisms, Straight line mechanism, Indicator diagrams, Universal Joint, Steering gear Mechanism	7

Contents : Unit	Topics	Contact Hours
3	**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	10
4	**Gear Trains** Introduction, Basic concepts of Simple & compound, Reverted gear trains, Analysis of gear trains, Motion Analysis of Epicyclic gear trains by different methods	8
5	**Cam & Follower** Introduction, Introduction to various classification of cam & follower, Terminology of cam, Various types of displacement diagram for various follower motions, Velocity & acceleration diagrams for various follower motions, Cam profile construction, Determination of basic dimensions of profile of cam, Cam and its construction using Graphical techniques	10
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Solve problems on mobility calculation using Kutzbach and Grubler's criteria for various mechanisms.** Solve problems on mobility calculation using Kutzbach and Grubler's criteria for various mechanisms.	2
2	**Identify and classify kinematic pairs and kinematic chains from given diagrams.** Identify and classify kinematic pairs and kinematic chains from given diagrams.	2
3	**Perform inversion of a four-bar mechanism and draw the different inversions.** Perform inversion of a four-bar mechanism and draw the different inversions.	2
4	**Draw and explain working of various straight-line mechanisms (like Peaucellier, Hart's mechanism).** Draw and explain working of various straight-line mechanisms (like Peaucellier, Hart's mechanism).	2
5	**Solve problems on steering gear mechanism (Ackermann and Davis Steering Mechanisms).** Solve problems on steering gear mechanism (Ackermann and Davis Steering Mechanisms).	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
6	**Calculate sliding velocity and angular velocity in gear pairs with given data.** Calculate sliding velocity and angular velocity in gear pairs with given data.	2
7	**Draw and differentiate between cycloidal and involute tooth profiles; solve related problems.** Draw and differentiate between cycloidal and involute tooth profiles; solve related problems.	2
8	**Solve numerical examples to determine minimum number of teeth to avoid interference.** Solve numerical examples to determine minimum number of teeth to avoid interference.	2
9	**Perform motion analysis of simple and compound gear trains (speed ratios, torque).** Perform motion analysis of simple and compound gear trains (speed ratios, torque).	2
10	**Solve problems on epicyclic gear trains using tabular and algebraic methods.** Solve problems on epicyclic gear trains using tabular and algebraic methods.	2
11	**Construct displacement diagrams (uniform velocity, SHM, cycloidal motion) for followers.** Construct displacement diagrams (uniform velocity, SHM, cycloidal motion) for followers.	2
12	**Graphical construction of cam profile for a given follower motion (knife edge/roller follower).** Graphical construction of cam profile for a given follower motion (knife edge/roller follower).	2
Total Hours		**24**

Textbook :

1 Theory Of Machine And Mechanisms, Gordon R. Pennock & Joseph E. Shigley John J. Uicker, Oxford University Press, 2014

2 Theory of Machines, Rattan S S., Tata McGraw-Hill, 2017

References:

1 Kinematics and Dynamics of Machinery, Kinematics and Dynamics of Machinery, Norton R L, McGraw-Hill, 2013

2 Mechanism and Machine Theory, Mechanism and Machine Theory, Ambekar, A G, PHI Learning, 2007

3 Theory of Machines, Theory of Machines, Singh Sadhu, Pearson Education, 2011

4 Theory Of Mechanicsms Machines, Theory Of Mechanicsms Machines, A Ghosh, East West, 2008

References:

5 Design of Machine Elements, Design of Machine Elements, V B Bhandari, McGraw Hill, 2020

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
0.00	0.00	50.00	25.00	25.00	0.00

Instructional Method:

1 ICT and Problem based teaching learning
2 Power Point Presentation

Supplementary Resources:

1 https://onlinecourses.nptel.ac.in/noc20_me21/preview