SEMESTER S4

KINEMATICS OF MACHINERY

Course Code	PECPT412	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	GBEST213	Course Type	Theory

Course Objectives:

1. To Understand the fundamentals of kinematics and dynamics of machinery
2. To summarize techniques for studying motion of machines and their components.
3. To Illustrate the synthesis, analysis of cam mechanisms and explain the characteristics of involute action in gear trains.
4. To explain the kinematic analysis of spatial chains and robot kinematics.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to mechanisms: kinematic pairs, kinematic diagrams, classification of kinematic chains, kinematic inversions, and equivalent linkages. Kinematic analysis of planar mechanisms: mobility analysis and range of movement, Grashof criterion and inversions, displacement analysis, relative instantaneous centers, Aronhold-Kennedy theorem, velocity and acceleration analysis.	9
2	Dimensional synthesis of planar mechanisms: three position synthesis for function generation, path generation and rigid body guidance, dead center problems, branch and order defects.	9
3	Cams: synthesis of translating flat-face, translating roller and oscillating roller follower cams. Gears: fundamental law of gearing, characteristics of involutive action, analysis of gear trains.	9
4	Spatial kinematic chains and robot kinematics: kinematic analysis of spatial chains, Denavit- Hartenberg parameters, robot kinematics.	9

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Course Assessment Method

(CIE: 40 marks , ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	Each question carries 9 marks. Two questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

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Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the classification and characteristics of kinematic chains and mechanisms	**K2**
CO2	Understand the mobility and range of movement of planar mechanisms	**K2**
CO3	Apply planar mechanisms for three-position synthesis, path generation, and to address dead center problems.	**K3**
CO4	Apply knowledge of cam profiles and motion characteristics.	**K3**
CO5	Understand fundamental laws of gearing, characteristics of involute action, and analyze gear trains for various applications.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

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

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Theory of Applied Robotics	Reza N. Jazar	Springer	2/e, 2010
2	Modern Robotics	Kevin M. Lynch, Frank C. Park	Cambridge University Press	1/e, 2017

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Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Theory Of Machines	R S Khurmi, J K Gupta	S Chand	4/e, 2019
2	Mechatronics : Principles, Concepts And Applications	Nitaigour Mahalik	McGraw Hill Education	2/e, 2017

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1-4	https://nptel.ac.in/courses/112105236