



CO-PO MAPPING

Course Title: Kinematics of Machines			
Type: Core		Course Code: 18ME44	
No of Hours			
Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total hours/Week	Total teaching hours
3	0	3	42
Marks			
Internal Assessment	Examination	Total	Credits
40	60	100	3
Aim/Objectives of the Course			
<ol style="list-style-type: none"> 1. Familiarize with mechanisms and motion analysis of mechanisms. 2. Understand methods of mechanism motion analysis and their characteristics. 3. Analyze motion of planar mechanisms, gears, gear trains and cams. 			
Course Learning Outcomes			
After completing the course, the students will be able to			
CO1	Model displacement diagrams for followers with various types of motions and Cam profile drawing for various followers.		K3 Applying
CO2	Understanding the basic terminology of planar mechanisms and their motion study.		K2 Understanding
CO3	Evaluating the transmission of power by application of various gears and gear trains.		K4 Analyzing
CO4	Constructing velocity and acceleration diagrams for planar mechanisms by Graphical method		K4 Analyzing
CO5	Inspect velocity and acceleration of planar mechanisms by complex algebra method and kinematic synthesis of four bar and slider crank kinematic chain		K4 Analyzing
Syllabus Content			
Module 1:			CO1
Cams: Types of cams, types of followers. displacement, velocity and acceleration curves for uniform velocity, Simple Harmonic Motion, Uniform Acceleration Retardation, Cycloidal motion. Cam profiles: disc cam with reciprocating / oscillating follower having knife-edge, roller and flat-face follower inline and offset.			10 hrs
Analysis of Cams: Analysis of arc cam with flat faced follower			PO1-3 PO2-3 PO3-2 PO4 - 2 PO5-1 PO12 -1 PSO1-3 PSO2-1
LO: At the end of this session the student will be able to,			

1. Understand the concept of cams and analysis of cams
2. Construct cam profile for specific follower motion
3. Explain the concept symmetric cams

Module 2:

Introduction: Definitions: Link, kinematic pairs, kinematic chain, mechanism, structure, degrees of freedom, Classification links, Classification of pairs based on type of relative motion, Grubler's criterion, mobility of mechanism, Groshoff's criteria, inversions of Grashoff's chain.

Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Oldham's coupling, Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms: Geneva wheel mechanism, Ratchet and Pawl mechanism, toggle mechanism, pantograph, condition for correct steering, Ackerman steering gear mechanism.

LO: At the end of this session the student will be able to,

1. Understand the mechanism analysis
2. Explain different mechanisms
3. Understand the terminology of mechanisms

CO2
10 hrs.

PO1-3
PO2-3
PO3-2
PO4-2
PO5-1
PO6-1
PO12-1
PSO1-3
PSO2-1

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, back lash, condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact

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

LO: At the end of this session the student will be able to,

1. Explain concept of interference and minimum number of teeth
2. Understand the motion transmission through gear trains
3. Explain Gear terminology and law of gearing
4. Understand the concept of path of contact, arc of contact

CO3
10 hrs

PO1-3
PO2-3
PO3-2
PO4-2
PO5-1
PO6-1
PO12-1
PSO1-3
PSO2-1

Module 4:

Velocity and Acceleration Analysis of Mechanisms (Graphical

Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism. Mechanism illustrating. Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's theorem,

Determination of linear and angular velocity using instantaneous center method.

CO4
10hrs

PO1-3
PO2-3
PO3-2
PO4-2
PO5-1
PO6-1

<p>Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.</p> <p>LO: At the end of this session the student will be able to,</p> <ol style="list-style-type: none"> 1. Determine position, displacement, velocity and acceleration of various parts in mechanisms. 2. Apply the knowledge of graphical method & instantaneous centre method to determine velocity and acceleration of links 	<p>PO12-1 PSO1-3 PSO2-1</p>
<p>Module 5: Velocity and Acceleration Analysis of Mechanisms (Analytical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra Method. Freudenstein's equation for four bar mechanism and slider crank mechanism. Function Generation for four bar mechanism</p> <p>LO: At the end of this session the student will be able to,</p> <ol style="list-style-type: none"> 1. Understand the Concept of analytical method to determine velocity and acceleration of links. 2. Understand mechanism synthesis. <p>Apply the knowledge of mechanism synthesis to evaluate function generation</p>	<p>CO5 10hrs</p> <p>PO1-3 PO2-3 PO3-2 PO4-1 PO5-1 PO6-1 PO12-1 PSO1-3 PSO2-1</p>
<p>Text Books</p> <ol style="list-style-type: none"> 1. . Theory of Machines, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009. 2. Mechanism and Machine Theory, A. G. Ambekar PHI, 2007 	
<p>Reference Books (specify minimum two foreign authors text books)</p> <ol style="list-style-type: none"> 1. Michael M Staniscic, Mechanisms and Machines-Kinematics, Dynamics and Synthesis, Cengage Learning, 2016. 2. Sadhu Singh, Theory of Machines, Pearson Education (Singapore)Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006. 3. Theory of Machines, Thomas Beavan 	
<p>Useful Websites</p> <ul style="list-style-type: none"> • http://www.sciencedirect.com/ • https://nptel.ac.in/courses/112104114/ • https://www.youtube.com/playlist?list=PL46AAEDA6ABAFCA78 	
<p>Useful Journals</p> <ul style="list-style-type: none"> • www.journals.elsevier.com/mechanism-and-machine-theory • www.sciencedirect.com/journal/journal-of-mechanisms 	

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<p>Useful Websites</p> <ul style="list-style-type: none"> • http://www.science-direct.com • https://nptel.ac.in/courses/117/001/14/ • https://www.youtube.com/playlist?list=PL46AAEDA6ABAFCA78 	
<p>Useful Journals</p> <ul style="list-style-type: none"> • www.journals.elsevier.com/mechanism-and-machine-theory • www.sciencedirect.com/journal/journal-of-mechanisms 	

Teaching and Learning Methods

1. Lecture class: 42 hours
2. Practical classes: 0 hours

Assessment**Type of test/examination:** Written examination**Continuous Internal Evaluation(CIE)** : 40 marks (30 marks -Average of three tests + 10 marks Assignments)**Semester End Exam(SEE)** : 100 marks (students have to answer all main questions) which will be reduced to 60 Marks.**Test duration:** 1 :30 hours**Examination duration:** 3 hours**CO to PO Mapping**

PO1: Science and engineering Knowledge
PO2: Problem Analysis
PO3: Design & Development
PO4: Investigations of Complex Problems
PO5: Modern Tool Usage
PO6: Engineer & Society

PO7: Environment and Society
PO8: Ethics
PO9: Individual & Team Work
PO10: Communication
PO11: Project Mngmt & Finance
PO12: Life long Learning

PSO1: Ability to apply concept of mechanical engineering to design a system, a component or a process/system to address a real world challenges**PSO2:** Ability to develop effective communication, team work, entrepreneurial and computational skills

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
17 ME44	K-level														
CO1	K3	3	3	2	2	1	--	-	-	-	-	-	1	3	1
CO2	K2	3	3	2	2	1	1	-	-	-	-	-	1	3	1
CO3	K4	3	3	2	2	1	1	-	-	-	-	-	1	3	1
CO4	K4	3	3	2	2	1	1	-	-	-	-	-	1	3	1
CO5	K4	3	3	2	1	1	1		-	-	-	-	1	3	1



Course In charge



Head of the Department



Principal