



## LESSON PLAN

### Department of Mechanical Engineering

Name of the Subject	<b>Theory of Machines</b>	Name of the handling Faculty	<b>Dr.G.Ramesh</b>
Subject Code	<b>ME3491</b>	Year / Sem	<b>II / IV</b>
Academic Year	<b>2022-2023</b>	Batch	<b>2021-2025</b>

### Course Objective

- To study the basic components of mechanisms, analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and design cam mechanisms for specified output motions.
- To study the basic concepts of toothed gearing and kinematics of gear trains
- To Analyzing the effects of friction in machine elements
- To Analyzing the force-motion relationship in components subjected to external forces and analyzing of standard mechanisms.
- To Analyzing the undesirable effects of unbalances resulting from prescribed motions in mechanism and the effect of dynamics of undesirable vibrations.

### Course Outcome

**On completion of the course, the student is expected to be able to**

CO1: Explain the basics of mechanism and sketch the camprofile

CO2: Solve problems on gears and gear trains.

CO3: Examine friction in machine elements.

CO4: Calculate static and dynamic forces of mechanisms.

CO5: Calculate the balancing masses and their locations of reciprocating and rotating masses. Computing the frequency of free vibration, forced vibration and damping coefficient.

### Lesson Plan

Sl. No.	Topic(s)	T / R*	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc )	Blooms Level (L1-L6)	CO	PO
		Book					

### UNIT I: KINEMATICS OF MECHANISMS

1	Introduction to the subject, mechanisms and terminology	R3	1	BB	L1	CO1	PO1, PO12
2	Four bar chain and inversion of four bar chain, Transmission angle, mechanical advantage	R3	1	PPT/BB	L2	CO1	PO1, PO12
3	Other inversion mechanisms, kinematic analysis in simple mechanisms	R3	1	PPT/BB	L2	CO1	PO1, PO12
4	Velocity and acceleration polygons, Analytical method	R3	1	BB	L3	CO1	PO1, PO2, PO12
5	Introduction to CAM, Classification, nomenclature	R3	1	BB	L2	CO1	PO1, PO12
6	Different follower motion and Displacement diagrams	R3	1	BB	L2	CO1	PO1, PO12
7	Problems in layout of cam profile	R3	1	BB	L3	CO1	PO1, PO2, PO12
8	Problems in layout of cam profile	R3	1	BB	L3	CO1	PO1, PO2, PO12
9	Circular and tangent cams description	R3	1	BB	L2	CO1	PO1, PO2, PO12

**Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any.**

**Evaluation method: Tutorials**

UNIT II: GEARS AND GEAR TRAINS							
10	Introduction to gears, Law gearing and gear profiles	R3	1	PPT/BB	L1	CO2	PO1, PO12
11	Spur Gear terminology, definitions, Length of path of contact and contact ratio, Interference and under	R3	1	PPT/BB	L1	CO2	PO1, PO12
12	Problems on finding the length of path of contact arc of contact , contact ratio	R3	1	BB	L3	CO2	PO1, PO2, PO12
13	Problems on finding the length of path of contact arc of contact , contact ratio	R3	1	BB	L3	CO2	PO1, PO2, PO12
14	Problems on finding the minimum number of teeth on gears to avoid interference	R3	1	BB	L3	CO2	PO1, PO2, PO12
15	Introduction to gear train, types, speed ratio, train value and epicyclic gear train.	R3	1	BB	L2	CO2	PO1, PO2, PO12
16	Epicyclic Gear Trains and related problems	R3	1	BB	L3	CO2	PO1, PO2, PO12
17	Epicyclic Gear Trains and related problems	R3	1	BB	L3	CO2	PO1, PO2, PO12
18	Automotive transmission gear trains	R3	1	PPT/BB	L2	CO2	PO1, PO2, PO12
Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any							
Evaluation method: Tutorials							
UNIT III: FRICTION IN MACHINE ELEMENTS							
19	Laws of friction, limiting friction , static and kinetic friction , angle of friction	R3	1	PPT/BB	L2	CO3	PO1, PO12
20	Friction in screw threads, principle of operation of screw jack (inclined plane analogy), efficiency of and	R3	1	PPT/BB	L2	CO3	PO1, PO12
21	Problems on screw jacks	R3	1	BB	L3	CO3	PO1, PO2, PO12
22	Friction clutches and Belt and rope drives	R3	1	PPT/BB	L2	CO3	PO1, PO2, PO12
23	Problems on clutch and belt drives	R3	1	BB	L3	CO3	PO1, PO2, PO12
24	Problems on clutch and belt drives	R3	1	BB	L3	CO3	PO1, PO2, PO12
25	Friction in brakes, Band and Block brakes and related problems	R3	1	PPT/BB	L3	CO3	PO1, PO2, PO12
26	Problems in brakes	R3	1	BB	L3	CO3	PO1, PO2, PO12
27	Bearings and lubrication.	R3	1	BB	L2	CO3	PO1, PO2, PO12
Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any							
Evaluation method: Assignment							
UNIT IV: FORCE ANALYSIS							
28	Introduction to force analysis, applied and constrained forces	R3	1	BB	L2	CO4	PO1, PO12
29	Free body diagrams, Static and dynamic equilibrium	R3	1	BB	L2	CO4	PO1, PO2, PO12
30	Equilibrium of Two, Three and four force members	R3	1	BB	L2	CO4	PO1, PO2, PO12
31	Static force analysis in simple machine members, superposition principle	R3	1	BB	L2	CO4	PO1, PO2, PO12
32	Static force analysis in simple machine members	R3	1	BB	L3	CO4	PO1, PO2, PO12

33	Dynamic force analysis, inertia force and inertia torque	R3	1	BB	L2	CO4	PO1, PO2, PO12
34	D'Alembert's principle, equivalent offset inertia force	R3	1	BB	L2	CO4	PO1, PO12
35	Dynamic force analysis in simple machine members, superposition principle	R3	1	BB	L3	CO4	PO1, PO2, PO12
36	Dynamic force analysis in simple machine members	R3	1	BB	L3	CO4	PO1, PO2, PO12

**Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any**

**Evaluation method: Students Seminar**

## **UNIT V: BALANCING AND VIBRATION**

37	Introduction to balancing, Static and dynamic balancing	R3	1	BB	L2	CO5	PO1, PO12
38	Balancing of rotating masses in different planes	R3	1	BB	L2	CO5	PO1, PO12
39	Problems solving in Balancing of revolving masses	R3	1	BB	L3	CO5	PO1, PO2, PO12
40	Balancing of reciprocating mass, force balancing of locomotives and problems	R3	1	BB	L3	CO5	PO1, PO2, PO12
41	Introduction to vibration, free vibrations and types	R3	1	BB	L2	CO5	PO1, PO12
42	Equation of motion for natural frequency, damped vibration	R3	1	BB	L2	CO5	PO1, PO2, PO12
43	Transverse vibration, critical speed of simple shaft	R3	1	BB	L2	CO5	PO1, PO2, PO12
44	Torsional vibration, forced vibration, vibration isolation	R3	1	BB	L3	CO5	PO1, PO2, PO12
45	Gyroscope concepts.	R3	1	BB	L2	CO5	PO1, PO12

**Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any**

**Evaluation method: Seminar**

## **Content Beyond the Syllabus Planned**

1	Concept of flywheel
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### **Text Books**

1	Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.
2	Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 3rd edition 2019

### **Reference Books**

1	Amitabha Ghosh and Asok Kumar Mallik, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., 1988.
2	Rao.J.S. and Duggipati.R.V. "Mechanism and Machine Theory", New Age International Pvt. Ltd., 2nd edition, 2014.
3	Rattan, S.S, "Theory of Machines", McGraw-Hill Education Pvt. Ltd., 5th edition 2019.
4	Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 2013.
5	Wilson and Sadler, Kinematics and Dynamics of Machinery, Pearson, 2008.

### **Website / URL References**

1	<a href="https://nptel.ac.in/courses/112/106/112106270/">https://nptel.ac.in/courses/112/106/112106270/</a>
2	<a href="https://nptel.ac.in/courses/112/104/112104121/">https://nptel.ac.in/courses/112/104/112104121/</a>
3	<a href="https://nptel.ac.in/courses/112/105/112105268/">https://nptel.ac.in/courses/112/105/112105268/</a>

Blooms Level														
Level 1 (L1) : Remembering					Lower Order Thinking	Fixed Hour Exams	Level 4 (L4) : Analyzing					Higher Order Thinking	Projects / Mini Projects	
Level 2 (L2) : Understanding							Level 5 (L5) : Evaluating							
Level 3 (L3) : Applying							Level 6 (L6) : Creating							
Mapping syllabus with Bloom's Taxonomy LOT and HOT														
Unit No	Unit Name					L1	L2	L3	L4	L5	L6	LOT	HOT	Total
Unit 1	KINEMATICS OF MECHANISMS					1	5	3	0	0	0	9	0	9
Unit 2	GEARS AND GEAR TRAINS					2	2	5	0	0	0	9	0	9
Unit 3	FRICTION IN MACHINE ELEMENTS					0	4	5	0	0	0	9	0	9
Unit 4	FORCE ANALYSIS					0	6	3	0	0	0	9	0	9
Unit 5	BALANCING AND VIBRATION					0	6	3	0	0	0	9	0	9
Total					3	23	19	0	0	0	45	0	45	
Total Percentage					6.6667	51.1111	42.2222	0	0	0	100	0	100	
CO PO Mapping														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	3	2	2		2			1				1	3	1
CO2	3	2	2		2			1				1	3	1
CO3	3	2	2		2			1				1	3	1
CO4	3	2	2		2			1				1	3	1
CO5	3	2	2		2			1				1	3	1
Avg	3	2	2		2			1				1	3	1
Justification for CO-PO mapping														
CO1	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered effectively , PO3: A considerable impact is given to the complex problems. PO5: Modern tools used whre ever needed. PO8: Importance given to follow ethics during the design process, PO12: Concepts helps in life long learning													
CO2	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered effectively , PO3: A considerable impact is given to the complex problems. PO5: Modern tools used whre ever needed. PO8: Importance given to follow ethics during the design process, PO12: Concepts helps in life long learning													
CO3	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered effectively , PO3: A considerable impact is given to the complex problems. PO5: Modern tools used whre ever needed. PO8: Importance given to follow ethics during the design process, PO12: Concepts helps in life long learning													
CO4	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered effectively , PO3: A considerable impact is given to the complex problems. PO5: Modern tools used whre ever needed. PO8: Importance given to follow ethics during the design process, PO12: Concepts helps in life long learning													
CO5	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered effectively , PO3: A considerable impact is given to the complex problems. PO5: Modern tools used whre ever needed. PO8: Importance given to follow ethics during the design process, PO12: Concepts helps in life long learning													
3		High level			2			Moderate level			1		Low level	
Name & Sign of Faculty In charge : Dr. Ramesh G														
Name & Sign of Subject Expert :Dr. Ramesh G														
Head of the Department : Dr. Shunmugasundaram M														

