TEACHING PLAN

	Course Title	Semester	Branches	Contact Periods /Week	Academic Year	Date of commencement of Semester
23ME4T03	THEORY OF MACHINES (R23)	IV	Mechanical Engineering & Robotics	6	2025-26	10-12-2025

COURSE OUTCOMES

1	Discuss the plane motion mechanism with single degree of freedom. **[K2]**
2	Analyse velocity and acceleration of different links in a mechanism **[K4]**
3	Apply the effects of gyroscopic couple in ships, aeroplanes and road vehicles. **[K3]**
4	Estimate unbalance mass in rotating machines **[K3]**
5	Analyse free and forced vibrations of single degree freedom systems. **[K4]**
6	Construction of turning moment diagrams and apply them in designing flywheels. **[K3]**

UNIT	Out Comes / Bloom's Level	Topics No.	Topics/Activity	Text Book / Reference	Contact Hour	Delivery Method
I	Examine the plane motion mechanism with single degree of freedom		**Unit-1 Simple Mechanisms**			
		1.1	Classification of mechanisms – Basic kinematic concepts and definitions	T1, R1	2	Chalk and talk /ppt/ /quiz/ PBL/ Videos/ Animation
		1.2	Mobility (Chebychev–Grübler–Kutzbach criterion), inversions	T1, R1	1	
		1.3	Grashof's conditions for 4-bar chain	T1, R1	1	
		1.4	4 bar Mechanisms and its first and second inversions.	T1, R1	1	
		1.5	Third and fourth inversions of 4 bar mechanism	T1, R1	1	
		1.6	Single slider crank chain mechanisms and their first 2 inversions	T1, R1	1	
		1.7	Third and fourth inversions of slider crank chain mechanism	T1, R1	1	
		1.8	Mechanisms with Lower Pair: Pantograph, Exact Straight-Line Mechanisms	T1, R1	2	
		1.9	Peaucellier, Hart and Scott Russell mechanisms	T1, R1	1	
		1.10	Approximate Straight-Line Mechanisms – Grasshopper, Watt, Tchebicheff and Robert Mechanisms Mechanical advantage-Transmission angle	T1, R1	1	
		1.11	Modified Scott Russell mechanism, Hooke's Joint.	T1, R1	1	
Content beyond Syllabus			Linkage 3.10 software for motion generation of various mechanisms		1	
				Total	**14**	

II	Analyze the velocity of various links in mechanisms using velocity diagrams or instantaneous center method as well as determine the acceleration of links using acceleration diagrams.I	**Unit-2. Plane and motion analysis**				
		2.1	Displacement, velocity and acceleration analysis of simple mechanisms	T1	2	Chalk and talk /ppt/ /quiz/ Videos/ Animation
		2.2	graphical velocity analysis using instantaneous centers	T1	2	
		2.3	velocity and acceleration analysis using loop closure equations	T1	2	
		2.4	kinematic analysis of simple mechanisms	T1	1	
		2.5	slider crank mechanism dynamics	T1	1	
		2.6	Coincident points and Coriolis component of acceleration.	T1	2	
		2.7	Problems	T1	2	
Content beyond Syllabus			Determination of velocity and acceleration by using software		1	
				Total	**13**	
III	Design and analyze Cams for specified motion and follower and and analyze motion of higher pairs like toothed gears, gear trains	**Unit-3. Gyroscope & Gear Profile**				
		3.1	Introduction to Gyroscope, Principle of gyroscope and terminology	R1,T1	1	Chalk and talk /ppt/ /quiz/ PBL/ Videos/ Animation
		3.2	gyroscopic effect in an aeroplane	T1, T2	1	
		3.3	gyroscopic effect in an ship, car	T1, T2	1	
		3.4	gyroscopic effect in an two wheeler	T1, T2	2	
		3.5	Problems on gyroscope	T1, T2	2	
		3.6	Gear parameters, fundamental law of gearing, Involute and cycloidal gear profiles	R1,T1	2	
		3.7	conjugate action, spur gear contact ratio	T1, T2	1	
		3.8	interference/undercutting	T1, T2	1	
		3.9	helical, bevel, worm, rack & pinion gears,	T1, T2	1	
		3.10	epicyclic and regular gear train kinematics.	R1,T1	2	
Content beyond Syllabus			Modeling of gyroscope		1	
				Total	**15**	
IV	Analyze the effect of gyroscopic couple on planes and ships as well as Construction of turning moment diagrams and apply them in designing flywheels	**Unit-4. Balancing of Rotating masses & Cams**				
		4.1	Need for balancing, balancing of single mass using analytical and graphical methods	T1, T2	1	Chalk and talk /ppt/ /quiz/ Videos/ Animation/flipped class
		4.2	balancing of several masses in different planes, using analytical and graphical methods	T1, T2	2	
		4.3	Classification of cams and followers	T1, T2	1	
		4.4	Terminology and definitions	T1, T2	1	
		4.5	Displacement diagrams, Uniform velocity, parabolic, simple harmonic and cycloidal motions	T1, T2	2	
		4.6	specified contour cams- circular and tangent cams	T1, T2	2	
		4.7	pressure angle and undercutting	T1, T2	1	
Content beyond Syllabus			Auto CAD software for generating cam profiles		1	
				Total	**11**	

V	Estimate unbalances force in rotating members and reciprocating mechanisms and Solve problems of Governors..	**Unit 5. Vibrations & Turning Moment Diagrams and Flywheels**				
		5.1	Introduction, degree of freedom, types of vibrations	T1, R1	1	Chalk and talk /ppt/ /quiz/ PBL/ Videos/ Animation
		5.2	free natural vibrations, Newton method and energy method for single degree of freedom	T1, R1	2	
		5.3	Damped vibrations- under damped	T1, R1	1	
		5.4	critically damped and over damped systems	T1, R1	1	
		5.5	forced vibrations with and without damping in single degree of freedom	T1, R1	2	
		5.6	Vibration isolation and transmissibility	T1, R1	1	
		5.7	Turning moment diagrams for steam engine	T1, R1	1	
		5.8	I.C engine and Multi Cylinder Engine.	T1, R1	1	
		5.9	Crank effort – coefficient of fluctuation of energy	T1, R1	1	
		5.10	Fly Wheel and their design, fly wheels for punching press.	T1, R1	2	
Content beyond Syllabus		Modal analysis by using ansys software			1	
				Total	**14**	
				CUMULATIVE PROPOSED PERIODS	**67**	

Text Books:

S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
1	S. S. Rattan ,Theory of Machines, fifth edition ,TMH,2019
2	R.K. Bansal,J.S. Brar Theory of Machines, fifth edition, Laxmi Publications (P)Ltd,2016

Reference Books:

S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
1	R. S. Khurmi, J. K. Gupta,Theory of Machines,15 edition, S. Chand,2012
2	V.P. Singh,Theory of Machines,6 edition ,Dhanpat Rai & Co. (P) Limited,2017

Web Details

1	http://mechanicalexpressions.com/explore/kinematics
2	http://vlabs.iitkgp.ernet.in/mr
3	https://www.youtube.com

		Name	Signature with Date
i.	Faculty	Mr. B MAHESH KRISHNA	
ii.	Faculty II (for common Course)	Mr. CH HARISH KUMAR	
iii.	Course Coordinator	Mr. B MAHESH KRISHNA	
iv.	Module Coordinator	Dr.M FRANCIS LUTHER KING	
v.	Programme Coordinator	Dr.M FRANCIS LUTHER KING	

Principal