

THEORY OF MACHINES

Course Code	23ME3403	Year	II	Semester	II
Course Category	Professional Core	Offering Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

	Statement	Skill	Level	UNIT
CO1	Understand the functional details various mechanisms, and their kinematic and dynamic behaviour.	Understand	L2	1,2,3,4,5
CO2	Apply graphical and Instantaneous center methods for determining the velocity and acceleration of four bar and slider crank mechanisms.	Apply	L3	2
CO3	Analyze the mechanisms to generate straight line motion, gear profile and gear train, and cam profile.	Analyze	L4	1,3,4
CO4	Analyze the gyroscopic effects in several moving bodies, forces acting on flywheels, and perform balancing of rotating parts.	Analyze	L4	3,4,5
CO5	Compute natural frequencies of undamped and damped free and forced vibrations of single degree freedom systems.	Apply	L3	5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H:High (3), M:Medium (2), L:Low (1))

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1						1		2	3	1
CO2	3	3	1	1						1		2	3	1
CO3	3	3	1	1						1		2	3	1
CO4	3	3	1	1						1		2	3	1
CO5	3	3	1	1						1		2	3	1

Syllabus		
UNIT	Content	Mapped CO
I	Simple Mechanisms: Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains, Limit positions – Mechanical advantage- Transmission angle Straight line mechanisms: Accurate – Peaucellier, Scott Russel; Approximate – Grasshopper, Watt, Universal joint.	CO1
II	Velocity Analysis: Displacement, velocity analysis of simple mechanisms of four bar, single slider mechanism using graphical method and instantaneous centers. Acceleration Analysis: Acceleration analysis of simple mechanisms of four bar, single slider mechanism using graphical method, – Coriolis component of acceleration.	CO1, CO2

III	<p>Gear Profile: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel</p> <p>Gear train kinematics: Simple Gear Train, Compound Gear Train, Reverted Gear train, Planetary or Epicyclic Gear Train, Analysis of Epicyclic Gear Train,</p> <p>Gyroscope: Principle of gyroscope, gyroscopic effect in an aeroplane, ship, car and two wheelers, simple problems</p>	CO1, CO3, CO4
IV	<p>Balancing of Rotating masses: Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses in different planes.</p> <p>Cams: Classification of cams and followers- Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – derivatives of follower motions–pressure angle and undercutting</p>	CO1, CO3, CO4
V	<p>Vibrations: Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.</p> <p>Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design, fly wheels for punching press.</p>	CO1, CO3, CO5

Learning Recourse(s)**Text Book(s)**

1. S.S.Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

Referencebooks

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J.: Prentice Hall, 1993

Online Learning Sources

1. <https://archive.nptel.ac.in/courses/112/106/112106270/>
2. <https://archive.nptel.ac.in/courses/112/104/112104121/>
3. https://onlinecourses.nptel.ac.in/noc24_me44/preview
4. <https://archive.nptel.ac.in/courses/112/104/112104114/>