

Branch Name:	Mechanical Engineering
Program Code:	ET402
Course Title:	Theory of Machines
Course Code:	2ET4020405
Pre-requisite Course:	Engineering Mechanics

Course Objectives:

1. To Draw inversions and determine velocity and acceleration of different mechanisms.
2. To Construct different types of cam profile for a given data.
3. To Calculate loss of power due to friction in various machine elements.
4. To Solve problems on power transmission.
5. To Construct turning moment diagram.
6. To Calculate balancing mass and its position.
7. To Identify different types of vibration, their causes and remedies.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Introduction: - Theory of machines: introduction, need, scope and importance in design and analysis. Kinematics, kinetics and dynamics-concept and examples. - Define link, pairs, mechanisms, inversion, structure and machines. - Basic terminology related to machines and mechanisms. Draw inversions of Different mechanisms. Development of different mechanisms and its inversions like four bar chain mechanism, slider crank mechanism, - double slider crank mechanism, etc.	04	10
2	Velocity and acceleration diagram: - Basic concept used in solving velocity and acceleration problems. - Approach to solve velocity and acceleration related to mechanisms using Relative velocity method for single slider crank mechanism and Four bar chain mechanism. Klein’s construction for single slider cranks mechanism.	05	10
3	Cam and cam profile: - Introduction, functions and types of cams and cam followers. Types of motions and displacement for different types of cam and cam followers. - Various terms used in radial cam profile. - Construct different types of cam profiles.	05	10

4	Power transmission: • Introduction, need and modes of power transmission. • Types of power transmission. Belt drive- types, terminology and standards/designation methods as per BIS/ISO. Belt speed-co- efficient of friction, velocity ratios and slip. Power transmitted by flat belt - tensions, centrifugal tensions, maximum tension, condition for transmitting maximum power and initial tension. (with derivations), numerical examples. • Merits and demerits of power transmission drives. Gear trains-types, numerical examples and applications.	10	25
5	Flywheel and governor: • Turning moment diagram: (i)Concept. (ii) Its use for different machines. (iii) Fluctuations of energy. • Co-efficient of fluctuation of speed and energy. Method to construct turning moment diagram, numerical examples. • Differentiate between flywheel and governor. Flywheel: functions and types. Moment of inertia and mass calculation of flywheel-numerical examples. • Governors: terminology types & functions.	06	17
6	Balancing and vibrations: • Concepts and types of balancing. Effects of unbalanced masses. • Balancing of revolving masses in same plane: • Analytical and graphical methods to find balancing mass. • Numeric examples. • Vibration: Identify different types of vibration, its terminology, effects cause and remedies.	08	18
7	Friction • Introduction and basic concept of friction related to body motion on: Horizontal plane, inclined plane (up and down) Types and working of simple friction brakes. • Different types of dynamometers, operational principles and working.	04	10

List of Practical:

1. Write various course related SI units and their conversations, scalar and vector quantities.
2. Prepare one sheet on velocity and acceleration diagram for given mechanisms by relative velocity method and by Klein's construction method.
3. Prepare a sheet on construction of cam profile for given data.
4. Identify various power transmission systems by observing different machines and equipment used in mechanical engineering.
5. Prepare a sheet on balancing using graphical and analytical method for a given data.
6. To demonstrate the working of Rope Brake/Hydraulic/Eddy current dynamometer.

Reference Books:

1. Jagdish Lal Theory of Machines Metropolitan book New Delhi.
2. S S Ratan Theory of Machines Tata McGraw Hill New Delhi
3. A Ghosh & A K Malik Theory of Machines East-West Press (Pvt) Ltd. New Delhi
4. Sadhu Singh Theory of Machines Pearson Education, India
5. R S Khurmi & J K Gupta Theory of Machines S Chand, New Delhi
6. Dr. V. P. Singh Theory of Machines Dhanpat Rai Publishing Co Pvt Ltd

List of Open-Source Software/learning website:

1. <https://nptel.ac.in/courses/112106270>
2. <https://nptel.ac.in/courses/112104121>
3. <https://nptel.ac.in/courses/112103108>
4. <https://youtu.be/ASIl3HWTT4U>
5. <https://youtu.be/MAuVDB-G-HQ>
6. <https://youtu.be/ApuBEn2zct8>
7. <https://youtu.be/SJGFX1Nub1A>
8. <https://youtu.be/devo3kdSPQY>
9. https://youtu.be/HY_PjmHRxuE
10. <https://youtu.be/6DL0j0eKD8Y>
11. https://youtu.be/lqo0_StXf4M
12. <https://youtu.be/m4UmBbS7mfl>
13. <https://youtu.be/uwZGtFRtGoU>
14. <https://youtu.be/zDRc01bD6a8>
15. <https://youtu.be/uW1CvgfJuEg>
16. <https://youtu.be/Ibs10c9FX0M>

Course Learning Outcomes (CLO):

1. Know different machine elements and mechanisms.
2. Calculate loss of power due to friction in various machine elements.
3. Select Suitable Drives and Mechanisms for a particular application.
4. Identify different types of balancing and vibration, their causes and remedies.
5. Draw inversions and determine velocity and acceleration diagram of different mechanisms.
6. Understand different types of cams and their motions and draw cam profiles for various.

Mapping of CLO with PO and PSO

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	L												L			
CLO2	H												M	M		
CLO3	L				M								M			
CLO4	L	M											L	M		
CLO5	M	L		M												
CLO6	L												L	L		

H: High, M: Medium, L: Low