Subject Code: 1ET4020405	**Subject: Theory of Machines**
Pre-Requisite	--

RATIONALE:

In industries, the mechanical engineers/technicians are supposed to manage functioning of equipment with proper planning, operation and maintenance of equipment. Such a functional requirement needs knowledge and skills of various motion and force transforming mechanisms and devices, such as four bar mechanism, belt pulley, clutches, flywheel, etc. This course is included in the curriculum to provide such necessary knowledge and skills in the area of mechanical equipment and devices to help in understanding of kinematics & dynamics of different equipment being used in industry. Thus it is a key course for mechanical engineers/technicians.

COURSE OBJECTIVE:

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes. i. Draw inversions and determine velocity and acceleration of different mechanisms. ii. Construct different types of cam profile for a given data. iii. Calculate loss of power due to friction in various machine elements. iv. Solve problems on power transmission. v. Construct turning moment diagram. vi. Calculate balancing mass and its position. vii. Identify different types of vibration, their causes and remedies.

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**			
				Theory		**Practical**	
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous assessment**
4	-	2	5	60	40	20	30

SUBJECT CONTENTS:

SR 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.	08	14
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.	12	22
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	08	14
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,	12	22

	numerical examples and applications.		
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.	08	14
6	**Balancing and vibrations:** Concepts and types of balancing. Effects of unbalanced masses. Balancing of revolving masses in same plane: i. Analytical and graphical methods to find balancing mass. ii. Numeric examples. Vibration: Identify different types of vibration, its terminology, effects causes and remedies.	08	14

COURSE OUTCOMES:

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

i. Draw inversions and determine velocity and acceleration of different mechanisms.
ii. Construct different types of cam profile for a given data.
iii. Calculate loss of power due to friction in various machine elements.
iv. Solve problems on power transmission.

v. Construct turning moment diagram.

vi. Calculate balancing mass and its position.

vii. Identify different types of vibration, their causes and remedies.

SUGGESTED LIST OF EXERCISES / PRACTICALS:

1	**Preparatory Activity:** Write various course related SI units and their conversations, scalar and vector quantities.
2	**Sheet preparation: Velocity and Acceleration** Prepare one sheet on velocity and acceleration diagram for given mechanisms by relative velocity method and by Klein's construction method.
3	**Sheet preparation: Cam Profile** 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	**Sheet preparation: Balancing** Prepare a sheet on balancing using graphical and analytical method for a given data.

SUGGESTED LEARNING RESOURCES:

(A) List of Books:

Sr.No.	Title of Books	Author	Publication
1	Theory of Machines	Jagdishlal	Metropolitan Book New Delhi, Company, Daryaganj, Delhi.
2	Theory of Machines	S.S.Ratan	Tata McGraw Hill , New Delhi.
3	Theory of Machines	Abdulla Shariff	Dhanpatray and sons, New Delhi.
4	Theory of Machines	Shah &Jadvani D	Dhanpatray and sons, New Delhi
5	Theory of Machines	A Ghosh and AK Malik	East West Press (Pvt) Ltd., New Delhi
6	Theory of Machines	R.S.Khurmi	S.chand, New Delhi.
7	Theory of Machines	P.L.Bellaney	Khanna publication, NewDelhi
8	Theory of Machines	Joseph Edward Shigley	McGrawHill
9	Theory of Machines	Thomas Bevan	CSB Publishers & Distributors

(B) List of equipments:

i. Working Models / wooden/thermocol theoretical models of:
a. Kinematic links and pairs. b. Single slider crank. c. Four bar chain.
ii. Types of cams and followers.
iii.cam/follower arrangements
iv. Dynamometers - all types.
v. Friction clutches - all types.
vi. Friction brakes - all types.
vii. Rope/belt – All types of flat and vee.
viii. Gear trains - all types.(Simple, compound, reverted, epicyclical).

ix. Balancing machines -Revolving masses, Reciprocating masses.
x. Steam engine, internal combustion engine.
xi. Governors - all types.
xii. Vibration -spring and mass model.
xiii. Any machine having flywheel.