

GUJARAT TECHNOLOGICAL UNIVERSITY

PRODUCTION ENGINEERING (25) AND MANUFACTURING

ENGINEERING (34)

THEORY OF MACHINES

SUBJECT CODE: 2142504

B.E. 4th SEMESTER

Type of course: Engineering Science

Prerequisite: Zeal to learn the subject

Rationale:

Theory of Machines is a fundamental course for production and manufacturing engineers to understand the working principals of any machine. This course is essential to understand the motion transmission between various machine components.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	2	0	5	70	20	10	30	0	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

Sr. No.	Topic	Lecture	weightage
1.	Basics of Mechanisms and Machines: Types of Motion, Links, Kinematic Pair, Types of Joints, Degree of Freedom, Classification of Kinematic Pairs, Kinematic Chain, Linkage, Mechanism and Structure, Inversions of Four-bar and Slider Crank Mechanism, Mobility of Mechanisms, Transmission Angle	04	8%
2.	Mechanisms with Lower Pair: Pantograph, Straight Line Mechanisms, Automobile Steering Gears, Hooke's Joint	04	8%
3.	Velocity and Acceleration Analysis of Mechanisms Absolute and Relative Motion, Velocity and Acceleration Diagrams for four bar and six bar mechanisms, Velocity by Instantaneous Centre Method, Coriolis Acceleration, Klein Construction	07	17%
4.	Kinematic Synthesis of Mechanisms Number Synthesis, Freudenstein's Equation, Function Generation, Stages of Kinematic Synthesis and Errors, Chebyshev Spacing of Precision points, Two and Three Position Synthesis of Four Bar and Slider Crank Mechanisms	07	17%

5.	Friction and Friction Drives Types of friction, Laws of Friction, Coefficient of Friction, Uniform Pressure and Uniform Wear, Friction Clutches, Rolling Friction, Flat Belt, V Belt and Rope Drives, Velocity Ratio in Belt Drives, Law of Belting, Ratio of Friction Tensions in Belts, Power Transmitted by Belts and Ropes, Maximum Power Transmission by Belt, Types of Brakes, Block and Shoe Brake, Band Brake, Internal Expanding Shoe Brake	10	24%
6.	Gears and Gear Trains Classification of Gears, Gear Terminology, Law of Gearing, Velocity of sliding, Gear Teeth Profile, Path of Contact, Arc of Contact, Contact Ratio, Interference of in Involute Gears, Minimum Number of Teeth, Undercutting, Gear Forces, Different Types of Gear Trains, Analysis of Epicyclic Gear Train	07	17%
7.	Cams Types of Cams and Followers, Cam Terminology, Derivatives of Follower Motion, Cam Profile Layout	04	9%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
7	21	14	14	14

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. Theory of Machines, Rattan S S, Tata McGraw-Hill
2. Kinematics and Dynamics of Machinery, Norton R L, McGraw-Hill
3. Mechanism and Machine Theory, Ambekar, A G, Prentice Hall
4. Theory of Machines, V P Singh, Dhanpat Rai & Co.

Course Outcomes:

1. Students will understand the fundamentals related to kinematics of mechanisms and machines.
2. Students will be able to synthesize and analyze the mechanisms.
3. Students will be able to determine the size and shape of the cam for required motion.
4. Students will able to understand the fundamentals of machine components like belt, gear, brake, and clutch.

Tutorials:

1. Drawing work related to inversion of four bar mechanism and slider and crank mechanism.
2. Drawing work related to velocity and acceleration diagram of various mechanisms.
3. Drawing work related to lower pair mechanisms.
4. Drawing work related to two and three positions synthesis for mechanisms.

5. Drawing work related to cam profile.
6. Tutorial based on belt and rope.
7. Tutorial based on gear and gear Train.
8. Tutorial related to brake and clutch.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.