GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3144102
Semester – IV

Subject Name: KINAMATICS AND DYNAMICS OF MACHINE

Type of course: Engineering

Prerequisite: Zeal to learn the subject

Rationale: Kinematics and Dynamics is fundamental course for mechatronics engineers to understand various mechanisms. This course is essential for kinematic and dynamic analysis of any mechanism and machine.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
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, Pantograph, Exact and Approximate Straight Line Mechanisms	06
2	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	09
3	BELT, ROPES AND CHAINS: Belt and Rope Drives, Open and Cross Belt Drives, Velocity Ratio, Slip, Material of Belts, Types of Pulleys, Law of Belting, Length of Belts, Ratio of Friction Tensions, Power Transmitted, Centrifugal Effect on Belts, Maximum Power Transmission by Belt, Initial Tension, Creep, Chains, Chain Length, Angular Speed Ratio.	05
4	GEAR 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

5	CAMS: Types of Cams and Followers, Cam Terminology, Derivatives of Follower Motion, Cam Profile Layout	04
6	GYROSCOPE: Angular Velocity, Angular acceleration, Gyroscopic Torque, Gyroscopic Effect on Naval Ships, Aero plane, Two wheel and Four wheel Automobile	05
7	BALANCING: Static Balancing and Dynamic balancing of Rotating Masses, Balancing of Several Masses in Different Planes, Balancing of Reciprocating Mass	05
8	VIBRATION: Fundamentals of Vibration, Types of Vibrations, Degree of Freedom, Free Vibration, Damped Vibration, Forced Vibration of Single Degree of Freedom System, Magnification Factor, Vibration Isolation and Transmissibility	10

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	**30**	**10**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create 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.
5. Theory of Mechanisms and Machines,Amitabha Ghosh &Mallik A. K., EastWest Press

Course Outcomes:

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Analyze the velocity and acceleration aspects of the planar mechanisms	25
CO-2	Design mechanisms such as belt drive, gear drive etc. from kinematics point	25

	of view	
CO-3	Design cam profiles based on known inputs and analyze velocity and acceleration	25
CO-4	Understand gyroscopic effects and learn basics of vibrations	25

List of Experiments:

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 balancing of rotating masses.
4. Drawing work related to cam profile.
5. Experiment related to gyroscope.
6. Experiment related to balancing of rotating masses.
7. Experiments related to vibration single degree of freedom system free vibration, damped vibration and forced vibration.

Major Equipment:

1. Various mechanisms related to the course material
2. Balancing instruments
3. Gyroscope
4. Vibration measuring instruments
5. Other relevant instruments related to course material

List of Open Source Software/learning website:

https://nptel.ac.in/course.php
http://nptel.iitm.ac.in/courses.php