Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester- 3

Subject: Kinetics of Machinery- BETME13304

Type of course: Major(Core)

Prerequisite: Introduction to Mechanical Engineering

Rationale: Kinematics of machines is a branch of mechanical engineering that deals with the motion of components within machines and mechanisms without considering the forces causing the motion. It focuses on describing the geometry and behavior of moving parts, including their positions, velocities, and accelerations. At its core, kinematics provides engineers with a systematic framework for understanding and analyzing the motion of machine elements such as linkages, gears, cams, and sliders. By studying kinematics, engineers can design, optimize, and control the movements of machines to achieve desired functionalities and performance

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	-	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course content	Hrs.	% Weightage
1	**Introduction of Mechanisms and Machines:** • Concepts of Kinematics and Dynamics, Mechanisms and Machines, Planar and Spatial Mechanisms, Kinematic Pairs, Kinematic Chains, Kinematic Diagrams, Kinematic Inversion, Four bar chain and Slider Crank Mechanisms and their Inversions • Degrees of Freedom	08	16%
2	**Velocity and Acceleration Analysis:** • Graphical and analytical velocity analysis of four bar pin jointed linkages and four bar slider crank linkages • Instant centers of velocity • Graphical and analytical acceleration analysis of four bar pin jointed linkages and four bar sliders crank linkages • Graphical velocity and acceleration analysis of quick return mechanisms	12	24%
3	**Cams** • Types of cams, Types of followers, Follower displacement programming, Derivatives of follower Motion, Motions of follower • Layout of cam profiles	10	15%
4	**Belt, Ropes and Chains:** • Types of belt drive, Velocity ratio, Slip, Pulley arrangement, Length of belt, Law of belting, Ratio of friction tension, Power transmitted, Centrifugal effects on belts • Maximum power transmitted, Creep, Chains, Chain length • Angular speed ratio • Classification of chain	10	15%
5	**Friction, Clutch and Brake:** • Introduction to friction, Law of friction, Coefficient of friction • Inclined plane, Pivot and Collars, Friction clutches • Rolling Friction • Types of brakes, Block and Shoe brakes, Differential band brake, Internal expanding shoe brake • Braking effect in vehicle	10	15%

6	**Gears and Gear Trains** • Terminology, Law of Gearing • Characteristics of involute and cycloidal action • Interference and undercutting • Center distance variation, minimum number of teeth, contact ratio, spur, helical, spiral bevel and worm gears, problems • Gear Trains: Synthesis of Simple, compound & reverted gear trains, Analysis of epicyclic gear trains	10	15%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Draw Inversions** Draw work related to inversion of four bar mechanism and slider and crank mechanism and uploads it on a GMIU web portal.	10
2	**Velocity and acceleration of linkages** Faculty will assign mechanism and student will determine position, velocity and acceleration of linkages in mechanism and upload answer on a GMIU web portal.	10
3	**Capture photographs** Click any two photographs of brake, clutch, rope, chain or gear and upload it on GMIU web portal.	10
Total		30

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks **(Revised Bloom's Taxonomy)**						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	35%	30%	10%	0%	5%

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.

Course Outcome:

After learning the course the students should be able to:	
CO1	Understand basic structure and elements of machines
CO2	Identify functional characteristics of various machine elements.
CO3	Synthesize various mechanisms based on position, velocity and acceleration requirement
CO4	Determine position, velocity and acceleration of linkages in mechanism at any instant.

List of Practical

Sr. No	Descriptions	Unit No	Hrs
1	To study various types of kinematic links, pairs, chains and mechanisms	1	4
2	To study inversion of single slider crank mechanism	1	2
3	To study inversion of double slider crank mechanism	1	2
4	Drawing work related to velocity diagram for various mechanisms	2	4
5	Drawing work related to acceleration diagram of various mechanism	2	4
6	Drawing work related to CAM profile	3	4
7	Study of Dynamometers	4	4
8	Demonstration of Clutch	5	2
9	Demonstration of Break	5	2
10	Demonstration of Power transmission system	6	2
	Total		30

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Theory of Machines, Rattan S S, Tata McGraw-Hill

[2] Theory of Machines and Mechanisms, Uicker J J Jr., Pennock G R, Shigley J E, Oxford Press

[3] Kinematics and Dynamics of Machinery, Norton R L, McGraw-Hill.

[4] Mechanism and Machine Theory, Ambekar, A G, Prentice Hall