



FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: Bachelor of Technology (Automobile Engineering)

Semester: V

Course Code: 202010503

Course Title: Kinematics and Theory of Machines

Course Group: Professional Core Course

Course Objectives: Kinematics and theory of Machines is a fundamental course of mechanisms and machines. It is intended to introduce essential elements of machines and their functionality and engenders skills for kinematics analysis of various machine elements as well as for automotive applications.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	50 / 18	25 / 9	50 / 17	25 / 9	150 / 53

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Introduction to 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, Grubler's criterion, Number Synthesis, Grashof's criterion.	7



2	Velocity and Acceleration Analysis: Graphical and analytical velocity analysis of four bar pin jointed linkages and four bar slider crank linkages, Instantaneous centers of velocity, Graphical and analytical acceleration analysis of four bar pin jointed linkages and four bar slider crank linkages, Graphical velocity and acceleration analysis of quick return mechanisms.	10
3	Cams & Followers : Types of cams, Types of followers, Follower displacement programming, Derivatives of follower Motion, Motions of follower, Layout of cam profiles.	7
4	Belt, Rope and Chain drives : 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.	6
5	Gyroscope: Angular Velocity, Angular acceleration, Gyroscopic Torque, gyroscopic effect on naval ships, stability of automobile, stability of two wheel and four wheel automobile.	5
6	Balancing: Forces due to revolving masses. Balancing of revolving masses in one plane and in different planes.	5
7	Vibrations for automotive applications: Introduction, Basic features of vibration systems - single degree of freedom systems and vibration isolation, Automotive applications.	5
	Total	45

List of Practicals / Tutorials:

1	Introduction to Mechanisms & Machines.
2	Cam profile with reciprocating follower.
3	Cam profile with reciprocating & oscillating follower.
4	Velocity analysis by relative velocity method.
5	Velocity analysis by Instantaneous centre (I-centre) method.



6	Acceleration analysis of mechanisms.
7	Analysis of Belt, Rope & Chain drive.
8	Analysis of gyroscopic effect.
9	Balancing of revolving masses.
10	Understand applications vibration in Automobile.
11	Seminar Report on advanced topic of kinematics of machines.

Reference Books:

1	Theory of Machines; R.S.Khurmi & J.K.Gupta, S.Chand & Company Ltd.
2	Theory of Machines; S.S.Rattan, Tata McGraw Hill
3	Theory of Machines; Jagdish Lal, Metropolitan Book Co.
4	Theory of Mechanisms and Machines; Amitabha Ghosh & Mallik A.K., East West Press
5	Mechanism & Machine Theory; Rao J.S. and Dukkipati R.V., New Age International Pub.
6	Kinematics and Dynamics of Machinery; Charles E.Wilson & J.Peter Sadler, Pearson Education publications.
7	Theory of Machines; V.P.Singh, Dhanpat Rai & Co.
8	Theory of Machines; Dr.R.K.Bansal, Laxmi Publications (P) Ltd.
9	Theory of Machines; Singh Sadhu, Pearson Education

Supplementary learning Material:

1	NPTEL Resources
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Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment



Internal Evaluation :

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
25	25	20	20	5	5	

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the basic structure, functional characteristics and elements of mechanisms & machines.	20
CO-2	Understand velocity and acceleration requirements of mechanisms.	20
CO-3	Understand analysis of cams and followers.	20
CO-4	Understand analysis of drives and gyroscopic effects.	20
CO-5	Understand balancing and vibration in various applications.	20

Curriculum Revision:

Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2027