

# BVM ENGINEERING COLLEGE [AN AUTONOMOUS INSTITUTION]

## 2ME06: KINEMATICS OF MACHINES

CREDITS - 4 (LTP:3,1,0)

### Course Objective:

To analyze mechanisms and machines for desired motions.

### Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
L	T	P		C	Theory		Practical	
			ESE		CE	ESE	CE	
3	1	0	4	60	40	20	30	150

### Course Contents:

Unit No.	Topics	Teaching Hours
1	<b>Introduction of Mechanisms and Machines:</b> Concepts of Kinematics and Dynamics, Classification of mechanisms, Basic kinematic concepts and definitions, Degree of freedom, Mobility, Kutzbach criterion, Gruebler's criterion, Grashof's Law, Kinematic inversions of four-bar chain and slider crank chains, Limit positions, Mechanical advantage, Transmission Angle. Lower Pair Mechanisms: Straight line mechanisms, Hooke's Joint, Steering Mechanisms.	08
2	<b>Kinematics of Linkage Mechanisms:</b> Displacement, velocity and acceleration analysis of simple mechanisms, Graphical method- Velocity and acceleration polygons, Velocity analysis using instantaneous centres, kinematic analysis of simple mechanisms, Coincident points, Coriolis component of Acceleration, Introduction to linkage synthesis problem.	08
3	<b>Belts, Ropes and Chains:</b> Introduction, belt and ropes drives, selection of belt drive, types of belt drives, materials used for belt and rope drives, slip and creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, classification of chain drives and types of chains.	06
4	<b>Gears and Gear Trains:</b> Gears: Law of toothed Gearing, Characteristics of involute and cycloid action, Spur gear terminology and definitions, Interference and undercutting, center distance variation, minimum number of teeth, contact ratio, Helical, Bevel, Worm, Rack and Pinion gears. Gear Trains: Simple, Compound, Reverted and Epicyclic gear trains.	08
5	<b>Cams and Followers:</b>	06

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Unit No.	Topics	Teaching Hours
6	Classification of cams and followers, nomenclature, displacement diagrams of follower motion, different cam profiles. Cams with specified contours: Tangent and circular arc cam <b>Friction in Machine Elements:</b> Classification of clutches, Torque transmission capacity, Considerations for uniform wear and uniform pressure theory, Analysis of Clutches: Single plate, Multi-plate, Cone and Centrifugal clutches. Classification of brakes, Braking effect, Analysis of Mechanical Brakes: Block brake, Band brake, Band and block brake, Internal expanding shoe brake.	06
<b>Total</b>		<b>42</b>

## List of References:

1. S S Ratan, "*Theory of Machines*", McGraw-Hill publishing co.
2. V P Singh, "*Theory of Machines*", Dhanpat Rai & Co. (P) Ltd.
3. Singh Sadhu, "*Theory of Machines*", Pearson Education.
4. A G Ambekar, "*Mechanism and Machine Theory*", Prentice Hall.
5. Jagdishlal, "*Theory of Machines*", Metropolitan book.
6. J J Uicker, G R Pennock, J E Shigley, "*Theory of Machines and Mechanisms*", Oxford Press.
7. R L Norton, "*Kinematics and Dynamics of Machinery*", Tata McGraw-Hill publishing co.

## Course Outcomes (COs):

At the end of this course students will be able to ...

1. Identify different types of motions and determine degrees of freedom.
2. Analyze the position, velocity, and acceleration of mechanisms
3. Analyze belts, ropes and chain drives.
4. Evaluate kinematics of gears and gear trains.
5. Analyze cam-follower mechanisms.
6. Analyze friction devices such as different types of clutch and brake.