

BMEE207L	Kinematics & Dynamics of Machines	L	T	P	C
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Pre-requisite	BMEE201L	Syllabus version			
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Course Objectives					
1. To enable students to understand the fundamental concepts of mechanisms. 2. To facilitate students to understand the functions of cams, gears, and flywheel. 3. To impart knowledge on design of mechanisms and dynamic loads acting on the mechanism. 4. To give an insight on the concepts of balancing, vibration and speed governing devices.					
Course Outcome					
At the end of the course, the student will be able to 1. Examine the kinematic behaviour of various planar mechanisms. 2. Construct velocity and acceleration diagrams for various planar mechanisms. 3. Analyse kinematics of cam and gear-train mechanisms. 4. Investigate the dynamic forces acting on planar mechanisms. 5. Analyse the balancing of masses and vibrations of mechanical systems. 6. Assess the characteristics of governors and gyroscopic effects.					
Module:1	Mechanisms and kinematics	6 hours			
Introduction, mechanisms and machines, terminology, planar mechanism - Kinematic diagram and inversion, Mobility, Coincident joints, Grubler and Grashoff's law, Four bar, single and double slider mechanisms and their inversions.					
Module:2	Velocity and Accelerations in Mechanisms	8 hours			
Velocity and acceleration in planar mechanisms - Relative velocity method, Coriolis component of acceleration, Kennedy's Theorem, Instantaneous Centre method.					
Module:3	Kinematic analysis of Cams and Gears	7 hours			
Cams: Types of cams – Types of followers – Definitions – Motions of the followers – Layout of cam profiles. Gear: terminology, fundamental of gearing, involute profile, interference and undercutting, minimum number of teeth, contact ratio - Gear trains: simple, compound and epicyclic.					
Module:4	Synthesis of planar mechanism	4 hours			
Two position and Three position synthesis of planar mechanism - Graphical and analytical methods - Freudenstein equation.					
Module:5	Dynamic Force Analysis	6 hours			
Introduction-D' Alembert's principle-static and inertial force analysis of reciprocating engine-Equivalent dynamic system. Turning moment diagram-four stroke engine-multicylinder engine-design of flywheel of IC engine-design of flywheel rim- design of flywheel of punching press.					
Module:6	Balancing and Vibration	8 hours			
Static and Dynamic Balancing of Rotating Masses, Balancing of Reciprocating Masses. Introduction to vibration - Terminologies - Single degree of freedom- damped and undamped- free and forced vibration – Vibration isolation and Transmissibility. Transverse vibrations of shafts – Whirling of shaft -Torsional vibration of single rotor and two rotors' systems.					
Module:7	Governors and Gyroscope	4 hours			
Governors: Centrifugal Governors- types and its characteristics - Working principle of electronic governor. Gyroscope – Gyroscopic Effects on the Movement of airplanes and Ships – Gyroscope Stabilization.					
Module:8	Contemporary Issues	2 hours			
Total Lecture hours:					45 hours
Text Book(s)					
1.	Rattan S. S, Theory of Machines, Tata McGraw Hill, 2019				

Reference Books			
1.	Joseph Edward Shigley and John Joseph Uicker Jr., Theory of Machines and Mechanisms SI Edition, 2014, Oxford University Press		
2	Norton R. L, Kinematics and Dynamics of Machinery, , 2017, McGraw-Hill Education		
3	Norton R. L., Design of Machinery, An Introduction to the Synthesis and Analysis of Mechanisms and Machines, 2019McGraw-Hill Higher Education		
Mode of Evaluation: CAT, Written assignment, Quiz, FAT			
Recommended by Board of Studies		09-03-2022	
Approved by Academic Council		No. 65	Date 17-03-2022