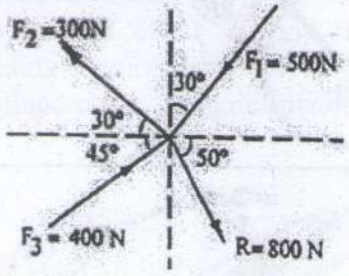
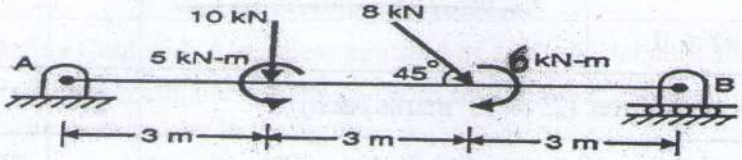
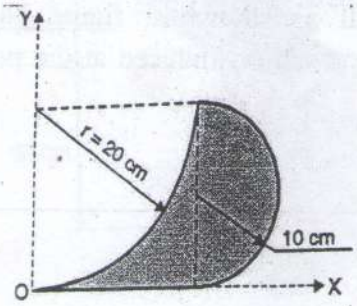
K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

April 2025
B. Tech. Program: All Branches Scheme: III
Supplementary ~~Regular~~ Examination: FY Semester: I
Course Code: BSC104 and Course Name: Engineering Mechanics
Date of Exam: 07/4/2025 Duration: 2.5 Hours Max. Marks: 60

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.
(4) Use $g = 9.81\ m/s^2$.

Q. No.	Question	Max. Marks	CO	BT level
Q.1	Solve any **TWO** questions out of three: (05 marks each)	10		
a)	Find the force F_4 so as to give the resultant of the force system as shown in the figure. 		CO1	BT2
b)	Find the reactions at the supports of the beam applying conditions of equilibrium. 		CO1	BT3
c)	Determine the centroid for the shaded portion of the plane lamina shown below. 		CO2	BT2

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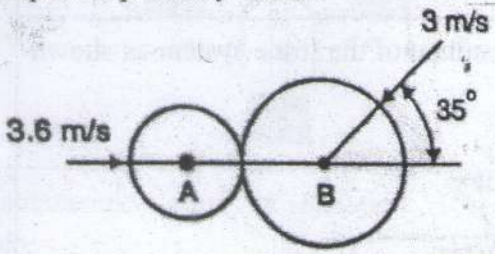
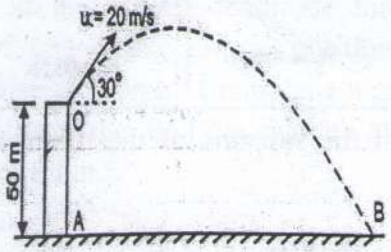
Q.2	Solve any **TWO** questions out of three: (05 marks each)	10		
a)	The car moves in a straight line such that for a short time its velocity is defined by $v= (9t^2+2t)$ m/s, where t is in seconds. Determine the position and acceleration when t = 3 sec. Take at t=0, x=0		CO4	BT2
b)	Just before collision, two disks on a horizontal surface have velocities as shown in the fig. Knowing that 90N disk 'A' rebounds to the left with a velocity of 1.8m/s, determine the rebound velocity of 135N disk 'B'. Assume that the impact is perfectly elastic. 		CO6	BT2
c)	A particle is projected from the top of the tower of height 50m with a velocity of 20 m/s at an angle 30° to the horizontal. Determine: (i) Horizontal distance AB. (ii) Velocity at B. (iii) Total time from O to B. 		CO4	BT2
Q.3	Solve any **TWO** questions out of three. (2+8=10 marks each)	20		
a) i)	State Lami's theorem and necessary conditions for application of Lami's theorem.		CO1	BT1, BT3
ii)	Two identical rollers each of mass 50kg are supported by an inclined plane and a vertical wall as shown in figure No.1. Assuming smooth surfaces, find the reactions induced at the point of support A,B,C.			

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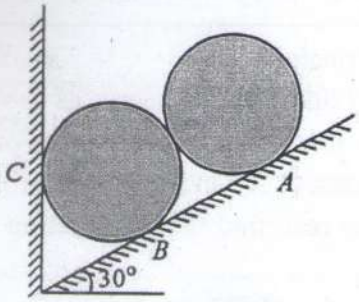
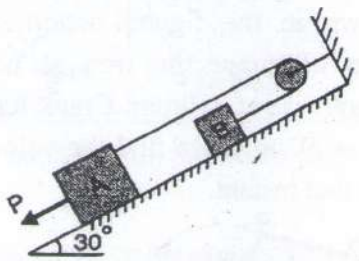
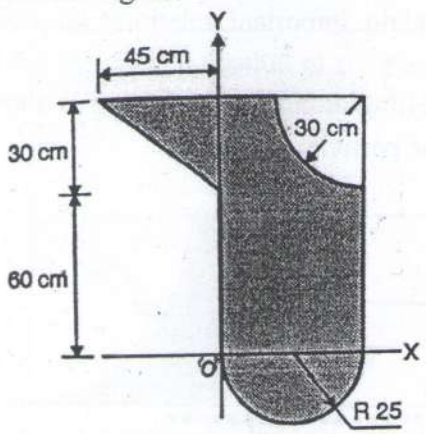
		 figure No.1			
b)	i) ii)	What are the laws of friction? Determine the force 'P' required for the motion to impend. Take masses of blocks 'A' and 'B' as 8kg and 4kg respectively and the coefficient of sliding friction as 0.3. The force 'P' and rope are parallel to the inclined plane. Assume frictionless pulley. 		CO3	BT1, BT3
c)	i) ii)	Define Centroid. Also show centroid of any two standard shapes. Find the coordinates of the centroid of the shaded area with respect to the axes shown in the figure. 		CO2	BT1, BT2

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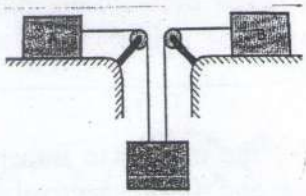
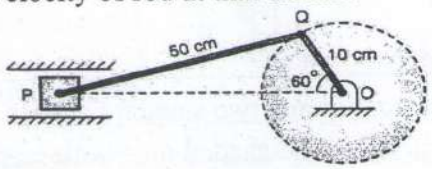
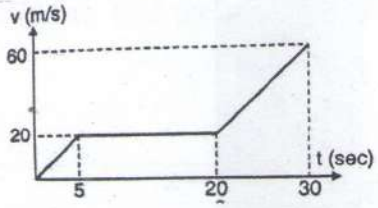
Q.4		Solve any **TWO** questions out of three. (2+8=10 marks each)	20		
a)	i)	State and explain D'Alembert's Principle.		CO6	BT1, BT3
	ii)	Masses A (5kg), B (10kg) and C (20kg) are connected as shown by an inextensible cord passing over massless and frictionless pulleys. The coefficient of friction for masses 'A' and 'B' with ground is 0.2. If the system is released from rest, find the acceleration of the blocks and tension in the cords. 			
b)	i)	Define Instantaneous Centre of Rotation (ICR) and write its characteristics.		CO5	BT1, BT3
	ii)	For the crank mechanism shown in the figure, determine the instantaneous centre of rotation of connecting rod at position shown. The crank OQ rotates clockwise at 310rpm. Crank length is 10cm and connecting rod length is 50cm. Also find the velocity of 'P' and angular velocity of rod at that instant. 			
c)	i)	What are motion curves? Explain important relations of motion curves.		CO4	BT1, BT3
	ii)	v-t diagram for a particle travelling along a straight line is shown. Draw a-t and x-t diagram for the particle. 			

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