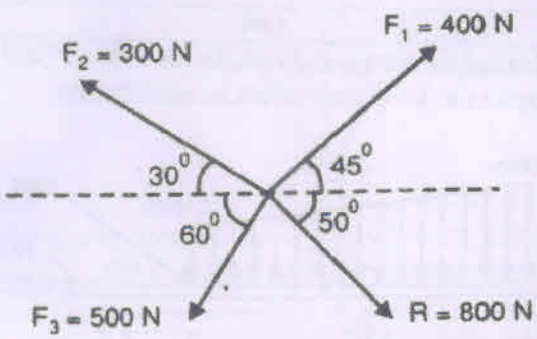
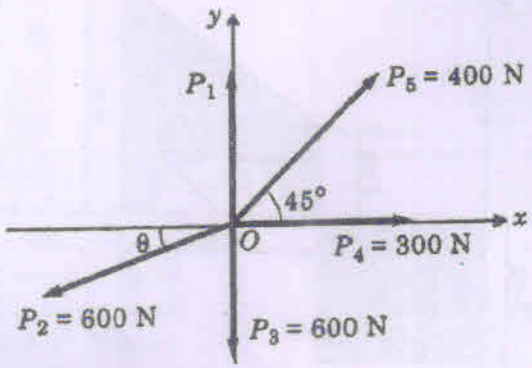
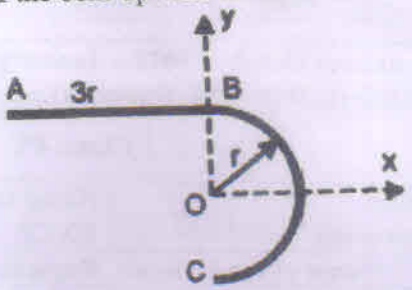
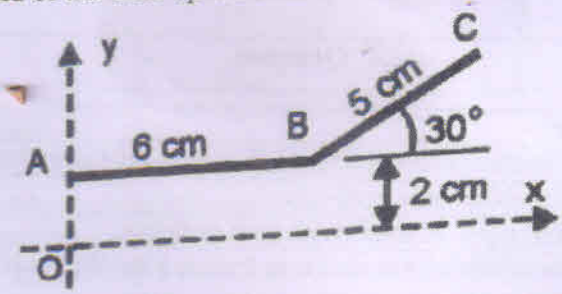
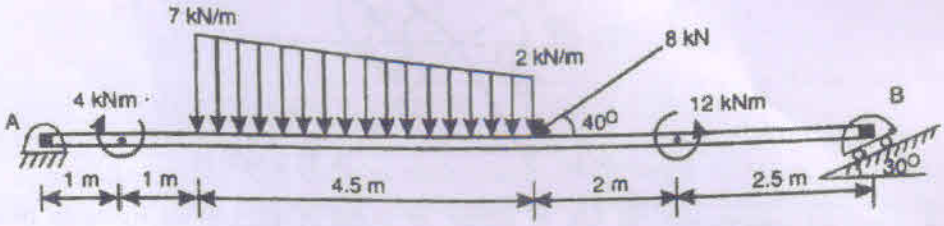
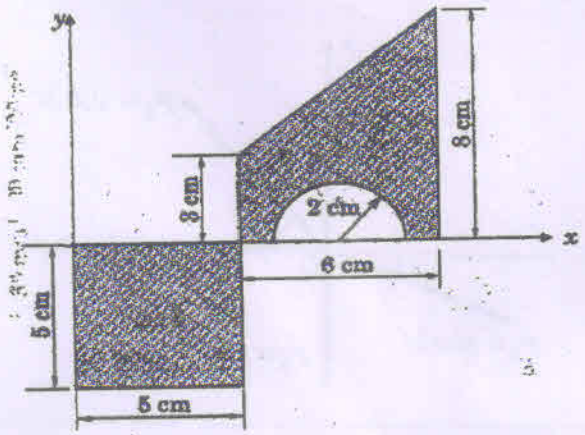
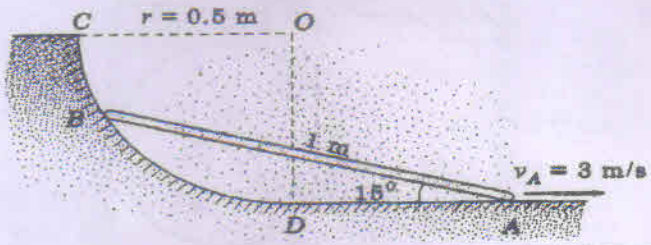
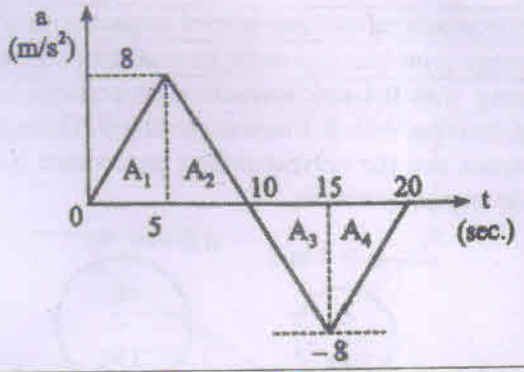
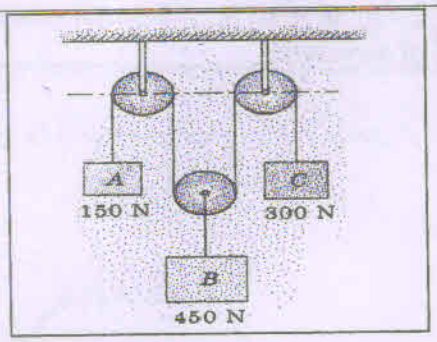
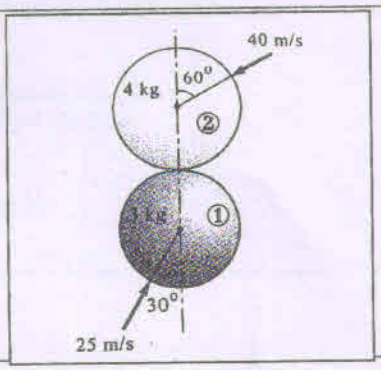
13·2·2023 (M)

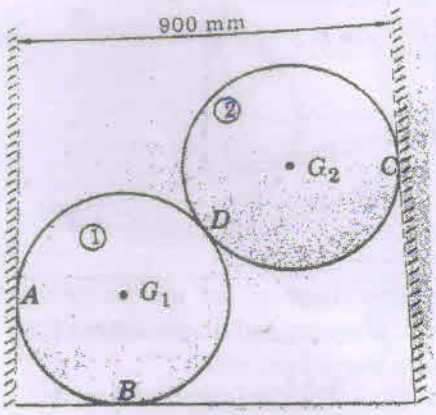
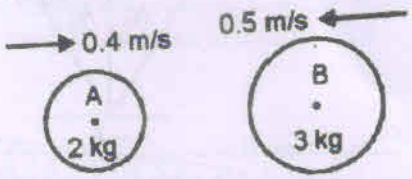
SOMAIYA VIDYAVIHAR UNIVERSITY

Semester: October 2022 – January 2023		
Maximum Marks: 100 **Examination: ESE Examination**		**Duration:3 Hrs.**
Programme code: 01 **Programme: B.Tech**	**Class: FY**	**Semester:I (SVU 2020)**
Name of the Constituent College: **K. J. Somaiya College of Engineering**	**Name of the department:COMP / IT / EXCP**	
Course Code: 116U06C104	**Name of the Course: Engineering Mechanics**	
Instructions: 1)Draw neat diagrams 2) All questions are compulsory **3) Assume suitable data wherever necessary**		

Que. No.	Question	Max. Marks
Q1	Attempt any **Four**	**20**
i)	Describe angle of friction and cone of friction with neat sketches.	5
ii)	Discuss on elastic and inelastic collision.	5
iii)	Discuss on different types of loads with neat sketches.	5
iv)	R = 800 N is the resultant of 4 concurrent forces. Find the fourth force F_4? 	5
v)	A force of magnitude 50 kN is acting at point A (2,3,4) m towards point B (6,-2,-3) m. Find the moment of the given force about a point D (-1,1,2) m.	5
vi)	If the resultant of five forces acting at point O is zero, determine the force P_1 and angle θ as shown in figure. 	5

Q2 A	Solve the following	10
i)	Determine the centroid of the bent-up wire in terms of r. 	5
ii)	Locate the centroid of the bent-up wire ABC. 	5
	OR	
Q2 A	The beam AB is loaded by forces and couples as shown. Find the reaction force offered by the supports to keep the system in equilibrium. 	10
Q 2 B	Solve any **One**	10
i)	Find the coordinates of centroid for the shaded area shown in figure. 	10
ii)	State and prove Varignon's Theorem.	10

Q3	Solve any **Two**	20
i)	Bar AB is 1 m long. End A of the bar moves with a velocity of 3 m/s on the horizontal plane. End B travels along circular path CD of radius 0.5 m. Find the velocity of B for the given position. 	10
ii)	For the acceleration time diagram for the linear motion is shown in figure. Construct velocity time diagram and displacement time diagram for the motion. Assume that the motion starts from rest. Solve the problem by motion curve (graphical) method. Also show type (nature) of each curve on all the diagrams. 	10
iii)	A particle moves along a hyperbolic path $\frac{x^2}{16} - y^2 = 28$. If the x-component of velocity is V_x = 4 m/s and remains constant, determine the magnitudes of particles velocity and acceleration when it is at point (32,6) m.	10
Q4	Solve any **Two**	20
i)	Three weights A, B and C are connected as shown in figure. Determine the acceleration of each weight and tension in the string. Given : W_A = 150 N , W_B = 450 N and W_C = 300 N. 	10
ii)	Two smooth balls of ball 1 of mass 3 kg and ball 2 of mass 4 kg are moving with velocities 25 m/s and 40 m/s respectively at an angle of 30^0 and 60^0 with the vertical as shown in figure. If coefficient of restitution between two balls is 0.8, find the magnitude and direction of velocities of these balls after impact. 	10

iii)	Two smooth spheres of weight 100 N and of radius 250 mm each are in equilibrium in a horizontal channel of width 900 mm as shown. Find the reaction at the surface of contact A, B, C and D, assuming all the surfaces to be smooth.  	10
Q5	Attempt any **four**	**20**
i)	Discuss on Direct central and oblique central impact with neat sketches.	5
ii)	Explain Work energy principle and write its mathematical expression.	5
iii)	A 2 kg ball moving with 0.4 m/s towards right collides head on with another ball of mass 3 kg, moving with 0.5 m/s towards left. Determine the velocities of the balls after impact and the corresponding percentage loss of kinetic energy, when the impact is perfectly elastic.  	5
iv)	Discuss on different types of supports with neat sketches.	5
v)	Discuss on laws of friction.	5
vi)	A particle travels on a circular path whose arc distance travelled is defined by $s = (0.5t^3 + 3t)$ m. If the total acceleration is 10 m/s^2 at t = 2 sec., find the radius of curvature?	5