U.S.N.										

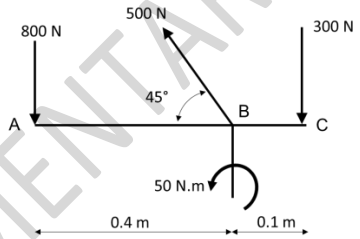
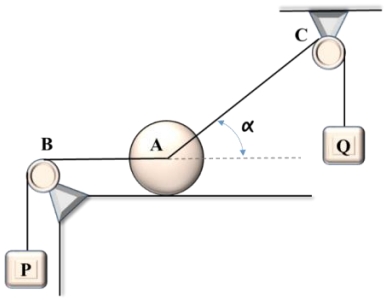
B.M.S. College of Engineering, Bengaluru-560019

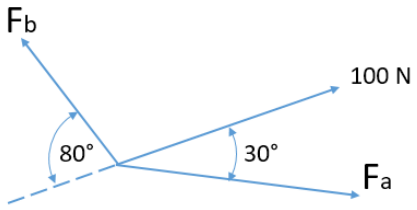
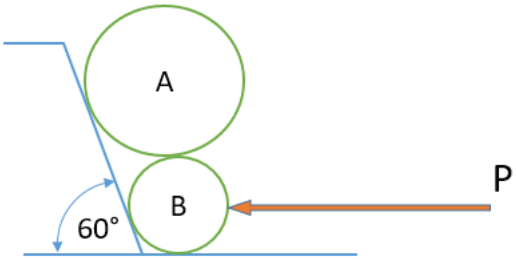
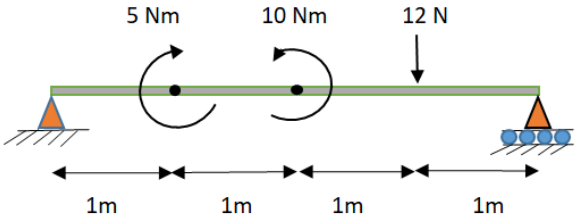
Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: I**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV1ESENM **Max Marks: 100**
Course: ENGINEERING MECHANICS

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	CO	PO	Marks
1	a)	State the following principles. i. Principle of superposition of forces; ii. Principle of transmissibility of forces.	*CO1*	*P O1*	**4**
	b)	A bracket is subjected to coplanar force system as shown in Fig. Q.1 (b). Determine the magnitude, direction and the x-intercept of the resultant force with respect to 'A' as origin.  Fig. Q.1 (b)	*CO2*	*PO1*	**8**
	c)	A ball weighing 400 N rests upon a smooth horizontal plane and has attached to its center two strings AB and AC which pass over frictionless pulleys at B and C and carry loads P and Q, respectively, as shown in Fig. Q 1 (c). If the string AB is horizontal, find the angle α that the string AC makes with the horizontal when the ball is in a position of equilibrium. Also find the reaction R between the ball and the plane.  Fig. Q 1 (c)	*CO2*	*PO1*	**8**

			OR			
	2	a)	Explain the basic idealizations in mechanics.	*CO1*	*PO1*	**4**
		b)	Find the components of the 100 N force shown in Fig. Q 2 (b) by the method of triangle law of forces.  Fig. Q 2 (b)	*CO1*	*PO1*	**6**
		c)	Two cylinders A and B of radius 400 mm and 200 mm having weights 400N and 200N respectively, lean over an inclined wall on one side as shown in Fig. Q 2 (c). A horizontal force P=260N is applied on cylinder 'B' to prevent the cylinders from rolling. Find the reactions developed at all contact surfaces.  Fig. Q 2 (c)	*CO2*	*PO1*	**10**
			UNIT - II			
	3	a)	Explain different types of loading over beams.	*CO1*	*PO1*	**6**
		b)	Determine support reactions for the beam shown in Fig. Q 3(b).  Fig. Q 3 (b)	*CO2*	*PO1*	**6**
		c)	Analyse the truss shown in Fig. Q 3 (c) by the method of joints. Indicate the member forces on the truss elements and mention the nature of force.	*CO2*	*PO1*	**8**

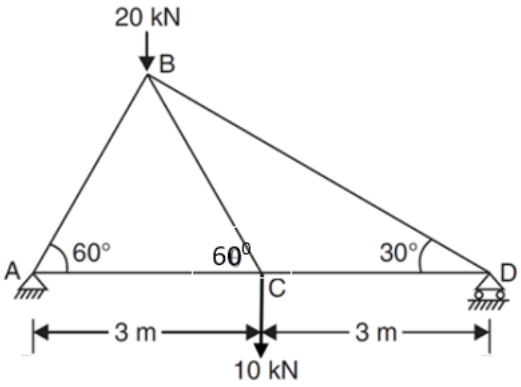


Fig. Q 3 (c)

UNIT - III

4	a)	Explain the phenomenon of friction with a neat graphical sketch.	*CO1*	*PO1*	**4**
	b)	A uniform ladder 4.8 m long and weighing 'W' is placed with one end on the ground and the other end against a vertical wall as shown in Fig. Q 4 (b). The angle of friction at all contact surfaces is 20^0. Find the minimum value of the angle 'θ' at which the ladder can be inclined with the horizontal before slipping occurs.	*CO2*	*PO1*	**8**
	c)	Two blocks A and B weighing 25 kN, and 5 kN respectively, are held in position against an inclined plane by applying a horizontal force P as shown in Fig. Q 4 (c). Find the least value of P which will induce motion of the block A upwards. Angle of limiting friction for all contact surfaces is 12^0.	*CO2*	*PO1*	**8**

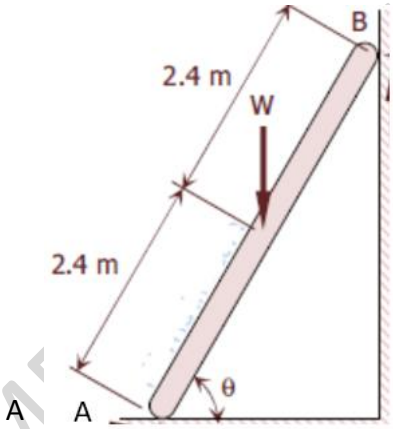


Fig. Q 4 (b)

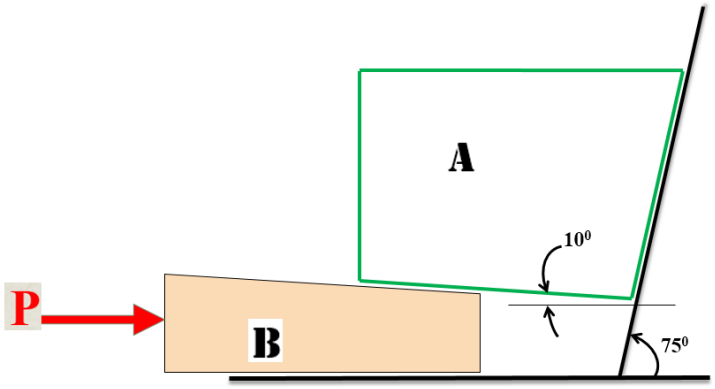
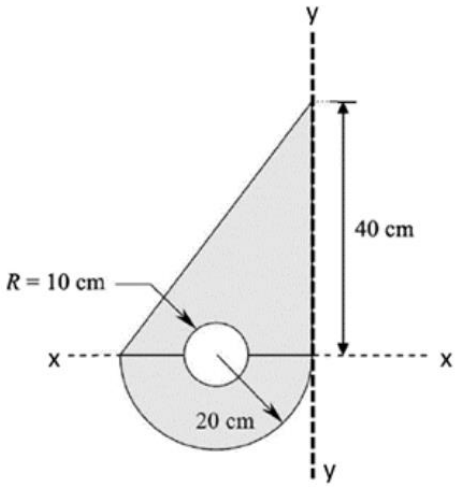


Fig. Q 4 (c)

			UNIT - IV			
	5	a)	State the following: - i. Parallel axis theorem ii. Radius of gyration	*CO1*	*PO1*	**6**
		b)	Determine the moment of inertia of the composite area shown in Fig. Q 5 (b) about the x and y axes indicated.  Fig. Q 5 (b)	*CO2*	*PO1*	**14**
			UNIT - V			
	6	a)	State D Alembert's principle	*CO1*	*PO2*	**4**
		b)	Determine the minimum stopping distance 's' and the corresponding time 't' required by a truck, if a crate kept on the horizontal flatbed of the truck is not slipped forward. Take μs = 0.4 and μk = 0.3 between the crate and the flatbed of the truck which has a speed of 90km/h.	*CO3*	*PO2*	**8**
		c)	A cricket ball is hit by a batsman at a height of 1.6 m above the ground. The ball is caught by the fielder near the boundary at a height of 0.6 m above the ground exactly after 5 seconds. If the ball is hit with a velocity of 90 kmph determine the angle at which the ball is to be hit by the batsman. Also determine the distance between the batsman and the fielder.	*CO3*	*PO2*	**8**
			OR			
	7	a)	State work-energy principle.	*CO1*	*PO2*	**4**
		b)	A train weighing 3000 kN is moving down a slope of 1 in 150 at a constant speed of 18 kmph and develops a power of 35 kW. i. Calculate the tractive resistance. ii. When it is pulled up the slope at the same speed, calculate the power developed by the engine.	*CO3*	*PO2*	**8**
		c)	A tram car weighs 100 kN, the tractive resistance being 5N/kN weight. Calculate the power required to propel the car at a uniform speed of 20 kmph i. On level surface ii. Up an incline of 1 in 200 and Down an inclination of 1 in 300 Take efficiency of motor as 80%	*CO3*	*PO2*	**8**

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