U.S.N.										

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

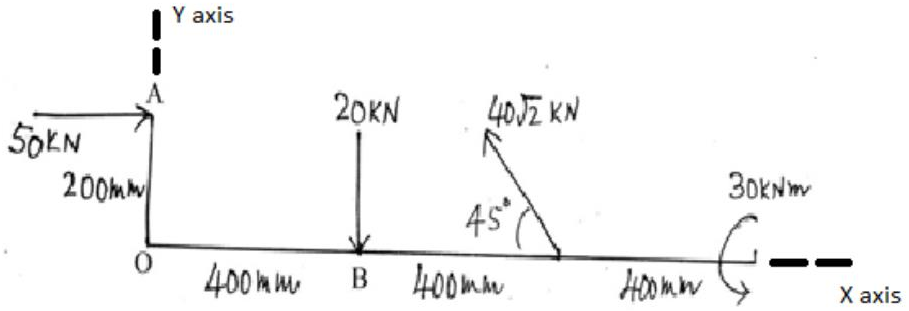
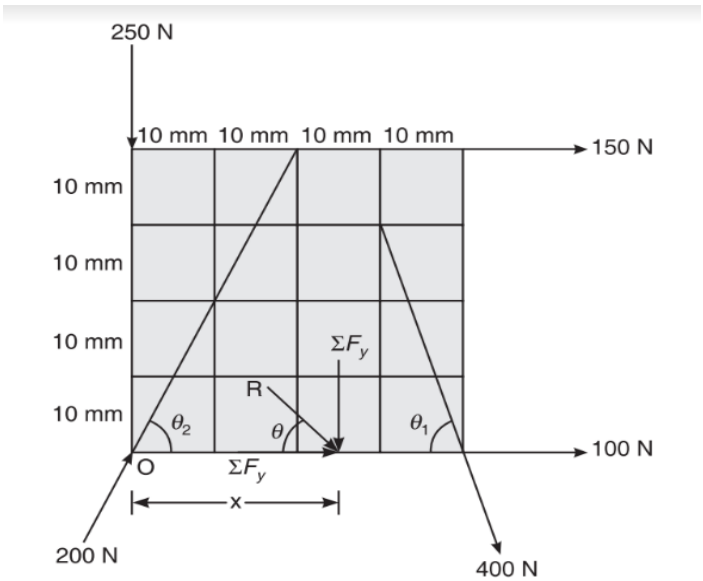
Autonomous Institute Affiliated to VTU

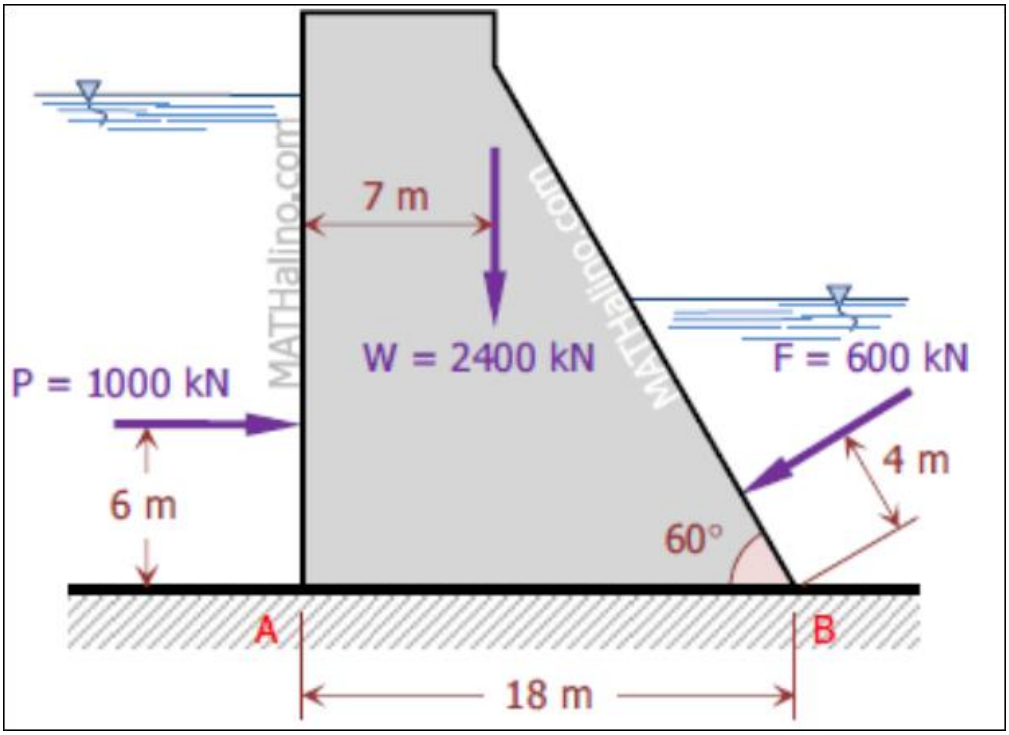
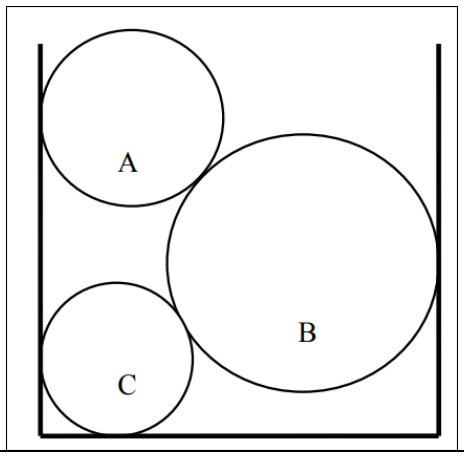
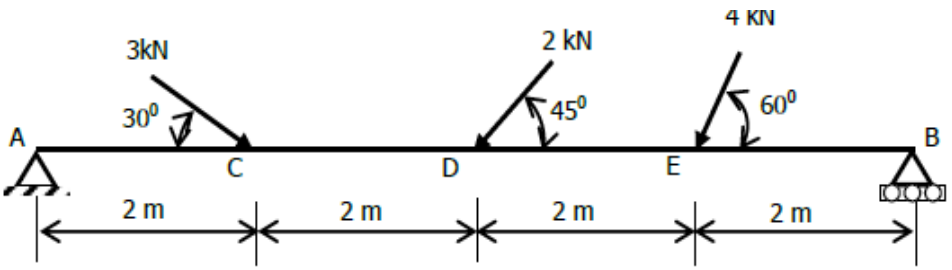
December 2023 Supplementary Examinations

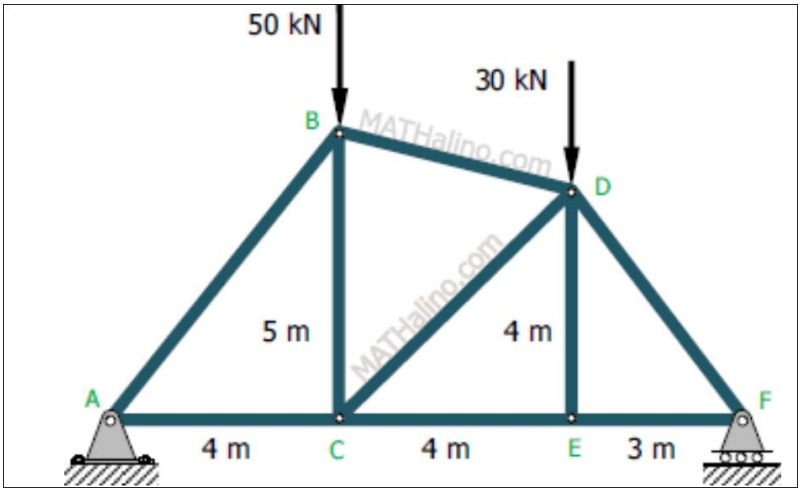
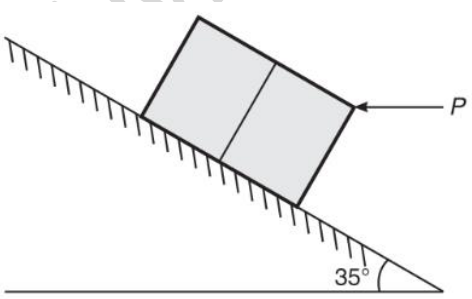
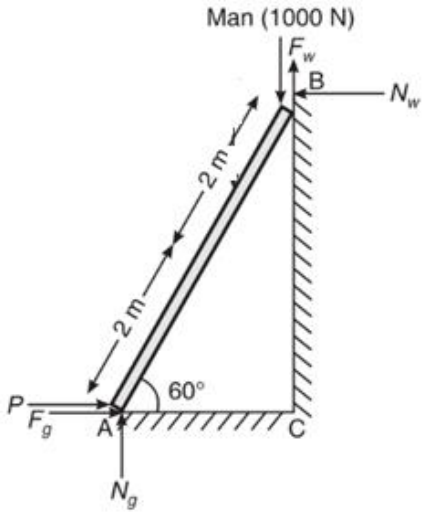
Programme: B.E. **Semester: I**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV1ESENM **Max Marks: 100**
Course: Engineering Mechanics

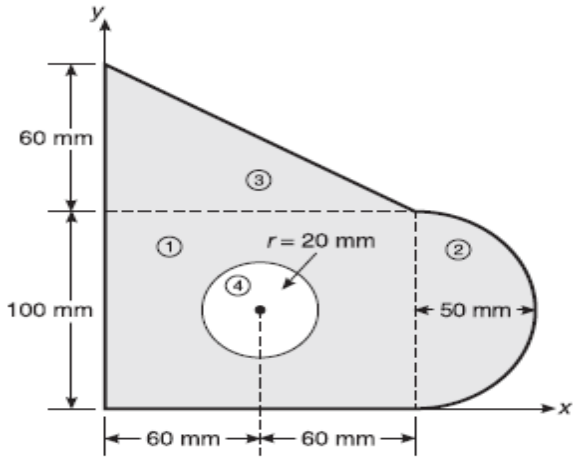
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	
1	a)	Find the resultant of the force system shown in figure and locate the position of line of action of resultant along X-axis with origin at O. Also replace the resultant by an equivalent Force-couple system acting through 'A'		**10**
	b)	Determine the resultant of a system of forces as shown in Figure, acting on a 40 mm x 40 mm size plane lamina. Each grid is of size 10 mm X 10 mm. Also determine the x and y intercepts of the resultant.		**10**

			OR	
	2	a)	Determine the resultant of the three forces acting on the dam shown in Fig. and locate its intersection with the base AB. For good design, this intersection should occur within the middle third of the base. Does it? Note: 600 kN force is perpendicular to the inclined face of the dam.  	**10**
		b)	Three cylinders, A (radius 5.0cms, weight 20N), B (radius 6.0cms, weight 40N) and C (radius 4.0cms, weight 15N) are placed in a rectangular container of base width 18.0cms, as shown in Fig below (a) Draw the free body diagram of all the cylinders (b) Neglecting friction, determine the reactions at all the contact point.  	**10**
			UNIT - II	
	3	a)	Find the support reactions for beam shown below:  	**10**

		b)	Analyse the truss shown in Figure by the method of joints and indicate the member forces on a neat sketch of the truss.  	**10**
			UNIT - III	
	4	a)	The crate shown in Figure below has a mass of 580 kg. If P = 6000 N, find the magnitude of the frictional force which acts on the crate. What value of P will cause the crate to have impending motion up the plane? Find the minimum value of P required to keep the crate from sliding down the plane. For what range of value of P will the crate remain in the equilibrium position shown in the figure? Assume coefficient of friction as 0.25.  	**08**
		b)	A uniform ladder 4 m long weighs 200 N. It is placed against a wall making an angle of 60° with the floor as shown in Figure. The coefficient of friction between the wall and the ladder is 0.25 and that between the ground and the ladder is 0.35. The ladder in addition to its own weight, must support a man of 1000 N at the top at B. Calculate: (i) The horizontal force P to be applied to the ladder at the ground level to prevent slipping. (ii) If the force P is not applied, what should be the minimum inclination of the ladder with the horizontal, so that it does not slip with the man at the top?  	**12**

			UNIT - IV	
	5	a)	Locate the position of centroid for the area shown in figure. 	**12**
		b)	State Parallel & Perpendicular axis theorems and prove the Parallel axes theorem.	**8**
			UNIT - V	
	6	a)	State and explain D' Alemberts Principle	**04**
		b)	The motion of a particle along a straight line is defined by the relation $s = \frac{1}{3}t^3 - 36t$ Find (i) Average acceleration during 4^{th} second. (ii) The acceleration when it reverses its direction.	**06**
		c)	A bus of mass 10,000 kgs moving at 60 kmph is stopped by applying brakes in a distance of 40 metres. Determine the breaking force assuming it to be constant. Solve using D' Alemberts Principle	**10**
			OR	
	7	a)	Prove that the path traced by a projectile is parabolic. Also derive an expression for max. height and range of the projectile.	**08**
		b)	A projectile is aimed at a mark on a horizontal plane through the point of projection and falls 12 m short when the angle of projection is 15°, while it overshoots the mark by 24 m, when the angle of projection is 45°. Find the angle of projection to hit the mark. Assume no air resistance. Take the velocity of projection constant in all cases.	**12**

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