

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY (VSSUT), ODISHA

Mid Semester (even) Examination for session 2023-24

COURSE NAME: B. Tech

SEMESTER: 2nd

BRANCH NAME: (Section: D.E.F, H. I, J, K)

SUBJECT NAME: Engineering Mechanics

FULL MARKS: 30

TIME: 90 Minutes

Answer All Questions.

The figures in the right hand margin indicate Marks. Symbols carry usual meaning.

Q1

Answer all Questions.

2 × 3

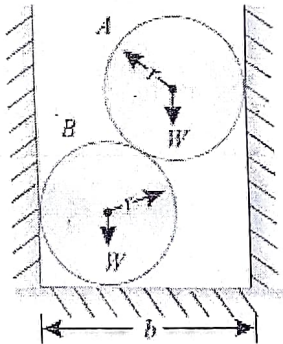
- a) Distinguish clearly between resolution of forces and composition of forces.
- b) Explain the statically indeterminate truss.
- c) Define coefficient of friction and limiting friction.

Q2

- a) Describe the stable equilibrium and unstable equilibrium
- b) Two smooth spheres of weight W and radius r each are in equilibrium in a horizontal channel of A and B vertical sides as shown in Fig. Find the force exerted at all contact points. Calculate these values, if $r = 250$ mm, $b = 900$ mm and $W = 100$ N.

2

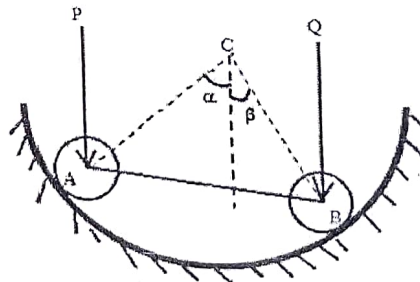
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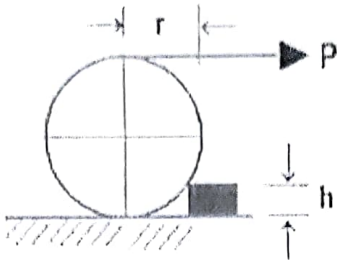
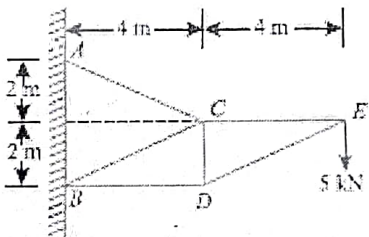
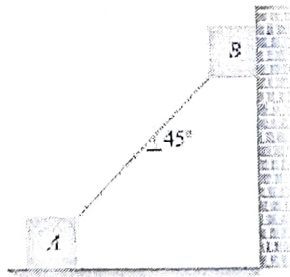


OR

Two rollers of weights " P " = 222.5N and " Q " = 445N are connected by a rigid bar at its ends & supported inside a circular ring in a vertical plane as shown in figure. The length of the bar " AB " is such that radii " AC " and " BC " form right-angle at center of the circular ring " C ". Neglecting friction and weight of the bar, find the compressive force in the bar " AB ". Assuming that the bar, AB makes $(\alpha - \beta)/2$ with the horizontal.

8



Q3			
	a)	State & prove Varignon's theorem.	2
	b)	A roller of weight 500 N has a radius of 120 mm and is pulled over a step of height 60 mm by a horizontal force P. Find magnitudes of P to just start the roller over the step.	6
		 <p>The diagram shows a circular roller of radius r on a horizontal floor. A horizontal force P is applied to the right at the top of the roller. A step of height h is shown to the right of the roller. The roller is just starting to lift off the floor as it moves over the step.</p>	
		OR	
		A ladder of length 4.4 m and weight 250 N is placed at one end on wall and other end is on floor. The ladder makes 65° with the floor. To prevent slipping of the ladder, a rope PC (horizontally) is tied with the wall. The point C is on the ladder and is 1.2 meter distance from its bottom. Using method of virtual work, determine the tension of rope.	8
Q4			
	a)	Explain the 'redundant constraints'	2
	b)	Determine the force in each member of the truss shown.	6
		 <p>The diagram shows a truss structure. Joint A is at the top left, supported by a pin. Joint B is at the bottom left, supported by a roller. Joint C is in the middle, and joint D is directly below it. Joint E is at the far right. A horizontal force of 5 kN is applied downwards at joint E. Dimensions: horizontal distance from A to C is 4 m, and from C to E is 4 m. Vertical distance from A to B is 2 m, and from B to D is 2 m. Members connect A-B, B-D, D-E, A-C, C-D, and C-E.</p>	
		OR	
		Two identical blocks of weight W are supported by a rod inclined at 45° with the horizontal as shown in Figure. If both the blocks are in limiting equilibrium, find the coefficient of friction, assuming it to be the same at floor as well as at wall.	8
		 <p>The diagram shows two identical blocks, A and B. Block A is on a horizontal floor, and block B is against a vertical wall. A rod is inclined at 45° to the horizontal, with one end at the bottom of block A and the other end at the top of block B.</p>	