ISLFM003A

Final Assessment Test – November 2018

VIT
Vellore Institute of Technology

Course: MEE1002 - Engineering Mechanics

Class NBR(s): 0655 / 0758 / 0786 / 0802 / 0808 / 0815 / 0827 / 0837 / 0842 / 0856

Slot:A1+TA1+V1

Time: Three Hours

Max. Marks: 100

General Instructions :

i) Draw neat diagram wherever required

ii) Make suitable assumption if needed

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. A container is supported by three cables that are attached to a ceiling as shown in figure 1. Determine the weight W of the container, knowing that the tension in cable AB is 6 kN.

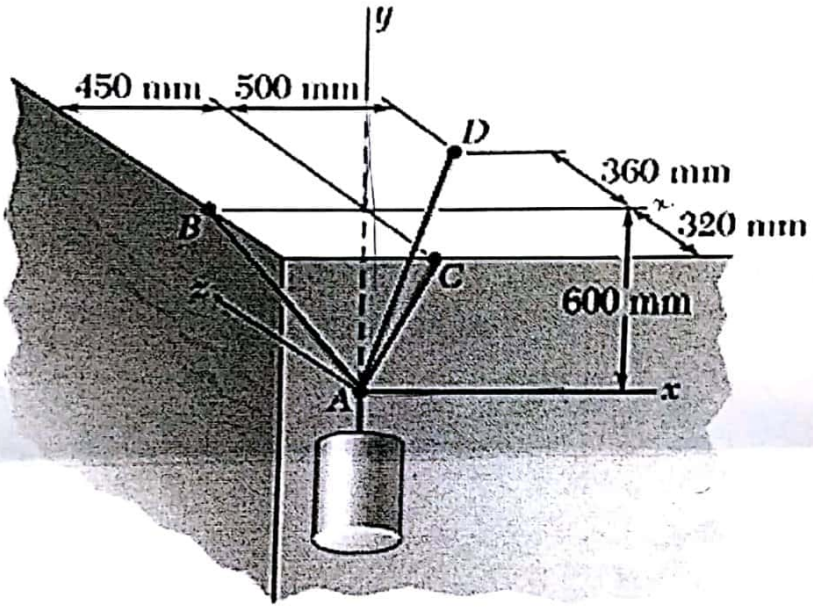

Figure 1

2. A single force P acts at C in a direction perpendicular to the handle BC of the crank shown in figure 2. Knowing that M_x = +20 Nm and M_y = - 8.75 Nm and M_z = - 30 Nm, determine the magnitude of P and the values of ϕ and θ.

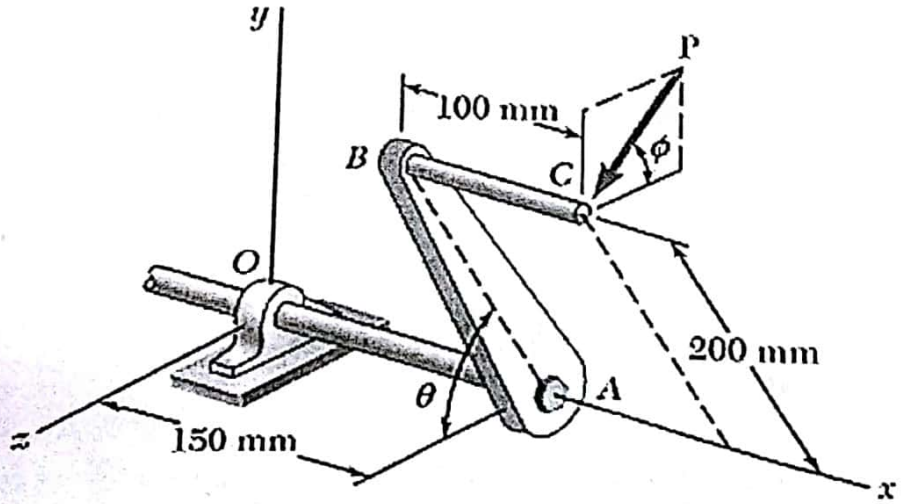

Figure 2

3. A machine component is subjected to the forces and couples shown in figure 3. The component is to be held in place by a single rivet that can resist a force but not a couple. For P =0, determine the location of the rivet hole if it is to be located (i) on line FG, (ii) on line GH.

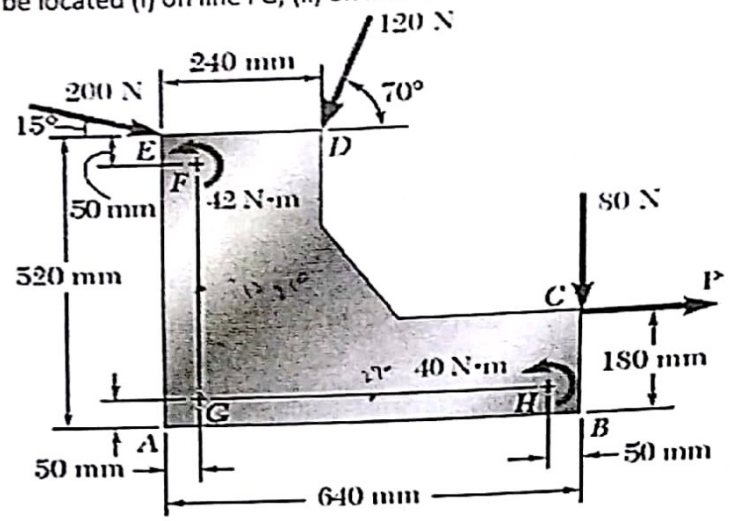

Figure 3

4. The truss shown in figure 4 is one of several supporting an advertising panel. Determine the internal forces of the members meeting at the joint 'E' of the truss for a wind load equivalent to the two forces of 800 N each shown at the joints D and E. State whether these members are in tension or compression.

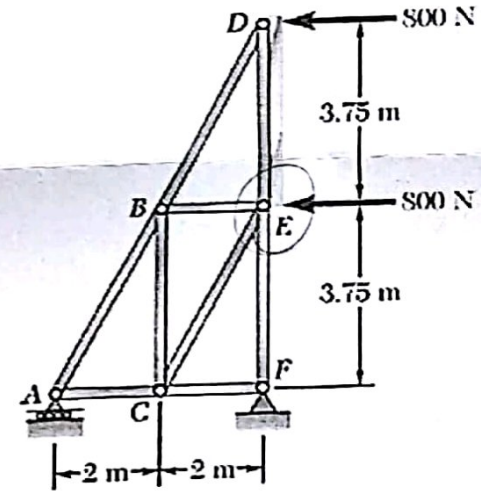

Figure 4

5. A 40 kg packing crate is pulled by a rope as shown in figure 5. The coefficient of static friction between the crate and the floor is 0.35. If α = 40 degrees, determine (i) the magnitude of the force P required to move the crate, (ii) whether the crate will slide or tip.

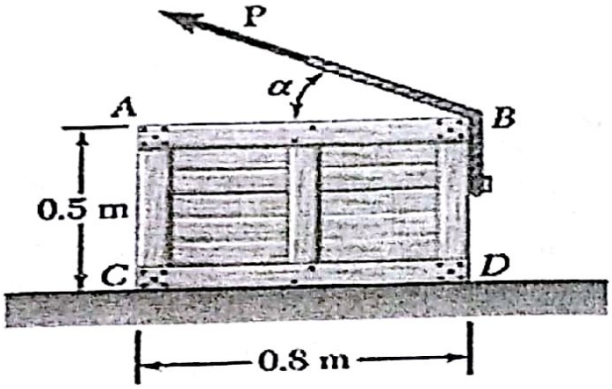

Figure 5

6. The frame for a sign is fabricated from thin, flat steel bar stock of mass per unit length 4.73 kg/m. The frame is supported by a pin at C and by a cable AB as shown in figure 6. Determine (i) the tension in the cable, (ii) the reaction at C.

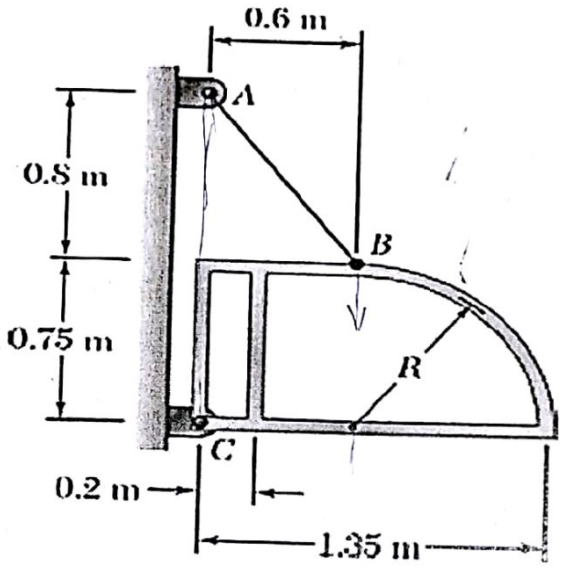

Figure 6

7. For the area indicated in figure 7, determine the orientation of the principal axes at the origin 'C' and the corresponding values of the moments of inertia.

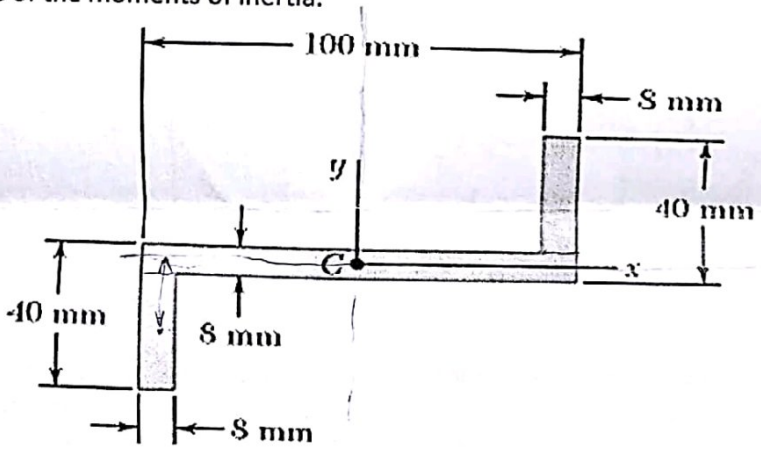

Figure 7

8. Derive an expression for the magnitude of the couple M required to maintain the equilibrium of the linkage shown in figure 8 applying method of virtual work.

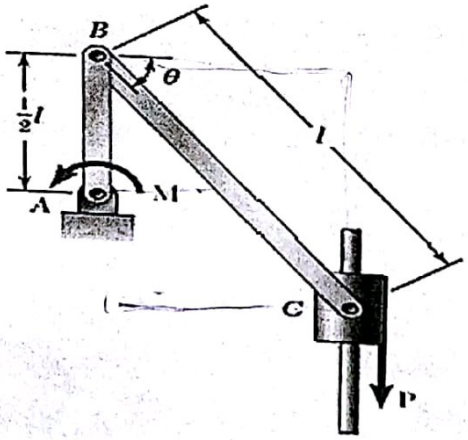

Figure 8

9. A helicopter is flying with a constant horizontal velocity of 180 km/h and is directly above point A when a loose part begins to fall. The part lands 6.5 sec later at point B on an inclined surface. Determine (i) the distance 'd' between points A and B, (ii) the initial height 'h'.

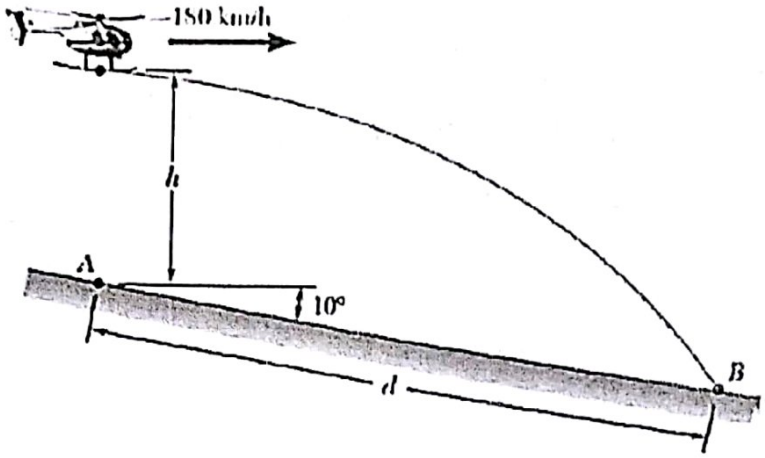

Figure 9

10. Knowing that at the instant shown in figure 10 the angular velocity of rod AB is 15 rad/s clockwise, determine (i) the angular velocity of rod BD, (ii) the velocity of the midpoint of rod BD.

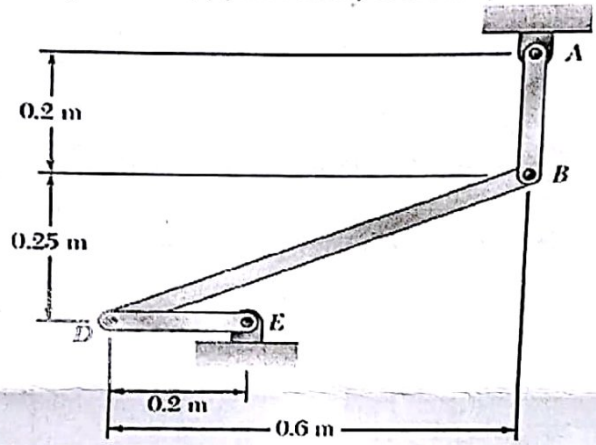

Figure 10

11. To transport a series of bundles of shingles A to a roof, a contractor uses a motor-driven lift consisting of a horizontal platform BC which rides on rails attached to the sides of a ladder. The lift starts from rest and initially moves with a constant acceleration a_1 as shown in figure 11. The lift then decelerates at a constant rate a_2 and comes to rest at D, near the top of the ladder. Knowing that the coefficient of static friction between a bundle of shingles and the horizontal platform is 0.3, determine the largest allowable acceleration a_1 and the largest allowable deceleration a_2 if the bundle is not to slide on the platform.

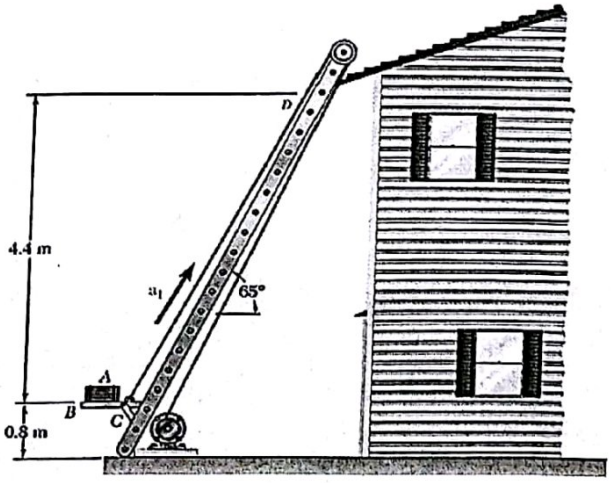

Figure 11

The double pulley shown in figure 12 has a mass of 15 kg and a centroidal radius of gyration of 160 mm. Cylinder A of 5 kg and block B of 15 kg are attached to cords that are wrapped on the pulleys as shown. The coefficient of kinetic friction between block B and the surface is 0.2. Knowing that the system is at rest in the position shown when a constant force P = 200 N is applied to cylinder A, determine the velocity of cylinder A as it strikes the ground.

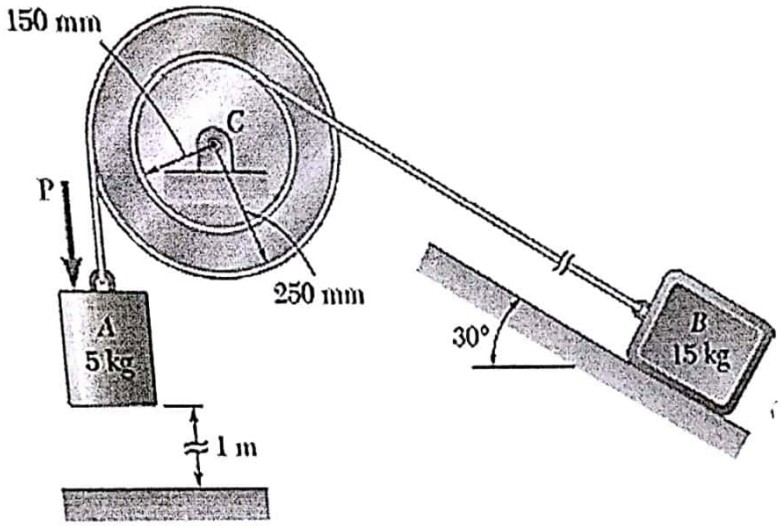

Figure 12

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