VIT
Vellore Institute of Technology

Final Assessment Test – April 2019

Course: MEE1002 - Engineering Mechanics
Class NBR(s): 2145 / 5630
Time: Three Hours

Slot: A1+TA1+V1
Max. Marks: 100

Answer any TEN Questions
(10 X 10 = 100 Marks)

1. Three cables are connected at *A*, where the forces **P** and **Q** are applied as shown in Fig.1. Knowing that *Q* = 0, find the value of *P* for which the tension in cable *AD* is 305 N.

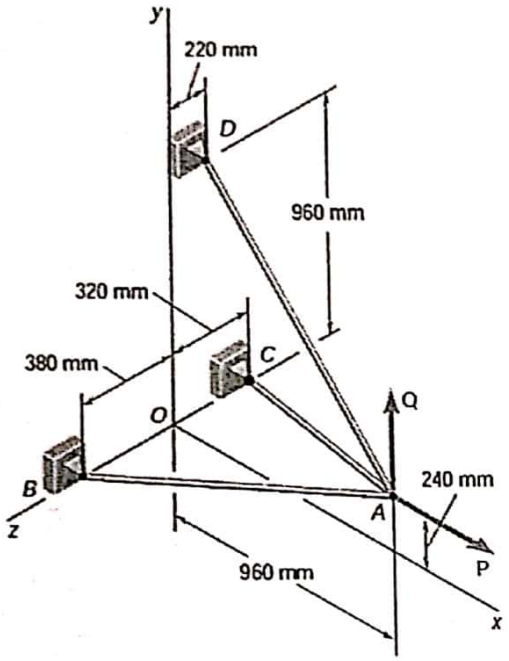

Fig.1

2. Replace the two forces and single couple for Fig.2 by an equivalent force-couple system at point **A.**

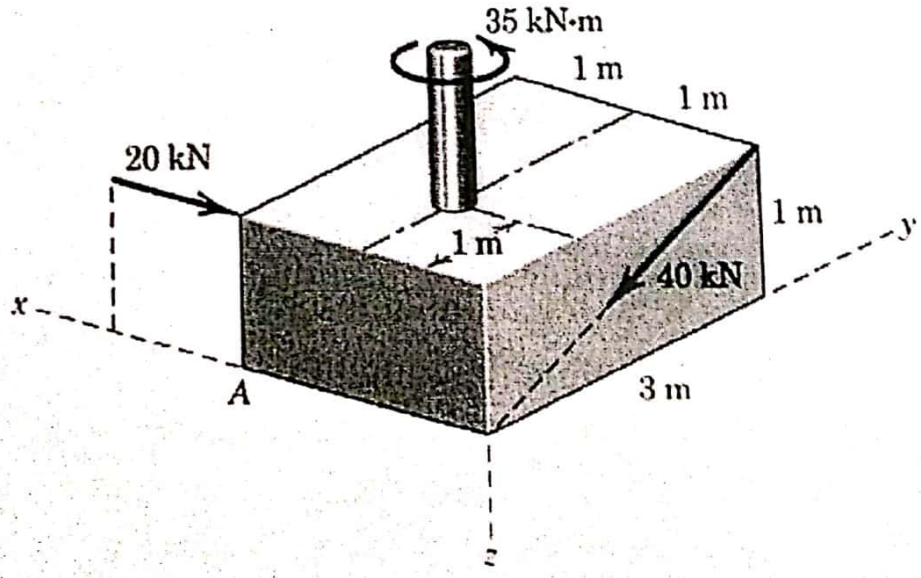

Fig.2

3. For the frame and loading shown in Fig.3, determine the components of all forces acting on member ABC 6.

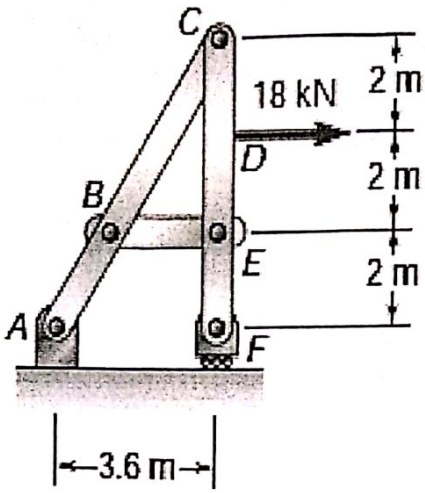

Fig.3

4. Determine the force in each member of the Fink roof truss shown in Fig.4.

State whether each member is in tension or compression

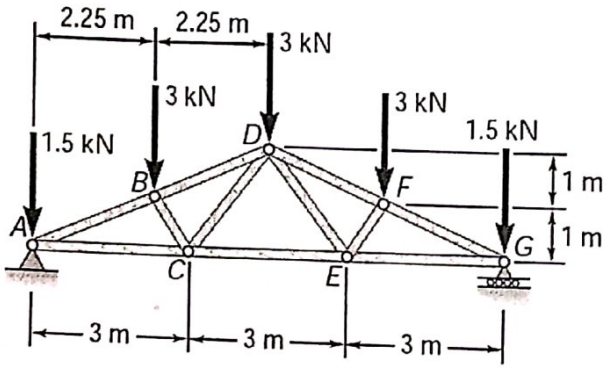

Fig.4.

5. Two blocks are placed on the incline with the cable taut as shown in Fig.5.

a) Determine the force P required to initiate motion of the 15 kg block if P is applied down the incline.

b) If P is applied up the incline and slowly increased from zero, determine the value of P which will cause motion and describe the motion?

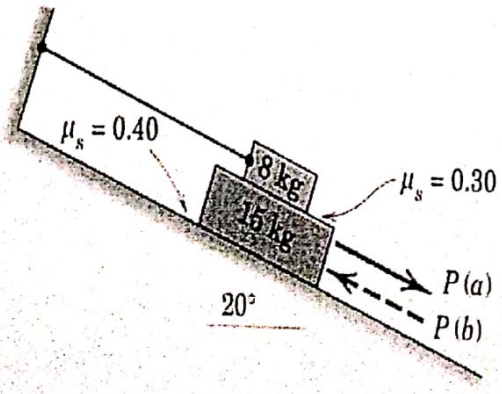

Fig.5.

6. Determine the range of cylinder mass m for which the system is in equilibrium as in Fig.6. The co-efficient of friction between the 50 kg block and the incline is 0.15 and that between the cord and cylinder support is 0.25

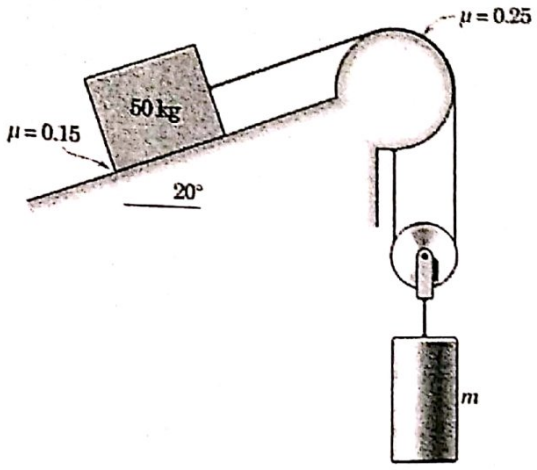

Fig.6.

7. Calculate the moment of inertia and radius of gyration about the x-axis for the shaded area shown in Fig.7.

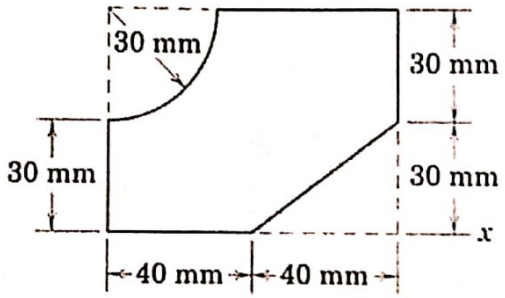

Fig.7.

8. Calculate the maximum and minimum moments of inertia of the structural angle as shown in Fig.8 about axes through its corner A and find the angle α measured counter clockwise from the x-axis to the axis of maximum moment of inertia. Neglect the small radii and fillet.

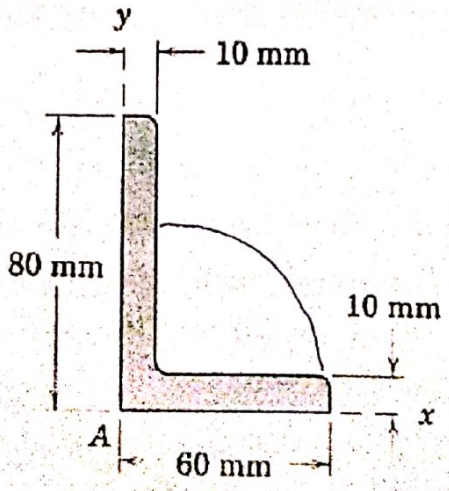

Fig.8.

9. For the mechanism shown in Fig.9, the Spring Constant k is unstreched when $\theta = 0$. Derive an expression for the force P required to deflect the system to and angle θ. The mass of the bars is negligible.

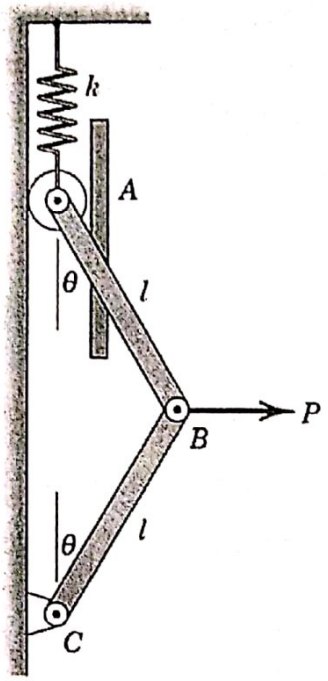

Fig.9

10. A tennis player serves the ball at a height $h = 2.5$ m with an initial velocity of V_o at an angle of 5° with the horizontal. Determine the range of V_o for which the ball will land in the service area that extends to 6.4 m beyond the net as shown in Fig.10

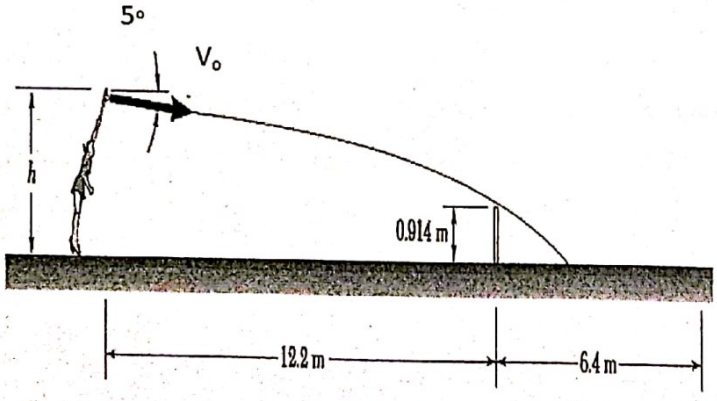

Fig.10

11. A spring is used to stop a 60-kg package which is sliding on a horizontal surface as shown in Fig.11. The spring has a constant $k = 20$ kN/m and is held by cables so that it is initially compressed 120 mm. Knowing that the package has a velocity of 2.5 m/s in the position shown and that the maximum additional deflection of the spring is 40 mm, determine (*a*) the coefficient of kinetic friction between the package and the surface, (*b*) the velocity of the package as it passes again through the position shown.

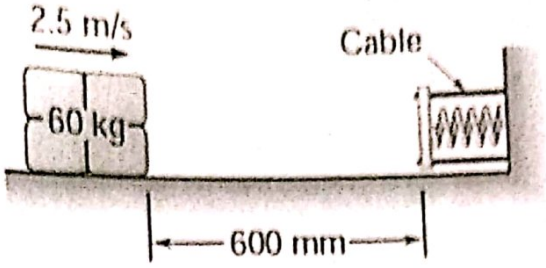

Fig.11

12. A 60-mm-radius drum is rigidly attached to a 100-mm-radius drum as shown in Fig.12. One of the drums rolls without sliding on the surface shown, and a cord is wound around the other drum. Knowing that end *E* of the cord is pulled to the left with a velocity of 120 mm/s, determine (*a*) the angular velocity of the drums, (*b*) the velocity of the center of the drums, (*c*) the length of cord wound or unwound per second.

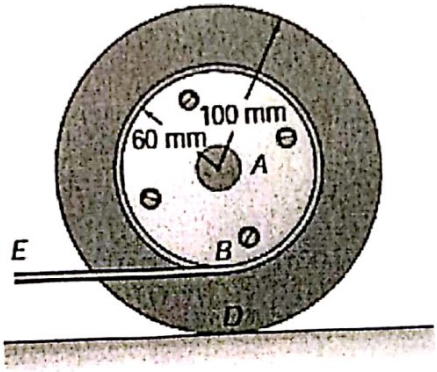

Fig.12

⇔⇔⇔