B.E.INSTRUMENTATION AND ELECTRONICS ENGINEERING FIRST YEAR FIRST SEMESTER EXAM - 2019(OLD)

ENGINEERING MECHANICS- I

Time : 3 hours Answer any Eight [8] questions All questions carry equal marks Full Marks-100

1. a) Given that the forces $P=4i-2j+3k$, $Q=2i+4j+5k$ and $R=7i-j+xk$. Determine the value of x for which the forces will be coplanar.

b) The 30-N force P is applied perpendicular to the portion BC of the bent bar. Determine the moment of P about point B and about point A. (Fig-1)

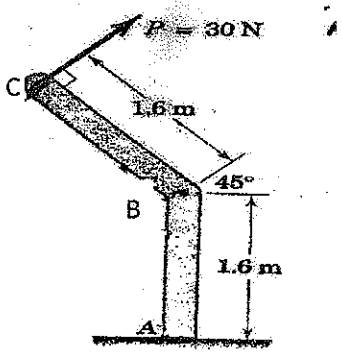

Fig-1

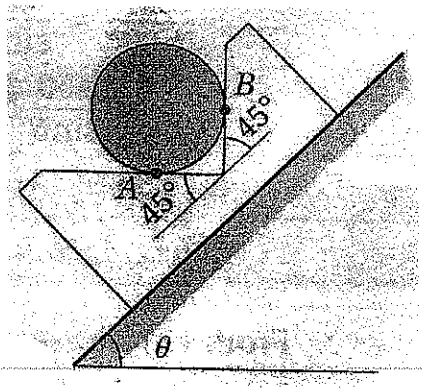

Fig-2

2.a) Find the angle of tilt θ with the horizontal so that the contact force at B will be one -half that at A for the smooth cylinder(Fig-2)

b) State and prove Lami's theorem.

3.a) Determine the force P required to being rolling the uniform cylinder of mass m over the obstruction of height h.(Fig-3)

b) For the parking brake lever of prob. Fig-4, the force-couple system at o equivalent to the force F is known to consist of a 40-N force and a counterclockwise couple with a moment of 12 N.m. Determine the location x of the force F.

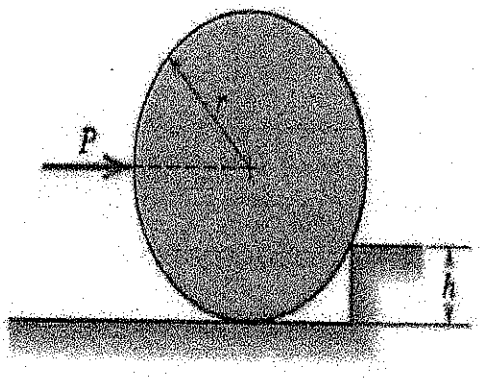

Fig-3

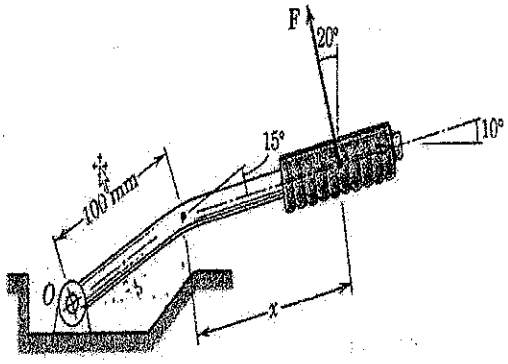

Fig-4

4.a)The tension in the supporting cable AB is 10 KN. Write the force which the cable exerts on the boom BC as a vector T. Determine the angles θ_x, θ_y, θ_z which the line of action of T forms with the position *x*-, *y*-, *z*-axes.(Fig-5)

b) Two forces (X+Y) and (X-Y) make angle 2α with one another, and their resultant makes an angle θ with the bisector of the angle between them. Prove that, $X \tan\theta = Y \tan\alpha$.

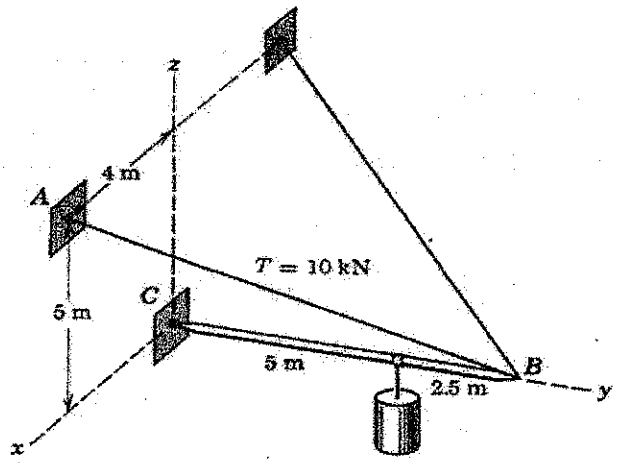

Fig-5

5. a) Find the co-ordinate of the centroid of the shaded area as shown in Fig-6.

b) State the law of friction. What are the angle of friction and angle of repose? Derive the relation between these two angles.

6. a) Find the location of the centroid of the composite area(Fig-7).

b) Derive the relation of the vector components if the co-ordinate of the system rotates θ with respect to Z axis?

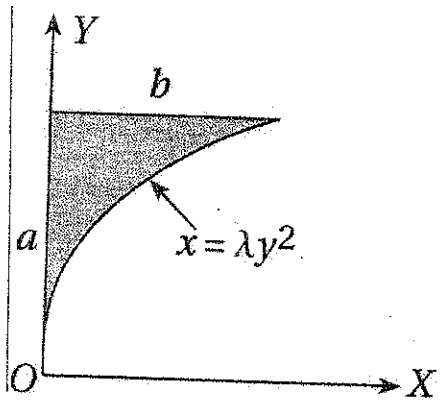

Fig-6

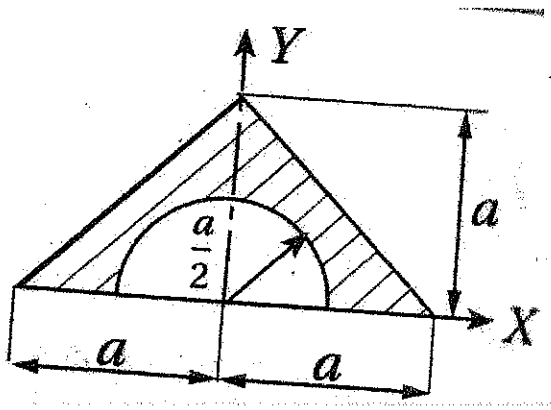

Fig-7

7. Find the moment of Inertia of the L section about K-K axis

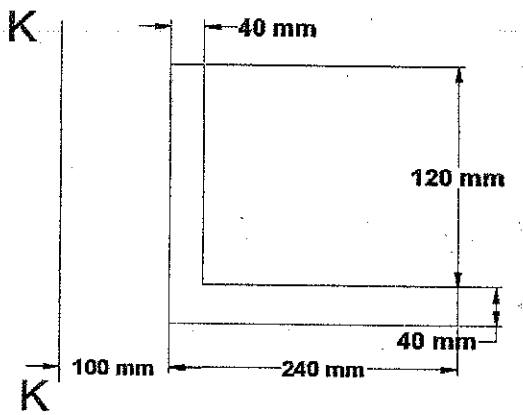

Fig-8

8. W_1=200 N,W_2=50 N, μ=0.3(all contact surfaces), Find the necessary P to impend slipping.(Fig-9)

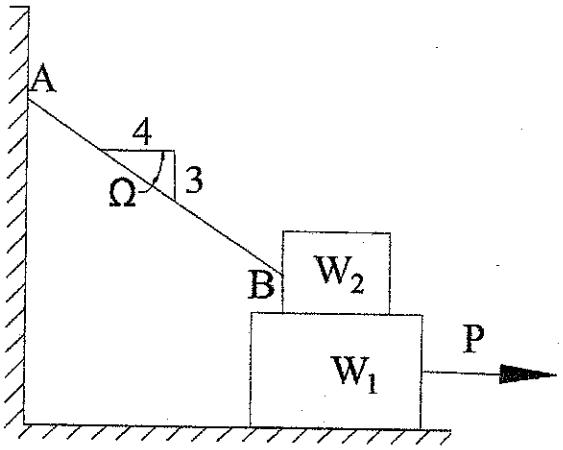

Fig-9

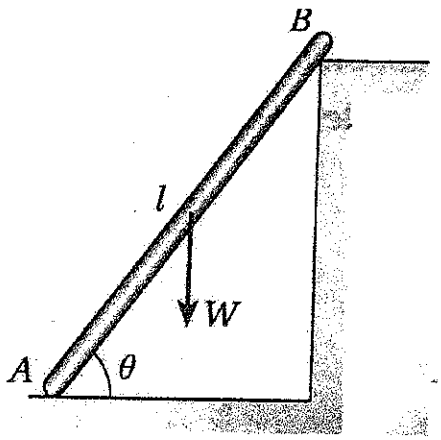

Fig-10

9. A uniform rod AB of weight W is held in equilibrium as shown (Fig-10). Find the greatest angle θ it can make with horizontal so the rod does not slip. Assume μ to be static friction coefficient for all contact surfaces.

10.a) The uniform 15-m pole has a mass of 150 kg and is supported by its smooth ends against the vertical walls and by the tension T in the vertical cable. Compute the reactions at A and B.(Fig-11).

b) The pin at A can support a maximum force of 3.2 kN. What is the corresponding maximum load L which can be supported by the bracket? (Fig-12).

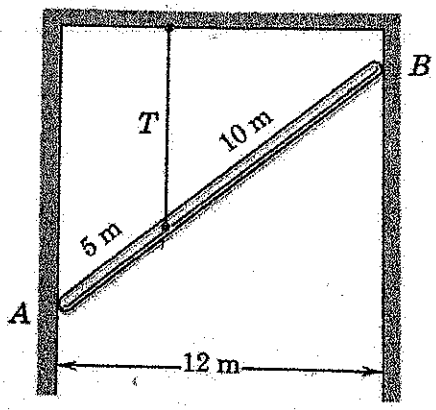

Fig-11

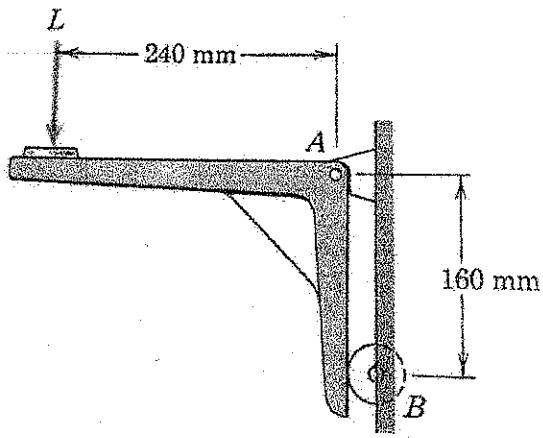

Fig-12