B.E. CONSTRUCTION ENGINEERING FIRST YEAR FIRST SEMESTER SUPPLEMENTARY EXAM - 2018

**ENGINEERING MECHANICS- I** **Time : 3 hours** **Full Marks-100**

**Answer any Eight [8] questions**

1. a) Derive the relation of the vector components if the co-ordinate of the system rotate θ with respect to X axis?

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)

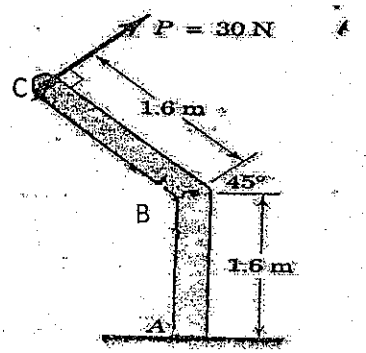



Fig-1

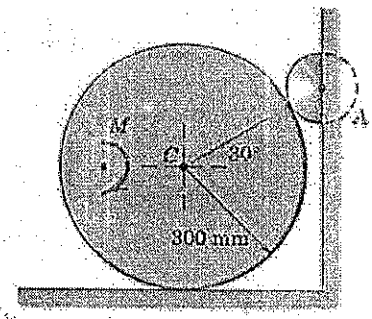



Fig-2

2.a) The 100-kg wheel rests on a rough surface and bears against the roller A when the couple $M$ is applied. If $M = 60$ N· m and the wheel does not slip, compute the reaction on the roller A.

b) State and prove Varignon'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.

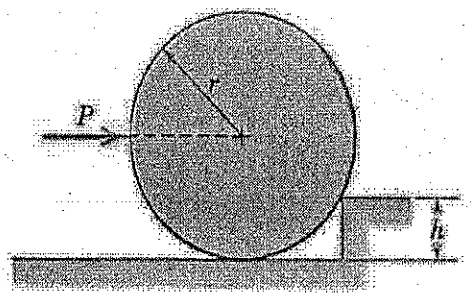



Fig-3

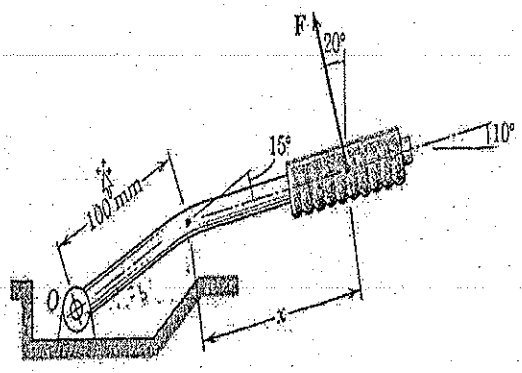
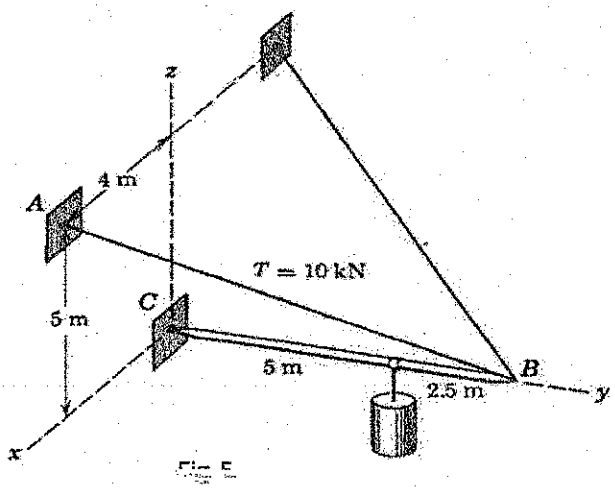



Fig-4

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 $\theta_x$, $\theta_y$, $\theta_z$ which the line of action of T forms with the position *x*-, *y*-, *z*-axes.(Fig-5)

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




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

b) A force F= 400N acting from A(3,2,-5) to B(6,-2,5).Find out the force vector.

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

b) Discuss about the effect of equal vector .

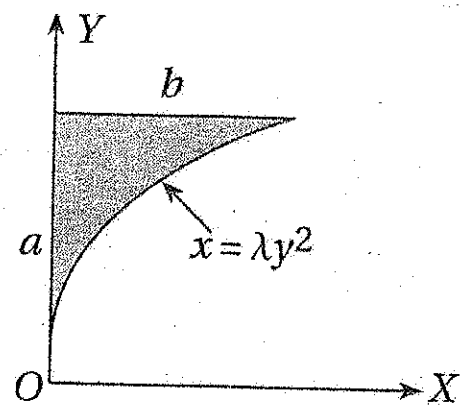



Fig-6

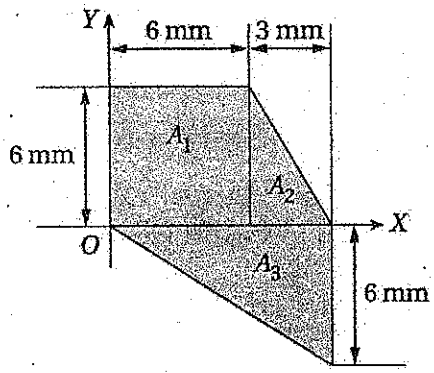
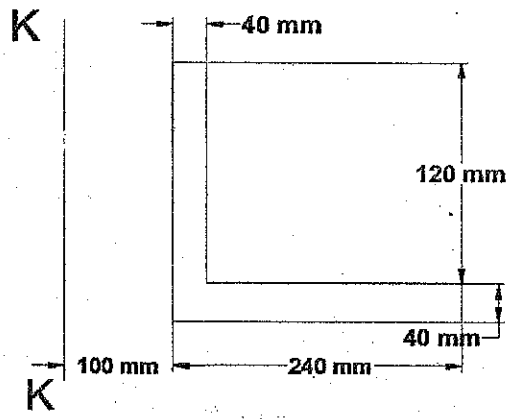
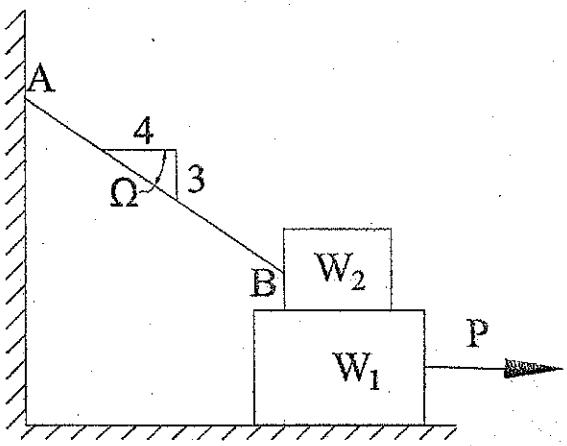



Fig-7




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)

9. 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 beam ABCD has overhangs at each end and carries a uniform load of intensity q. For what ratio b/L, will the bending moment at the midpoint of the beam be zero, shown in Fig-10.

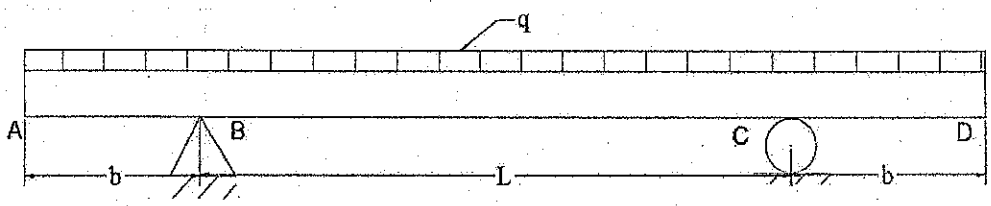



Fig-10

10. Draw the shear force and bending moment diagram of the following figure.

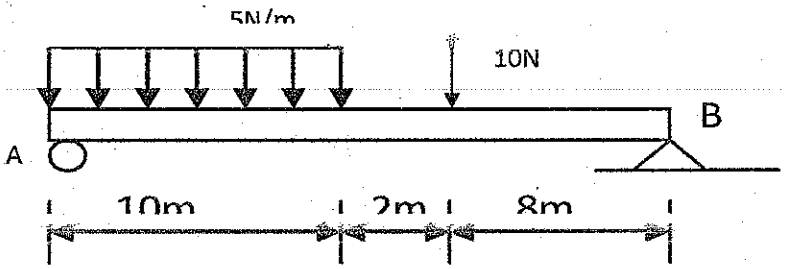



Fig-11

11. Determine the forces on each member by method of joint(Fig-12).

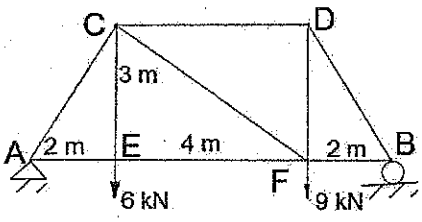



Fig-12