Fig. 3

Fig. 4

2 **Attempt any two parts of the following:** **(10x2=20)**

(a) An overhanging beam is shown in Fig.5. Determine shear force and bending moment at distances of 3.5 m and 4.5 m from the left support. Find the position and magnitude of maximum bending moment.

(b) A simply supported beam of span 6 m is subjected to a concentrated moment of 2000 N-m at a distance of 4 m from left (hinged support). Draw the Shear force diagram and bending moment diagram for the beam.

(c) Determine the force in members FE, FC and BC of the truss shown in Fig. 6.

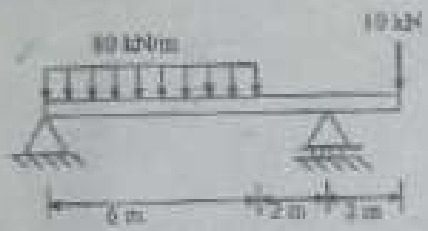

Fig. 5

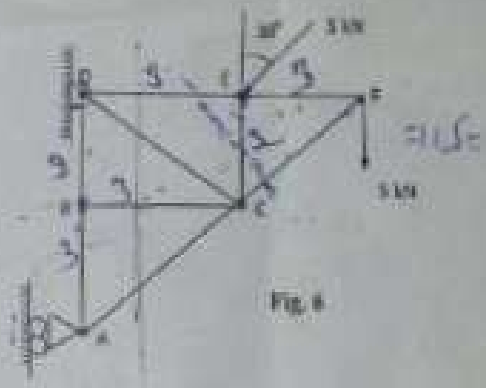

Fig. 6

3 **Attempt any two parts of the following:** **(10x2=20)**

(a) Derive the expression for mass moment of inertia of a hollow cylinder of mass M, inner radius r and outer radius R about its axis.

(b) A triangle is removed from a semicircle as shown in the fig. 7. Locate the centroid of remaining area.

(c) Find the moment of inertia of T section as shown in fig. 8 about the centroidal xx and yy axis. All dimensions are in mm x-axis is parallel to the flange width.

Fig. 7

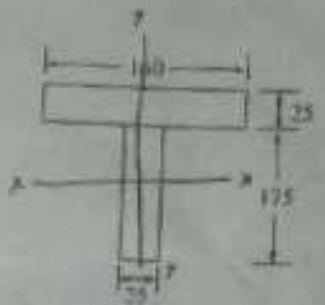

Fig. 8

4. **Attempt any two parts of the following:** **(10x2=20)**

(a) A particle describes a path $y = 5.4\ x^3$, where x and y are in meters. The particle has constant velocity 3 m/s along x-axis. Determine the x and y components of displacement, velocity and acceleration in terms of time, if the particle is at the origin at the start of the motion.

(b) A bullet moving at a rate of 60 m/s is fired into a thick target which it penetrates to the extent of 15 cm. If fired into a target 7.5 cm thick with equal velocity, with what velocity would it emerge supposing the resistance to be uniform and the same in both cases?

(c) A particle is moving along the path whose equation is r=4.0 m. If the angle $\theta = t^3$ rad, determine the velocity and acceleration of the particle when $\theta = \pi/4$ rad.

5. **Attempt any two parts of the following:** **(10x2=20)**

(a) Through principle of virtual work, determine the vertical force that must be applied at D to maintain the equilibrium of the system of forces shown in fig. 9.

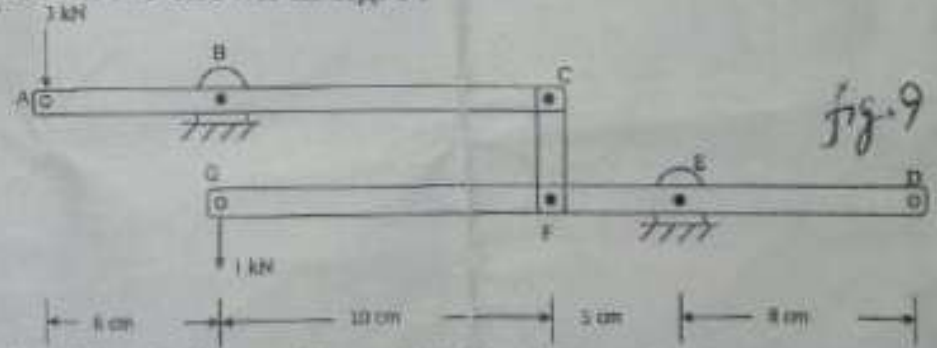

Fig. 9

(b) Two pin joined bars AB and AC of length 3 m are held on frictionless plane by a rope EF as shown in Fig. 10. The distance of rope from pin A is 1 m. If $\theta = 30^0$, find the tension in the rope EF.

Printed pages: 4

K. N. I. T., SULTANPUR

(Paper code and roll No. to be filled in your answer book)

Paper code: KME-202

Roll No. 1 5 5 0 2

B.Tech. (Main & COP)
Second Semester Examination, 2015-16
Engg. Mechanics

Time: 3 Hours **Total Marks: 100**

Note: Attempt all questions. Assume missing data if any.

1. Attempt any four parts of the following: **(5x4=20)**

(a) A simply supported beam of span 5 m supports a single concentrated load of 15 kN. How far from the left support should the 15 kN load be placed so that the left reaction is 6 kN? Neglect the weight of the beam.

(b) If P_1 and the 600 N force as shown in the fig. 1 sum vectorially to P_T, determine the P_1 and P_T.

(c) Establish the relationship between number of members and number of joints for a perfect truss.

(d) A beam is loaded as shown in the fig 2. Determine the shear force at (i) 5 m (ii) 12 m and (iii) 30 m from left support.

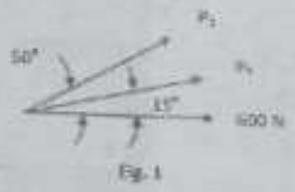

Fig. 1

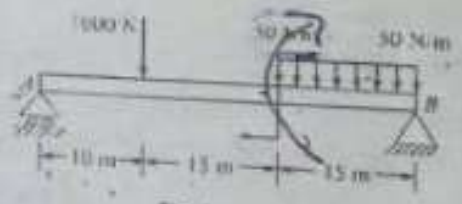

Fig. 2

(e) A force P is applied horizontally on a body kept on an inclined plane (Fig. 3). If coefficient of friction between body and plane is 0.4, find the value of P required to prevent the downward motion of the body. The weight of the body is 50N.

(f) A rope is wrapped for 2.5 turns around the fixed drum as shown in Fig. 4. At one end of the rope; a force of 300 N is applied. The other end of the rope supports a load W. Determine the value of W if the belt is about to slip in counter clockwise direction. The coefficient of friction is 0.3.