NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

ZZ1001 ENGINEERING MECHANICS

End Semester Examination **Winter Semester 2013-14**

Time: **3 hrs** Max Marks: **50**

1. Find the reactions at the supports *A* and *B* of the frame shown in Fig. 1. [5]

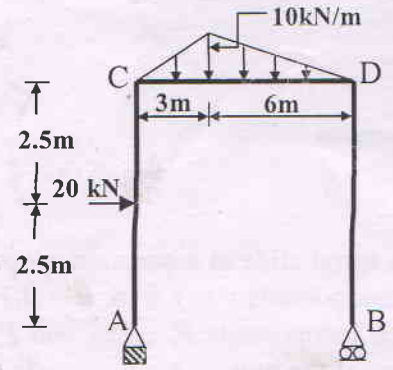

Fig. 1

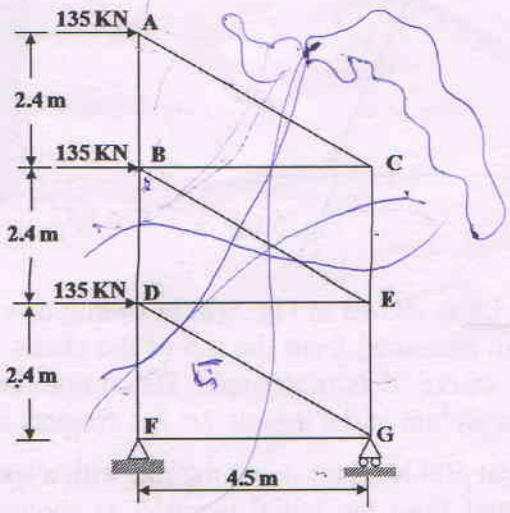

Fig. 2

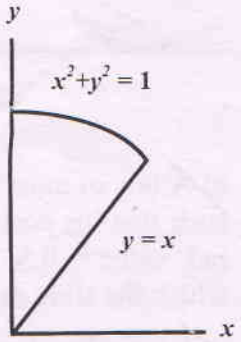

Fig. 3

2. For the truss as loaded in Fig. 2, find the forces in the members *BD*, *BE* and *DE* using method of sections. Tabulate the results indicating the nature. [5]

3. Determine the coordinates of the centroid of the area shown in Fig. 3. The area is bounded by the circle $x^2 + y^2 = 1$, straight line $y = x$, and the y axis. (Hint: Use polar co-ordinates). [5]

4. a) At any instant the horizontal position of the weather balloon shown in Fig. 4 (a) is defined by $x = 8t$ m, where t is in seconds. If the equation of the path is $y = x^2/10$, determine the magnitude and direction of the velocity and the acceleration when $t = 2$ s. [5]

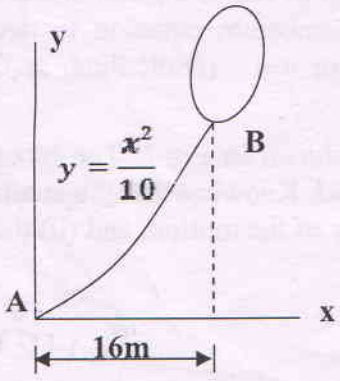

Fig. 4 (a)

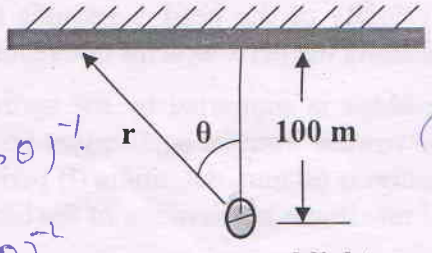

Fig. 4 (b)

b) The searchlight in Fig. 4 (b) casts a spot of light on the face of a wall that is located 100 m from the searchlight. Determine the magnitudes of the velocity and acceleration at which the spot appears to travel on the wall at the instant $\theta = 45°$. The searchlight rotates at a constant angular speed of $\dot{\theta} = 4$ rad/s. (The spot is moving in the $r\theta$ plane. i.e., z = 0). [5]