B.Tech. Civil (Construction Management) /
B.Tech. Civil (Water Resources Engineering)

Term-End Examination

June, 2007

ET-202(A) : ENGINEERING MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of calculator is allowed.*

1. (a) Determine the magnitude and direction of the resultant of the following set of forces acting on a body as shown in Figure 1.

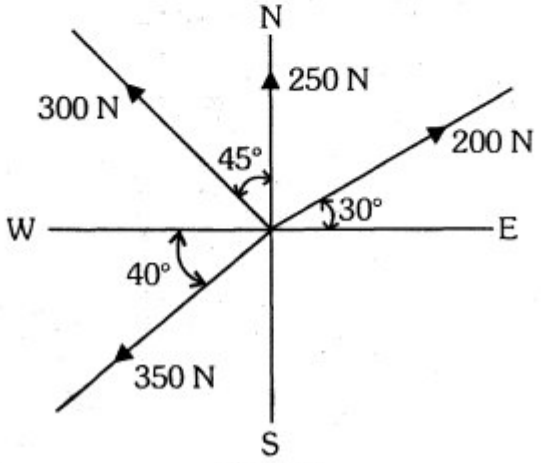

Figure 1

(b) Calculate the tensile force in the cables AB and BC as shown in Figure 2. Assume the pulleys to be frictionless.

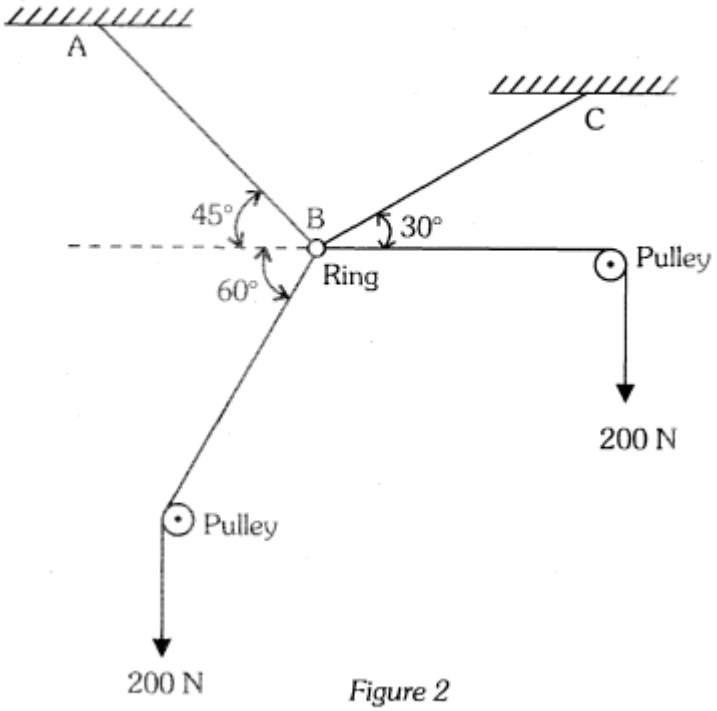

Figure 2

7+7

2. (a) A beam AB of span 8 m is hinged at A and is on rollers at B. It carries a uniformly distributed load, and two concentrated loads at points C and D as shown in Figure 3. Determine the reactions at A and B for the loading shown.

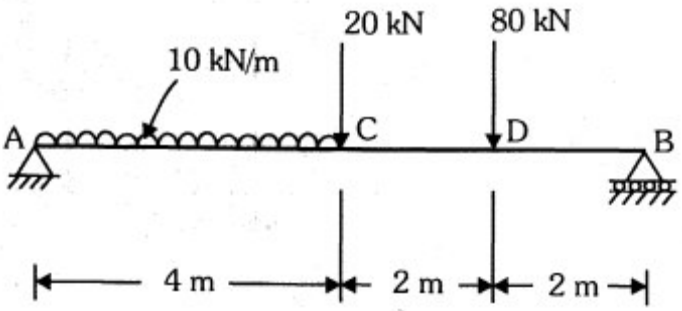

Figure 3

(b) Determine the forces in each member of the cantilever truss loaded as shown in Figure 4.

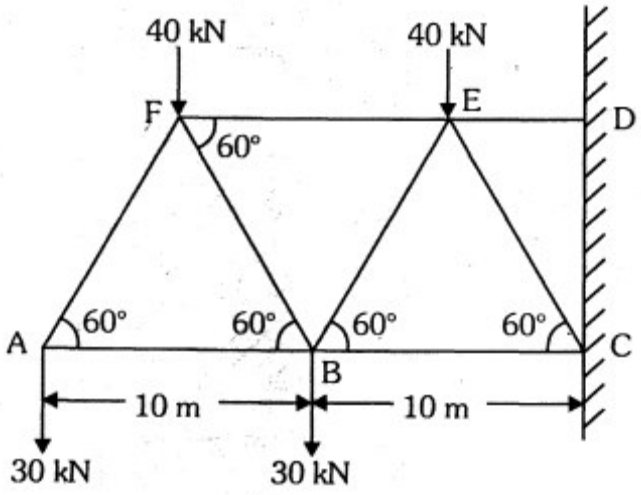

Figure 4

5+9

3. (a) Locate the centroid of the area as shown in Figure 5 with respect to the axes indicated in the figure.

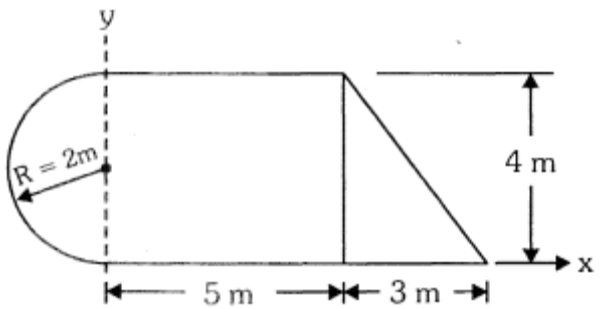

Figure 5

(b) Determine the moment of inertia of the area shown shaded in Figure 6, about axis xx which coincides with the base edge AB.

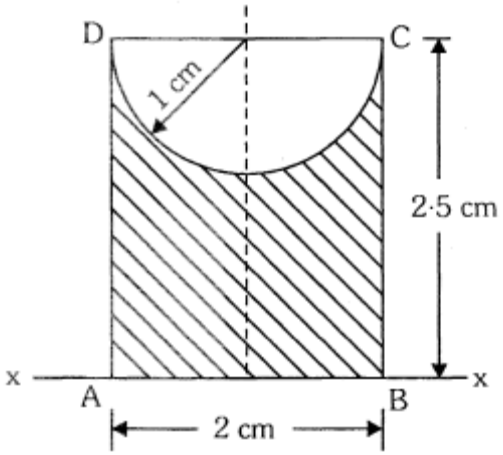

Figure 6

7+7

4. (a) A body of weight 100 N rests on a rough horizontal surface (μ = 0·30) and is acted upon by a force applied at an angle of 30° to the horizontal as shown in Figure 7. What force is required to just cause the body to slide over the surface ? Also determine the inclination and magnitude of minimum force required to set the block into impending motion.

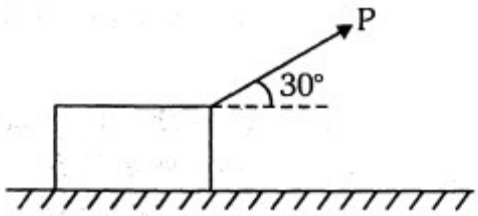

Figure 7

(b) Construct the shear force and bending moment diagram for the cantilever beam loaded as shown in Figure 8.

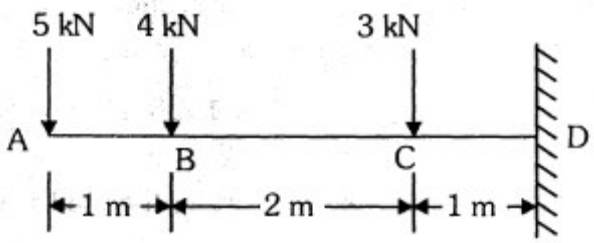

Figure 8

7+7

5. (a) A particle moves along a straight line and its motion is represented by the equation

$$s = 16t + 4t^2 - 3t^3$$

where s is in metres and t is in seconds.
Determine

(i) Displacement and acceleration when velocity is zero.

(ii) Displacement and velocity when acceleration is zero.

(b) A projectile is fired with an initial velocity of 200 m/s to hit a target located 500 m above the level of gun point and at a horizontal distance of 3000 m. Neglecting the air resistance, determine the firing angle. 7+7

6. (a) A ball of mass 2 kg moving with a velocity of 3 m/s impinges directly on a ball of mass 4 kg at rest. After impact the 2 kg mass ball comes to rest. Determine the velocity of the 4 kg ball after striking and the coefficient of restitution between the two balls.

(b) A lift carrying a load of 1000 N is moving with uniform acceleration of 2·5 m/s^2. Calculate the tension in the cable supporting the load when

(i) lift is moving upward, and

(ii) lift is moving downward. 7+7