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

Term-End Examination

June, 2008

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 minimum value of force P required so that the cylinder is just on the point of riding over the step which is 250 mm high as shown in Figure 1. The diameter of the cylinder is 1 m and its weight is 1000 N.

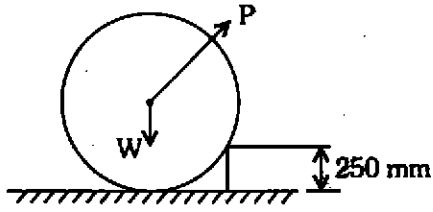

Figure 1

(b) Determine the reactions at the supports A and E for the beam loaded as shown in Figure 2.

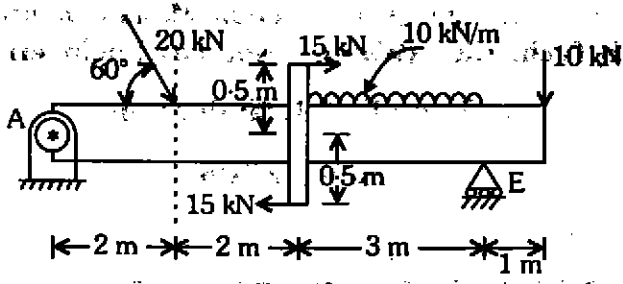

Figure 2

2×7=14

2. (a) A cylinder weighing 400 N is resting over two semi cylinders as shown in Figure 3. The semi cylinders weigh each 100 N. The radius of semi cylinders is 200 mm each and that of cylinder is 500 mm. Determine the minimum coefficient of friction required between semi cylinders and ground to maintain equilibrium.

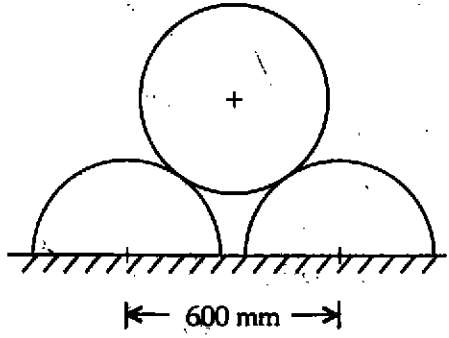

Figure 3

(b) Determine area moment of inertia of a T-section about its centroidal axis as shown in Figure 4.

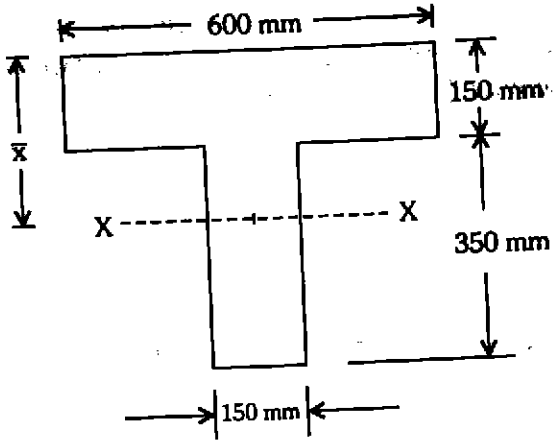

Figure 4 2×7=14

3. (a) Explain 'Simple Harmonic Motion'. A ship 'A' moves with a velocity of 50 kmph from the south to north and another ship 'B' moves from west to east at a velocity of 60 kmph. Find the velocity of B as it appears to an observer on the ship A.

(b) A bullet weighing 0·08 N is fired horizontally with a velocity of 100 m/s. The bullet hits a wooden block weighing 5 N. The block offers a resistance of 204 N during penetration of bullet. Determine by how much distance the bullet penetrates when

(i) block is held firmly

(ii) the block is free to move on the plane surface which has coefficient of friction 0·15. 6+8=14

4. (a) A mass of 5 kg rests at the top of a cylinder as shown in Figure 5. The mass slides over the surface of the cylinder. At which angle from the vertical diameter will the mass leave the surface of the cylinder ? The radius of the cylinder is 1 m.

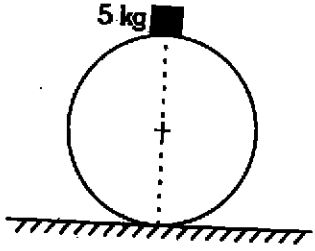

Figure 5

(b) A solid cylinder and a thin cylinder have equal masses which is 200 kg for each. They are connected together by means of rods on sides as shown in Figure 6. They roll freely without slipping down the inclined plane. Assuming frictionless bearing, calculate total force in the rods.

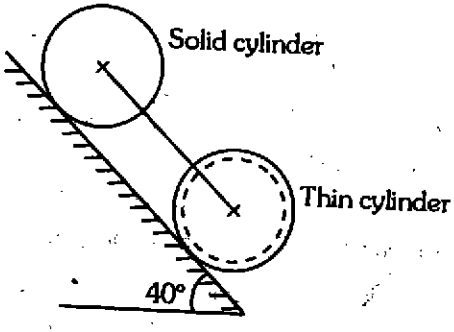

Figure 6

6+8=14

5. (a) A beam ABC is simply supported at A and B as shown in Figure 7. The length of the beam is 6 m. It carries a uniformly distributed load of intensity 10 kN/m for the full length. Find the value of maximum B.M. in the beam.

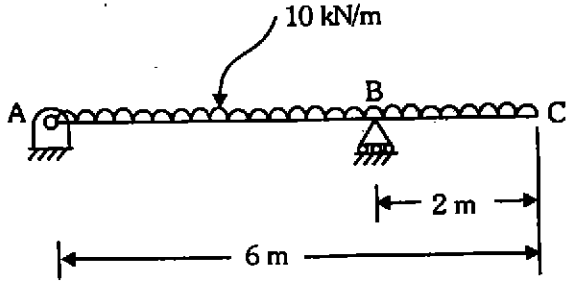

Figure 7

(b) Determine the magnitude and the nature of the forces in all the members of the truss shown in Figure 8.

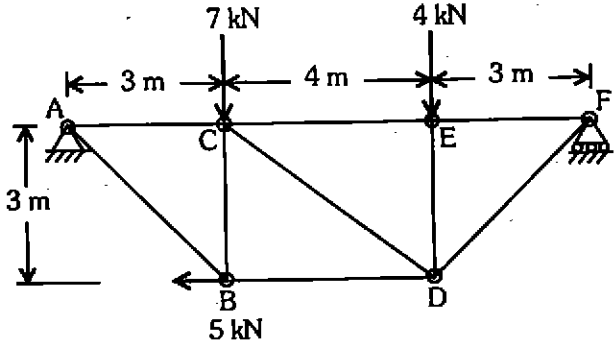

Figure 8

6+8=14

6. (a) A steel rod circular in section tapers from 4 cm diameter to 6 cm in diameter in a length of 1 m. Find out the increase in length of the bar under a concentric pull of 40 kN. Assume $E = 2{\cdot}1 \times 10^4$ kN/cm^2.

(b) A rod of variable cross-section built in at one end is subjected to the axial forces as shown in Figure 9. Find maximum normal stress.

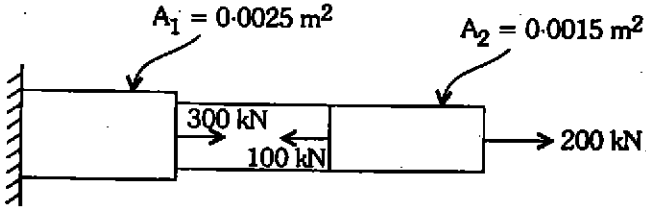

Figure 9

7+7=14

7. (a) A stone is thrown vertically upwards with a velocity of 19·6 m/s from the top of a tower 49 m high. Calculate

(i) Time required for the stone to reach the ground.

(ii) Velocity of the stone in its downward travel at the level of the point of projection.

(iii) The maximum height to which the stone will rise in its flight.

(b) A vehicle of mass 800 kg and moving with a velocity of 14 m/s strikes another vehicle of mass 500 kg moving at 10 m/s in the same direction. Both the vehicles get coupled together after the impact. Find the common velocity with which the two vehicles will move. Also find the loss of kinetic energy due to impact. *2×7=14*

8. (a) Two forces act at an angle of 120°. The bigger force is 40 N and the resultant is perpendicular to the smaller one. Find the smaller one and the resultant force.

(b) A pull of 20 N, inclined at 30° to the horizontal plane is required just to move a body placed on a rough horizontal plane. But the push required to move the body is 30 N. If the push is inclined at 30° to the horizontal, find the weight of the body and the coefficient of friction. *2×7=14*