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ET-202(A)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering) / BTCLEVI/BTMEVI/BTELVI/BTECVI/BTCSVI

Term-End Examination

00532 **December, 2016**

ET-202(A) : ENGINEERING MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***five*** *questions. Use of scientific calculator is permitted.*

1. (a) Two equal loads of 2500 N are supported by a flexible string ABCD at points B and C as shown in Figure 1. Find the tensions in the portions AB, BC and CD of the string. 7

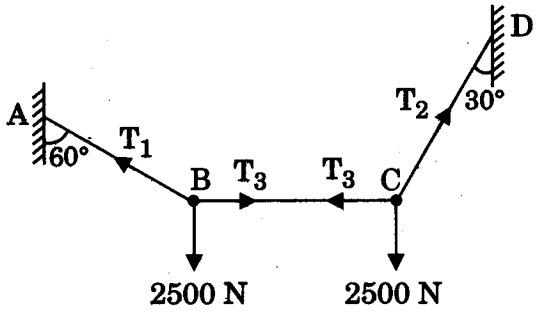

Figure 1

(b) A rigid prismatic weightless bar AB is supported in a vertical plane by a hinge at the end A and by a horizontal string attached to the bar at D as shown in Figure 2. The end B of the bar carries a load W. Find the tension in the string and the direction of the reaction at the hinge in terms of W and θ. 7

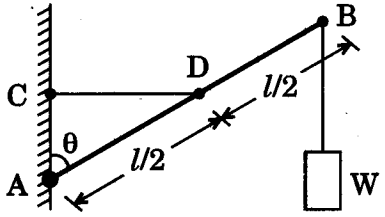

Figure 2

2. (a) A boy throws a ball so that it may just clear a wall 3·6 m high. The boy is at a distance of 4·8 m from the wall. The ball was found to hit the ground at a distance of 3·6 m on the other side of the wall. Find the least velocity with which the ball can be thrown. 7

(b) Two adjacent guns having the same muzzle velocity of 400 m/s, fire simultaneously at angles of θ_1 and θ_2 for the same target situated at a range of 5000 m. Find the time difference between the two hits. 7

3. (a) Two blocks, A and B, placed one above the other are of weight 500 N and 1000 N respectively. They are resting on an inclined plane. Block A is attached to the bracket by a rigid rod. Determine the angle α of the plane which will make the motion of block B down the plane. The coefficient of friction for all contact surfaces is 0·32. 7

(b) A 6 m ladder weighing 220 N is placed against a vertical wall leaning at 30°. A man weighing 600 N reaches at point 5 m from the lowest point of the ladder. At this instant, the ladder is about to slip. If the coefficient of friction between the ladder and the wall is 0·25, determine the coefficient of friction between the ladder and the floor. 7

4. (a) Locate the centroid of the area shown in Figure 3. 7

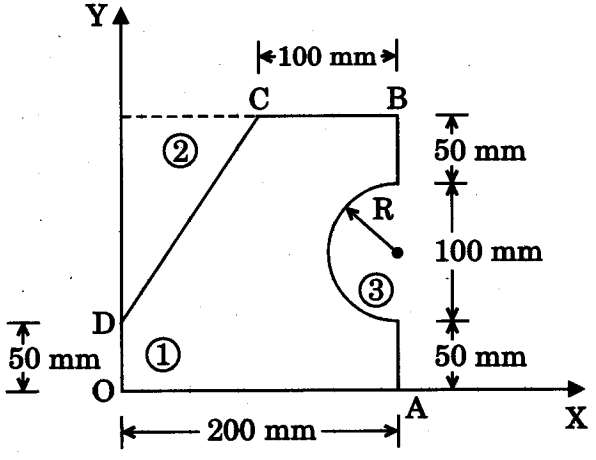

Figure 3

(b) Calculate the moment of inertia of the channel section shown in Figure 4 about the centroidal axes . 7

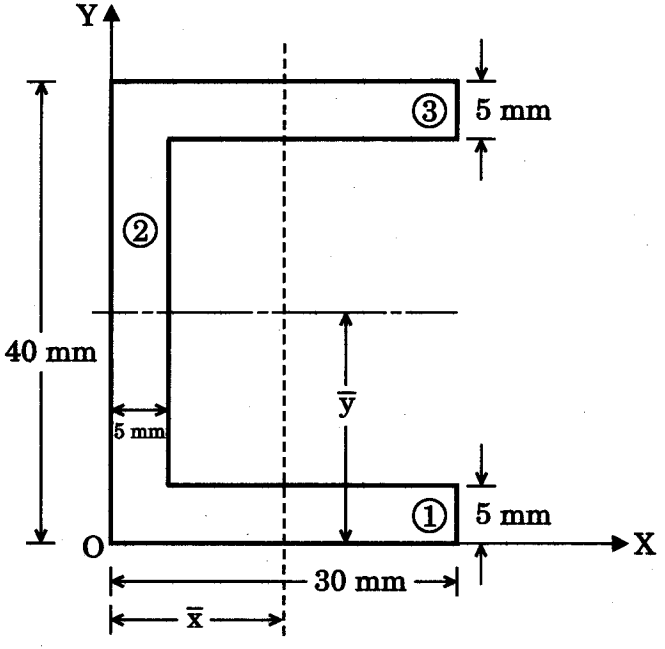

Figure 4

5. (a) Determine the forces in the members of the truss shown in Figure 5. 7

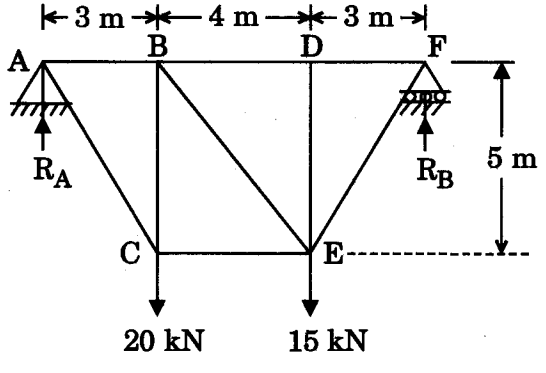

Figure 5

(b) Draw the bending moment and shear force diagrams for the simply supported beam shown in Figure 6. 7

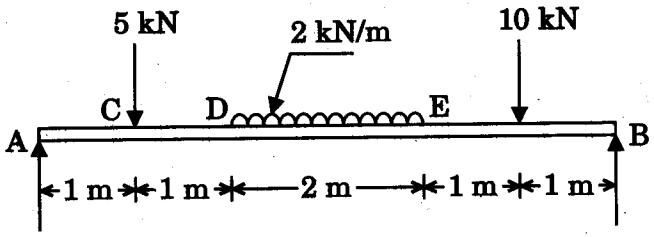

Figure 6

6. (a) The coefficient of restitution between two spheres of masses 1 kg and 5 kg is 0·75. The sphere of mass 1 kg, moving with a velocity of 3 m/s, strikes the sphere of mass 5 kg moving in the same direction with a velocity of 60 cm/s. Find the velocities of the two spheres after the impact and also find the loss of kinetic energy during the impact. 7

(b) A ball of mass 20 kg moving with a velocity of 5 m/s strikes directly another ball of mass 10 kg moving in the opposite direction with a velocity of 10 m/s. If the coefficient of restitution is equal to 5/6, determine the velocity of each ball after the impact. 7

7. (a) A body performing simple harmonic motion has a velocity = 12 m/s when the displacement is 50 mm and 3 m/s when the displacement is 100 mm. The displacement is measured from the mid-point. Calculate the frequency and amplitude of the motion. What is the acceleration when the displacement is 75 mm ? 7

(b) Determine the work done by the electric motor in winding up a uniform cable which hangs from a hoisting drum, if its free length is 10 m and weight is 500 N. The drum is rotated by the motor. 7