ET-202(A)

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

Term-End Examination

00048

June, 2016

ET-202(A) : ENGINEERING MECHANICS

Time : 3 hours   *Maximum Marks : 70*

Note : *Answer any **five** questions. Use of non-programmable scientific calculator is permitted.*

1. (a) The resultant of two forces, one of which is double the other, is 300 N. If the direction of the larger force is reversed and the other remains unaltered, the resultant force reduces to 150 N. Determine the magnitude of the forces and the angle between them.   7

   (b) A string of length 60 cm is tied to two supports at the same level and 40 cm apart. A smooth ring of weight 400 N is tied to the string at 40 cm from the left end and pulled by a horizontal force P. Determine the magnitude of the force P, assuming that tensions in the string on both the sides of the ring are same.   7

2. (a) A body A is thrown with a velocity of 10 m/s at an angle of 60° to the horizontal. Another body B is thrown at an angle of 45° to the horizontal. Find its velocity, if it has the same (i) horizontal range, (ii) maximum height, (iii) time of flight, as the body A.   *7*

(b) A soldier positioned on a hill fires a bullet at an angle of 30° upwards from the horizontal. The target lies 50 m below him and the bullet is fired with a velocity of 100 m/s. Determine

(i) the maximum height to which the bullet will rise above the position of the soldier,

(ii) the velocity with which the bullet will hit the target, and

(iii) the time required to hit the target.   *7*

3. **(a)** In Figure 1, three blocks A, B and C are of weight 30 N, 40 N and 80 N respectively. The coefficient of friction between any two sliding surfaces is 0·25. A is held at rest by a massless rigid rod fixed to the wall, while B and C are connected by a light flexible cord passing over a fixed frictionless pulley. Find the force P necessary to drag C along the horizontal surface to the left at a constant speed. Assume that the arrangement shown in the figure, B on C and A on B is maintained all throughout. **7**
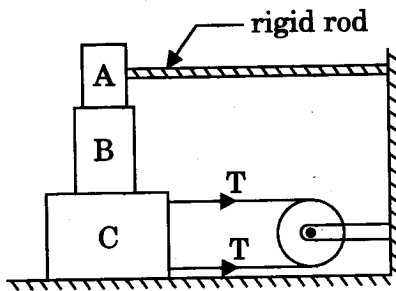

Figure 1

(b) A body of weight W is resting on an inclined plane of angle α. A force P is applied to the body horizontally. Determine the value of P, when (i) the body is going up the plane, and (ii) the body is going down the plane. **7**

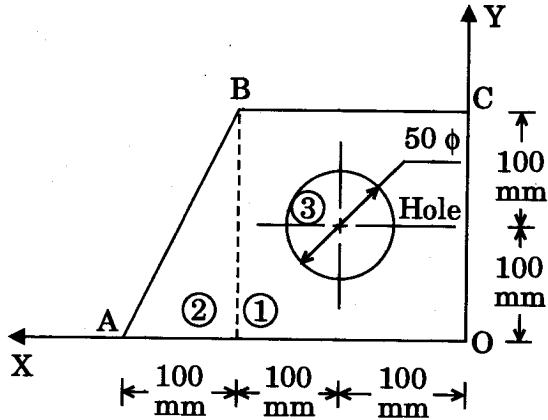**4.** (a) Locate the centroid of the area shown in Figure 2. 7

Figure 2

(b) A corner of radius 20 mm is cut-off from a square plate of 40 mm side as shown in Figure 3. Determine the moment of inertia of the remainder plate about its axes of symmetry. 7
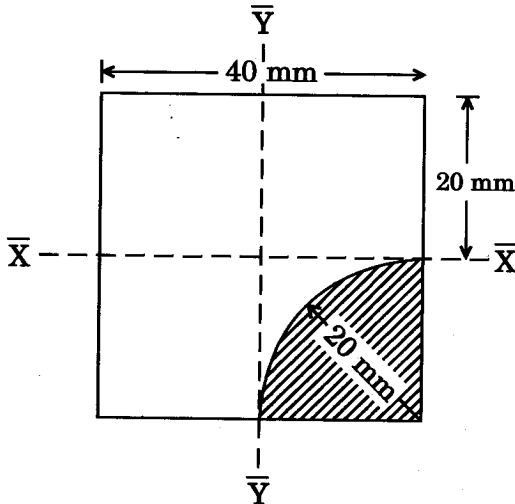

Figure 3

5. (a) Find by the method of joints, the magnitude and direction of the forces in each member of the truss shown in Figure 4. **8**
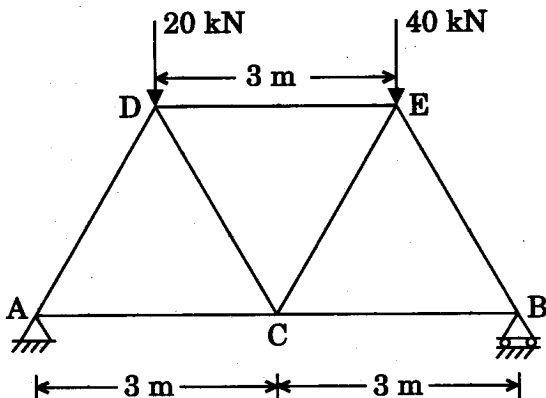

20 kN   40 kN

3 m

D   E

A   B

C

3 m   3 m

Figure 4

(b) Draw the B.M. and S.F. diagrams for the beam loaded as shown in Figure 5. **6**

10 kN   15 kN

C   D B
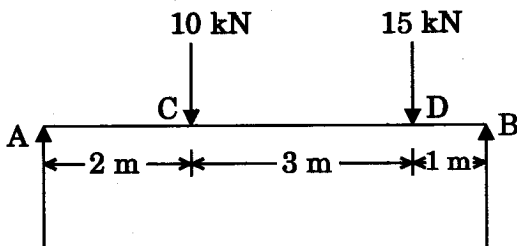
A

2 m   3 m   1 m

Figure 5

6. (a) Three perfectly elastic balls A, B and C of masses 2 kg, 6 kg and 12 kg are moving in the same direction with velocities 12 m/s, 4 m/s and 2 m/s respectively. If the ball A strikes with the ball B which in turn, strikes with the ball C, find the final velocities of balls A and B. **7**

(b) A ball of mass 100 gm strikes directly another ball of same mass, which is at rest. The first ball is reduced to rest by the impact. Find the loss of kinetic energy, if the cofficient of restitution is $1/\sqrt{2}$.　　7

7. (a) Explain D'Alembert's principle.　　7

(b) Define modulus of elasticity and modulus of rigidity. Find the relation between them.　　7

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