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**B. Tech.**

**(SEM III) THEORY EXAMINATION 2022-23**

**ENGINEERING MECHANICS**

***Time: 3 Hours*** | ***Total Marks: 100***

**Note:** Attempt all Sections. If require any missing data; then choose suitably.

## SECTION A

**1. Attempt *all* questions in brief.** **2 x 10 = 20**

(a) What is the difference between collinear and concurrent forces?

(b) State the concept of impending motion.

(c) Explain perfect and imperfect truss.

(d) Define point of contraflexure.

(e) Differentiate between centroid and centre of gravity.

(f) State parallel axis theorem.

(g) Distinguish between relative velocity and resultant velocity.

(h) State work energy equation.

(i) Define the term strain energy.

(j) What do you understand by the term section modulus?

## SECTION B

**2. Attempt any *three* of the following:** **10x3=30**

(a) A smooth weightless cylinder of radius 600 mm rests on a horizontal plane and is kept from rolling by an inclined string of length 1000 mm. A bar AB of length 1500 mm and weight 1200 N is hinged at A and placed against the cylinder of negligible weight. Determine tension in the string shown in Figure 1.

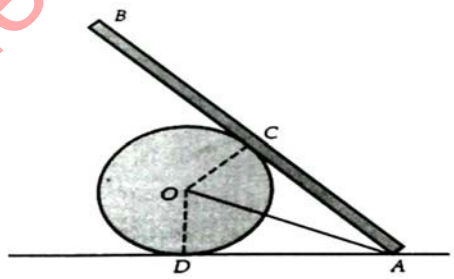


Fig. 1

(b) For the overhanging beam shown in figure 2. Draw its shear force and bending moment diagram.

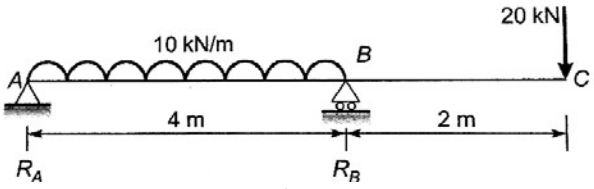


Fig. 2

(c) Locate the centre of gravity of the right circular cone having radius R and height h.

(d) Three loads W, 2W and 3W are connected by a weightless inextensible string passing over a smooth pulley as shown in figure3. The coefficient of friction between table and the weights is 0.15. What is acceleration of weight W and the

magnitude of tension in the string connecting the weight 2W and 3W.

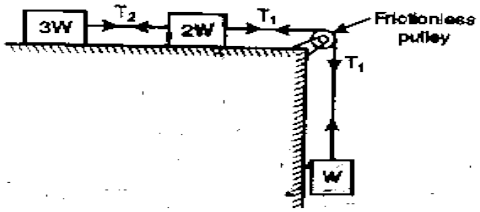


Fig. 3

(e) State the assumptions used in simple bending and derive the bending equation.

## SECTION C

**3. Attempt any *one* part of the following: 10x1=10**

(a) Define and explain the terms: Principle of equilibrium, force law of equilibrium and moment law of equilibrium.

(b) An effort of 180 N is required just to move a certain body up an inclined plane of angle $15^0$, the force being parallel to the plane. If the angle of inclination of the plane is made $20^0$, the effort required, again applied parallel to the plane, is found to be 210 N. Find the weight of the body and co-efficient of friction.

**4. Attempt any *one* part of the following: 10x1=10**

(a) For the truss shown in the figure 4, the forces $F_1$ and $F_2$ are 9 kN and 3 kN respectively. The force (in kN) in the member QS is (All dimensions are in m).

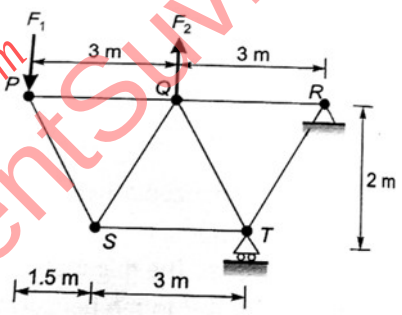


Fig. 4

(b) Drawshear force and bending moment diagram for the cantilever beam loaded as shown in figure 5.

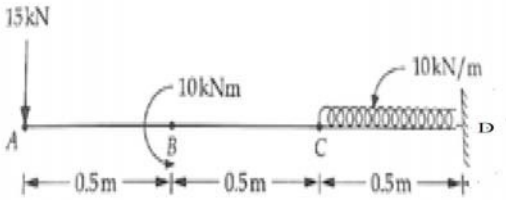


Fig. 5

**5. Attempt any *one* part of the following: 10x1=10**

(a) A semicircular area is removed from a trapezium as shown in figure 6determine the centroid of the remaining area.

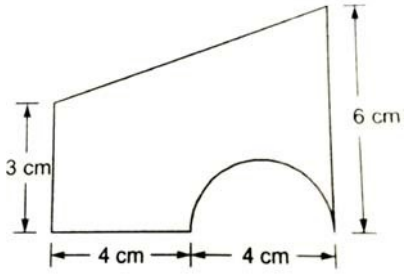


Fig. 6

(b) Find the moment of inertia of the shaded area (figure 7) with respect to the centroidal axis parallel to AB.

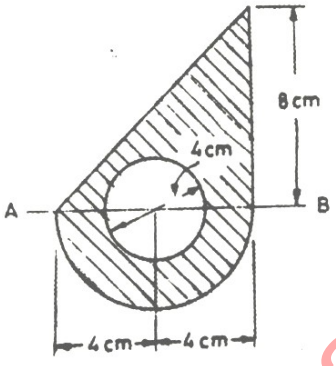


Fig. 7

**6. Attempt any *one* part of the following: 10x1=10**

(a) A 10 gm bullet is shot horizontally in a wood block of mass 1 kg. the bullet gets embedded in the block and the block is displaced on a rough horizontal table (μ = 0.2) through 1 m. What was the velocity of bullet?

(b) Two disc A and B with identical mass (m) radius (R) are initially at rest. They roll down from the top of identical inclined planes without slipping. Disc A has all of its mass concentrated at the rim, while Disc B has its mass uniformly distributed at the bottom of the plane, determine the ratio of velocity of the center of disc A to the velocity of the center of the disc B

**7. Attempt any *one* part of the following: 10x1=10**

(a) Determine the diameter of rod 200 m long length vertically and subjected a axial pull of 325 kN at its lower end if its weight per cubic meter is 80 kN and working stress is 75 MPa. Also determines the total elongation of rod. Take E = 210 GPa

(b) A hollow shaft of 1 m length is designed to transmit a power of 30 kW at 700 rpm. The maximum permissible angle of twist in the shaft is 1°. The inner diameter of the shaft is 0.7 times the outer diameter. The modulus of rigidity is 80 GPa. Calculate the outside diameter of the shaft