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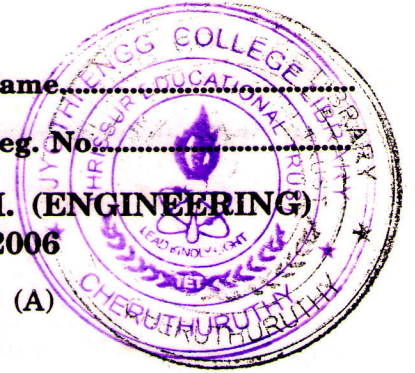
Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING)  
DEGREE EXAMINATION, DECEMBER 2006

EN 2K 107 (A)—ENGINEERING MECHANICS (A)

(Common to AI/CH/CE/CS/EE/EC/IT/IC/AR)



Time : Three Hours

Maximum : 100 Marks

- I. (a) Write and explain with suitable illustration the equations of equilibrium for non-concurrent and non-parallel system of forces.
- (b) Define the following :
- (i) resultant. (ii) equilibrant.
- (iii) equilibrium. (iv) free body diagram.
- (c) Sketch and explain any *two* types of roof strusses.
- (d) Deduce the expression for moment of a force about a given axis from first principles.
- (e) Determine the centroid of a quarter circle in the first quadrant with X and Y axes as its radii.
- (f) Determine the centroid of a right circular cone with its axis as X axis and its apex at the origin.
- (g) Discuss the direct central impact of elastic bodies.
- (h) Briefly explain the following :
- (i) D'Alembert's principle's.
- (ii) Projectiles.

(8 × 5 = 40 marks)

- II. (a) A spherical ball of 75 N is attached to a string and is suspended from the ceiling of a building. Find the tension in the string if a horizontal force 'F' of 150 N is applied through the center of the sphere. Find also the angle the string makes with the vertical after the application of the horizontal force. Also determine the minimum value of force F and its angle with vertical for the string to deflect to the same angle as in the above case.

(15 marks)

Or

- (b) (i) Prove that in belt drives  $T_1/T_2 = e^{\mu\theta}$ . (8 marks)
- (ii) A belt is running over a pulley of diameter 1.2 m. at 300 rpm. The angle of contact is  $150^\circ$  and coefficient of friction is 0.35. If the maximum tension in the belt is 500 N, determine the power transmitted by it. (7 marks)

Turn over

III. (a) Find the forces in members EC, DC and DH of the truss shown in Fig. 1.

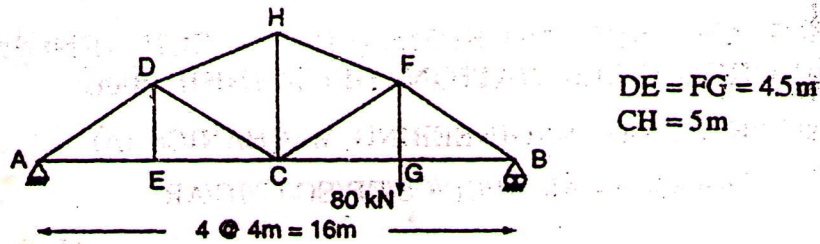


Fig. 1.

Or

(b) A suspension cable is supported at two points 20 m apart. The left support is 2 m above the right support. The cable is loaded with udl of 20 kN/m. throughout the span. The maximum dip from left support is 4 m. Find the maximum tension in the cable.

IV. (a) A thin plate of 6 mm. thick is cut and a machine component is made from the plate as shown in Fig. 2. Assuming the density of steel as 7850 kg/m<sup>3</sup>, calculate the mass moment of inertia about Z axis shown in the figure.

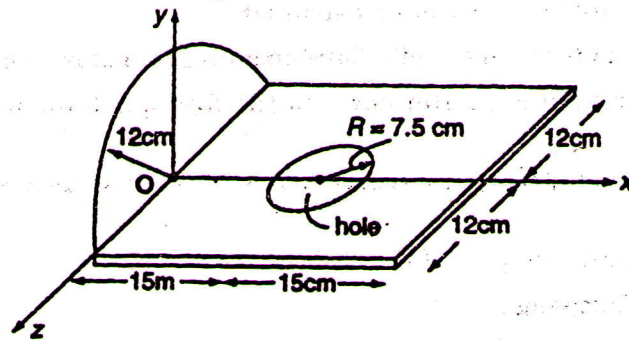


Fig. 2.

Or

(b) Collars A and B slide freely on the frictionless rods as shown in Fig. 3. knowing that the length of the wire A B is 550 mm, and weight of the collar W = 63 N, determine the magnitude of force P required to maintain equilibrium of the system when (i) c = 100 mm. (ii) C = 450 mm.

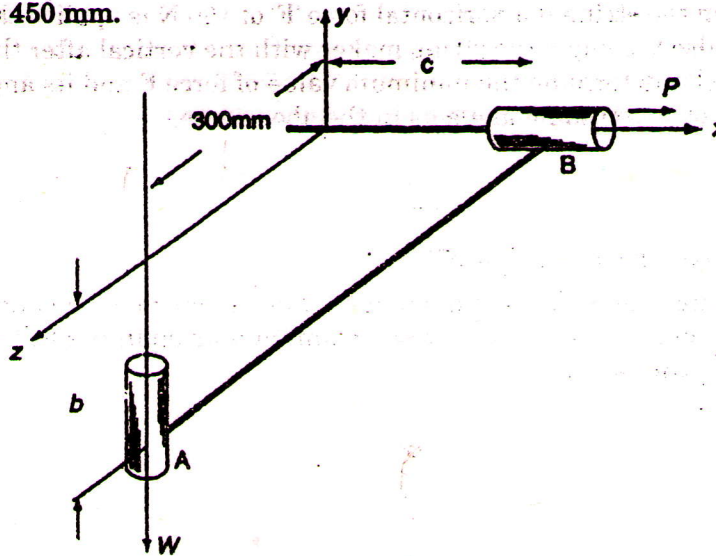


Fig. 3.



- V. (a) Two balls are projected from the same point in the direction inclined at  $60^\circ$  and  $30^\circ$  to the horizontal. Determine the ratio of projection if they have:
- same maximum height.
  - same horizontal range.

Or

- (b) A block of weight 12 N falls at a distance of 0.75 m on top of a spring. Determine the spring stiffness if it is compressed by 150 mm to bring the weight momentarily to rest.

(4 × 15 = 60 marks)

