

Total number of printed pages – 7

B. Arch  
BEG 2001

**Second Semester Examination – 2008**

**MECHANICS – II**

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory  
and any **five** from the rest.

The figures in the right-hand margin  
indicate marks.



1. Answer the following questions : 2×10
- (a) Define radius of gyration.
  - (b) Explain shear strain.
  - (c) An axial load is applied on a circular section of diameter  $D$ . If the same load is applied on a hollow circular section with inner diameter  $0.5 D$ , find the ratio of the stresses.

- (d) What do you mean by product of inertia?
  - (e) State principle of virtual work.
  - (f) Efficiency of machine in an inclined plane decreases with increase in coefficient of friction. Justify.
  - (g) Differentiate between stable and unstable equilibrium.
  - (h) Explain the term center of oscillation in case of compound pendulum.
    - (i) Define poission's ratio.
    - (j) Distinguish between normal and tangential acceleration.
2. (a) A beam AB of length 3 meters is hinged at A and supported at C on a roller at a distance of 2 meters from the hinged end. Determine the reaction of the support C

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using method of virtual work. The beam carries a load of 15 kN at a distance of 1 meter from the hinged end. 5

- (b) A solid of uniform density is made of a hemisphere and a right circular cone have a common base of radius  $r$  as shown in Fig.1 Determine the largest value of height  $h$  of the cone consistent with stability of the body in the vertical position. 5

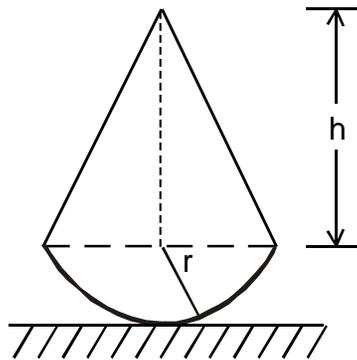


Fig. 1

3. (a) Find the polar moment of inertia of a circular of diameter  $D$  with respect to its center. 3

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- (b) Find the moment of inertia about an axis parallel to  $x$  axis and passing through the center of gravity of the 'T' section shown in Fig. 2. 7

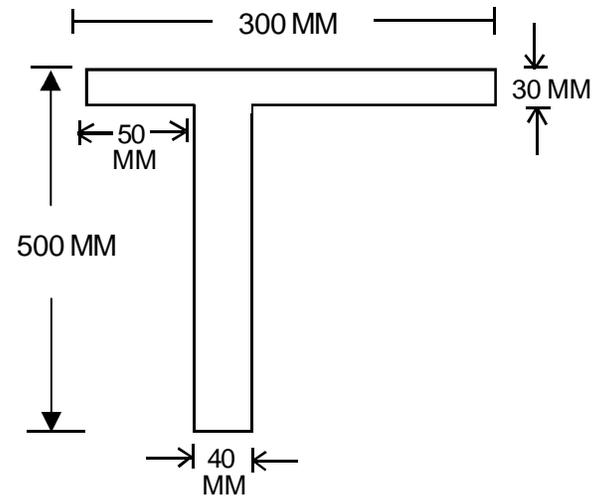


Fig. 2

4. (a) The coefficient of friction between wet asphalt pavement and the tires of an automobile is found to have the value  $\mu = 0.2$ . At what constant speed can the automobile travel around a curve of radius 250 meters without skidding if the road is level? 4

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- (b) Prove that the path of a projectile motion is same as the equation of a parabola having a vertical axis. 6
5. (a) Calculate the period of small oscillation of a circular cylindrical bar of length 'L' and diameter  $D$  suspended from one end. 6
- (b) A shaft of radius  $r$  rotates with constant angular speed  $w$  in bearings for which the coefficient of friction is  $\mu$ . Through what angle will it rotate after the driving torque is removed ? 4
6. (a) A steel rod 4 meters long and 20 mm diameter is subjected to an axial tensile load of 45 kN. Find the change in length and change in diameter. Take  $E = 200000$  N/mm<sup>2</sup> and  $\mu = 0.25$ . 5

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- (b) Explain Mohr's circle method to obtain normal and tangential stress on a plane at an angle  $\theta$  with the major principal plane  $p_1$ . The plane is subjected to two unequal like principal stress  $p_1$  and  $p_2$ . 5

7. The following data refer to a mild steel specimen tested in a laboratory 2×5

- |   |           |
|---|-----------|
| (i) Diameter of specimen                  | = 25mm    |
| (ii) Length of specimen                   | = 320 mm  |
| (iii) Extension under a load of 15 kN     | = 0.06 mm |
| (iv) Load at yield point                  | = 150 kN  |
| (v) Maximum load                          | = 220 kN  |
| (vi) Length of the specimen after failure | = 380 mm  |
| (vii) Neck diameter                       | = 20 mm   |

Determine

- (a) Young's modulus  
 (b) Stress at Yield point  
 (c) Ultimate stress  
 (d) percentage of elongation  
 (e) percentage reduction in area

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8. (a) A small ball of weight  $W$  starts from rest at A and moves without friction along a curved path ACB as shown in Fig. 3 in a vertical plane defined by the equation  $y = \frac{4\delta}{l^2} x^2$ . Determine the reaction exerted on the ball by the path at point C. 5

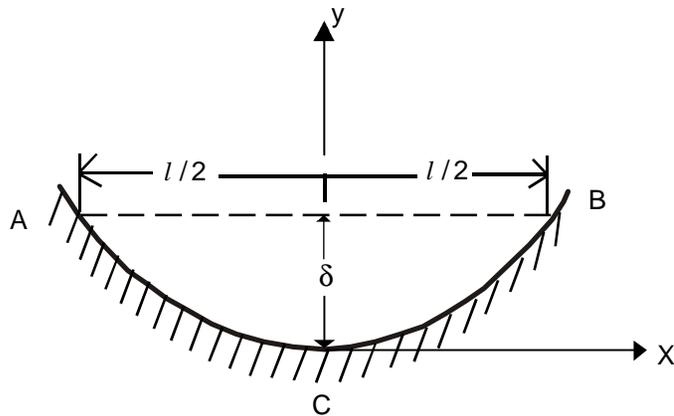


Fig. 3

- (b) Explain with the neat sketch : 2.5×2
- (i) Parallel axis theorem
  - (ii) Limit of proportionality.