17311

13141

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Figures to the right indicate full marks.

(4) Use of Non-programmable Electronic Pocket Calculator is permissible.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any <u>SIX</u> of the following:** **12**

i) State perpendicular axis theorem and give its expression.

ii) Define elasticity and elastic limit.

iii) Define modulus of elasticity and modulus of rigidity.

iv) Define temperature stress.

v) Draw shear stress distribution diagram for rectangular and hollow rectangular section.

vi) State any two assumptions in Euler's Theory.

vii) Define slenderness ratio and effective length of column.

viii) Define proof resilience and modulus of resilience.

Marks

b) **Attempt any <u>TWO</u> of the following:** **08**

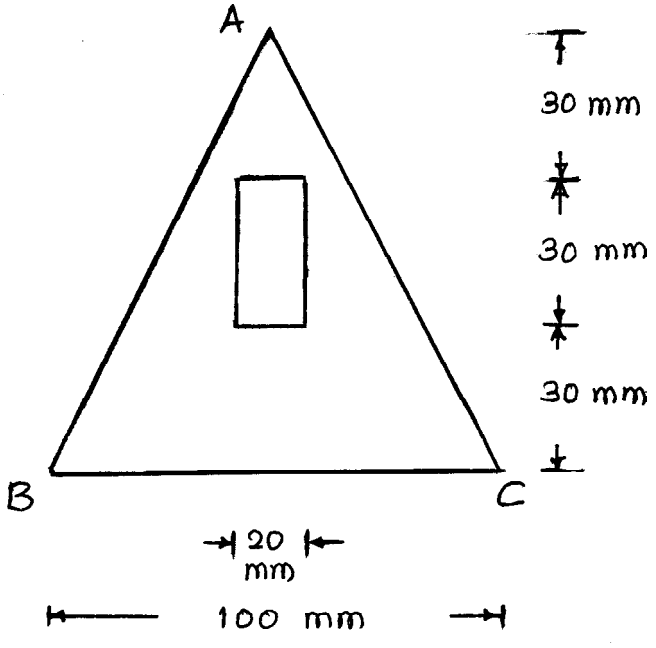
i) A rectangular beam 300 mm deep is simply supported over a span of 4 m. What udl per m the beam may carry, if the bending stress is not to exceed 120 N/mm^2 Take $I = 8 \times 10^6$ mm^4.

ii) A circular section of 100 mm diameter is subjected to a shear force of 3 kN when used as a beam. Determine the maximum and minimum shear stress and draw shear stress distribution diagram.

iii) A column having diameter 200 mm is of length 3 m. Both ends of column are hinged. Find Euler's cripping load if $E = 2 \times 10^5$ MPa.

2. Attempt any <u>TWO</u> of the following: **16**

a) A rectangular hole is made in a triangular section as shown in Figure No.l. Determine the M.I. of the section about X-X axis passing through its C.G. and the base BC.



<u>Fig. No. 1</u>

Marks

b) Find the M.I. of a T section with flanges 250×25 mm and web 150×25 mm about X-X and Y-Y axis.

c) A rod 10 m long at 10°C is heated to 70° C. It the free expansion is prevented, find the magnitude and nature of stress induced if $E = 2.1 \times 10^5$ N/mm^2, $\alpha = 12 \times 10^{-6}/^oC$.

3. Attempt any <u>TWO</u> of the following: **16**

a) An equilateral triangular bar of 15 mm side and 2.5 m long is found to contract in length by 2 mm. Calculate the push on the bar if the Young's modulus is 20×10^4 N/mm^2. Also calculate corresponding stress and strain.

b) A mild steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm. The composite bar is subjected to an axial pull of 40 KN. If E for steel and copper is 200 GN/m^2 and 100 GN/m^2 respectively. Find the stresses developed in the rod and tube. Also find extension of the rod.

c) A bar of 30 mm diameter is subjected to a pull of 60 KN. The measured extension on gauge length of 200 mm is 0.09 mm and change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the values of the three moduli.

Marks

4. Attempt any <u>TWO</u> of the following: **16**

a) A steel cube block of 50mm side is subjected to a force of 6 KN (tension), 8 KN (compression) and 4 KN (tension) long x, y and z directions respectively. Determine the change in the volume of the block. Take E as 200 KN/mm^2 and m as 10/3.

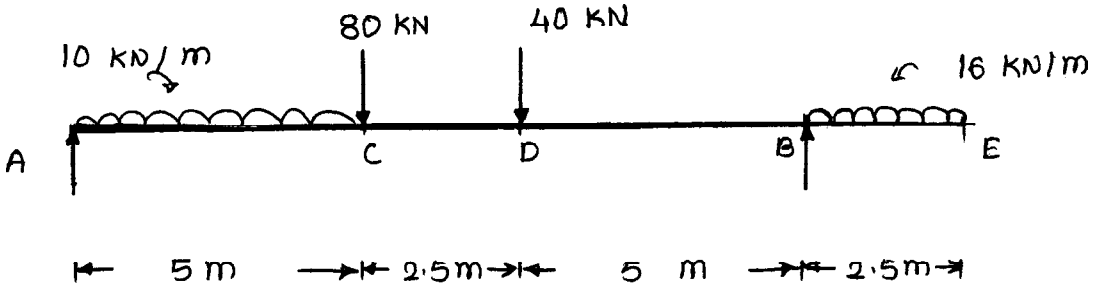
b) When a copper wire of 40 mm diameter is subjected to an axial pull of 80 KN, it reduces its diameter by 0.00775 mm. The modulus of rigidity for the wire is 0.4×10^5 MPa. Calculate the Poisson's ratio and modulus of elasticity for the material.

c) A beam 6m long is simply supported at the ends and carries a udl of 15 KN/m and three point loads of 10 KN, 20 KN, and 30 KN acting respectively at the left quarter point, centre point and right quarter point. Draw S.F.D. and B.M.D. and find max B.M.

5. Attempt any <u>TWO</u> of the following: **16**

a) A cantilever 1.5m long is loaded with a udl of 2 KN/m running over a length of 1.25m from the free end. It also carries a point load of 3 KN at a distance of 0.25m from the free end. Draw S.F.D. and B.M.D.

b) Draw S.F.D. and B.M.D. for the beam shown in Figure No.2.



<u>Fig. No. 2</u>

Marks

c) A T section beam having flange 160mm wide and 20mm thick and web 180mm long and 20mm thick carries udl of 500 KN/m over an effective span of 8m. Calculate the maximum stress induced due to bending.

6. Attempt any <u>TWO</u> of the following: **16**

a) A hollow rectangular section, 200mm × 400mm externally with uniform thickness of 40mm carries a shearing force of 100 KN at a section. Construct the shear stress distribution diagram giving all important values. Also calculate the ratio of max to average shear stress.

b) A cast iron column with both ends fixed carries safe load of 800 KN with factor of safety 4. If column is 4m long, having external diameter of 200mm, calculate internal diameter of column c/s. Use Euler's equation.
Take $E = 2 \times 10^5$ N/mm^2.

c) An unknown weight falls through 15mm on a collar rigidly attached at the lower end of a vertical bar 4m long and 800mm^2 in area. If the max. instantaneous elongation is measured to be 3mm. What is corresponding stress and value of unknown weight? $E = 210$ kN/mm^2.