22306

24225

3 Hours / 70 Marks Seat No. | | | | | | | | |

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

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

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

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

Marks

1. Attempt any FIVE of the following : **10**

a) State Hooke's law.

b) Find polar moment of inertia of a circle of 50 mm diameter.

c) What is volumetric strain.

d) Define concentrated load, show it on sketch.

e) Define neutral axis.

f) Define torsional rigidity. Write SI unit.

g) Define axial load and eccentric load.

Marks

2. Attempt any THREE of the following : **12**

a) Calculate moment of inertia about any tangent of a circle of diameter 100 mm.

b) A rod is 2 m long at 10°C. Find expansion of rod when the temperature is raised to 80°C, if its expansion is prevented. Find the stress with its nature.

c) Draw S.F.D. and B.M.D. for a simply supported beam of span L carrying u.d.l. w/unit length over the entire span.

d) For a material, for which E = 2K, Determine the Poission's ratio and $\frac{E}{G}$.

3. Attempt any THREE of the following : **12**

a) Find the power transmitted by a solid shaft of diameter 60 mm running at 220 rpm. If the permissible shear stress is 68 MPa. The maximum torque is to exceed the mean torque by 25%.

b) Draw S.F.D. and B.M.D. for a cantilever beam of 2 m long subjected to a u.d.l. of 20 kN/m for a distance of 1.5 m from the fixed end.

c) In a bi-axial stress system, the stresses along the two directions are $\sigma_x = 50$ N/mm^2 and $\sigma_y = 30$ N/mm^2 both tensile. Determine the strains along these two directions $E = 2 \times 10^5$ N/mm^2, Poission's ratio = 0.3.

d) State any four assumptions in the theory of simple bending.

4. Attempt any THREE of the following : **12**

a) A rectangular column 200 mm wide and 100 mm thick. It is subjected to a load of 180 kN at an eccentricity of 100 mm in the plane bisecting the thickness. Draw stress distribution diagram showing values.

b) A circular beam is subjected to a maximum shear force of 5 kN. The maximum shear stress induced is 0.8 N/mm^2. Find the diameter of beam.

Marks

c) State the torsional formula and explain the meaning and units of each term.

d) Write the B.M. equation for the beam loaded as shown in Fig. No. 1. Draw B.M.D.

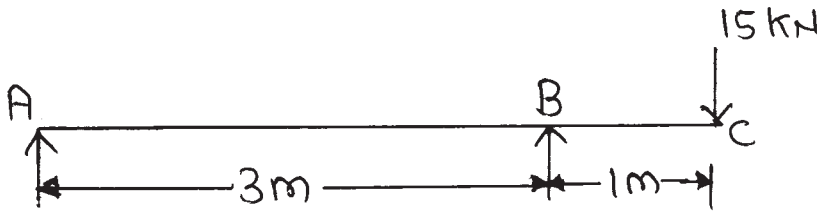

Fig. No. 1

e) A brass bar shown in Fig. No. 2, is subjected to a tensile load of 40 kN find the total elongation of the bar, if $E = 1 \times 10^5$ N/mm^2 and also find the maximum stress induced.

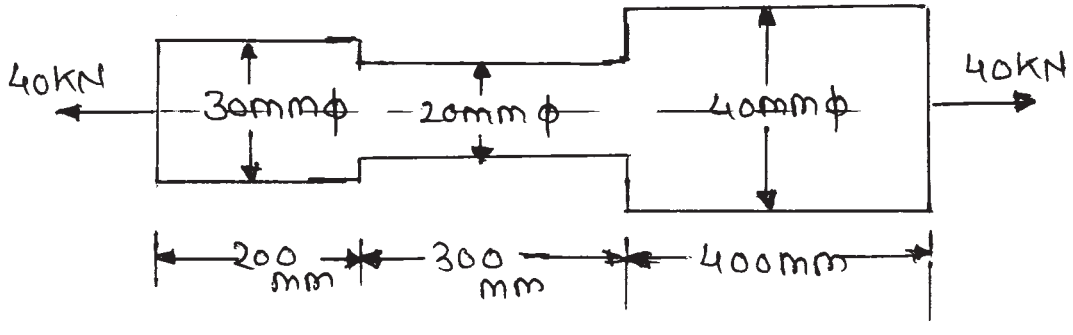

Fig. No. 2

5. Attempt any TWO of the following : **12**

a) A steel bar 1.2 m long, 40 mm wide and 20 mm thick is subjected to an axial tensile load of 50 kN in the direction of its length. Find the change in length, width and thickness of the bar. Take $E = 2 \times 10^5$ N/mm^2 and Poission's ratio = 0.26.

Marks

b) A 30 mm diameter rod is bent up to form an offset link as shown in Fig. No. 3. If permissible tensile stress is 80 MPa determine the maximum value of P.

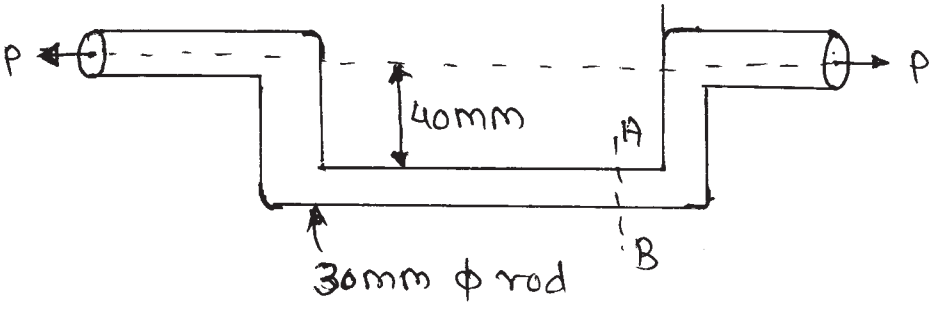

Fig. No. 3

c) Draw S.F.D and B.M.D. for a beam loaded as shown in Fig. No. 4. Find the point of contraflexure if any.

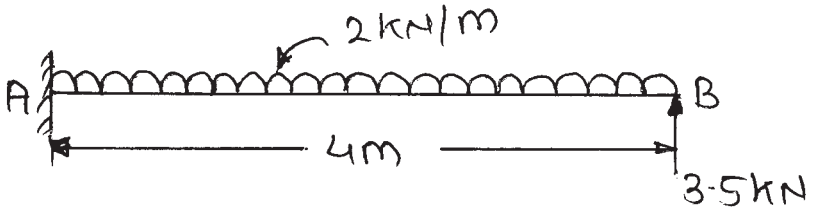

Fig. No. 4

6. Attempt any TWO of the following : **12**

a) Calculate I_{xx} of inverted T-section with flange 200 × 12 mm and web 350 × 10 mm.

b) A rectangular beam 120 mm wide and 300 mm deep is simply supported over a span of 4 m. What u.d.l. the beam may carry if the bending stress is not to exceed 120 MPa. The width of beam is 120 mm.

c) Determine the safe diameter of solid shaft which transmits 500 KW at 100 rpm. The value of shear stress and the angle of twist are 100 MN/m^2 and 1° in 1.5 m length respectively. The maximum torque is more than 40% than mean torque. Take $G = 8.5 \times 10^4$ MN/m^2.