12043

13141

3 Hours / 100 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. Solve any TEN : **20**

(a) Define Ductility and Brittleness.

(b) Define Hook's Law.

(c) Define Poisson's Ratio.

(d) Define Temperature Stress.

(e) What is point of Contraflexure ?

(f) Write relationship between shear force and bending moment.

(g) State parallel axis theorem.

(h) Define polar moment of Inertia.

(i) What is section modulus ?

(j) Define eccentricity and eccentric load.

(k) What is core or kernel of section ?

(l) Write torsion formula and meaning of each term.

(m) Calculate polar M.I. of shaft of diameter 100 mm.

(n) Write formula for power transmitted by shaft.

2. Solve any TWO : **16**

(a) A member ABCD, subjected to loads as shown in Fig. 2(a), find maximum stress and total elongation.

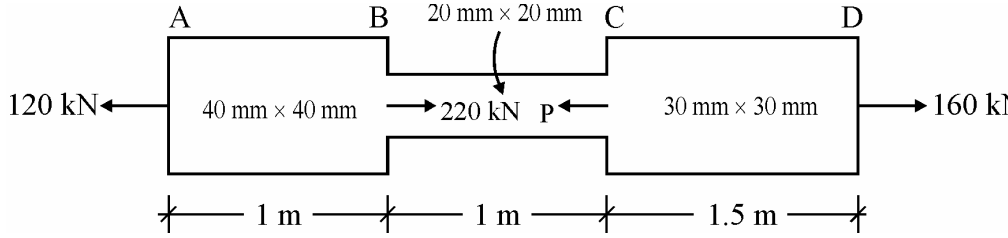

Fig. 2 (a)

(b) A steel bar 2 m. long, 20 mm wide and 10 mm. thick is subjected to an axial pull of 20 kN in the direction parallel to 2 m length. Find change in length, breadth, thickness and volume of a bar, also find bulk modulus. Take $E = 2 \times 10^5$ MPa and Poisson's ratio $= \frac{1}{m} = 0.4$

(c) Draw shear force and bending moment diagram for a beam shown in Fig. 2(c), also locate point of contraflexure.

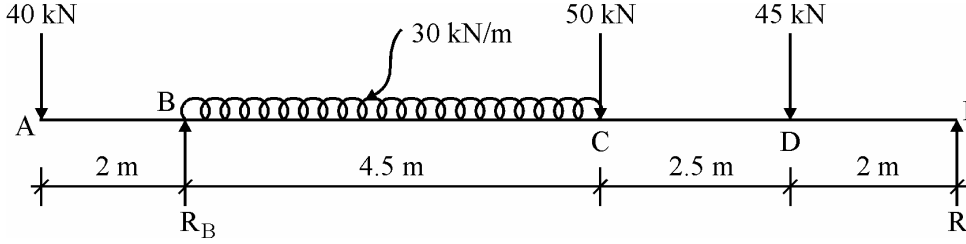

Fig. 2 (c)

3. Solve any TWO : **16**

(a) A steel rod is subjected to a pull of 10 kN and ends are rigidly fixed at certain temperature. Find magnitude of stress and its nature due to change in temperature by 20 °C (both rise and fall). Area of bar A = 200 mm^2, Modulus of Elasticity E = 200 GPa and coefficient of linear expansion $\alpha = 12 \times 10^{-6}$/°C.

(b) A cantilever beam AB fixed at A and has span of 4 m. The beam is subjected to UDL of 2 kN/m throughout and upward point load of 3.5 kN at free end B. Draw SFD and BMD, also find point of contraflexure and point of zero shear.

(c) Find M.I. of T-section 200 mm × 200 mm × 20 mm about centroidal axes. The overall depth of section is ħ = 200 mm.

4. Solve any TWO : **16**

(a) A semi-circular portion of diameter 40 mm is cut from a plate 40 mm × 80 mm as shown in Fig. 4(a), find M.I. about centroidal axes.

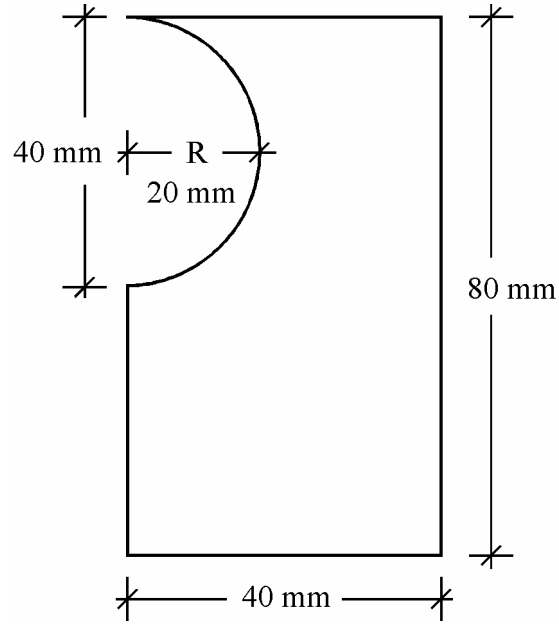

Fig. 4 (a)

(b) A 3m span cantilever beam 100 mm × 200 mm in cross-section loaded with point load "W" at free end. The self weight of beam is 0.1 kN/m. The bending stress anywhere in the section of beam shall not exceed to 7 N/mm^2, find unknown load "W".

(c) (i) A cantilever beam of span 4m carries UDL of 5 kN/m and permissible stresses in the material of beam is 5 N/mm^2. Design section of beam, if depth to width ratio is 2.

(ii) Write any four assumptions in the theory of simple bending.

5. Solve any FOUR : **16**

(a) During tensile test the following observations were made on 40 mm diameter and 200 mm long specimen elongation with 40 kN load is 0.0304 mm. Yield load = 161 kN, Ultimate load = 242 kN, Length of specimen at fracture = 249 mm. Determine Young's modulus, Yield stress, ultimate stress, percentage elongation.

(b) A simply supported beam, subjected to point load of W kN at mid-span, draw SFD & BMD.

(c) Find M.I. on tangent of a circle, whose diameter is 100 mm. Also find polar moment of Inertia.

(d) For a circular section of radius "R" prove that maximum eccentricity (e_{max}) has relationship as $2\ e_{max} = \frac{R}{2}$.

(e) A solid circular column of diameter 100 mm carries a vertical load of 50 kN at outer edge of column. Calculate maximum and minimum stresses for 100 mm dia column.

(f) A rectangular column 300 mm wide and 200 mm thick carries an axial load of 180 kN and clockwise moment of 2.8 kN/m in plane bisecting 200 mm side. Calculate the resultant stress induced at the base.

6. Solve any TWO : **16**

(a) An M.S. tube of 50 mm external diameter and 10 mm thickness is bent in the form of hook as shown in Fig. 6(a). What maximum load "P" the hook can lift if the stress on c/s AB should not exceed 100 MPa in tension and 25 N/mm^2 in compression ?

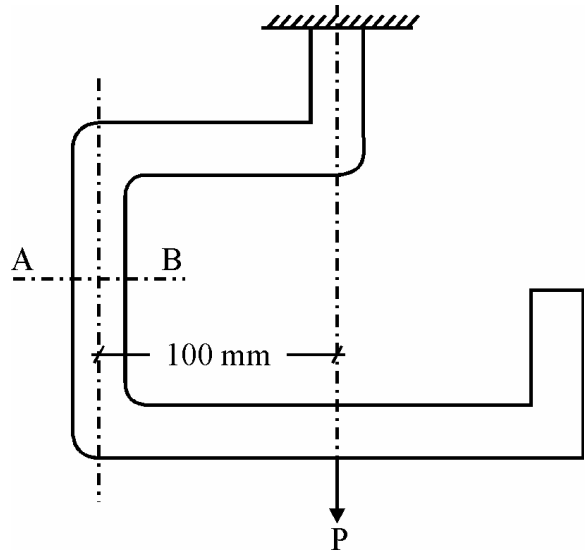

Fig. 6 (a)

(b) A shaft transmitting 150 kW at 200 rpm. If allowable shear stress is 80 N/mm^2 and allowable twist is 1.5° per 4 m length, find diameter of shaft. Take modulus of rigidity $G = 0.8 \times 10^5$ N/mm^2.

(c) A solid circular shaft is replaced by a hollow circular shaft of same material to transmit the same power. If the inside diameter of hollow shaft is 2/3 of outside diameter, find the saving in material if any, by this replacement.