1451

Code : 15ME31T

Register Number

STRENGTH OF MATERIALS (SOM)

Time : 3 Hours | **[Max. Marks : 100**

Note :   (i)   Answer any **six** questions from Part – **A** and any **seven** questions from Part – **B**.

        (ii)   Assume suitable data if necessary.

PART – A

(Each question carries 5 marks)

1.   Define Young's Modulus and Shear Stress.   **5**

2.   Explain Hoop stress and longitudinal stress in their cylindrical shell.   **5**

3.   Define Centre of gravity and moment of inertia.   **5**

4.   Locate CG for Triangle, Rectangle, Circle, Semicircle and Trapezium with the help of plain figure.   **5**

5.   Define Shear force and bending moment in beams.   **5**

6.   Explain Sagging and Hogging bending moment.   **5**

7.   List the assumptions in Theory of simple bending.   **5**

8.   Explain Modulus of section for Rectangular and Circular sections.   **5**

9.   Explain proof resilience and modulus of resilience.   **5**

PART – B
(Each Question carries 10 marks)

10. A circular rod of steel is 20 mm in diameter and 500 mm long. It is subjected to an axial pull of 45 kN. If E for steel is 2×10^5 N/mm^2 find stress, linear strain, change in length and change in volume. Take $\frac{1}{m} = \frac{1}{4}$. **10**

11. (a) Draw stress strain diagram for ductile materials with all parameters. **5**

    (b) A cylindrical shell of 1.3 mtr diameter is made up of 18 mm thick plates. Find the circumferential and longitudinal stress in the plates. If the boiler is subjected to an internal pressure of 2.4 MPa. Take efficiency of the joints as 70%. **5**

12. (a) Determine the centroid of the T-section $150 \times 120 \times 20$ mm. **5**

    (b) Calculate the CG of the lamina shown in Fig. (i) **5**
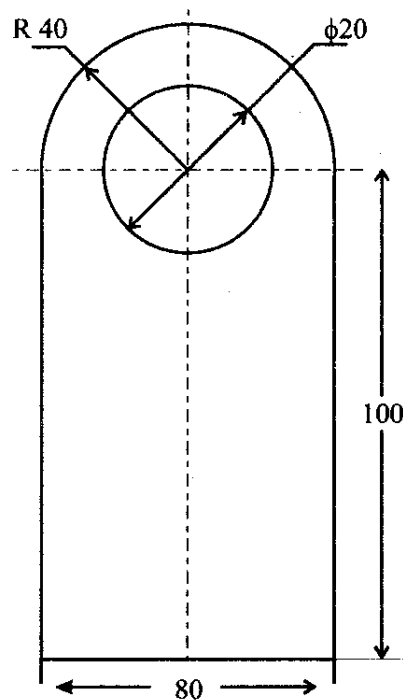
R 40   φ20

100

80

Fig. (i)
Note : All dimensions are in mm.

13. Find the Moment of Inertia (MI) of I-Section shown in Fig. (ii) about horizontal and vertical centroidal axis passing through CG of section. **10**
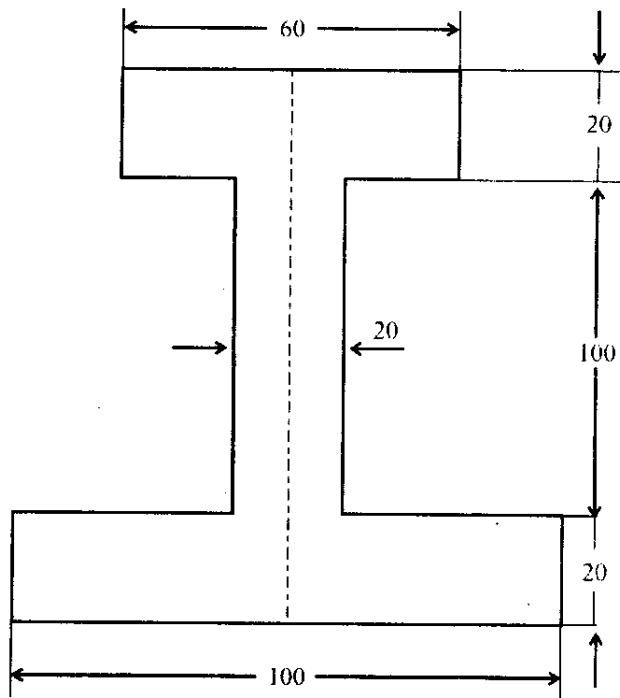

Fig. (ii)

Note : All dimensions are in mm.

14. A cantilever beam of span 3 mtr. carries an UDL of 2 kN/m over a length of 2 mtr from support. In addition, it also carries point loads of 1 kN, 2 kN and 3 kN at free end, 1 mtr and 2 mtr from free end respectively. Draw SF and BM diagrams. **10**

15. A simply supported beam of 8 mtr span carries point loads of 10 kN and 20 kN at 3 mtr and 5 mtr respectively from the left support. In addition it also carries a UDL of 10 kN/m for 3 mtr starting from the right support. Draw SFD and BMD. **10**

16. A steel plate is bent into a circular arc of 12 mtr radius. If the plate section is 100 mm wide and 20 mm thick. Find the maximum stress induced in the plate and also the bending moment which can produce this stress. Take $E = 2 \times 10^5$ N/mm^2 ($E = 2 \times 10^5$ N/mm^2) **10**

[Turn over

17. A timber beam of rectangular section supports a load of 20 kN uniformly distributed over a span of 3.6 mtr. If depth of the beam is twice the width and maximum stress is not to exceed 7 MPa. Find the dimensions of the beam section. **10**

18. (a) List the assumptions made in theory of torsion. **5**

    (b) An axial pull of 20 kN is suddenly applied on steel rod 2.5 mtr long and 1000 mm^2 in area of cross section. Calculate the strain energy which can be stored in the rod. Take E = 2×10^5 N/mm^2. **5**

19. A solid circular shaft is required to transmit 100 kW at 180 rpm. The permissible shear stress in the shaft is 60 N/mm^2. Find the suitable diameter of the shaft. The angle of twist is not to exceed 1° in a length of 3 mtr. The value of rigidity modulus is 0.8×10^5 N/mm^2. **10**