

Fig.Q4(a) (10 Marks)

- b. A thick cylindrical pipe of outside diameter 300 mm and internal diameter of 200 mm is subjected to an internal fluid pressure of 20 N/mm² and external fluid pressure of 5 N/mm². Determine the maximum hoop stress developed and draw the variation of hoop stress and radial stress across the thickness. (10 Marks)

Module-3

- 5 a. Draw the shear force and bending moment diagrams for the overhanging beam carrying uniformly distributed load of 2 kN/m over the entire length and a point load of 2 kN as shown in Fig.Q5(a). Locate the point of contra flexure. (10 Marks)

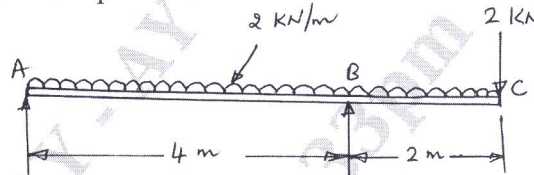


Fig.Q5(a) (10 Marks)

- b. Derive the equation $\frac{M}{I} = \frac{\sigma_b}{Y} = \frac{E}{R}$ with usual notations. State the assumptions in the derivation. (10 Marks)

OR

- 6 a. Draw the shear force and bending moment diagrams for the cantilever beam shown in Fig.Q6(a). (10 Marks)

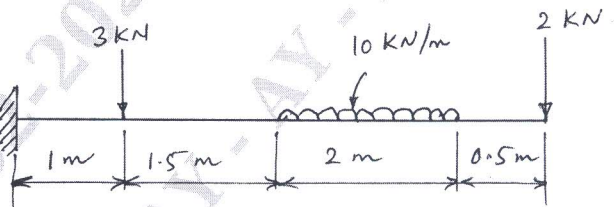


Fig.Q6(a) (10 Marks)

- b. A beam of an I-section 200 mm × 300 mm has web thickness 10 mm and flange thickness 10 mm. It carries a shearing force of 10 kN at a section. Sketch the shear stress distribution across the section. (10 Marks)

Module-4

- 7 a. Derive the torsion equation $\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$ with usual notations. State the assumptions made in the derivation. (10 Marks)

- b. The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of the bolt :
- Maximum principal stress theory
 - Maximum shear stress theory
- (10 Marks)

OR

- 8 a. Determine the diameter of a solid shaft which transmits 300 kW at 250 rpm. The maximum shear stress should not exceed 30 N/mm^2 and twist should not be more than 1° in a shaft length of 2 m. Take modulus of rigidity $G = 1 \times 10^5 \text{ N/mm}^2$. (10 Marks)
- b. A hollow shaft is to transmit 250 KW power at 100 rpm. If the shear stress is not to exceed 60 MPa and internal diameter is 0.6 times the external diameter, find the external and internal diameters, assuming that the maximum torque is 1.4 times the mean torque. (10 Marks)

Module-5

- 9 a. Derive Euler's buckling equation for a long column when both ends are hinged. Also state the assumptions made in the derivation. (10 Marks)
- b. Determine the buckling load for a strut of T-section, the flange width being 100 mm, overall depth 80 mm and both flange and stem 10 mm thick. The strut is 3 m long and is hinged at both ends. Take $E = 200 \text{ GN/m}^2$. (10 Marks)

OR

- 10 a. Derive expressions for strain energy due to: (i) axial load (ii) torsion (10 Marks)
- b. State and prove Castigliano's first theorem. (10 Marks)

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