CE 213 (R-22)

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II/IV B. Tech. DEGREE EXAMINATIONS, AUGUST - 2024

First Semester

CIVIL ENGINEERING

SOLID MECHANICS - I

Time : **Three Hours** Maximum : **70** Marks

Answer ONE Question from each Unit. 5x14=70 M

All Questions carry equal marks.

UNIT - I

1. a) Draw stress-strain diagram for mild steel. Indicate salient points and define them.

   b) A steel rod of 3 cm diameter and 5 m long is connected to two grips and the rod is maintained at a temperature of 950 C. Determine the stress and pull, when the temperature falls to 30°C, if (i) the ends do not yield and (ii) the ends yield by 0.12 cm. $E = 2 \times 10^5$ N/mm^2 and $\alpha = 12 \times 10^{-6}$/°C.

(OR)

2. a) A bar of 20 mm diameter subjected to a pull of 50 kN. The measured extension on gauge length of 250 mm is 0.12 mm and change in diameter is 0.00375 mm. Calculate: (i) Young's modulus (ii) Poisson's ratio and (iii) Bulk modulus.

   b) A copper bar is 900 mm long and circular in section. It consists of 200 mm long bar of 40 mm diameter, 500 mm long bar of 15 mm diameter and 200 mm long bar of 30 mm diameter. If the bar is subjected to a tensile load of 60 kN, find the total extension of the bar. Take E for the bar material as 100 GPa.

UNIT - II

3. a) A cantilever beam AB, 2 m long carries a uniformly distributed load of 1.5 kN/m over a length of 1.6 m from the free end. Draw shear force and bending moment diagrams for the beam.

   b) A simply supported beam of length 8m carries point loads of 4 kN and 6 kN at 3m and 7m from the left end. Draw the S.F. and B.M. diagrams for the beam.

(OR)

4. A simply supported beam of length 8 m rests on supports 6 m apart, the right-hand end is overhanging by 2 m. The beam carries a uniformly distributed load of 1500 N/m over the entire length. Draw S.F. and B.M. diagrams.

P.T.O.

UNIT - III

5. a) Write the assumptions made in the theory of simple bending.

   b) What do you mean by section modulus ? Find an expression for section modulus for a rectangular, circular and hollow circular sections.

(OR)

6. A timber cantilever 200 mm wide and 300 mm deep is 3 m long. It is loaded with a U.D.L. of 3 kN/m over the entire length. A point load of 2.7 kN is placed at the free end of the cantilever. Find the maximum bending stress produced.

UNIT - IV

7. a) Find the ratio of maximum shear stress to average shear stress is 1.5 in case of a rectangular section.

   b) Beam of triangular cross section having base width of 100 mm and height of 150 mm is subjected to a shear force of 13.5 kN. Find the value of maximum shear stress and sketch the shear stress distribution along the depth of beam.

(OR)

8. a) Derive the shear stress formula from fundamentals.

   b) The cross section of joist is a tee section 150 mm x 100 mm x 13 mm with 150 mm side horizontal. Find the maximum intensity of shear stress and sketch the distribution of stress across the section, if it has to resist a shear force of 80 kN.

UNIT - V

9. Determine the diameter of a solid shaft that will transmit 300 KN at 250 rpm. The maximum shear stress should not exceed 30 N/mm^2 and the twist should not be more than 10 in a shaft length of 2m. Take modulus of rigidity = 1×10^5 N/mm^2.

(OR)

10. A hollow shaft of external and internal diameters as 80 mm and 50 mm respectively is transmitting power at 150 r.p.m. Determine the power, which the shaft can transmit, if the shearing stress is not to exceed 40 MPa.