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Question Paper Code : 73244

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Third Semester

Civil Engineering

CE 2201/CE 34/CE 1202 A/080100010/10111 CE 304 — MECHANICS OF SOLIDS

(Regulations 2008/2010)

(Common to 10111 CE 304 – Mechanics of Solids for B.E. (Part-Time) First Semester – Civil Engineering – Regulations 2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What do you mean by stiffness?

2. With a simple sketch explain lateral strain.

3. Write the static equilibrium equations.

4. What is hoop tension?

5. State any four assumptions made in the theory of simple bending.

6. A steel wire of 10 mm diameter is bent into a circular arc of 20 metre radius. Determine the maximum stress induced in it. Take $E = 2 \times 10^5$ N/mm^2.

7. What is shear centre?

8. What is the maximum deflection of a simply supported beam of span L with UDL of magnitude w per unit run throughout its span?

9. Find the Torque which a shaft of 200 mm diameter can safely transmit, if the shear stress is not to exceed 50 N/mm^2.

10. Write down the differences between leaf spring and helical spring.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive a relation for change in length of a bar hanging freely under its own weight. (6)

(ii) Draw stress - strain curve for a mild steel rod subjected to tension and explain about the salient points on it. (10)

Or

(b) (i) Derive the relationship between Bulk modulus and Young's modulus. (6)

(ii) Derive relations for normal and shear stresses acting on an inclined plane at a point in a stained material subjected to two mutually perpendicular direct stresses. (10)

12. (a) Analyse the truss shown in Fig. 12 (a)

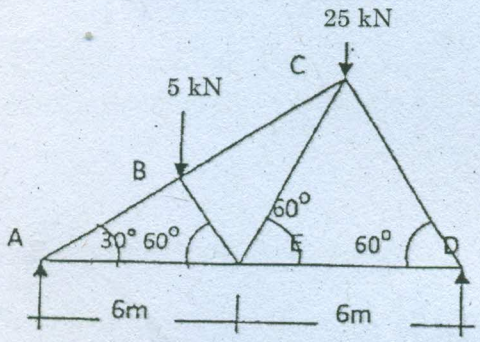

Fig. 12 (a)

Or

(b) A thin cylindrical tube 80 mm internal diameter and 5 mm thick, is closed at the ends and is subjected to an internal pressure of 6 MN/m². A torque of 2009.6 Nm is also applied to the tube. Find the hoop stress, longitudinal stress, maximum and minimum principal stresses and maximum shear stress.

13. (a) Draw the B.M. and S.F. diagrams for the overhanging beam shown in fig. Q. 13 (a)

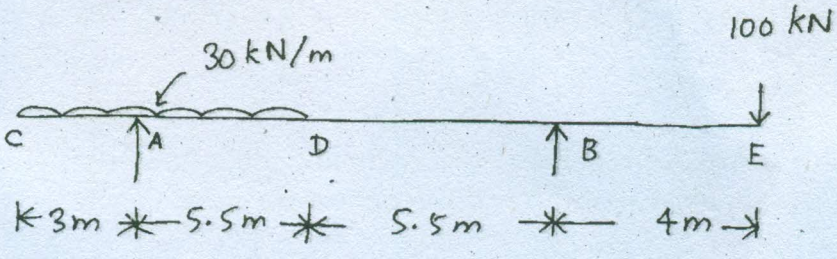

Fig. Q. 13 (a)

Or

(b) A cast iron water main 12 metres long, of 500 mm inside diameter and 25 mm wall thickness runs full of water and is supported at its ends. Calculate the maximum stress in the metal if density of cast iron is 7200 kg/m^3 and that of water is 1000 kg/m^3.

14. (a) A steel girder of uniform section, 14 m long is simply supported at its ends. It carries concentrated loads of 90 kN and 60 kN at two points 3 m and 4.5 m from the two ends respectively. Calculate (i) the deflection of the girder at the points under the two loads (ii) maximum deflection.

Take $I = 64\times10^{-4}$ m^4 and $E=210\times10^6$ kN/m^2.

Or

(b) A timber beam 150 mm × 250 mm in cross section is simply supported at its ends and has a span of 3.5 m. The maximum safe allowable stress in bending is 7500 kN/m^2. Find the maximum safe UDL which the beam carry. What is the maximum shear stress in the beam for the UDL calculated?

15. (a) A shaft transmits 300 kN power @ 120 r.p.m. Determine

(i) the necessary diameter of solid circular shaft (8)

(ii) the necessary diameter of hollow circular section, the inside diameter being 2/3 of the external diameter, The allowable shear stress is 70 N/mm^2. Taking the density of material is 77 kN/m^3, calculate the % saving in the material if hollow shaft is used. (8)

Or

(b) A open coiled helical spring, made out of 20 mm diameter steel rod, has 10 complete turns at a mean diameter of 150 mm, the angle of helix being 15°. An axial load of 400 N is applied. Compute

(i) deflection under the local and (8)

(ii) maximum intensities of direct and shear stresses, induced in the section of the wire. (8)

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