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Question Paper Code : 21196

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Third Semester

Civil Engineering

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

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the three types of stresses?

2. What is the use of Mohr circle?

3. Mention the methods available to analyse the forces in truss members.

4. Differentiate thin cylinders and thick cylinders.

5. List the types of supports.

6. Define shear force.

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. Give any two uses of leaf springs.

10. Write the equation of torsion in shafts.

PART B — (5 × 16 = 80 marks)

11. (a) A bar 0.3 m long is 50mm square in section for 120mm of its length, 25 mm diameter for 80 mm and of 40mm diameter for the remaining length. If a tensile force of 100 kN is applied to the bar, calculate the maximum and minimum stress produced in it, and the total elongation. Take $E = 200$ GN/m² and assume uniform distribution of load over the cross section.

Or

(b) A short metallic column of 500 mm² cross-sectional area carries an axial compressive load of 100 kN. For a plane inclined at 60 degrees with the direction of Load, calculate (i) normal stress (ii) Tangential stress (iii) Resultant stress (iv) maximum shear stress (v) obliquity of resultant stress.

12. (a) Determine the forces in all the members of the truss shown in Figure Q.12 (a) using method of joints.

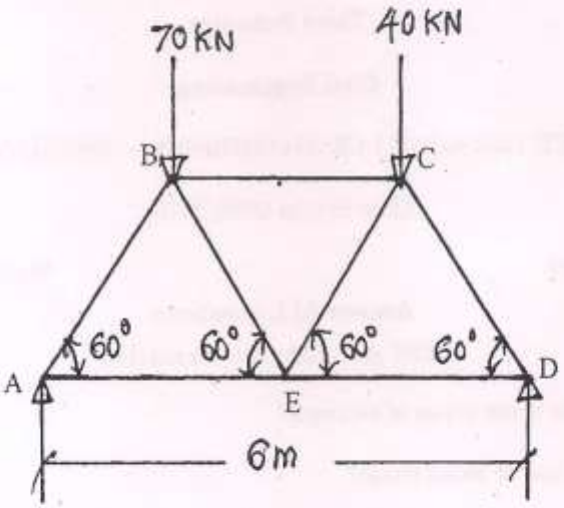

Figure Q. 12 (a)

Or

(b) A cylindrical shell 3 m long which is closed at the ends has an internal diameter of 1 m and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also change in the dimensions of the shell if it is subjected to an internal pressure of 1.5 MN/m².

13. (a) A simply supported beam of 16m effective span carries the concentrated loads of 4 kN, 5 kN and 3 kN at distances 3 m, 7 m and 10 m respectively from the left support. Calculate the maximum shearing force and bending moment. Draw SF and BM diagrams.

Or

(b) Determine the dimensions of joist of a timber for span 8m to carry a brick wall 200mm thick and 5m high, if the density of brick work is 1850 kg/m³ and the maximum permissible stress is limited to 7.5 MN/m². Given that the depth of joist is twice the width.

14. (a) A steel girder of uniform section, 14m long is simply supported at its ends. It carries concentrated loads of 90 kN and 60 kN at two points 3m 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 $I = 64 \times 10^{-4}$ m^4 and $E = 210 \times 10^6$ 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 solid steel shaft is subjected to a torque of 45 kNm. If the angle of twist is 0.5 degrees per meter length of the shaft and the shear stress is not to be allowed to exceed 90 MN/m^2, find (i) suitable diameter for the shaft (ii) Final maximum shear stress, and (iii) Maximum shear strain in the shaft. Take C = 80 GN/ m^2.

Or

(b) An open coiled helical spring of wire diameter 12 mm, mean coil radius 84 mm, helix angle 20 degrees carries an axial load of 480 N. Determine the shear stress and direct stress developed at inner radius of the coil.
