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Question Paper Code : 20326

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Fourth Semester

Civil Engineering

CE 8402 — STRENGTH OF MATERIALS II

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Maxwell's Reciprocal theorem.
2. What causes lack of fit?
3. Recall indeterminacy of a structure.
4. Determine the fixed end moments in a fixed beam of span 4m subjected to a uniformly distributed load of 5kN/m throughout its span.
5. How does end condition influence the effective length of a column?
6. Differentiate thin and thick cylinders. Give one example under each.
7. Outline principal planes.
8. State Maximum principal stress theory.
9. Define shear centre.
10. Give two examples of curved beams.

PART B — (5 × 13 = 65 marks)

11. (a) Find the vertical and horizontal deflection of the joint C of the pin jointed truss shown in Fig.1 by unit load method. The area of the horizontal member is 150 mm² and the area of the other members are 200 mm² each. Take E = 200 GPa.

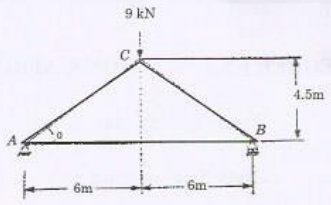

Fig. 1

Or

(b) A mild steel bar 100 mm diameter is bent as shown in Fig. 2. It is fixed at A and a load of 500 N hangs at D. Find the deflection at D by Castigliano's method. Take E = 200 GPa.

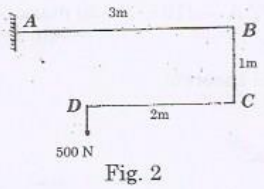

Fig. 2

12. (a) A beam AB of span 5m fixed at both ends carries uniformly distributed load of 12 kN/m over the whole span. If the right end B settles down by 12 mm determine the end moments for the beam and also vertical reactions at the ends. Take EI = 15 MN/m².

Or

(b) A two-span beam of length 8m each carried uniformly distributed load of 40 kN/m on the whole length is simply supported at the ends. Find the support moments and the reactions at the supports.

13. (a) Derive the Euler's load for a fixed column of height L.

Or

(b) The internal and external radii of a thick cylinder are 200 mm and 300 mm respectively. The external pressure on the cylinder is 4N/mm². Find the internal pressure that can be applied if the maximum hoop stress is limited to 15 N/mm². Sketch the distribution of radial pressure and hoop stress across the wall section.

14. (a) A shaft is supported in bearings 4m apart and transmits 60kW at 160 rpm. At 1.2m from one bearing the shaft carries a pulley transmitting a load of 50kN on the shaft.

Find the suitable diameter for the shaft for each of the following cases:

(i) the maximum direct stress shall not exceed 120 N/mm².

(ii) the maximum shear stress shall not exceed 60 N/mm².

Or

(b) A solid shaft is subjected to a bending moment of 300 Nm and a twisting moment of 9000 Nm. Find the diameter of the shaft to satisfy the condition that the strain energy stored per unit volume does not exceed the strain energy stored per unit volume under a pure shear stress of 30N/mm². Take E = 200 GPa and 1/m = 0.25.

15. (a) A beam of T-section (flange:100mm × 20mm; web : 150mm × 10mm) is 2.5m in length and is simply supported at the ends. It carries a load of 3.2kN inclines at 20° to the vertical and passing through the centroid of the section. If E = 200GPa, calculate the maximum tensile and maximum compressive stresses.

Or

(b) Locate the shear centre in a channel section with top and bottom flange dimensions 120mm × 20mm and that of rib 160mm × 10mm.

PART C — (1 × 15 = 15 marks)

16. (a) A steel tube of 200 mm external diameter is to be shrunk on to another steel tube of 60 mm internal diameter. After the shrinking, the diameter at the diameter at the junction is 120 mm. Before shrinking on, the difference of diameter at the junction is 0.08 mm. Find the hoop stresses developed in the two tubes after shrinking on, and the radial pressure at the junction. Take E = 200 GPa.

Or

(b) A continuous beam consists of three successive spans of 8m, 10m and 6m and carries loads of 60kN/m, 40kN/m and 80kN/m respectively on the spans. Determine the bending moments and reactions at the supports by the theorem of three moments. Plot the bending moment and shear force diagrams.