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Question Paper Code : 31201

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fourth Semester

Civil Engineering

CE 2252/CE 43/10111 CE 403/080100019 — STRENGTH OF MATERIALS

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Maxwell's reciprocal theorem.
2. Derive the relation for strain energy due to shear.
3. Find the reaction at the prop in a propped cantilever of span 3 m carrying a UDL of 5 kN/m over the entire span.
4. State the theorem of three moments.
5. Define slenderness ratio of a column.
6. State any four assumptions made in Lame's theory.
7. What is principal plane and principal stress?
8. What do you meant by tri-axial state of stress?
9. What are the assumptions made in Winkler-Bach formula?
10. What is principal moment of inertia?

PART B — (5 × 16 = 80 marks)

11. (a) Using Castigliano's first theorem, calculate the central deflection, and the slope at end of a simply supported beam carrying a UDL of intensity per unit length over the whole span. (16)

Or

(b) A beam simply supported over a span of 3.5 m carries a UDL of 25 kN/m over the entire span. Taking EI = 2.5 MNm^2 and using Castigliano's theorem, determine the deflection at the center of the beam. (16)

12. (a) A continuous beam ABCD is simply supported at A, B, C and D, AB = BC = CD = 5 m. Span AB carries a load of 30 kN at 2.5 m from A. Span BC carries an UDL of 20 kN/m. Span CD carries a load of 40 kN at 2 m from C. Draw the shear force and bending moment diagrams. (16)

Or

(b) A fixed beam of 8 m length is loaded with equal point loads of 130 kN each at distance 3 m from each support. Draw the bending moment and shear a force diagram where $E = 2 \times 10^8$ kN/m^2, $I = 8 \times 10^8$ mm^4. (16)

13. (a) Derive an expression for Euler's crippling load when one end of column is fixed and other end is hinged. (16)

Or

(b) A thick walled steel cylindrical shell of internal diameter 150 mm and external diameter 500 mm is subjected to fluid pressure of 100 MPa. Calculate the principal stress and maximum shear stress at a point on the inside surface of the cylinder and calculate the increase in inside diameter due to fluid pressure. Assume E = 200 kN/mm^2 and 1/m = 0.3. (16)

14. (a) The normal stress in two mutually perpendicular directions is 500 N/mm^2 and 100 N/mm^2 both are tensile. The complimentary shear stresses in these directions are of intensity 400 N/mm^2. Find the normal and tangential stresses in the two planes which are equally inclined to the planes carrying the normal stresses mentioned above. (16)

Or

(b) A steel flat of 250 mm long and 30 mm × 50 mm uniform section is acted upon by a tensile force of 30 kN along its length. A compressive force of 350 kN along its width, a compressive force of 200 kN along its thickness. Assuming Poisson's ratio of 0.3 and $E = 2 \times 10^5$ N/mm^2. Find change in dimensions and change in volume. (16)

15. (a) (i) Define Fatigue. (4)

(ii) What is the polar moment of inertia? (4)

(iii) What is unsymmetrical bending? (4)

(iv) What are the reasons for unsymmetrical bending occurring in the beams? (4)

Or

(b) A beam of T–section having flange of 100 mm × 20 mm and web of 150 mm × 10 mm and 4 m long is simply supported at its ends. It carries 5 kN at 40° to vertical and passing through the centroid of the section. Calculate the maximum tensile stresses and maximum compressive stresses, E = 200 kN/mm^2. (16)