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Question Paper Code : 50326

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Civil Engineering

CE 8301 — STRENGTH OF MATERIALS — I

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Sketch the stress strain diagram for mild steel and mark the salient points.

2. Recall composite bars.

3. Give the relationship between intensity of load. shear force and bending moment.

4. Classify loads and beams.

5. What is the maximum deflection and maximum slope in a simply supported beam carrying a concentrated load at the midspan?

6. Mention any two methods that can be used to determine slope of determinate beams.

7. Outline the applications of closed coiled helical springs.

8. Give the torsion equation and explain the terms involved.

9. Differentiate determinate and indeterminate structures.

10. Recall tension coefficient.

PART B — (5 × 13 = 65 marks)

11. (a) A steel cube block of 50mm side is subjected to a force of 6 kN (Tension), 8 kN (compression) and 4 kN (Tension) along x, y and z direction respectively. Determine the change in volume of the block. Take E= 2000 GPa and m = 10/3.

Or

(b) A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 150 MPa on the other at right angles to the former. Each of the above stresses is accompanied by a shear stress of 100 MPa such that when associated with the minor tensile stress tends to rotate the element in anticlockwise direction. Find :

(i) Principal stresses and their directions and

(ii) Maximum shearing stresses and the directions of the plane on which they act.

12. (a) A simply supported beam AB. 6 m long is loaded as shown in Fig. 12 (a) construct the shear force and bending moment diagrams for the beams and find the position and value of maximum bending moment.

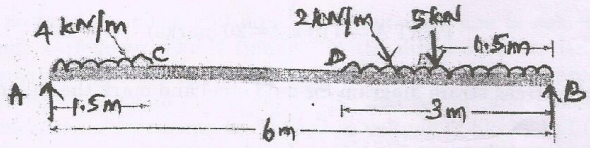

Figure – 12 (a)

Or

(b) The cross section of a beam is shown in Fig. 12 (b). The beam is made of material with permissible stress in compression and tension equal to 100 MPa and 140 MPa respectively. Calculate moment of resistance of cross-section, when subjected to a moment causing compression at the top and tension at the bottom. All dimensions shown in cross-section are in mm.

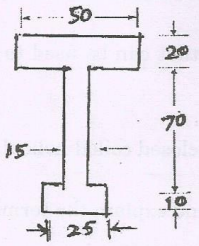

Figure – 12 (b)

13. (a) A beam of uniform section, 10 meters long, is simply supported at ends. It carries point loads of 100 kN and 60 kN at distances of 2 m and 5 m respectively from the left end. Calculate the deflection under each load and the maximum deflection. Given : $E=200\times10^6 N/m^2$ and $I=118\times10^4\ m^4$.

Or

(b) Using the conjugate beam method, for the beam shown in Fig 13 (b) find the slopes and deflection at A, B, C and D. Given : $E=200k\ N/m^2$ and $I=300\times10^{-4}m^4$. Neglect the weight of the beam.

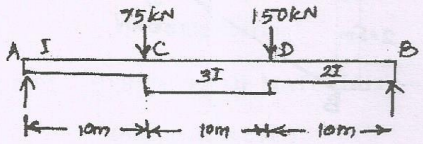

Figure – 13 (b)

14. (a) The maximum normal stress and the maximum shear stress analyzed for a shaft of 150 mm diameter under the combined bending and torsion, were found to be 120 MN/m^2 and 80 MN/m^2 respectively. Find the bending moment and torque to which the shaft is subjected. If the maximum shear stress is limited to 100 MN/m^2, find how much the torque can be increased if the bending moment is kept constant.

Or

(b) A helical spring B is placed inside the coils of a second helical spring A, having the same number of coils and free axial length and of the same material. The two springs are compressed by an axial load of 210N which is shared between them. The mean coil diameters of A and B are 90mm and 60mm and the wire diameters are 12mm and 7mm respectively. Calculate the load taken and the maximum stress in each spring.

15. (a) A truss of span 5 m is loaded as shown in Fig 15 (a). Find the reactions and forces in the members of the truss using the method of joints.

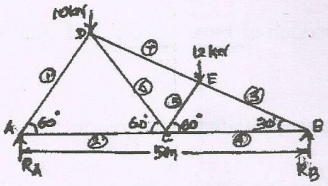

Figure – 15 (a)

Or

(b) Fig 15 (b). Shows the plan of a tripod. The feet A, B and C of the tripod are in the same horizontal plan and the apex D is 3.75 m above the plane. Horizontal loads of 100 kN and 150 kN are applied at D as shown. Using the method of tension coefficients, find the forces in all the members assuming that all joints are pin-jointed.

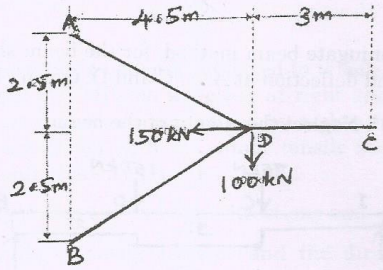

Figure – 15 (b)

PART C — (1 × 15 = 15 marks)

16. (a) A rectangular block 250 mm × 100 mm × 80 mm is subjected to axial loads as follows: 480kN (tensile) in the direction of its length; 900 kN (tensile) on the 250mm × 80 mm faces and 1000 KN (compressive) on the 250 rmn × 100mm faces. Taking E= 200 GN/m² and Poisson's ratio as 0.25 find the following: (i) Change in volume of block; and (ii) Values of the modulus of rigidity and bulk modulus for material of the block. (7+8)

Or

(b) A solid cylindrical shaft is to transmit 300 kW at r.p.m.

(i) If the shear stress is not to exceed 80 MN/m², find its diameter.

(ii) What percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals 0.6 of the external diameter, the length, the material and maximum shear stress being the same. (7+8)

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