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Question Paper Code : 40291

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third Semester

Civil Engineering

CE 8301 — STRENGTH OF MATERIALS – I

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define principal stress and principal strain.

2. State relationship between modulus of elasticity and modulus of rigidity.

3. Define the term Point of Contraflexure.

4. Draw the BMD for cantilever beam subjected to an anticlockwise moment at its free end.

5. When Macaulay's method is preferred?

6. A cantilever beam of span 'L' is subjected to a concentrated load 'W' at free end, What 'D' would be the maximum slope and deflection?

7. Write down the equation for maximum shear stress of a solid circular section in diameter 'D' when subjected to torque 'T'.

8. Calculate the maximum torque that a shaft of 125 mm diameter can transmit if the maximum angle of twist is 1° in a length of 1.5 m. take $C = 70 \times 10^3$ N/mm^2.

9. What is meant by Indeterminate structure?

10. Define redundant forces.

PART B — (5 × 13 = 65 marks)

11. (a) Find the Young's modulus and Poisson's ratio of a metallic bar of length 300 mm, breath 40 mm, depth 40 mm when the bar is subjected to an a axial load an 40 mm: Decrease in length is 0.75 mm and the increase in breadth is 0.03 mm. Also find the modulus of rigidity of the bar.

Or

(b) The composite bar shown in figure 11(b) is rigidly fixed at the ends. An axial pull of P = 15 KN is applied at B at 20°c, find the stresses in each material at 80°c. Take α_s = 11 × 10^{-6}/°c; α_a = 24 × 10^{-6}/°c; E_s = 210 kN/mm²; E_s = 70 kN/mm².

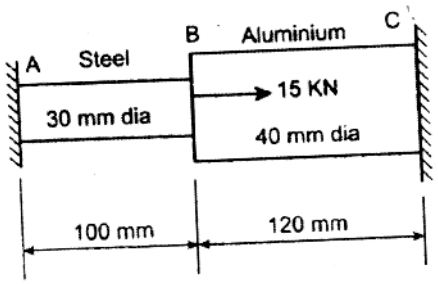

Fig. Q.No. 11(b)

12. (a) A beam of length 10 m is simply supported at its ends carries two concentrated loads of 5 KN each at a distance of 3m and 7m from the left support and also a uniformly distributed load of 1KN/m between the point loads. Draw the shear force and bending moment diagrams. Calculate the maximum bending moment.

Or

(b) A I–section beam 350 mm × 200 mm has a web thick ness of 12.5 mm and a flange thickness of 25 mm. it carries a shearing force of 20 kN at a section. Sketch the shear stress distribution across the section.

13. (a) For the cantilever beam shown in the figure 13(a). Find the deflection and slope at the free end. EI = 10000 KN/m².

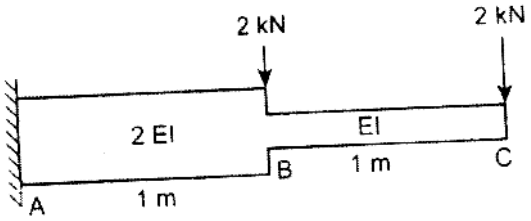

Fig. Q.No. 13(a)

Or

(b) Using conjugate beam method, obtain the slope and deflections at A, B, C and D of the beam shown in fig.13(b). Take E = 200GPa and I = 2×10^{-2} m^4.

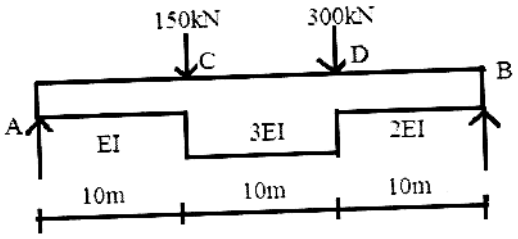

Fig. Q.No. 13(b)

14. (a) A helical spring of circular cross section wire 18 mm in diameter is loaded by a force of 500 N the mean coil diameter of the spring is 125 mm the modulus of rigidity is 80 KN/mm^2. Determine the maximum shear stress in the material of the spring. What number of coils must the spring have for is deflection to be 6 mm?

Or

(b) A solid cylindrical shaft is to transmit 300 KN power at 100 rpm. If the shear stress is not to exceed 60 N/mm^2, find its diameter. What percent saving in weights would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same?

15. (a) Analyze the pin-connected plane frame shown in fig. 15(a) The cross sectional area of each member is 3000 mm^2, Take E = 210 kN/ mm^2.

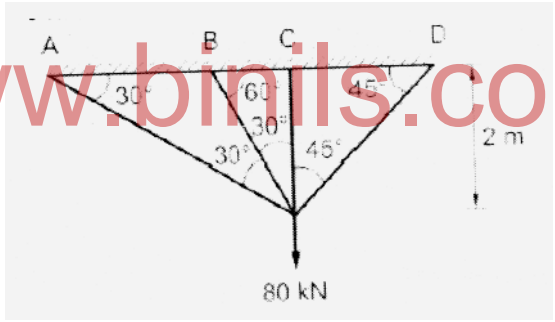

Fig. Q.No. 15(a)

Or

(b) Determine the forces in the member of the truss shown in figure 15(b). The cross sectional area of vertical and horizontal members is 4000 mm^2 and that of diagonal is 6000 mm^2.

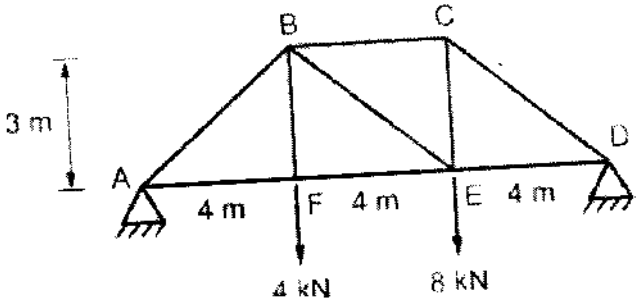

Fig. Q.No. 15(b)

PART C — (1 × 15 = 15 marks)

16. (a) A metallic bar 250 mm × 100 mm × 50 mm is loaded as shown in figure 16(a). Find the change in volume. Take E = 2×10^5 W/mm^2 and the Poisson's ratio = 0.25. Also find the change that would be made in the 4MN load, in order that three should be no change in the volume of the bar.

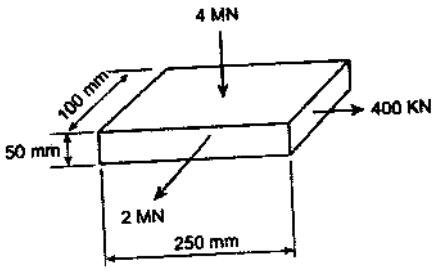

Fig. 16(a)

Or

(b) A shaft is required to transmit power of 300 Kw running at a speed of 120 rpm. If the shear strength of the shaft material is 7o N/mm^2, Design a hollow F shaft with the inner diameter equal to 0.75 times the outer diameter.