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Question Paper Code : 90313

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

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. What is the need of composite bar in structural applications?
2. Sketch the stress stain curves of a ductile material and mark the important points.
3. What is the need of drawing shear force and bending moment diagram?
4. Mention and sketch any two types of supports and corresponding reactions for the beams.
5. List any four methods of determining slope and deflection of loaded beam.
6. What is the relation between slope, deflection and radius of curvature of a beam?
7. What type of stresses are induced in a closed coil helical spring subjected to axial load?
8. Why are hollow shafts preferred to solid shafts?
9. Differentiate determinate and indeterminate trusses.
10. What are all the assumptions involved in design of trusses?

PART B — (5 × 13 = 65 marks)

11. (a) Three bars made of copper, zinc and aluminium are of equal length and have cross section 500, 750 and 1000 square mm respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 250 kN, estimate the proportional of the load carried on each rod and the induced stresses. Take the value of E for copper = 1.3×10^5 N/mm², for zinc = 1.0×10^5 N/mm² and for aluminium = 0.8×10^5 N/mm².

Or

(b) Derive the expression for young's modulus in terms of bulk modulus.

12. (a) A horizontal beam AB of length 8 m is hinged at A and placed on rollers at B. The beam carries three inclined point loads as shown in figure 1. Draw shear force, bending moment and axial force diagrams of the beam.

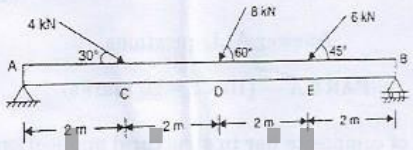

Figure 1

Or

(b) Write the assumptions involved in theory of simple bending and derive the bending equation.

13. (a) A simply supported beam AB of span 4 m, carrying a load of 100kN at its mid span C has cross sectional moment of inertia 24×10^6 mm⁴ over the right half. Find the slope at two supports and the deflection under the load using area moment method. Take E = 200 GPa.

Or

(b) A beam of length 6 m is simply supported at its end carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Take E = 2×10^5N/mm² and I = 85×10^6 mm⁴. Find deflection under each load using Macaulay's method.

14. (a) Derive the expression for torsion equation and also write the assumptions involved in this derivation.

Or

(b) Determine the diameter of a solid steel shaft which will transmit 90 kW at 160 rpm. Also determine the length of the shaft if the twist must not exceed 1° aver the entire length. The maximum shear stress is limited to 60 N/mm². Take the value of modulus of rigidity as 8×10^4 N/mm².

15. (a) Using the method of joint, determine the axial force in each member of the truss shown in Figure 2.

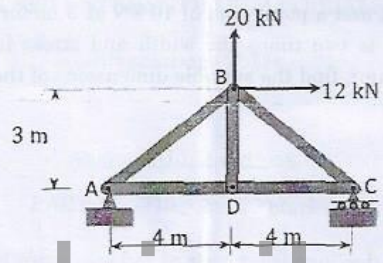

Figure 2

Or

(b) Using the method of section, determine the axial forces in members CD, CG, and HG of the truss shown in Figure 3.

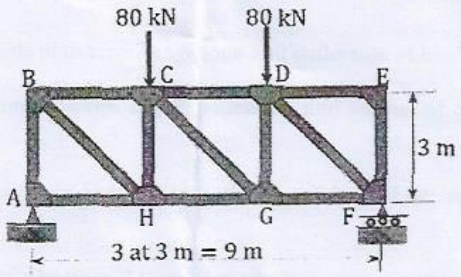

Figure 3

PART C — (1 × 15 = 15 marks)

16. (a) A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If at a temperature of 10°C there is no longitudinal stress, calculate the stresses in the rod and tube when the temperature is raised to 200°C. Take E for steel and copper as 2.1×10^5 N/mm² and 1×10^5 N/mm² respectively. The value of coefficient of linear expansion for steel and copper is given as 11×10^{-6} per °C and 18×10^{-6} per °C respectively.

Or

(b) A timber beam of rectangular section of length 8 m is simply supported. The beam carries a uniformly distributed load of 12 kN/m run over the entire length and a point load of 10 kN at 3 meter from the left support. If the depth is two times the width and stress in the timber is not to exceed 8 N/mm², find the suitable dimensions of the section.