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V 4537

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Third Semester

Chemical Engineering

CH 1203 — MECHANICS OF SOLIDS

(Common to Textile Technology)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Any data missing may be assumed reasonably.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. In a material the lateral and longitudinal strains are 3.33×10^{-3} and 1×10^{-2} respectively. $E = 2 \times 10^5$ N/mm^2. Find the value of Bulk Modulus.

2. For fillet weld, what is the strength per unit length?

3. For the beam shown in Fig.1, find the maximum B.M. and SF.

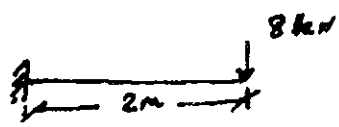

Fig. 1

4. What are the commonly used support conditions for beams?

5. For the beam shown in Fig. 2 what is maximum slope and deflection.

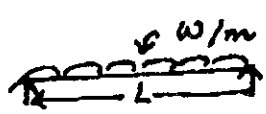

Fig. 2

6. State the Moment area I theorem.

7. State any two assumptions made in deriving the theory of simple bending.

8. For a rectangular beam of cross section $b \times d$, find the ratio of maximum and average shear stress.

9. Write any two differences between open coil and close coil helical spring.

10. What is slenderness ratio of a column? When a column can be classified as long column?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the relationship between E and K. (8)

(ii) A reinforced concrete column section 30 × 30 cm has 4 bars of steel each 22 m diameter. Calculate the safe load if the permissible stress is 400 N/cm², $E_S = 15\ E_C$. (8)

Or

(b) A steel bar is placed between two copper bars, each having same area and length as the steel bar. They are rigidly connected together at 15°C. When the temperature is raised to 300°C, the length of the bar increases to 0.144 cm. Determine the original length and final stresses.

$E_S = 2 \times 10^5$ N/mm² $\quad\quad$ $\alpha_S = 1 \times 10^{-2}$/°C

$E_C = 1 \times 10^5$ N/mm² $\quad\quad$ $\alpha_C = 0.0000175$/°C (16)

12. (a) For the beam shown in Fig. 3 draw SFD and BMD. (16)

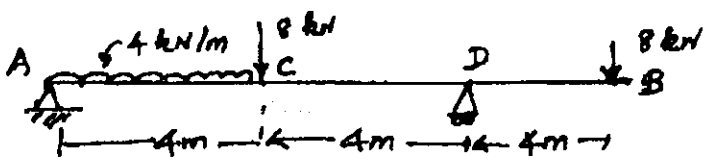

Fig. 3

Or

(b) For the simply supported beam shown in Fig. 4, draw BMD and SFD. Indicate the maximum shear force and bending moment. (16)

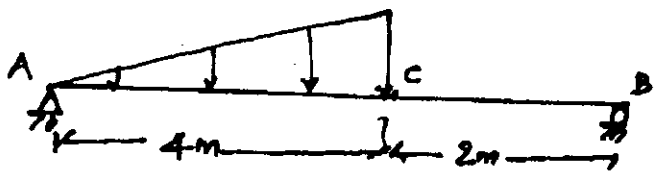

Fig. 4

13. (a) For the beam shown in Fig. 5 find the slope at 'C' and deflection at 'D' by MaCaulay's method. EI constant. (16)

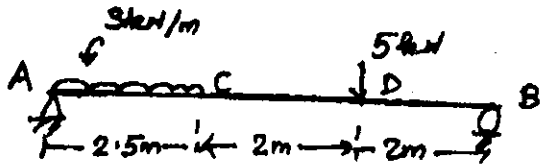

Fig. 5

Or

(b) By moment area method find the slope and deflection at 'D' for the beam shown in Fig. 6. (16)

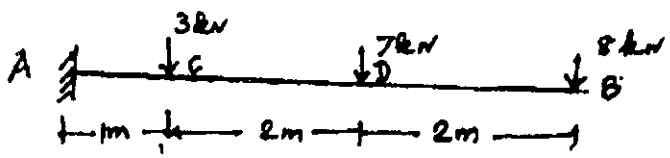

Fig. 6

14. (a) (i) Derive the relationship $\frac{\sigma}{y} = \frac{E}{R}$. (8)

(ii) A floor has to carry a load of 10 kN/m^2. The floor is supported on rectangular beams each 100 × 300 mm and 5 m long. Calculate the distance centre to centre at which the beams be placed so that the stress in the beam not exceeds to 6 MN/m^2. (8)

Or

(b) (i) Derive the relationship $\frac{\lambda}{r} = \frac{G\theta}{l}$. (8)

(ii) A simply supported beam at a section has to withstand 4 kN shear force. The cross section of the beam is 'T' with 12.5 cm × 2.5 cm flange and 2.5 cm width and 17.5 cm depth web. Calculate the maximum shear stress for the section. (8)

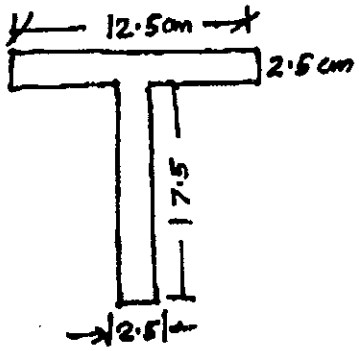

Fig. 7

15. (a) A steel shaft 6 m long is securely fixed at each end. A torque of 1200 Nm is applied to the shaft at a section 2 m from right end. What are the fixing torques set up? If the diameter of the shaft is 5 cm, what are the maximum shear stresses in the two portions? Calculate the angle of twist for the section where the torque is applied. G = 84 GN/m^2. (16)

Or

(b) (i) Derive Euler's equation for long column for both ends hinged. (12)

(ii) What is core of a section? Find the core of the circular section with diameter 20 cm. (4)

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