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**P 1105**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Fourth Semester

Mechanical Engineering

CE 251 — STRENGTH OF MATERIALS

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Poisson's ratio.
2. Define Complementary shear.
3. Draw the SFD for a simply supported beam of span 'L' subjected to two equal point load of intensity 'W' at each of the quarter span points.
4. Draw the BMD for a cantilever beam of span 'L' subjected to a central clockwise moment 'M'.
5. Draw the qualitative variation of shear stress in an I section.
6. Draw the cross section of a flitched beam made up of timber and steel.
7. Write down the expression for the stiffness of open coil helical spring.
8. If  $f_1$ ,  $f_2$  and  $f_3$  are the circumferential stress, longitudinal stress and shear stress due to torque respectively experienced by a cylindrical vessel, write the expression for the major principle stress.
9. Write down the two area moment theorems for the evaluation of slope and deflection.
10. Write the expression for strain energy due to torsion.

PART B — (5 × 16 = 80 marks)

11. (a) (i) The safe stress for a hollow steel column which carries an axial load of  $2.1 \times 10^3$  kN is  $125 \text{ MN/m}^2$ . If the external diameter of the column is 30 cm, determine the internal diameter. (4)
- (ii) Define Elastic constants and write the relationship between them. (12)

Or

- (b) An axial pull of 35000 N is acting on a bar consisting of three lengths as shown in Fig. 11(b). If the Young's modulus =  $2.1 \times 10^5 \text{ N/mm}^2$ , determine
- (i) Stresses in each section and
- (ii) Total extension of the bar.

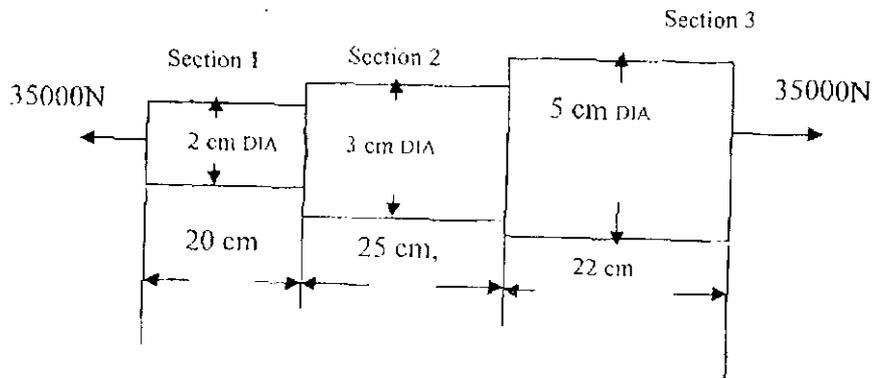


Fig. 11(b)

12. (a) Draw the Shear force and bending moment diagram for a simply supported beam of length 9 m and carrying a uniformly distributed load of 10 kN/m for a distance of 6 m from the left end. Also calculate the maximum B.M. on the section.

Or

- (b) Draw the shear force and bending moment diagram for the over-hanging beam ABC of length 6 m, carrying uniformly distributed load of 2 kN/m over the Entire length. The supported span AB is of 4 m length. Also locate the point of contraflexure.
13. (a) A beam is of square section of the side 'a'. If the permissible bending stress is 'f', find the moment of resistance when the beam section is placed such that (i) two sides are horizontal, (ii) one diagonal is vertical. Find also the ratio of the moment of the resistance of the section in the two positions.

Or

- (b) A beam is simply supported and carries a uniformly distributed load of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is  $120 \text{ N/mm}^2$  and moment of inertia of the section is  $7 \times 10^8 \text{ mm}^4$ , find the span of the beam.

14. (a) A solid circular shaft transmit 75 kW power at 200 r.p.m. Calculate the Shaft diameter. If the twist in the shaft is not to exceed  $1^\circ$  in 2 meters length of shaft, and shear stress is limited to  $50 \text{ N/mm}^2$ . Take  $C = 1 \times 10^5/\text{mm}^2$ .

Or

- (b) A thin cylinder of internal diameter 1.25 contains a fluid at an internal pressure of  $2 \text{ N/mm}^2$ . Determine the maximum thickness of cylinder if :
- (i) The Longitudinal stress is not to exceed  $30 \text{ N/mm}^2$ .
  - (ii) The Circumferential stress is not to exceed  $45 \text{ N/mm}^2$ .
15. (a) A horizontal beam AB is simply supported at A and B, 6 m apart. The beam is subjected to a clockwise couple of  $300 \text{ kN/m}$  at a distance of 4 m from the left end. If  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $I = 2 \times 10^8 \text{ mm}^4$ , determine :
- (i) Deflection at the point where couple is acting and
  - (ii) The maximum deflection.

Or

- (b) Find the slope at the support and deflection at midspan of a simply supported beam of span L subjected to a central concentrated load W using strain energy method.