

**T 8088**

B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

Fourth Semester

Civil Engineering

CE 1252 — STRENGTH OF MATERIALS

(Common to BE – (Part Time) Third Semester Regulation 2005)

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Castigliano's theorem to find slope and deflection in a beam.
2. What is meant by strain energy stored in a structure?
3. What is indeterminate beam?
4. What is meant by point of contraflexure?
5. What is middle third rule?
6. Write four assumptions made in Euler's theory of columns.
7. State Rankine's theory of failure.
8. What is principal plane, principal stress?
9. What is principal moment of inertia?
10. What is unsymmetrical bending?

PART B — (5 × 16 = 80 marks)

11. (a) Find the deflection at one third point from left end of the simply supported beam of span 6 m subjected to uniformly distributed load of 20 kN/m by strain energy principle.

Or

- (b) Find the deflection at E in the truss shown in Fig. 1. Areas of members are given in brackets in square cm. Assume  $E = 2 \times 10^5 \text{ N/mm}^2$ .

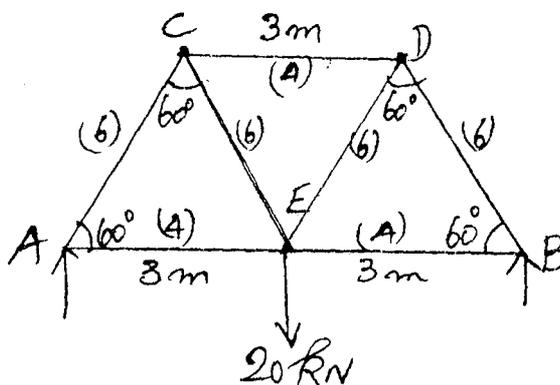


Fig. 1

12. (a) Find the support moments and reactions in a fixed beam of span of 9 m. It is subjected to concentrated loads of 36 kN and 54 kN at 3 m and 6 m from left support respectively. Also draw shear force and bending moment diagrams.

Or

- (b) A continuous beam ABCD is simply supported at A, B, C and D.  $AB = BC = CD = 4 \text{ m}$ . Span AB carries a load of 24 kN at 3 m from A. Span BC carries an uniformly distributed load of 24 kN/m. Span carries a central concentrated load of 48 kN. Draw shear force and bending moment diagrams.
13. (a) Find the Euler's critical load for a cast iron hollow column of external diameter 200 mm diameter, 25 mm thick and of length 6 m hinged at both ends.  $E = 0.8 \times 10^4 \text{ N/mm}^2$ . Compare Euler's load with Rankine's critical load. Assume  $f_c = 550 \text{ N/mm}^2$  and  $\alpha = 1/1600$ . Find the length of column at which both critical loads are equal.

Or

- (b) (i) A pipe of 400 mm internal diameter and 100 mm thick contains a fluid at a pressure of 10 N/mm<sup>2</sup>. Find maximum and minimum hoop stress across the section. Also sketch the stress distribution. (8)
- (ii) Find the thickness of steel cylindrical shell of internal diameter 200 mm to withstand an internal pressure of 35 N/mm<sup>2</sup>. Maximum hoop stress in the section not to exceed 120 N/mm<sup>2</sup>. (8)

Rectangular block of size 250 mm × 100 mm × 80 mm is subjected to principal loads as follows :

tensile force of 480 kN in the direction of its length. A tensile force of 600 kN in 250 mm × 80 mm faces. A compressive force of 1000 kN in 100 mm × 80 mm faces. Assuming Poisson's ratio of 0.25 and modulus of elasticity of  $2 \times 10^5$  N/mm<sup>2</sup>. Find strain and change in length in each direction. Also find volumetric strain and change in volume.

Or

A rectangular block is subjected to a tensile stress of 100 N/mm<sup>2</sup> on one plane and 50 N/mm<sup>2</sup> on a plane at right angles together with a shear stress of 60 N/mm<sup>2</sup> on the same plane. Find the direction of principal plane, magnitude and nature of principal stresses. Also find the maximum shear stress.

b) Find the principal moment of inertia of angle section 60 mm × 40 mm × 6 mm.

Or

b) A rectangular section of 80 mm wide and 120 mm deep is subjected to a bending moment of 12 kNm. The trace of plane of loading is inclined at 45° to YY axis of the section. Locate neutral axis and find the maximum stress induced in the section.