

M 2030

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Third Semester

Chemical Engineering

CH 1203 — MECHANICS OF SOLIDS

(Common to Textile Technology)

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a compound bar? Give an example.

2. A bar of length 200 mm, a diameter 40 mm carries an axial tensile load of 200 kN. What is lateral strain if $\nu = 0.25$ and $E = 200 \text{ kN/mm}^2$.

3. Write down the conditions for maximum bending moment at a section.

4. Draw the shear stress distribution for T-Section.

5. What is the maximum shear stress in circular shaft of diameter 100 mm and subjected to a torque of 90 kNm?

6. What are limitations of Euler's method?

7. A cantilever beam of span 2 m and $EI = 30000 \text{ kNm}^2$ is subjected to a point load 10 kN at free end. Find the deflection at free end.

8. What is point of contra flexure in beams? Give an example.

9. What is the stiffness of a closely coiled helical spring with coil diameter 100 mm and wire diameter 10 mm and the number of coils are 6? $G = 80 \text{ kN/mm}^2$.

10. What is the critical load for column of 40 mm circular cross section, 2 m long and hinged at the ends? Take $E = 200 \text{ kN/mm}^2$.

PART B — (5 × 16 = 80 marks)

11. (i) What are the types of beams? Explain. (4)
- (ii) Draw the shear force and bending moment diagrams for the beam shown in Fig. Q 11. Also indicate the points of contra flexure if any. (12)

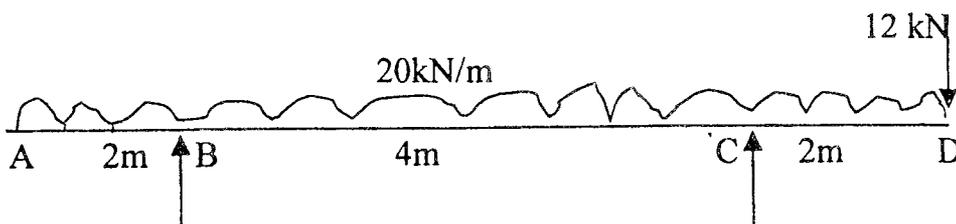


Fig. Q 11.

12. (a) Three tubes A, B, C are fitting loosely one over the other. Tube A is inside and tube C is outside. Each tube has a thickness of 10 mm and length of 300 mm. Inner tube A has internal diameter of 100 mm. If an axial load of 150 kN is applied, find load carried by each tube, change in length of each tube and stress in each tube. Take $E_A = 200 \text{ kN/mm}^2$, $E_B = 100 \text{ kN/mm}^2$, $E_C = \text{kN/mm}^2$.

Or

- (b) A brass bar having cross sectional area of 100 mm^2 , is subjected to axial forces as shown in Fig. Q 12 b. Find the force P and the total change in length of the bar. $E = 105 \text{ kN/mm}^2$.

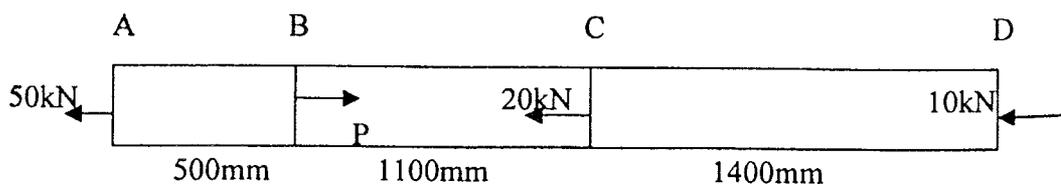


Fig. Q 12 b.

Find the deflection at C and slope at A for the beam shown in Fig. 13 a by Macaulay's method. $EI = 360000 \text{ kNm}^2$.

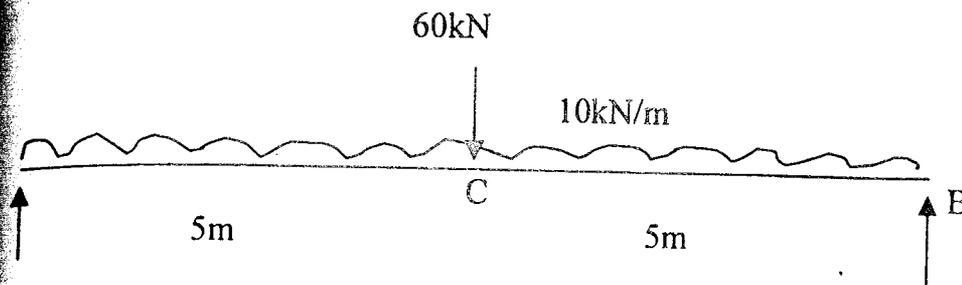


Fig. Q 13 a.

Or

a) A simply supported beam of 6 m span carries an UDL of 10 kN/m over the entire span and a concentrated moment of 30 kNm at mid span. Find the deflection at centre and slope at the ends. $EI = 40000 \text{ kNm}^2$.

b) A closed coiled helical spring is to have a stiffness of 1.5 N/mm in compression with a maximum load of 100 N and maximum shearing stress of 90 N/mm². The solid length of the spring (i.e., coils are touching) is 70 mm. Find the diameter and the number of coils. $G = 45 \text{ kN/mm}^2$.

Or

c) A hollow shaft is to transmit 900 kW at 100 rpm. If the shear stress is not to exceed 60 N/mm² and the internal diameter is 0.5 times the external diameter, find the diameters. The maximum torque is 1.25 times the mean torque.

d) Derive an expression for critical load of a long column fixed at one end and hinged at the other end.

Or

e) A circular column of length 6 m fixed at both ends how to carry a load of 150 kN with a factor of safety of 2.5. Determine the size of the column if $\sigma_c = 250 \text{ mPa}$ and $\alpha = \frac{1}{7500}$.