A 201

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Third Semester

Chemical Engineering

CH 235 — MECHANICS OF SOLIDS

(Common to Leather Technology and Textile Technology)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State and explain Hooke's law.

2. A short bar of length 100 mm tapers uniformly from a diameter 40 mm to a diameter of 30 mm and carries an axial compressive load of 200 kN. Find the change in length of the bar. E = 200 kN/mm^2.

3. Define shear force and bending moment.

4. Draw the shear stress distribution in an I-section due to bending.

5. What are the two conditions to be satisfied in the design of a circular shaft?

6. What is the effect of eccentricity in loading on columns?

7. State moment area theorems.

8. What is point of contraflexure in beams?

9. What is the stiffness of a helical spring?

10. What is the critical load for column of 50 mm circular cross section, 2 m long and fixed at the ends? Take E = 200 kN/mm^2.

PART B — (5 × 16 = 80 marks)

11. (i) Draw the shear force diagram for a simply supported beam having span 4 m and carrying a clockwise moment 10 kNm at left support. (6)

(ii) Draw the shear force and bending moment diagrams for the beam shown in Fig. Q11. Also indicate the points of contra flexure if any. (10)

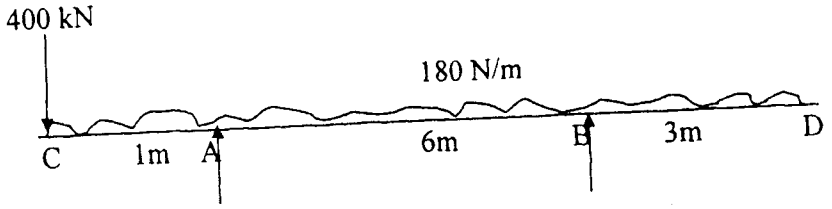

Fig. Q11

12. (a) A plate of aluminium 24 mm wide, 6 mm thick is place between two steel plates each 24 mm wide, 9 mm thick to form a composite bar 24 mm × 24 mm. These plates are fixed at the ends to 10°C. Find the stress in steel and aluminium plates if the temperature is raised to 50°C. Take E_S = 200 kN/mm², E_a = 66.67 kN/mm² , $\alpha_s = 12 \times 10^{-6}$ per °C, $\alpha_a = 23 \times 10^{-6}$ per °C.

Or

(b) 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 kN/mm², E_B = 100 kN/mm², E_C = 50 kN/mm².

13. (a) For the beam shown in Fig. Q13a find deflections at C and D using Macaulay's method. EI = 17000 kNm².

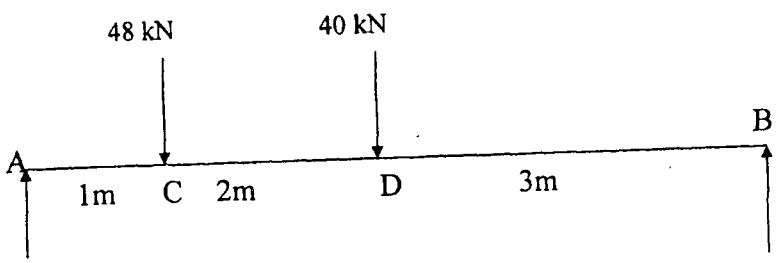

Fig. Q13a

Or

(b) Find slope and deflection at free end of the cantilever beam having span 3 m and carrying a point load 100 kN at free end. EI = 40000 kNm².

14. (a) A closed coiled helical spring is to have a stiffness of 800 N/m in compression with a maximum load of 50 N and maximum shearing stress of 100 N/mm^2. The solid length of the spring (i.e., coils are touching) is 50 mm. Find the diameters and the number of coils. G = 80 kN/mm^2.

Or

(b) A hollow shaft with diameter ratio 3/8 is required to transmit 375 kW at 100 rpm, the maximum torque being 20% greater than the mean. The maximum shear stress is not to exceed 60 N/mm^2 and the twist in a length of 2 m is not to exceed 1°. Calculate the minimum diameters required for the shaft. C = 85 kN/mm^2.

15. (a) Derive an expression for critical of a long column hinged at both the ends.

Or

(b) A column with cross section 100 mm × 50 mm is fixed at one end and hinged at the other end. The length of column is 4 m. E = 200 kN/mm^2. Find the critical load.
