Reg. No. : | | | | | | | | | | | |

H 2120

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

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 bar of Length 200 mm, a diameter 40 mm carries an axial tensile 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. What is the maximum shear stress in a rectangular cross-section?

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

6. State the difference between short and long columns.

7. State moment area theorems.

8. What is point of contra flexure in beams?

9. Define stiffness.

10. State effective length of column for different end conditions.

PART B — (5 × 16 = 80 marks)

11. (a) A plate of aluminium 48 mm wide, 12 mm thick is place between two steel plates each 48 mm wide, 18 mm thick to form a composite bar 48 mm × 48 mm. These plates are fixed at the ends at 20° C. Find the stress in steel and aluminium plates if the temperature is raised to 60° C. Take $E_s = 200$ kN/mm^2, $E_a = 66.67$ kN/mm^2, $\alpha_s = 12 \times 10^{-6}$ 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/mm^2, $E_B = 100$ kN/mm^2, $E_C = 50$ kN/mm^2.

12. (a) Draw the shear force and bending moment diagrams for the beam shown in Fig.Q. 12(a). Also indicate the points of contra flexure if any.

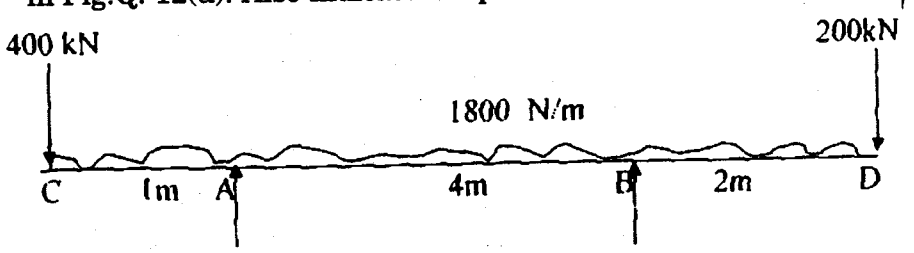

Fig.Q. 12(a)

Or

(b) Derive the relationship between the loading, shear force and bending moment.

13. (a) For the beam shown in Fig.Q. 13(a) find deflections at C and D using Macaulay's method. EI = 17000 kNm^2.

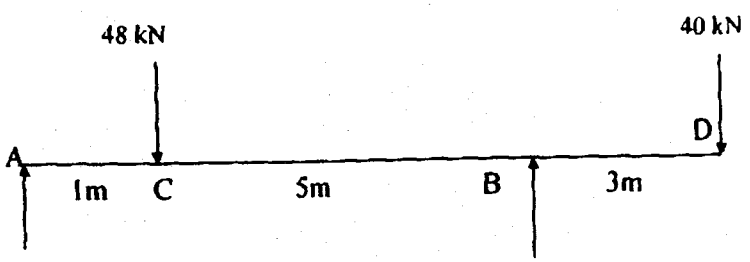

Fig.Q. 13(a)

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 mid span. EI = 50000 kNm^2.

14. (a) A closed coiled helical spring is to have a stiffness of 500 N/m in compression with a maximum load of 30 N and maximum shearing stress of 90 N/mm^2. The solid Length of the spring (i.e., coils are touching) is 60 mm. Find the diameters and the number of coils. G = 80 kN/mm^2.

Or

(b) A hollow shaft is to transmit 562.5 kW at 100 rpm. If the shear stress is not to exceed 60 N/mm^2 and the internal diameter is 0.4 times the external diameter, find the diameters. The maximum torque is 1.25 times the mean torque.

15. (a) Derive an expression for critical of a long column fixed 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.