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

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.   When the thermal stresses are induced?

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.   Write down the relationship between shear force and bending moment.

4.   What is the maximum shear stress in a rectangular cross-section?

5.   Write the expression for maximum shear stress for a hollow circular shaft with internal and external diameters d and D respectively and subjected to a torque T.

6.   What is short column?

7.   Give any two beams and the corresponding conjugate beams.

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 hinged at the ends? Take $E = 200$ kN/mm^2.

11. (i) What are the types of beams? Explain. (6)

    (ii) Draw the shear force and bending moment diagrams for the beam shown in Fig. Q 11. Also indicate the points of contraflexure if any. (10)
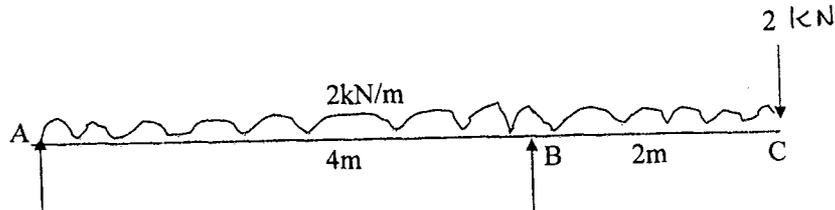
Fig. Q. 11

12. (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/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) A brass bar having cross sectional area of 1000 mm, is subjected to axial forces as shown in Fig. Q 12 (b). Find the total change in length of the bar $E = 105$ kN/mm². A = 100 mm².
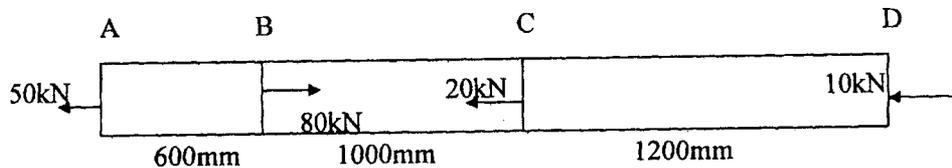
Fig. Q. 12 (b)

13. (a) Find the deflection at C and D for the beam shown in Fig. 13 (a) by Macaulay's method. EI = 360000 kNm².
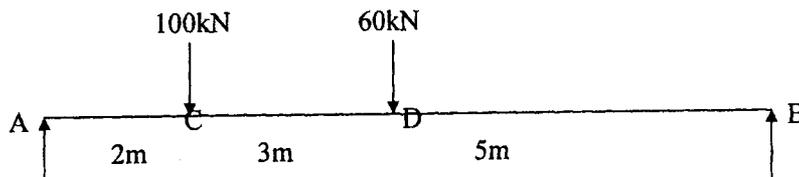
Fig. Q 13 (a)

Or

    (b) A simply supported beam of 6 m span carries an UDL of 10 kN/m over the entire span. Find the deflection at centre and slope at the ends. $EI = 40000$ kNm².

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14. (a) A closed coiled helical spring is to have a stiffness of 1.5 N/mm in compression with a maximum load of 60 N and maximum shearing stress of 125 N/mm². The solid length of the spring (i.e. coils are touching) is 50 mm. Find the diameters and the number of coils. $G = 45$ kN/mm².

Or

(b) A hollow shaft is to transmit 562.5 kW at 100 rpm. If the shear stress is not to exceed 60 N/mm² 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 200 mm × 100 mm is hinged at the ends. The length of column is 4 m. $E = 200$ kN/mm². Find the critical load.

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