T 8083

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

Third Semester

Civil Engineering

CE 1201 — MECHANICS OF SOLIDS

(Common to B.E. (Part-Time) Second Semester Regulation 2005)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A circular steel rod tapers uniformly from 40 mm to 15 mm diameter in a length of 400 mm. What is the elongation of the bar if the axial pull is 40 kN. $E = 2 \times 10^5$ N/mm^2.

2. State Hooke's Law.

3. What is a perfect frame?

4. What is tension coefficient?

5. What is the condition for maximum bending moment in a beam?

6. Write down the bending equation.

7. Give conjugate beam for a simply supported beam and cantilever beam.

8. Draw the variation of shear stresses in T-Section and rectangular section due to bending.

9. Compute torsional rigidity of a 100 mm diameter, 4 m length shaft C = 80 kN/mm^2.

10. Write down the expressions stiffness and shear stress in close coiled helical springs.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Calculate the modulus of rigidity and bulk modulus of the cylindrical bar of diameter 25 mm, length 1.5 m if the longitudinal strain is 4 times the lateral strain. $E = 1.5 \times 10^5$ N/mm^2.

(ii) Determine the total strain in a bar made of 40 mm diameter solid for a length of 80 mm and hollow circular cross section of outer diameter 40 mm and inner diameter of 20 mm for a length of 120 mm as shown in Fig. Q. 11. The axial load is 80 kN. $E = 200$ kN/mm^2.

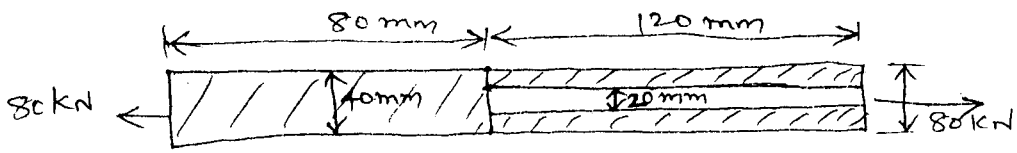

Fig. Q. 11

Or

(b) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on a gauge length of 200 mm is 0.09 mm and change in diameter is 0.0039 mm. Calculate Poisson's ratio and three moduli.

12. (a) Find the forces in the members of the truss shown in Fig. Q. 12(a).

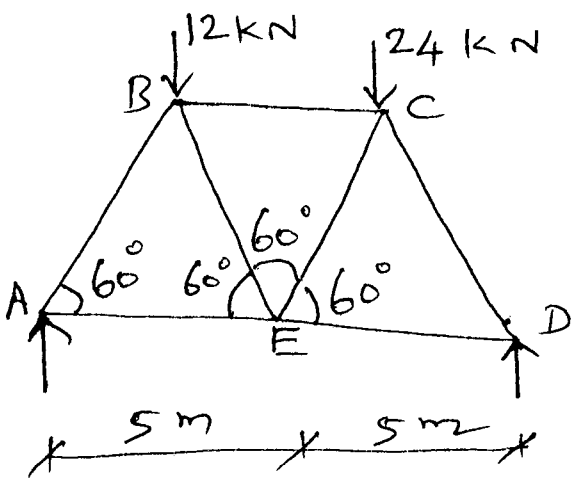

Fig. Q. 12(a)

Or

(b) A cylindrical shell 900 mm long, 150 mm internal diameter, 8 mm thick is filled with a fluid at atmospheric pressure. If an additional 20000 mm^3 of fluid is pumped into the cylinder find the pressure exerted by the fluid on the cylinder and the hoop stress induced. E = 2 × 10^5 N/mm^2 and $\gamma = 0.3$.

13. (a) Draw the shear force and bending moment diagrams for the beam shown in Fig. Q. 13(a).

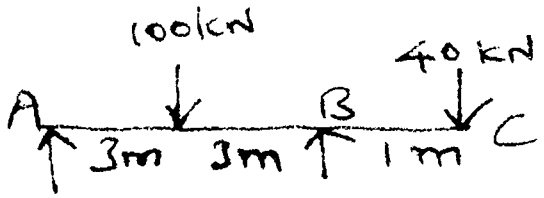

Fig. Q. 13(a)

Or

(b) Find the cross section dimensions of a wooden beam of span 4 m and carrying UDL of 10 kN/m over the entire span. The beam is of rectangular cross section. Assume the depth of the beam is twice the width.

14. (a) Find the maximum deflection using Macaulay's method for the beam shown in Fig. Q. 14(a). EI = 8.6 × 10^{10} kN/mm^2

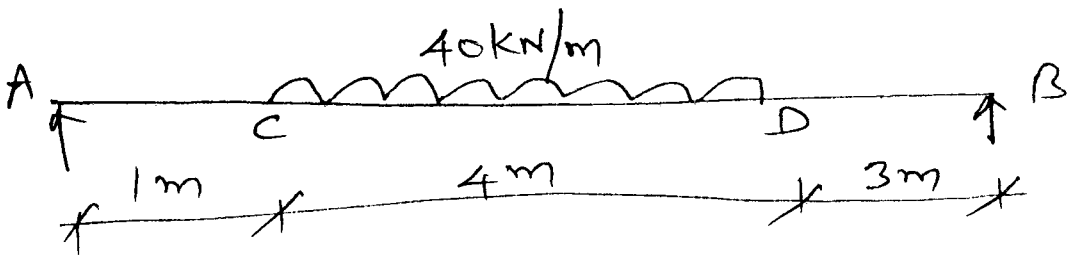

Fig. Q. 14(a)

Or

(b) Find the deflection at mid span and slope at the end A using conjugate beam method. EI = 16000 kNm^2. The beam is shown in Fig. Q. 14(b).

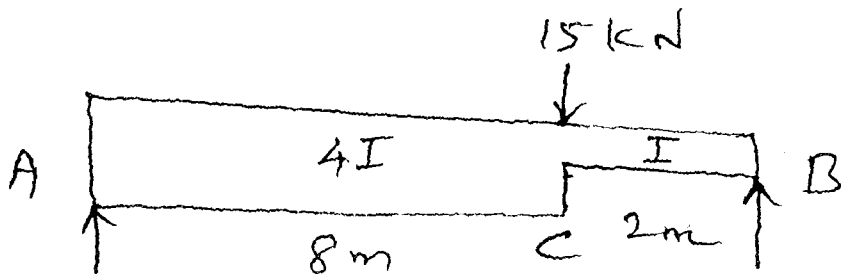

Fig. Q. 14(b)

15. (a) A hollow shaft with diameter ratio $\frac{3}{5}$ is required to transmit 450 kW at 120 rpm. The shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m is not to exceed 1°. Calculate the minimum external diameter of the shaft. C = 80 kN/mm^2.

Or

(b) It is required to design a close coiled helical spring which shall deflect 10 mm under an axial load at a 100 N at a shear stress of 90 N/mm^2. The coil mean diameter is 10 times the wire diameter. Find the diameters and the length of the wire. E = 80 kN/mm^2.