Reg. No. :

Question Paper Code : 97029

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Third Semester

Mechanical Engineering

CE 6306 — STRENGTH OF MATERIALS

(Common to Mechatronics Engineering, Industrial Engineering and Management, Industrial Engineering, Manufacturing Engineering, Mechanical Engineering (sandwich) and Material Science and Engineering)

(Regulation 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Derive a relation for change in length of a bar hanging freely under its our weights.

2. Write the relationship between shear modulus and young's modulus of elasticity.

3. Draw SFD for a 6 m cantilever beam carrying a clockwise moment of 6 kN-m at free end.

4. What are flitched beams?

5. What is meant by torsional rigidity?

6. Differentiate open coiled and closely coiled helical springs.

7. What are the limitations of double integration method?

8. Define strain energy.

9. What is meant by circumferential stress?

10. Write down Lame's equations.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive an expression for change in length of a circular bar with uniformly varying diameter and subjected to an axial tensile load 'P' (8)

(ii) A member is subjected to point loads as shown in Fig. Q. 11(a). Calculate the force P, necessary for equilibrium if P_1 = 45 kN, P_3 = 450 kN and P_4 = 130 kN. Determine total elongation of the member, assuming the modulus of elasticity to be E = 2.1 × 10^5 N/mm². (8)

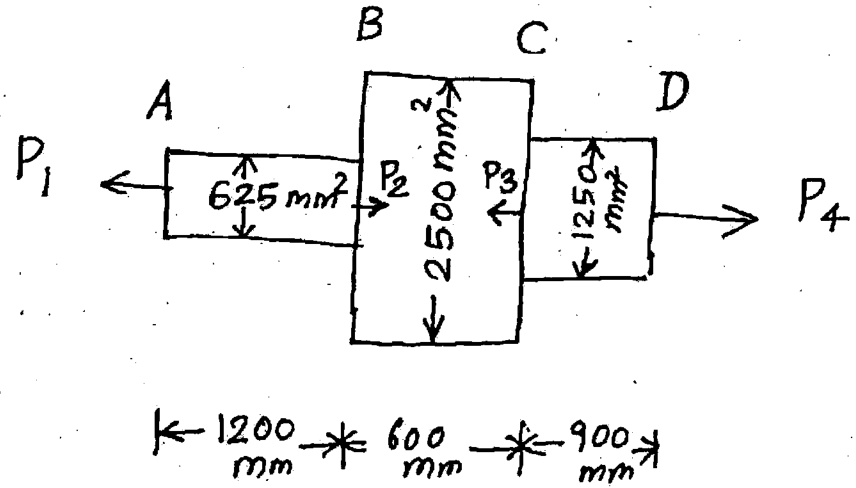

Fig. Q. 11(a)

Or

(b) A metallic bar 300 mm (x) × 100 mm (y) × 40 mm (z) is subjected to a force of 5 kN (tensile), 6 kN (tensile) and 4 kN (tensile) along x, y and z directions respectively. Determine the change in the volume of the block. Take E = 2 × 10^5 N/mm² and Poisson's ratio = 0.25.

12. (a) Draw SFD and BMD and find the maximum bending moment for the beam given in Fig. Q. 12(a).

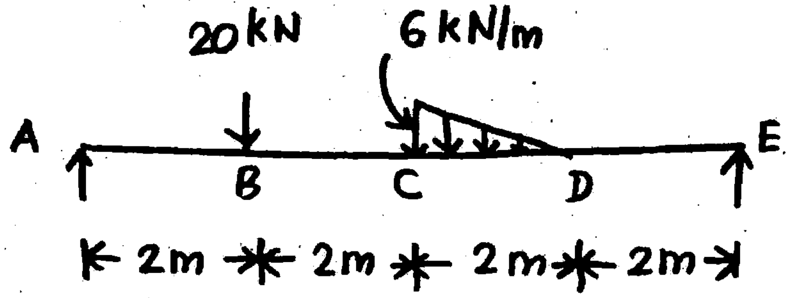

Fig. Q. 12(a)

Or

(b) Prove that the ratio of depth to width of the strongest beam that can be cut from a circular log of diameter 'd' is 1.414. Hence calculate the depth and width of the strongest beam that can be cut out of a cylindrical log of wood whose diameter is 300 mm.

13. (a) Derive torsion equation.

Or

(b) The stiffness of a close-coiled helical spring is 1.5 N/mm of compression under a maximum load of 60 N. The maximum shearing stress produced in the wire is 125 N/mm^2. The solid length of the spring (when the coils are touching) is given as 50 mm. Find

(i) The diameter of wire

(ii) The mean diameter of the coils

(iii) Number of coils required.

Take $C = 4.5 \times 10^4\ N/mm^2$.

14. (a) Determine the deflection of the beam at its mid span and also the position of maximum deflection and maximum deflection. Take $E = 2 \times 10^5\ N/mm^2$ and $I = 4.3 \times 10^8\ mm^4$. Use Macaulay's method. The beam is given in Fig. Q. 14(a).

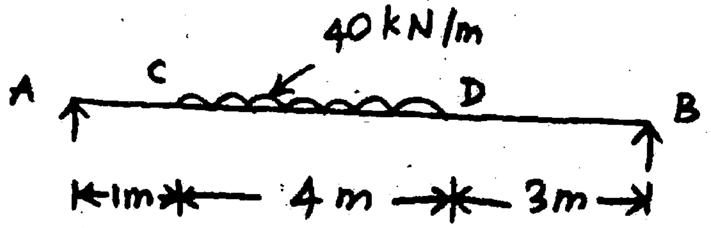

Fig. Q. 14(a)

Or

(b) Using conjugate beam method, determine the

(i) Slope at each end and under each load

(ii) Deflection under each load.

for the beam given in Fig. Q. 14(b). Take $E = 2 \times 10^5\ N/mm^2$ and $I = 10^8\ mm^4$.

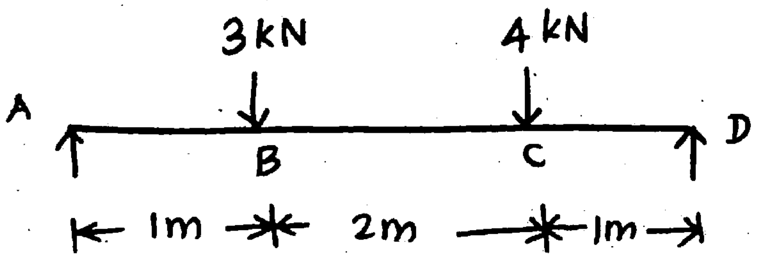

Fig. Q. 14(b)

15. (a) Derive relations for change in dimensions and change in volume of a thin cylinder subjected to internal pressure P.

Or

(b) Find the thickness of metal necessary for a thick cylindrical shell of internal diameter 160 mm to withstand an internal pressure of 8 N/mm^2. The maximum hoop stress in the section is not to exceed 35 N/mm^2.
