

Time : 3 Hours

Max.Marks: 100

Answer ALL questions

Part-A (5x2=10 marks)

1. State Hooke's Law and explain
2. Define lateral strain and volumetric strain?
3. What do you mean point of contraflexure? Give an example
4. Draw the shear force diagram for a cantilever beam of span 3m carrying a point load 10kN at mid span.
5. What is the power transmitted by a solid shaft at 160 rpm if torque is 2345kNm.
6. Write down the expression for the stiffness of a close coiled helical spring?
7. State moment area theorems.
8. Give any two real beams and the corresponding conjugate beams.
9. Write down the Lamé's equation?
10. Distinguish between thin and thick cylinders.

Part-B (5x16=80 marks)

11. Draw the shear force and bending moment diagrams for the beam shown in Fig.Q.11. and locate the points of contraflexure if any.

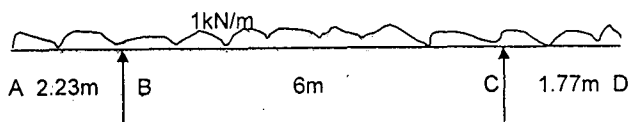


Fig.Q11

- 2-
- 12a. A metallic bar 300mm x 100mm x 40mm is subjected to a force of 5kN (tensile), 6kN (tensile) and 4 kN(tensile) along x,y and z directions respectively as shown in Fig. Q12a. Determine the change in dimensions and volume of the bar. Poisson's ratio=0.25 and $E=200 \text{ kN/mm}^2$.

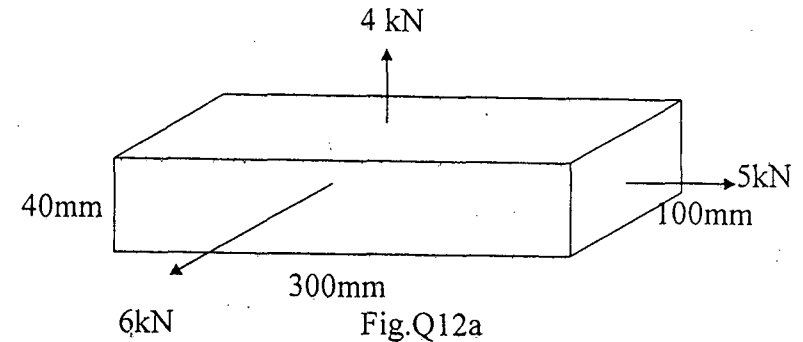


Fig.Q12a

(OR)

- b. Stresses at a point are $p_x=90\text{N/mm}^2$, $p_y = -60\text{N/mm}^2$, $q=80 \text{ N/mm}^2$. Determine principal planes , principal stresses and maximum shear stress.
 - 13a. A hollow shaft with diameter ratio 3/5 is required to transmit 450 kW at 120 rpm. The maximum shear stress is not to exceed 60 N/mm^2 and the twist in a length of 5m is not to exceed 2° . Calculate the minimum diameters required for the shaft. Take $C=80\text{kN/mm}^2$.
- OR
- b. A closed coiled helical spring is to have a stiffness of 900 N/m in compression with a maximum load of 45N and maximum shearing stress of 120N/mm^2 . The solid length of the spring (i.e., coils are touching) is 45 mm. Find the diameter of wire, mean diameter of coil and the number of coils. $C=40\text{kN/mm}^2$.
 - 14a. Find the slope and deflection at C for the beam shown below. $E=200\text{kN/mm}^2$, $I=5 \times 10^8 \text{ mm}^4$

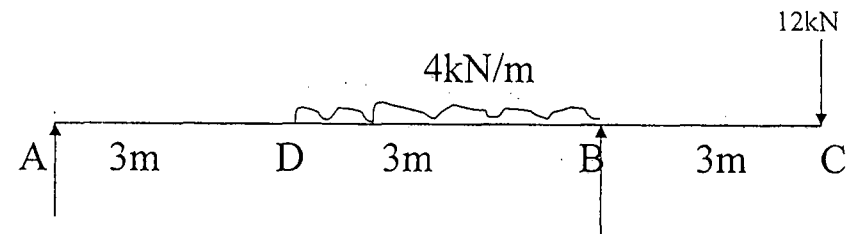


Fig.Q14a

23

- b. For the beam shown in Fig.Q14b find deflections at C and D using Conjugate beam method. $EI=17000\text{kNm}^2$.

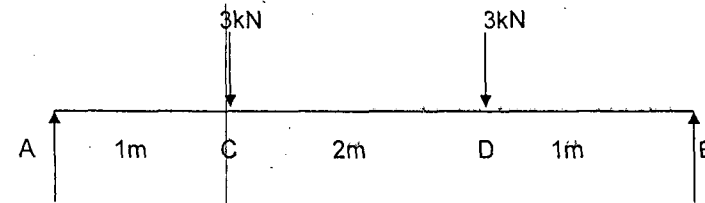


Fig.Q14b

- 15a. A cylindrical shell 3.25m long, 1000mm internal diameter, 10mm wall thickness is subjected to an internal pressure of 1N/mm^2 . Determine change in diameter, change in length and change in volume. Take Poisson's ratio $=0.3$ and $E=200\text{ kN/mm}^2$.

(OR)

- b. Find the thickness of metal necessary for thick cylindrical shell of internal diameter 200mm to withstand an internal pressure of 50N/mm^2 . The hoop stress in the section is not to exceed 150N/mm^2 .

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