

**MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL**

Paper Code : CE(PC)503 Structural Analysis - I

Time Allotted : 3 Hours

Full Marks : 70

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

**Group-A (Very Short Answer Type Question)**

1. Answer any ten of the following :

[ 1 x 10 = 10 ]

- (i) The ratio of the maximum deflections of a simply supported beam with a central load  $W$  and of a cantilever of same length and with a load  $W$  at its free end, is \_\_\_\_\_
- (ii) A concentrated load  $P$  is supported by the free end of a quadrantal ring  $AB$  whose end  $B$  is fixed. The ratio of the vertical to horizontal deflections of the end  $A$ , is \_\_\_\_\_
- (iii) The total strain energy of a beam of length  $L$ , having moment of inertia of its section  $I$ , when subjected to a bending moment  $M$ , is \_\_\_\_\_
- (iv) A truss containing  $j$  joints and  $m$  members, will be a simple truss if \_\_\_\_\_
- (v) The ratio of the deflections of the free end of a cantilever due to an isolated load at  $1/3$ rd and  $2/3$ rd of the span, is \_\_\_\_\_
- (vi) The equivalent length of a column of length  $L$ , having both the ends hinged, is \_\_\_\_\_
- (vii) Principal planes are subjected to \_\_\_\_\_ only.
- (viii) Hoop strain of the walls of a cylinder due to liquid is \_\_\_\_\_
- (ix) The ratio of maximum shear stress to average shear stress of a circular beam, is \_\_\_\_\_
- (x) The general expression for the B.M. of a beam of length  $l$  is the beam carries \_\_\_\_\_

$$M = \frac{wl}{2} \times \frac{wx^2}{2}$$

(xi) The point of contraflexure is the point where \_\_\_\_\_

(xii) In plastic analysis, the shape factor for a circular section, is \_\_\_\_\_

**Group-B (Short Answer Type Question)**

Answer any three of the following

[ 5 x 3 = 15 ]

2. What is degree of kinematic indeterminacy? [ 5 ]
3. Write down the Castigliano's first theorem. [ 5 ]
4. What is meant by absolute maximum bending moment in a beam? [ 5 ]
5. What is the significance of unit load method? [ 5 ]
6. Write the equation for final moments in moment distribution method. [ 5 ]

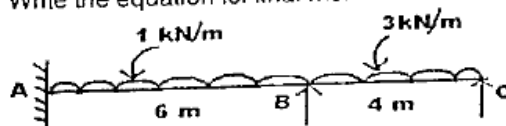


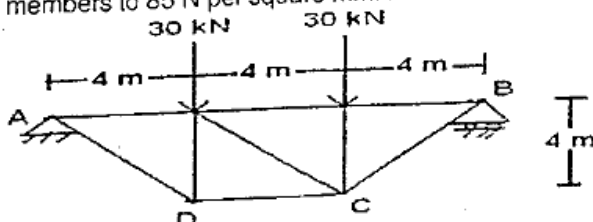
Fig.

**Group-C (Long Answer Type Question)**

Answer any three of the following

[ 15 x 3 = 45 ]

7. The steel truss shown in figure is anchored at  $A$  and supported on rollers at  $B$ . If the truss is so designed that, under the given loading, all tension members are stressed to 110 N per square mm and all compression members to 85 N per square mm. Find the vertical deflection of the point  $C$ . Take  $E = 2 \times 10^5$  N per square mm. [ 15 ]



8. Find the horizontal deflection of joint 'B' in the frame shown in figure. Take  $E = 2 \times 10^5 \text{ MPa}$  and  $I = 3.5 \times 10^8 \text{ mm}^4$ . [15]

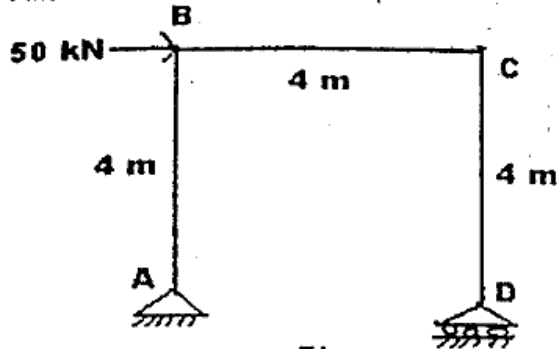


Fig.

9. Determine the horizontal displacement at the roller support of the rigid jointed frame shown in figure. Take  $E = 2 \times 10^5 \text{ MPa}$  and  $I = 30 \times 10^8 \text{ mm}^4$ . [15]

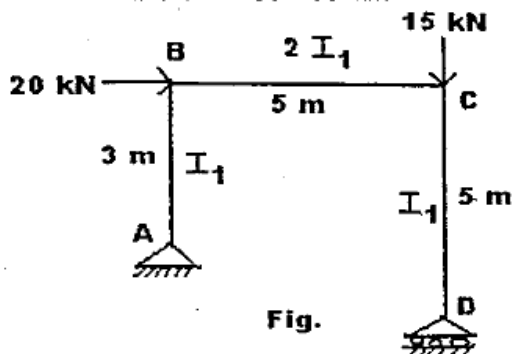


Fig.

10. Determine the vertical deflection of joint E for the Warren truss shown in figure. Take  $A = 645 \text{ mm}^2$  and  $E = 200 \text{ kN/mm}^2$  for all the members. [15]

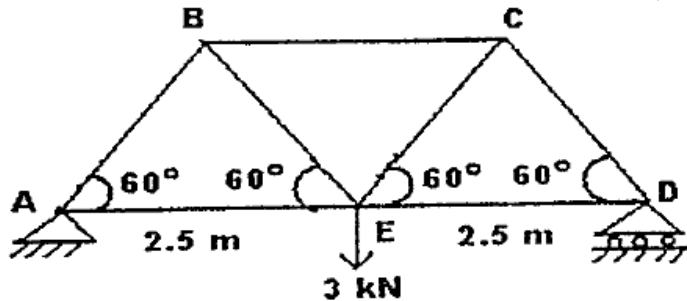


Fig.

11. Draw the ILD for the forces in members U2L2 and U2L3 of the truss shown in figure. [15]

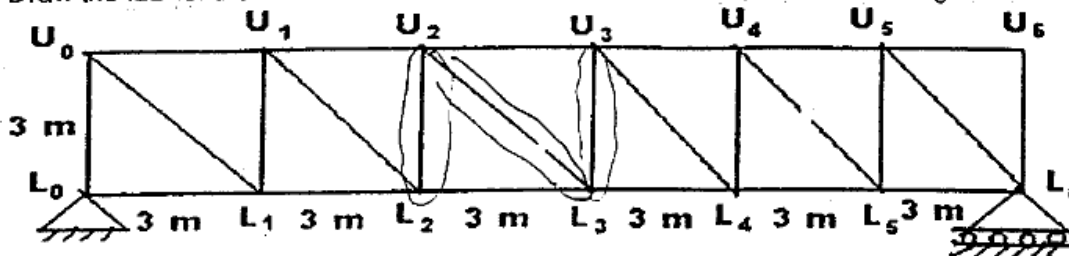


Fig.

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