

Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH(CE)(OLD)/SEM-4/CE-404/2012

2012

STRUCTURAL ANALYSIS – I

Time Allotted : 3 Hours

Ful Marks : 70

The figures in the margin indicate full marks

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

- i) For stable determinate plane frame structures, the number of members m and number of joints j are related by the equation

a) $m = 3j - 3$

b) $m = 2j - 3$

c) $m = 2j$

d) $m = 2j + 3$.

- ii) A joint of a frame is subjected to three tensile forces, A , B and C equally inclined to each other. If A is equal to 10 kN, the other forces will be

a) $B = 10 \text{ kN}$, $C = 0$

b) $B + C = 10 \text{ kN}$

c) $B = 10 \text{ kN}$, $C = 10 \text{ kN}$

d) $B + C = 5 \text{ kN}$.

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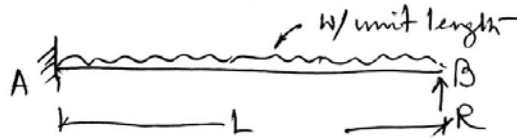
- iii) In the Moment Area method, the difference in slope between any two sections of a loaded flexural member is equal to
- area of M/EI diagram between these two sections
 - moment of the M/EI diagram between these two sections
 - $\frac{1}{2} \times$ area of M/EI diagram between these two sections
 - $\frac{1}{2} \times$ moment of the M/EI diagram between these two sections.
- iv) The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in
- vertical direction
 - inclined direction
 - the direction in which the deflection is required
 - horizontal direction
- v) A member having length L , cross-sectional area A , modulus of elasticity E , is subjected to an axial load W . The strain energy stored in this member is
- $\frac{WL^2}{AE}$
 - $\frac{WL^2}{2AE}$
 - $\frac{W^2L^2}{2AE}$
 - $\frac{W^2L}{2AE}$
- vi) The fixed support in a real beam becomes in the conjugate beam a
- roller support
 - hinged support
 - fixed support
 - free end.
- vii) Maxwell's reciprocal theorem in structural analysis can be applied to
- all elastic structures
 - plastic structures
 - symmetrical structures
 - none of these.

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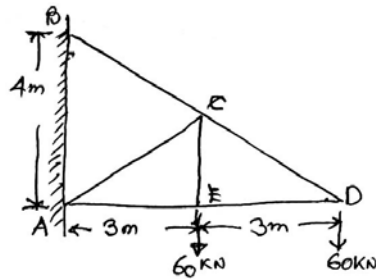
- viii) The ordinate of influence line diagram for bending moment always has like dimension of
- force
 - length
 - force \times length
 - force / length.
- ix) In a propped cantilever loaded with uniformly distributed load W throughout the span, the bending moment at the propped end is
- zero
 - $\frac{WL^2}{8}$
 - $\frac{WL^2}{2}$
 - $\frac{WL^2}{4}$.
- x) When a number of loads pass on a simply supported beam, absolute maximum bending moment will occur at a point when the loads lie on the beam when
- heaviest load is at the centre
 - the load nearest to the resultant to be at the centre
 - at a point under the load such that the resultant and that particular load is bisected at the centre
 - none of these.
- xi) A uniform beam of span L is rigidly fixed at both supports. It carries a uniformly distributed load W per unit length. The bending moment at mid-span is
- $\frac{WL^2}{8}$
 - $\frac{WL^2}{12}$
 - $\frac{WL^2}{16}$
 - $\frac{WL^2}{24}$.
- xii) Deflection at mid-span of simply supported beam of span L and loaded with a uniformly distributed load of W per unit length over the whole span is
- $\frac{WL^4}{12EI}$
 - $\frac{5WL^4}{48EI}$
 - $\frac{5WL^4}{192EI}$
 - $\frac{5WL^4}{384EI}$.

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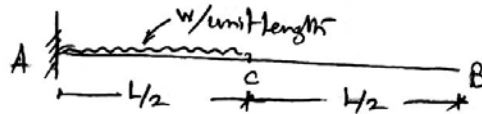
7. Define Conjugate Beam. With various end conditions indicate by sketches the shape of Original Beam vis-a-vis the shape of Conjugate Beam for 3 nos. of cases.
8. Apply Castigliano's second theorem, determine the reaction at the simply supported end of the beam having span L .

**GROUP - C****(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 15 = 45$

9. Determine the forces developed in the members of the truss shown in the figure.

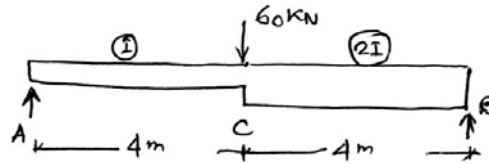


10. Find the rotation and deflection at the free end in the cantilever beam shown in the figure by 'Moment Area Theorem'.

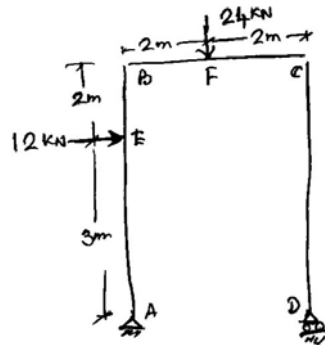


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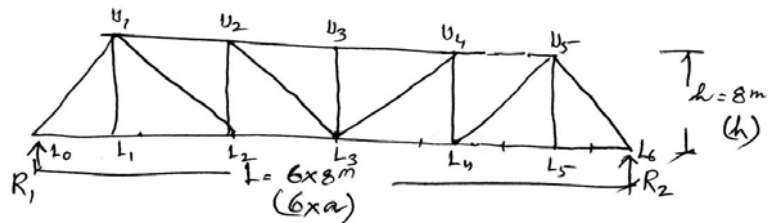
11. Determine $\theta_A, \theta_B, \theta_C$ and deflection Δ_C in the beam shown in the figure by Conjugate Beam Method.



12. Determine the horizontal displacement and rotation at roller support in the frame shown in the figure. Flexural rigidity EI is constant throughout. Apply Unit Load Method.

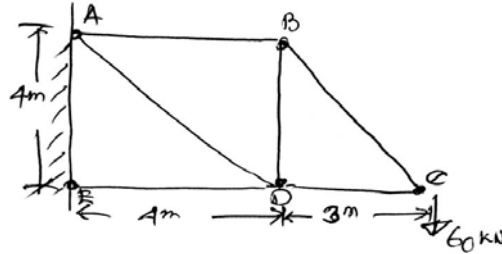


13. Four point loads 8, 5, 15 and 10 kN have centre to centre spacing of 2 m between consecutive loads and they traverse a girder of 30 m span from left to right with 10 kN load leading. Calculate the maximum bending moment and shear force at 8 m from the left support.
14. Determine the influence line diagrams for the forces in L_0U_1 and U_1U_2 for the symmetric truss shown in the figure.



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15. Determine the vertical deflection of point D in the truss shown in the figure. The cross-sectional areas of members AD and DE are 1500 mm^2 while those of the other members are 1000 mm^2 . Take $E = 200 \text{ kN/mm}^2$.



16. Analyse the hinged base portal frame shown in the figure by Strain Energy method and draw the bending moment diagram.

