WEST BENGAL UNIVERSITY OF TECHNOLOGY

CE-402

STRUCTURAL ANALYSIS

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable. All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. $10 \times 1 = 10$

(i) In the moment-area method, the difference in slope between any two sections of a loaded member is equal to the

(A) Area of the M/EI diagram between these two sections

(B) Moment of the M/EI diagram between these two sections about the second section

(C) Half of the area of the M/EI diagram between these two sections

(D) Moment of the M/EI diagram between these two sections about the first section

(ii) A parabolic two hinged arch subjected to vertical uniform distributed loading over the entire span has

(A) Zero BM at all section

(B) Maximum normal thrust at the crown

(C) Has varying radial shear over its length

(D) A parabolic variation of BM over the entire span

(iii) Shape of the influence line diagram for horizontal thrust in a symmetric three hinged parabolic arch is

(A) Rectangle (B) Traingle

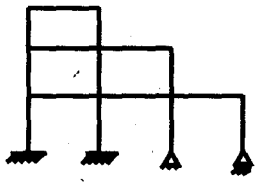
(C) Trapezoidal (D) Parabolic

(iv) The slope-deflection method of structural analysis is a

(A) Displacement method (B) Force method

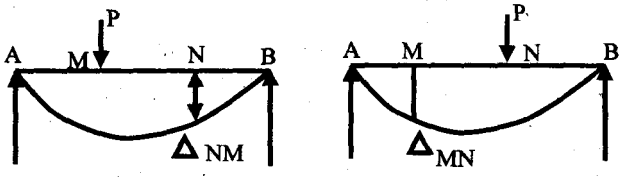
(C) Hybrid method (D) None of these

(v) Total degree of redundancy in the frame shown are



(A) 12 (B) 15 (C) 18 (D) 21

(vi) A simply supported beam AB is first loaded by (P) at M and then at N. If ΔNM be the deflection at N due to load at M and ΔMN be deflection at M due to the lead (P) at N then



(A) ΔMN>ΔNM

(B) ΔMN<ΔNM

(C) ΔMN = ΔNM

(D) Depends on position of M & N

(vii) In slope deflection equation, the deformation are considered to be caused by–

(A) Bending moment

(B) Shear force & Bending moment

(C) Axial force & Shear force

(D) Axial force & Shear force & Bending moment

(viii) Carry-over factor is defined as

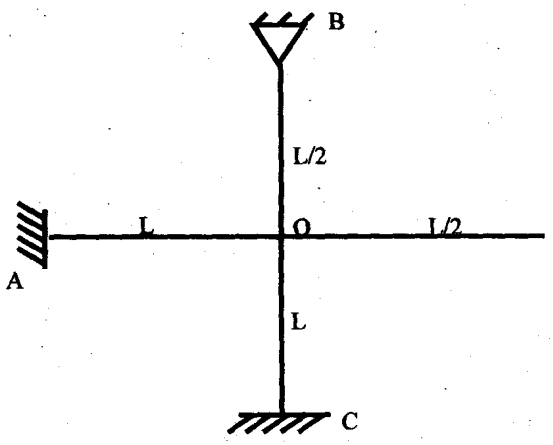
(A) modulus of elasticity

(B) flexural rigidity EI

(C) the ratio of moment produced at far end to the applied moment at the end

(D) the value of moment to be applied to an end to cause slope of 1 radian

(ix) If the joint O of the frame is rigid, the rotational stiffness of the frame at point O is given by



(A) 11 EI/L

(B) 10EI/L

(C) 8 EI/L

(D) 6EI/L

(x) Slope at the free end of a cantilever beam of span l and loaded with a u.d.l. of 'w/u.r' is

(A) $wl^3/8EI$ (B) $wl^3/3EI$ (C) $wl^3/4EI$ (D) $wl^3/6EI$

(xi) The strain energy due to torsion or twisting moment is given by:

(A) $U = \int \frac{T^2}{2GK} dx$ (B) $U = \int \frac{T}{2GK} dx$

(C) $U = \int \frac{T}{GK} dx$ (D) $U = \int \frac{T}{GK} dx$

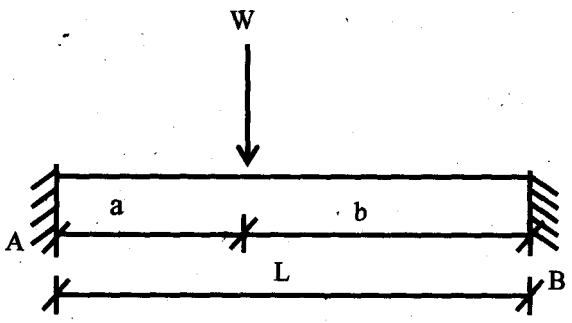
(xii) In a propped cantilever loaded with uniformly distributed load w throughout the span, the bending moment at the propped end is

(A) Zero (B) $wl^2/8$ (C) $wl^2/2$ (D) $wl^2/4$

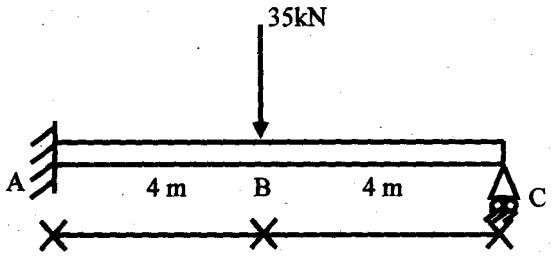
GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. Find the fixed end moment developed of a beam of length L, carrying a load W as shown in figure below, using any method.



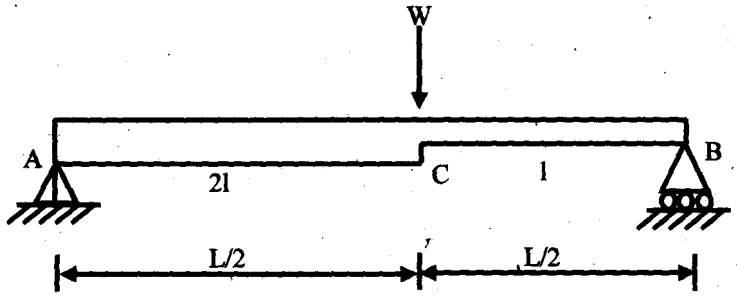
3. Analyse the propped cantilever beam shown below by consistent deformation method and draw BMD.



4. A two hinged semicircular arch has a span of 12 metres with the hinged supports at the same horizontal level. The rise of the arch is 6 m. A concentrated load (downward) of 20 kN acts at the central crown point. Find the horizontal thrust developed at the hinged support.

5. A cantilever beam 6m long with constant EI is subjected to two 45 kN loads, one at 2 m from end and another at free end respectively. Compute deflection at the free end using 'Moment Area Method'.

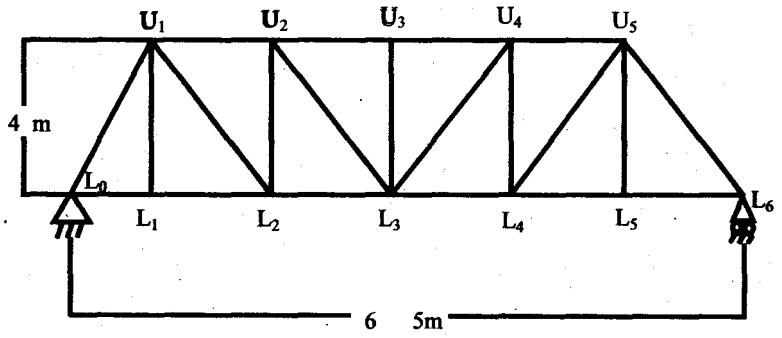
6. Find out the deflection at point C under the load by "Conjugate Beam Method".



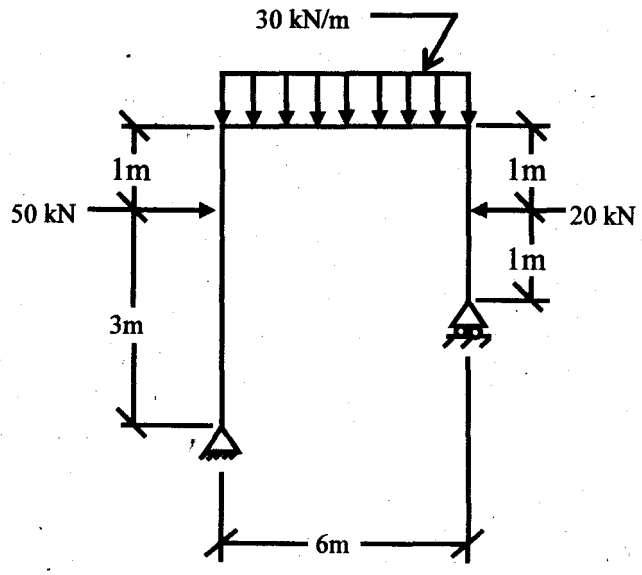
GROUP C
(Long Answer Type Questions)

Answer any *three* questions. $3 \times 15 = 45$

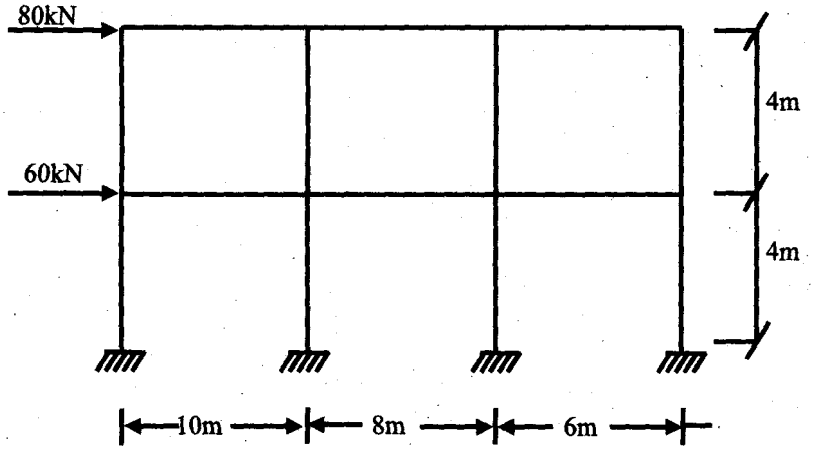
7. Draw the influence line diagram for the forces in the members U_2U_3, U_2L_3 and L_2L_3 of the truss as shown in figure below.



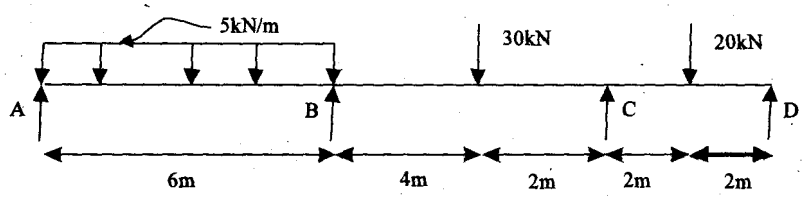
8. Analyse the portal frame shown in figure below and draw SFD, BMD and axial force diagram.



9. Analyse the following frame as shown below by cantilever method. Draw the bending moment diagram.



10. Analyse the continuous beam as shown below. Apply "Three Moment Theorem" EI = Constant.



11. Analyse the continuous beam as shown below using "Moment distribution method". Draw SFD and BMD. Assume flexural rigidity (EI) constant.