ANALYSIS OF STRUCTURES II
(CIVL 3101)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

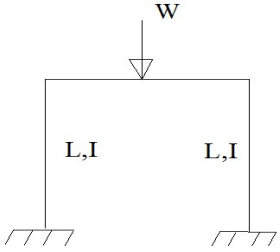
Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

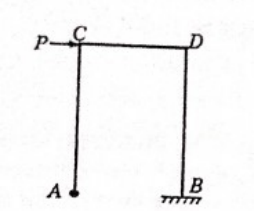
(i) Moment Distribution method is :
(a) interactive (b) finite difference
(c) iterative (d) none of these.

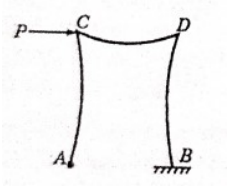
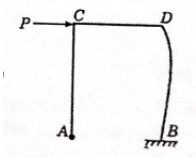
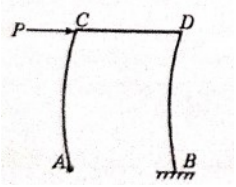
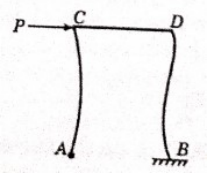
(ii) The portal frame shown below will



(a) No sway (b) Sway towards left
(c) Sway towards right (d) Sway either to left or right.

(iii) The deflection curve for the portal frame shown below is:



(a)  (b)  (c)  (d)  .

(iv) Building frames subjected to vertical loads can be approximately analysed with the assumption that:
(a) Inflection point will occur at 0.25 L from two ends of girder.
(b) Inflection point will occur at 0.1 L from two ends of girder.
(c) Inflection point will occur at 0.3 L from two ends of girder.
(d) Inflection point will occur at 0.15 L from two ends of girder.

(v) A propped cantilever beam AB of span L is subjected to a moment M at the prop end B. The moment at fixed end A is:
(a) 2M (b) 0.5 M (c) M (d) ¾ M.

(vi) In plastic analysis, the shape factor of circular section is:
(a) 1.5 (b) 1.6 (c) 1.7 (d) 2.5.]

(vii) In cantilever method, the basic deformation in the frame is:
(a) Torsion with shear (b) Torsion along with bending
(c) Bending and not shear (d) Only in shear.

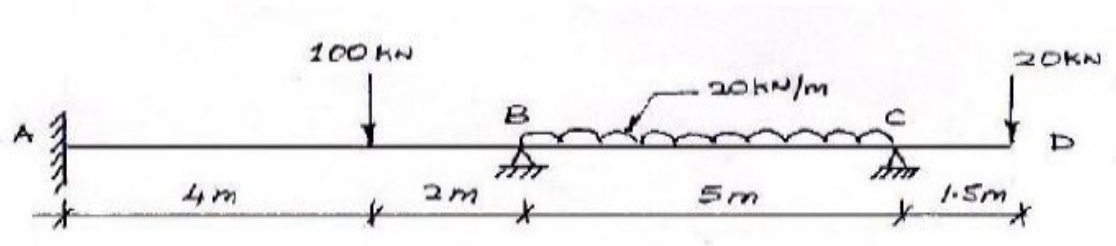
(viii) If the number of possible plastic hinges are 4 and the degree of indeterminacy of the structure is 2, then the number of possible independent mechanism(s) 'n' will be :
(a) 6 (b) 4 (c) 2 (d) 1.

(ix) For approximate analysis of lateral loads, the portal method is applicable for:
(a) only vertical loading on building frame
(b) only lateral loading on building frame
(c) both vertical as well as lateral loading on building frame
(d) none of these.

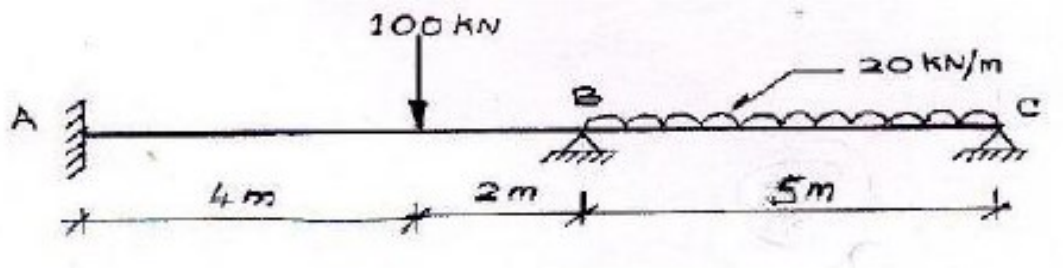
(x) For stable structures, one of the most important properties of flexibility and stiffness matrices is that elements on the main diagonal:
(a) of a stiffness matrix must be positive and that of flexibility matrix must be negative.
(b) of a stiffness matrix must be negative and that of flexibility matrix must be positive.
(c) of both stiffness and flexibility matrices must be negative.
(d) of both stiffness and flexibility matrices must be positive.

Group – B

2. (a) Analyze the continuous beam ABCD by Slope-deflection method and draw Bending Moment Diagram. Take EI constant.

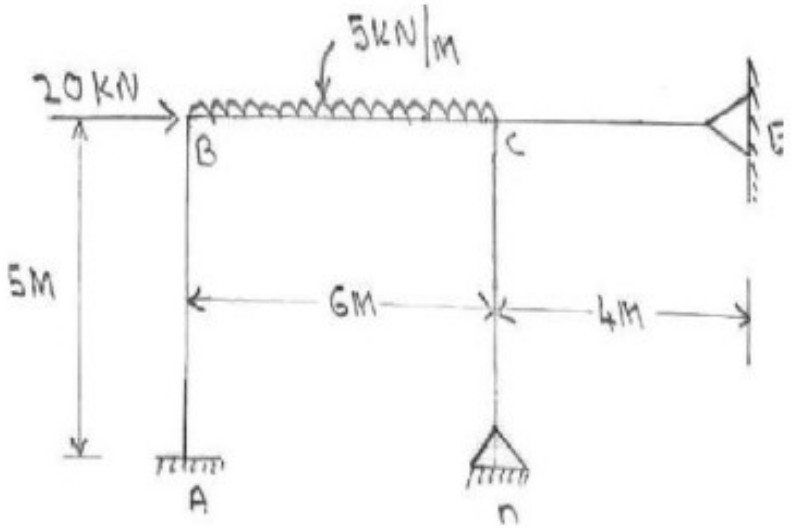


(b) Analyze two span continuous beam ABC by Slope-deflection method. Then Draw Bending Moment Diagram and Shear Force Diagram. Take EI is constant.



6 + 6 =12

3. Analyze the frame shown in fig. below by Moment Distribution method. Draw Bending Moment Diagram. Take EI is constant.



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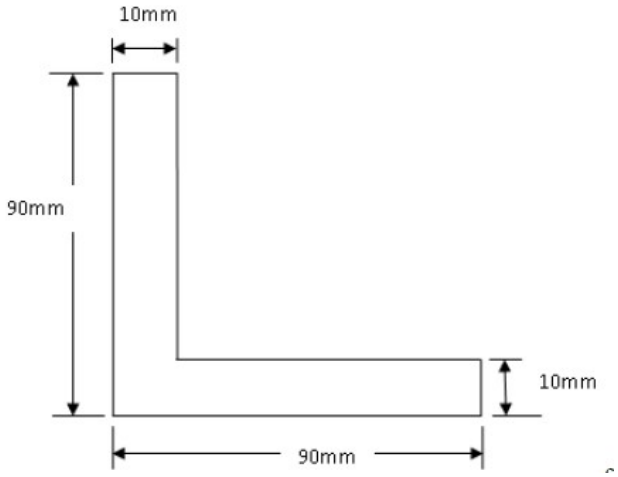
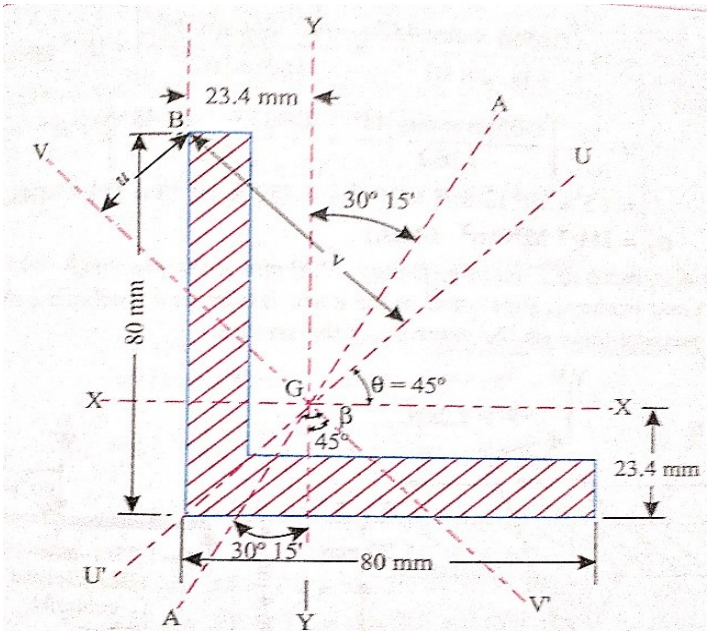
Group – C

4. (a) A 90mm × 90mm × 10mm equal angle is placed with the one leg vertical as shown in Fig below. It is subjected to a sagging bending moment of 700 N-m on the horizontal axis. Determine the stresses induced at points P1 and P2. P1 is at the left top corner point and P2 is at the right bottom corner.



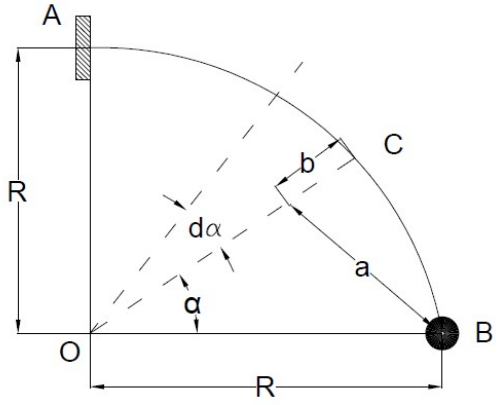
The fig. shows a 80 mm × 80 mm angle section having $I_{xx}=I_{yy}= 87.36 \times 10^{-8}$ m^4. It is used as freely supported beam with one leg vertical. On the application of the bending moment in the vertical plane YY the mid-section of the beam deflects in the direction AA' at 30° 15' to the vertical. Calculate the second moment of area of the section about it's principal axis.

(b) What is the bending stress at the corner B if the bending moment is 1.5 kNm ?



6 + 6 = 12

5. (a) A quarter circle beam of radius R curved in plan is fixed at end A and free at end B as shown below. It carries a vertical P at it's free end. Determine the deflection at the free end and sketch the shear force, bending moment and torsional moment diagrams. Assume flexural rigidity (EI)= twice the torsional rigidity (GJ).

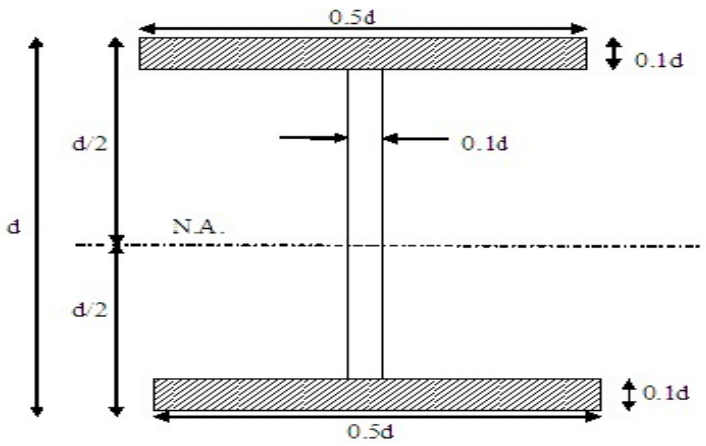


(b) At the critical section of crane hook, trapezoidal in section, the inner and outer sides are 4 cm and 2.5 cm respectively and depth is 7.5 cm. The centre of curvature of the section is a distance of 6 cm from the inner fibres and the load line is 5 cm. from the inner fibres. If the maximum stress > 120 MN/m^2. What is the maximum load the hook can carry?

6 + 6 = 12

Group – D

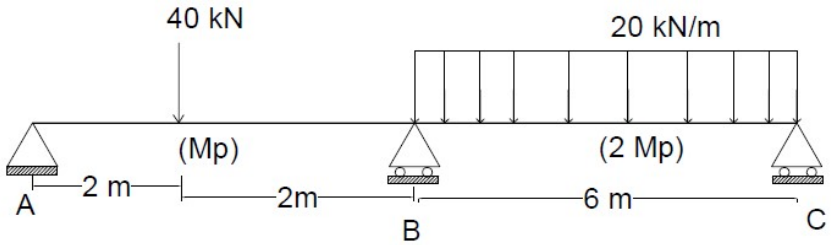
6. (a) Find the shape factor of the steel I-section provided below in the fig. Also determine the shape factor of the same I-section, if the imensions are doubled. (Here, d= 450 mm.)



(b) Calculate shape factor of a **Rectangular section.**

6 + 6 = 12

7.(a) Calculate the plastic moment capacity required for the continuous beam with load shown in the fig below. The load factor is 1.5.



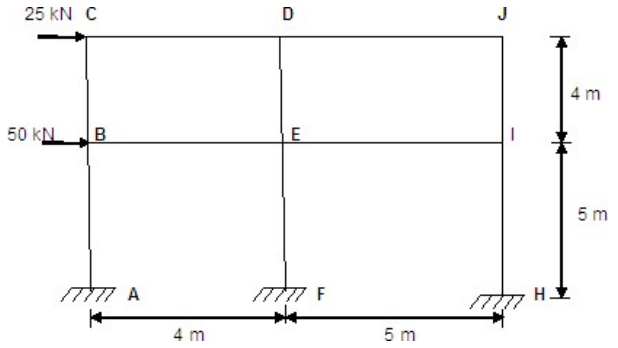
(b) A two span continuous beam ABC has a span of length AB=6m and BC=6m and carries an UDL of 30kN/m completely covering the span AB and BC. A and C are simply supports. If the load factor is 1.8 and shape factor is 1.15 for the I-section. Find the section modulus needed. Assume yield stress of the material is 250N/mm^2.

6 + 6 = 12

Group – E

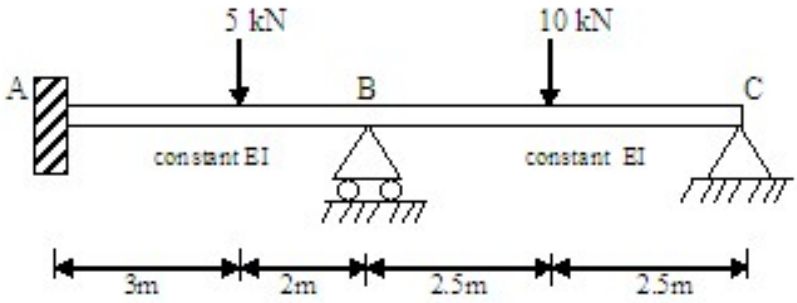
8. (a) Write the assumptions involved in Cantilever method of multi-storied frame analysis subjected to Lateral loads.

(b) Determine the forces in the members of the building frame shown below using Portal method. Draw BMD.



2 + 10 = 12

9. Develop the stiffness matrix for the continuous beam ABC shown below and determine the moments for joints A, B and C. Also draw the Bending Moment diagram.



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