



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

**Paper Code : CE-402**

## STRUCTURAL ANALYSIS

**Time Allotted : 3 Hours**

**Full 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) In a beam where bending moment changes sign,  
the shear force will be
- a) ~~a)~~ zero                      b) minimum  
c) maximum                  d) infinity.
- ii) The bending moment on a section is maximum  
where shear force is
- a) minimum                      b) ~~b)~~ maximum  
c) changing sign                d) zero.

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iii) The deflection at any point of a perfect frame can be obtained by applying a unit load in

- a) ☒ vertical direction
- b) ☒ the direction in which the deflection is required
- c) ☐ horizontal direction
- d) ☐ none of these.

iv) Influence line diagram is applicable for

- a) moving load                      b) dead load
- c) both (a) and (b)              d) none of these.

v) Under a uniformly distributed load a cable takes the shape of a <http://www.makaut.com>

- a) ☒ Parabola                      b) Circle
- c) ☐ Catenary                      d) ☐ Funicular polygon.

vi) The bending stress in a beam is ..... bending moment.

- a) ☐ equal to
- b) ☐ less than
- c) ☐ more than
- d) ☐ directly proportional to



x) Moment Distribution method is a/an

- a) Force Method
- b) Elastic Method
- c) Displacement Method
- d) None of these.

xi) A truss containing  $j$  joints and  $m$  members, will be a simple truss if

- a)  $m = 2j - 3$
- b)  $j = 2m - 3$
- c)  $m = 3j - 2$
- d)  $j = 3m - 2$ .

xii) The fixed support in a real beam becomes in a conjugate beam

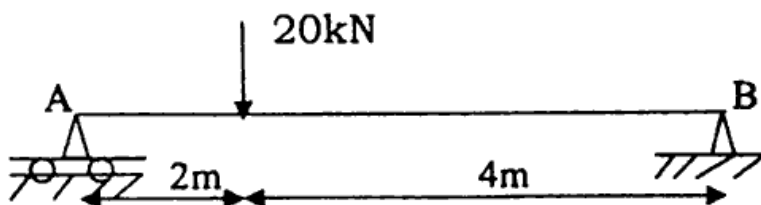
- a) Roller
- b) Hinged
- c) Fixed
- d) Free.

**GROUP - B**

**( Short Answer Type Questions )**

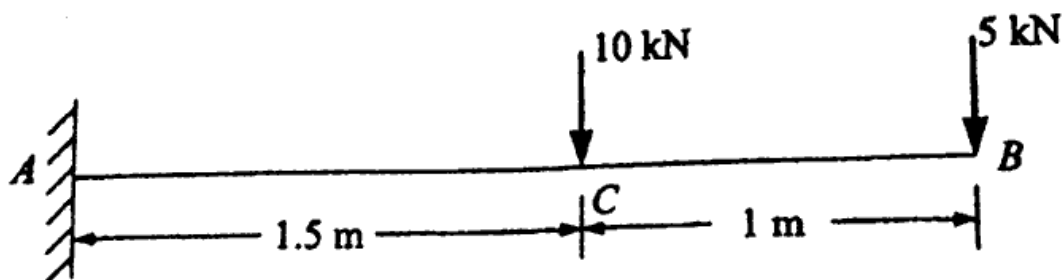
Answer any *three* of the following.  $3 \times 5 = 15$

2. A simply supported beam carries a point load of 20 kN as given in the figure below. Find out the deflection under the load and slopes at A and B by conjugate beam method. Take EI of the beam is constant.



3. Determine the slope and deflection at the free end of the given figure using moment area method.

Take  $EI = 4000 \text{ kN-m}^2$ .



4. Describe two theorems of Castigliano. Also find out the limitations of this theory.

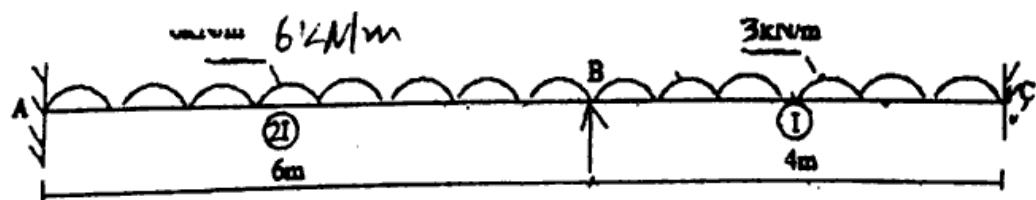
5. Define Static and Kinematic Indeterminacy with an example.
6. Differentiate between Portal method and Cantilever method in the analysis of lateral loads acting on the structure.

### GROUP - C

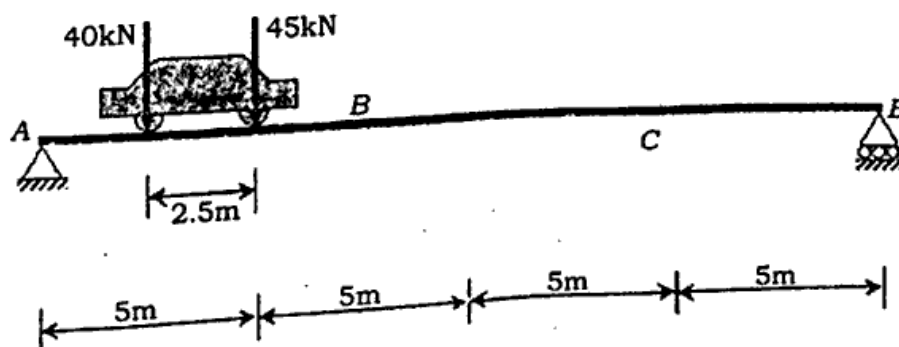
#### ( Long Answer Type Questions )

Answer any *three* of the following.  $3 \times 15 = 45$

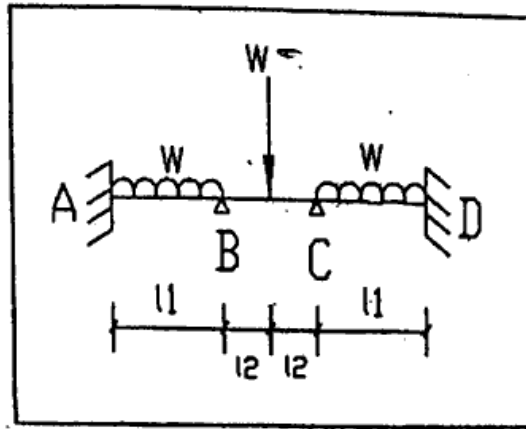
7. Analyze the continuous beam shown in figure, by moment distribution method. Assume  $E = 2 \times 10^5$  MPa and  $I = 8 \times 10^6$  mm<sup>4</sup> and draw Shear force and Bending moment diagram. <http://www.makaut.com>



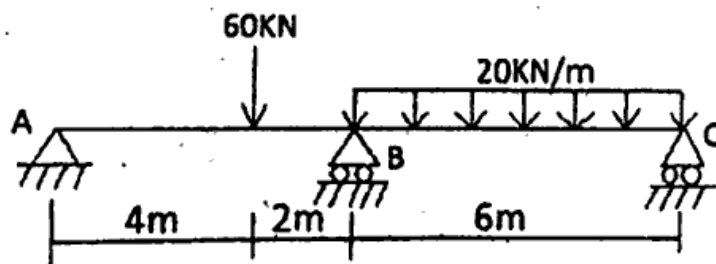
8. Find the maximum shear force at C for the moving load combination in the following figure :



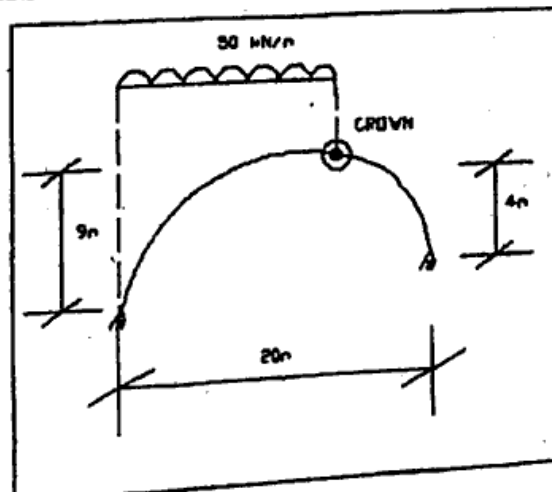
9. Draw bending moment and shear force diagrams by Slope Deflection Method for the following figure :



10. Analyze the beam by three moment theorem and draw BM and SF diagrams.



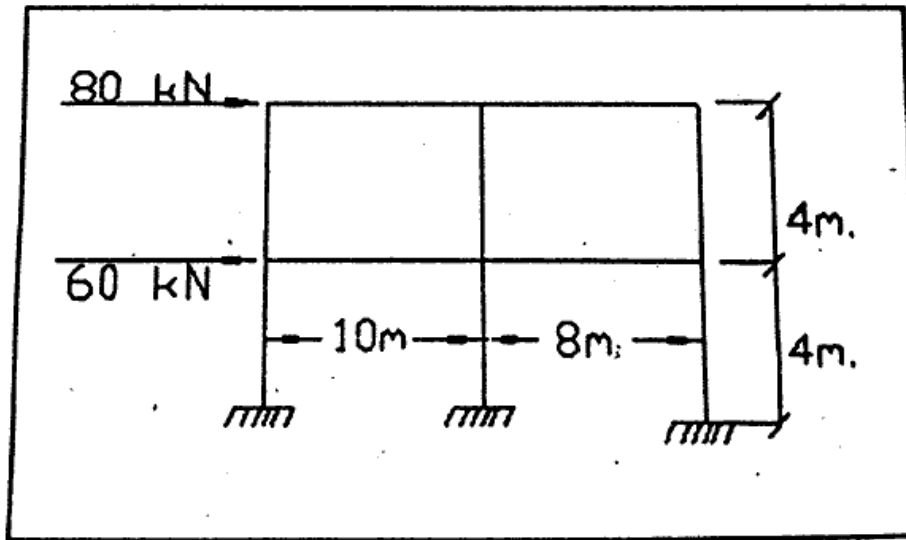
11. Determine the horizontal and vertical reactions at the supports of the three-hinged unsymmetrical parabolic arch shown below. Also find out the shear force, bending moment and normal thrust at a section at a horizontal distance of 4m from the left support.



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12. Analyse the following frame by cantilever method shown in figure. Draw the bending moment diagram.



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