

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH(CE-NEW)/SEM-4/CE-402/2012**

**2012**

**STRUCTURAL ANALYSIS**

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 × 1 = 10

- i) 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)  $U = \int \frac{T^2}{GK} dx$       d)  $U = \int \frac{T}{GK} dx.$

- ii) Maxwell's reciprocal theorem is applied to

- a) determinate structures
- b) indeterminate structures
- c) both (a) and (b)
- d) none of these.

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iii) Degree of static indeterminacy of a pin jointed structure is given by

- a)  $D_s = r_e + m - 2j$       b)  $D_s = r_e - m - 2j$   
 c)  $D_s = r_e + m + 2j$       d)  $D_s = r_e - m + 2j$ .

iv) The fixed end moments for a fixed beam of length  $L$  carrying a UDL throughout the span are

- a)  $-\frac{\omega L^2}{12}, \frac{\omega L^2}{12}$       b)  $\frac{\omega L^2}{36}, \frac{\omega L^2}{24}$   
 c)  $\frac{\omega L^2}{8}, -\frac{\omega L^2}{8}$       d)  $-\frac{\omega L^2}{8}, \frac{\omega L^2}{12}$ .

v) In case of a cantilever beam subjected to a UDL throughout the span, slope at the free end is

- a)  $\frac{\omega L^4}{84EI}$       b)  $\frac{\omega L^3}{6EI}$   
 c)  $\frac{\omega L^4}{8EI}$       d)  $\frac{\omega L^3}{384EI}$ .

vi) In case of a simply supported beam subjected to a UDL throughout the span, slope at the left end is

- a)  $\frac{\omega L^4}{84EI}$       b)  $\frac{\omega L^3}{6EI}$   
 c)  $\frac{\omega L^3}{24EI}$       d)  $\frac{\omega L^3}{384EI}$ .

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- vii) In case of a simply supported beam subjected to a UDL throughout the span, deflection at the mid span is

a)  $\frac{5\omega L^4}{384EI}$                       b)  $\frac{\omega L^3}{6EI}$

c)  $\frac{\omega L^3}{24EI}$                       d)  $\frac{\omega L^3}{384EI}$  .

- viii) In case of a simply supported beam subjected to a point load  $W$  at the mid-span, deflection at the mid-span is

a)  $\frac{WL^4}{384EI}$                       b)  $\frac{WL^3}{48EI}$

c)  $\frac{WL^3}{24EI}$                       d)  $\frac{WL^3}{384EI}$  .

- ix) In a three-hinged parabolic arch, carrying a UDL over the entire span, the bending moment will be

- a) maximum at the mid-span
- b) maximum at the quarter-span
- c) zero only at the mid-span
- d) zero throughout the span.

- x) In the displacement methods of structural analysis the basic unknown/s is/are

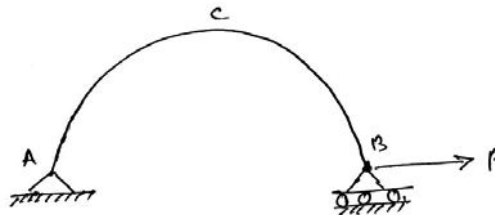
- a) displacement
- b) force
- c) displacement and force
- d) none of these.

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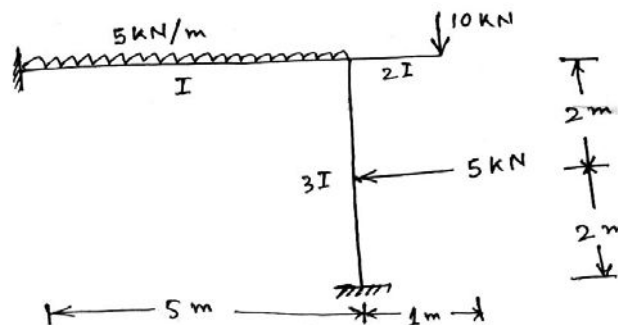
- xi) The ordinate of influence line diagram for bending moment always has the dimensions
- a) force                                      b) length  
c) force  $\times$  length                      d) force/length.
- xii) A single-bayed double storied rigid jointed portal frame fixed at base is statically redundant to
- a) first degree                              b) third degree  
c) sixth degree                              d) twelve degree

**GROUP - B****( Short Answer Type Questions )**Answer any *three* of the following.  $3 \times 5 = 15$ 

2. A circular bar is bent as shown in figure below. Suppose A is hinge & B is roller. Find out the horizontal displacement of the roller if a load  $P$  is applied at point B. Use strain energy method. Take  $EI$  of the bar is constant.

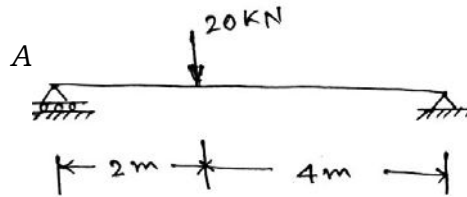


3. Analyse the rigid frame shown below by moment distribution method.



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4. A simply supported beam carries a point load of 20 kN as shown in 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.



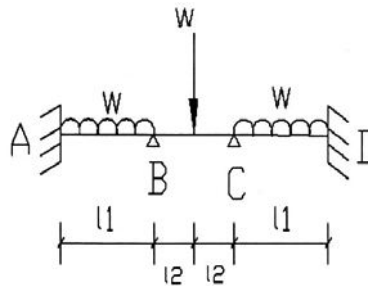
5. Draw the influence line diagram of 10 m from one end of a beam of span 25 m. Using this diagram find out the maximum shear force due to load.
6. a) Define & state the Castigliano's theorem.  
b) Define & state the Maxwell's Reciprocal theorem.
7. Derive the expressions for strain energy due to axial force and bending moment

### GROUP - C

#### ( Long Answer Type Questions )

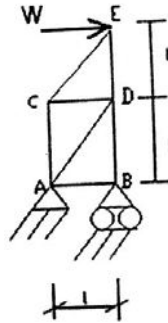
Answer any *three* of the following.  $3 \times 15 = 45$

8. Draw bending moment and shear force diagrams by Slope Deflection method for the following figure.

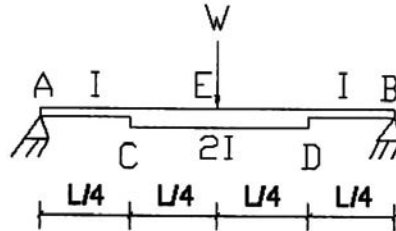


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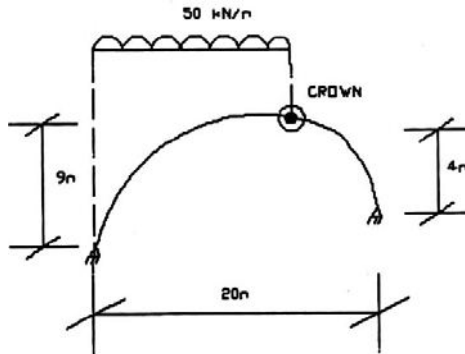
9. Find the horizontal deflection at  $E$  of the following truss. Assume  $AE = \text{constant}$ .



10. Applying conjugate beam theory, calculate the slope and deflection at the mid-span of the simply supported beam as shown in the following figure.

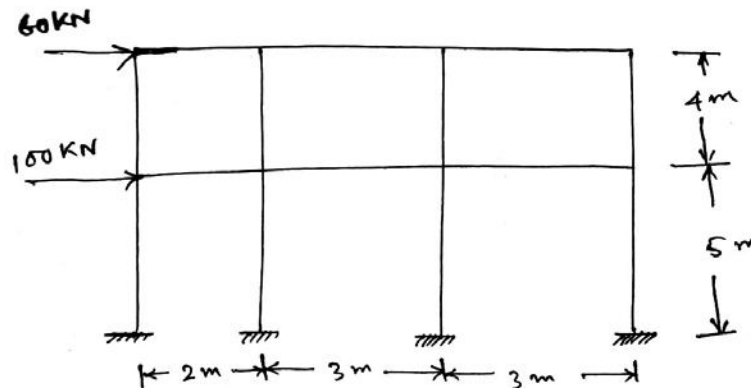


11. Determine the horizontal and vertical reactions at the supports of the three-hinged unsymmetrical parabolic arch shown below. Also find out the shear force, bending moment and normal thrust at a section at a horizontal distance of 4 m from the left support.



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12. Analyse the frame shown in the figure below by Cantilever method. Take  $EI$  is constant throughout the frame. Assume other data if necessary.



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