Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS / B.TECH (CE) / SEM-4 / CE-404 / 2011

2011

STRUCTURAL ANALYSIS – I

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

   a) $U = \int \dfrac{T^2}{2GK}\mathrm{d}x$ b) $U = \int \dfrac{T}{2GK}\mathrm{d}x$

   c) $U = \int \dfrac{T^2}{GK}\mathrm{d}x$ d) $U = \int \dfrac{T}{GK}\mathrm{d}x$

   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) $-\dfrac{wL^2}{12}, \dfrac{wL^2}{12}$

b) $\dfrac{wL^2}{36}, \dfrac{wL^2}{24}$

c) $\dfrac{wL^2}{8}, \dfrac{wL^2}{8}$

d) $-\dfrac{wL^2}{8}, \dfrac{wL^2}{12}$

v) The ordinate of influence line diagram for bending moment always have the dimension of

a) force

b) length

c) force × length

d) force / length.

vi) Influence line diagram is applicable for

a) moving load

b) dead load

c) both (a) and (b)

d) none of these.

vii) A no. of wheel loads 3t, 4t, 5t and 6t spaced 2 m , 3 m and 3 m respectively move on a simply supported beam AB of span 24 m with 3t load leading from left to right. To find the maximum B.M. at 18 m from A, the load that must be placed at the section

a) 3t

b) 4t

c) 5t

d) 6t.
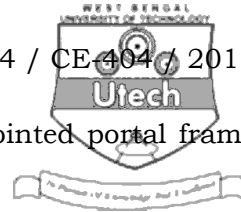
viii) A single-bayed double-storied rigid-jointed portal frame is statistically redundant to

    a)   first degree   b)   third degree

    c)   sixth degree   d)   twelfth degree.

ix) The degree of static indeterminacy of a propped cantilever beam is

    a)   0   b)   1

    c)   2   d)   3.

x) A single rolling load of 10 KN rolls along a girder of 12 m span. The absolute maximum bending moment will be

    a)   8 KN-m   b)   15 KN-m

    c)   30 KN-m   d)   60 KN-m.

xi) Find the force in member AC of the truss as shown in the figure given below :
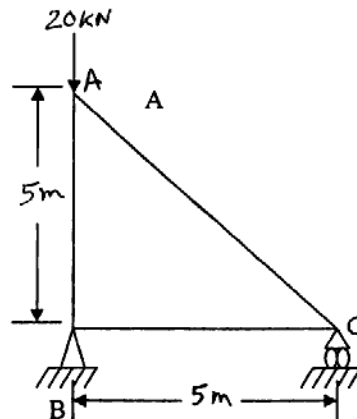
    a)   5 KN   b)   6 KN

    c)   10 KN   d)   zero.
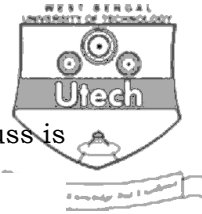
xii) Total degree of indeterminancy of the truss is
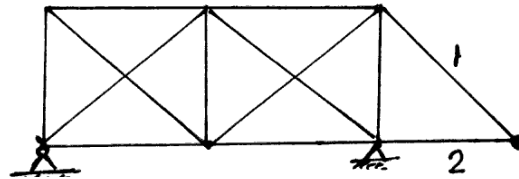
a) 2

b) 3

c) 4

d) 0.

xiii) Assumption in Analysis of Pin Jointed Plane Truss are

a) end joints of all members are perfect pin connection

b) load act on joint only

c) at any joint, axes of all members meeting at the joint pass through a single point

d) all of these.

xiv) A simply supported beam *MN* is at first loaded by *P* at *A* and then at *B*. If Δ_{BA} be deflection at *B* due to load at A and Δ_{AB} be deflection at *A* due to load at *B* then
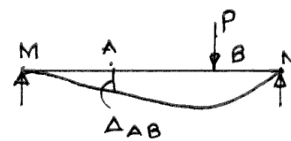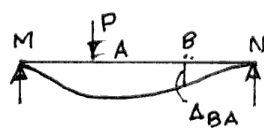
a) $\Delta_{AB} > \Delta_{BA}$

b) $\Delta_{AB} = \Delta_{BA}$

c) $\Delta_{AB} = \Delta_{BA}$
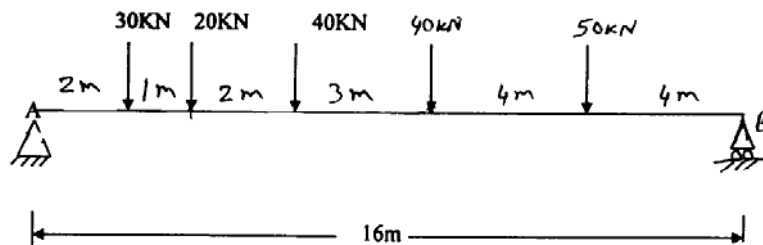
d) depend on position of *AB*.

GROUP – B

### (Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. A moving load system as shown in the figure below passes over a simply supported beam of span 16 m. Find the support reaction forces at *A* & *B* by drawing suitable influence line diagram for the given load system :

3. Describe the Maxwell's reciprocal theorem.

4. Find out the horizontal movement of the roller *D* by applying a point load *P* as shown in the figure below :
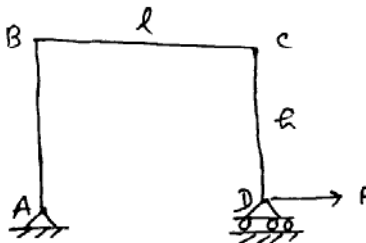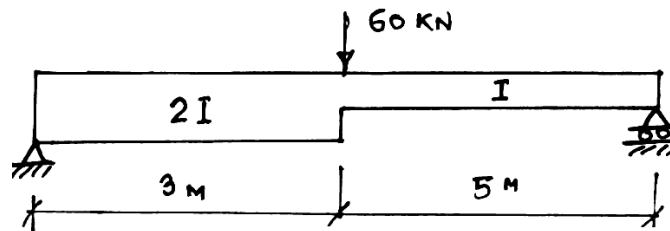

5. Analyse the truss shown given below (by any method) :
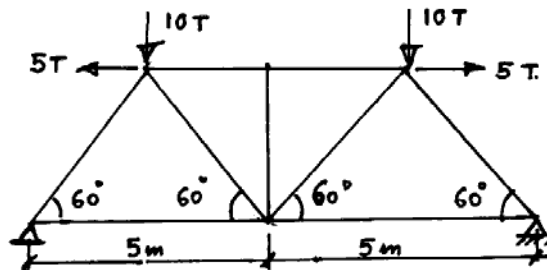
6. A simply supported beam with varying EI and loaded as shown below. Find deflection under concentrated load by applying conjugated beam method.
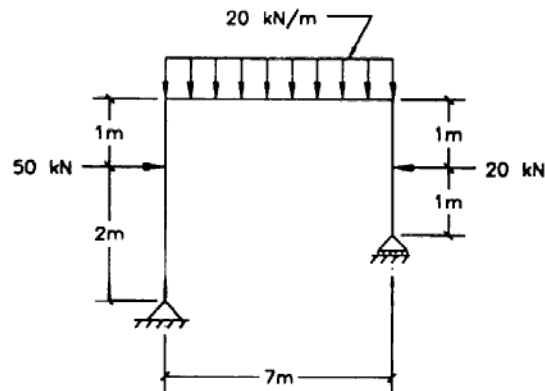

7. Define conjugate beam. State conjugate beam theorems.

GROUP – C

(Long Answer Type Questions)
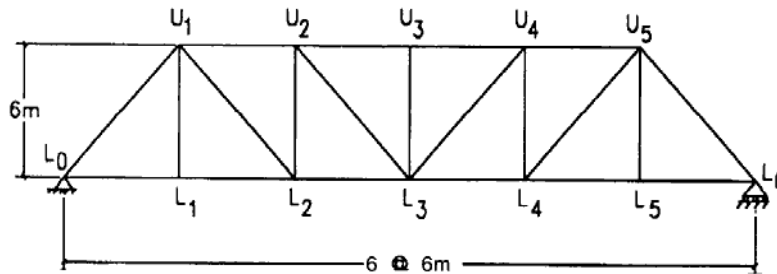
Answer any *three* of the following.   3 × 15 = 45

8. Analyze the portal frame shown in figure. Also sketch SFD, BMD and axial force diagram.

9. Draw the influence line diagram for the forces in the members U_2U_3, U_2L_3, and L_2L_3 in the Pratt truss shown in figure.

10. Determine the horizontal and vertical displacements of the tip C of the structure shown in figure.
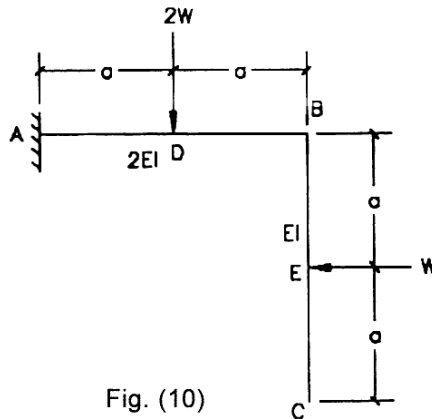

Fig. (10)

11. Determine the magnitude of maximum values of support reactions, shear force and bending moment at a section of 8 m from left, for a bridge of 20 m span for the following conditions :
    a) For wheel loads of 6, 4, 8 and 5 KN at 3 m, 2 m and 2 m spacing respectively cross a girder from left to right with 6 KN load leading.
    b) *udl* of 4 KN/m and 4 m long.

12. Determine the vertical displacements of both B and C for the truss as shown in the figure. The cross-sectional area of all members is 130 sq.mm and the modulus of elasticity is 200 KN/mm^2 are constant *EI*
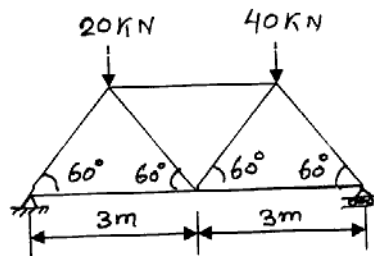
13. Analyse the following frame by cantilever method shown in figure. Draw the bending moment diagram.

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