(v)   For stable determinate truss, the number of members m and number of joints j are related by the equation
(a) m = 3j-3   (b) m = 2j-3   (c) m = 2j   (d) m = 2j+3.

(vi) The Value of the ordinate at quarter span of the influence line diagram for mid span bending moment of a simply supported beam is 0.6 m. If the span of the beam is doubled what will be the corresponding value?
(a) 0.6m   (b) 1.2m   (c) 0.3m   (d) none of the above.

(vii) Müller – Breslau principle is used to obtain the
(a) deflected shape   (b) influence line
(c) B.M. diagram   (d) S.F. at any section.

(viii) Maxwell's reciprocal theorem in structural analysis can be applied to
(a) linearly elastic structure   (b) plastic structures
(c) symmetrical structures only   (d) any type of structures.

(ix) Castigliano's theorem for deflection is true for
(a) linearly elastic material
(b) rigid material
(c) non linearly elastic material
(d) any material elastic or in elastic.

(x)   The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in
(a) vertical direction
(b) inclined direction
(c) the direction in which the deflection is required
(d) horizontal direction.

Group - B

2. (a) Determine (a) the reactions and (b) the location and magnitude of maximum tension in the cable shown in Fig.1

(a) Truss

(b) Moving Load

12
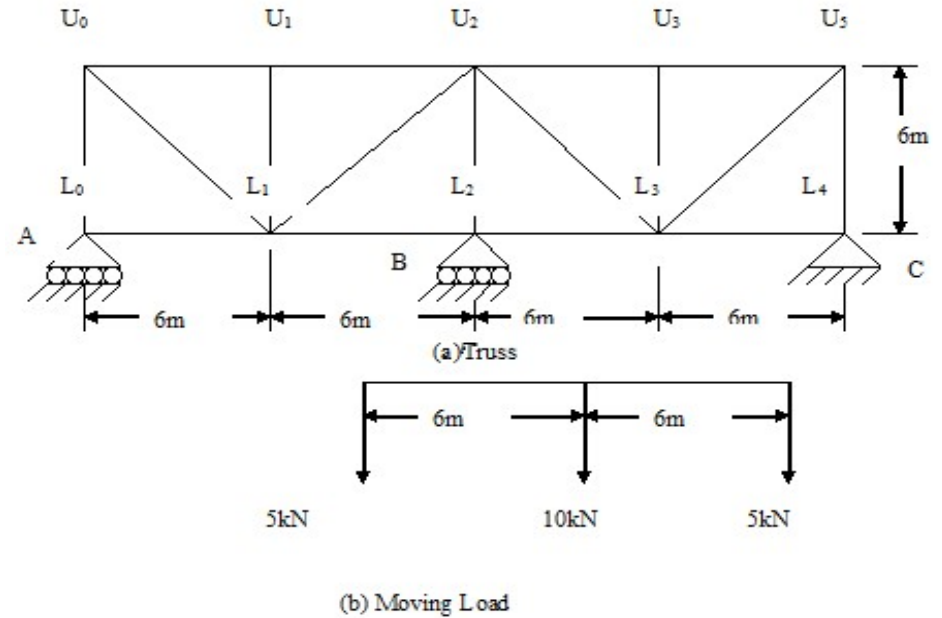
ANALYSIS OF STRUCTURES - I
(CIVL 2201)

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 alternatives for the following: **10 × 1 = 10**

   (i)   Find out the degree of kinematic indeterminacy of the following structure

   (a) 0   (b) 1   (c) 3   (d) 4.

   (ii)   Slope at the free end of a cantilever beam of span l , carrying a udl of w/unit length is given by

   (a) $\dfrac{wl^3}{8EI}$ (b) $\dfrac{wl^3}{4EI}$ (c) $\dfrac{wl^3}{6EI}$ (d) $\dfrac{wl^3}{3EI}$.

   (iii) The three moment equation written for an indeterminate support of a continuous beam expresses the condition of
   (a) slope compatibility at that point
   (b) moment equilibrium at that point
   (c) zero deflection at the support point
   (d) structural Stability

   (iv)   Compared to a beam, in an arch,
   (a) axial force increases   (b) shear force decreases
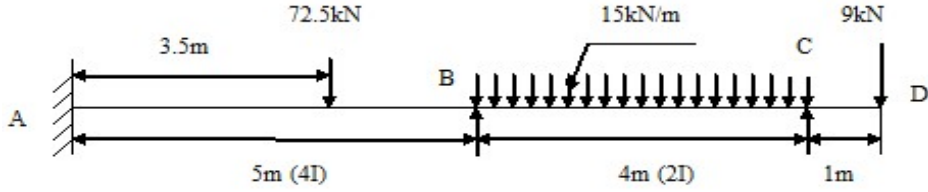   (c) B.M. decreases   (d) all the above.
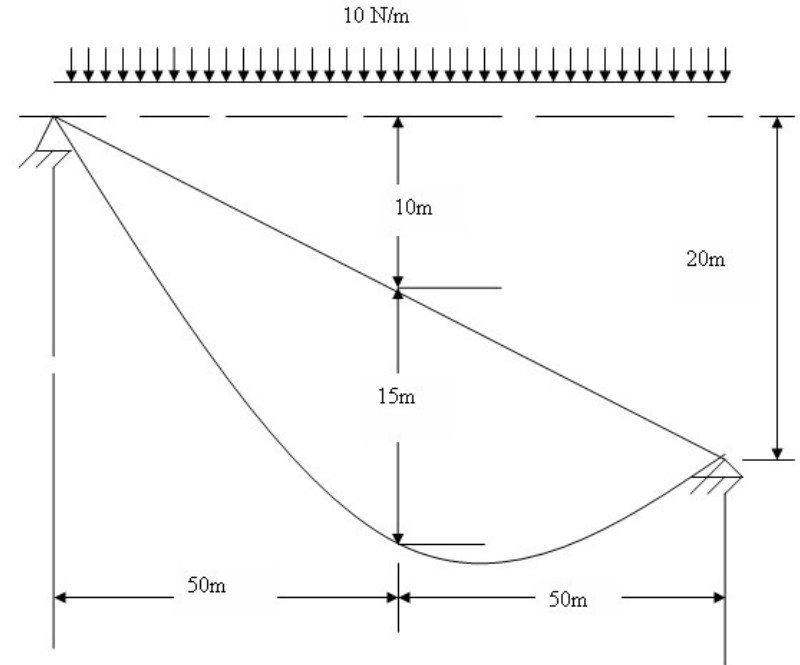
10 N/m
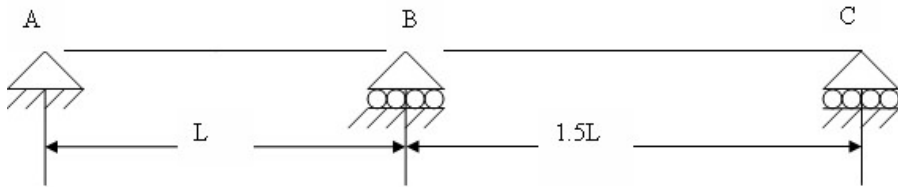
Fig.1

(b) For the three hinged circular arch shown in fig.2 determine (a) the support reactions (b) axial force (c) shear force and (d) bending moment at D.
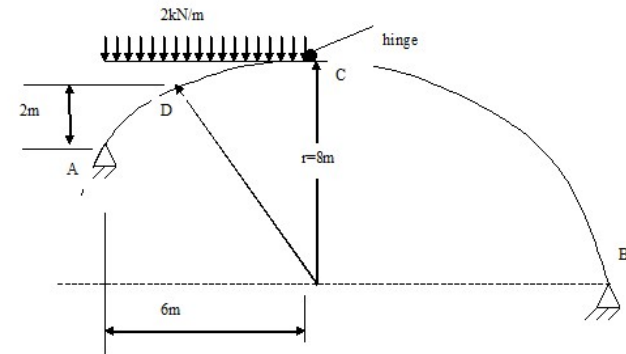
2kN/m

hinge

2m

D

C

r=8m

A

6m

B

Fig.2

6 + 6 = 12

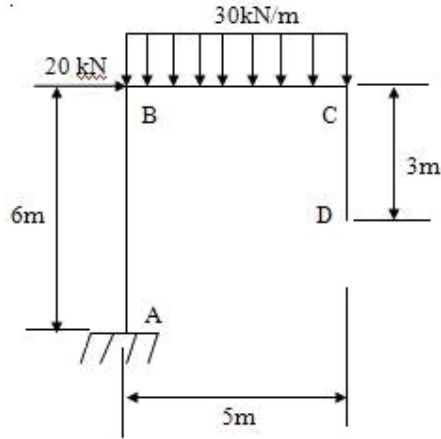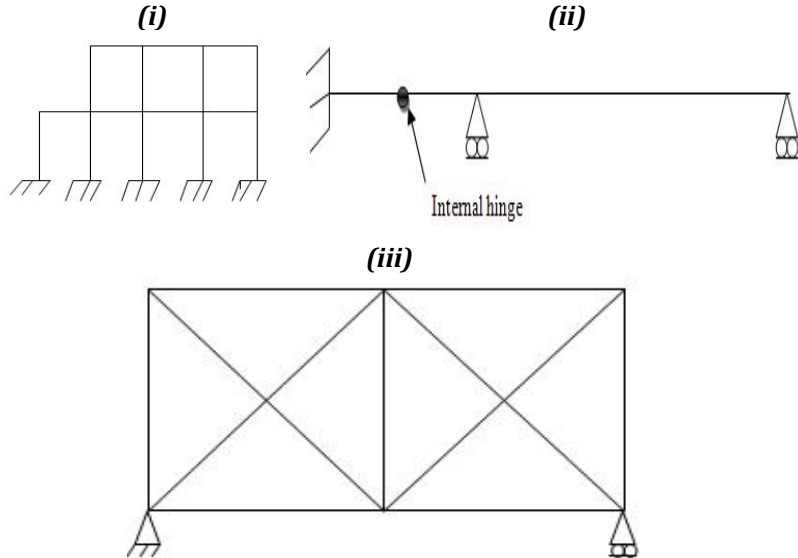3. (a) Determine the vertical and horizontal displacement at the free end D in the frame shown in Fig.3.

Fig.3

(b) Find out the degree of static indeterminacy of the following structures. (Any two)

(i) *(ii)*

Internal hinge

(iii)

10 + 2 = 12

Group - C

4. (a) A uniformly distributed load of 15 kN/m covering a length of 3m crosses a girder of span 10m. Find the maximum shear force and bending moment at a section 4m from left hand support. Indicate the sections that experience the absolute maximum shear and maximum moment.

(b) Two point loads of 50kN and 75kN spaced 3m apart with 50 kN load leading passes over a simply supported span of 12m from left to right. Using influence line diagrams calculate the maximum S.F. and B.M. at a section 4.8 m from left hand support. Also find out the section and the magnitude of the absolute maximum bending moment that may occur anywhere on the beam.

6 + 6 = 12

5. Draw influence line diagram for the forces in the members U_1U_2, L_1L_2, U_1L_2 of the Pratt type bridge truss shown in fig.4
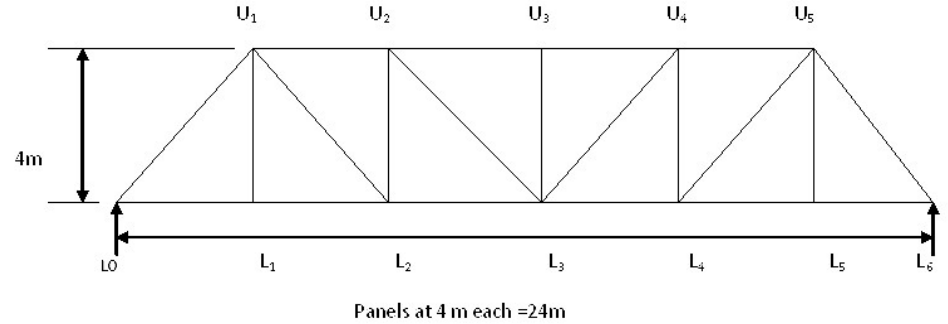
Panels at 4 m each =24m

Fig. 4

12

Group - D

6. (a) State and Explain Clapeyron's Theorem of three moment.

(b) Analyse the continuous beam shown in figure 5, if the support at B settles by 10mm. Beam fixed at end A.
Assume E=$2x10^2$ kN/mm^2 and I= $4x10^7$ mm^4.