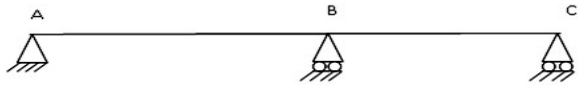


- (v) A cantilever beam of length l carries a point load P at its free end. Vertical displacement of its free end will be
 (a) $Pl^3/3EI$ (b) $Pl^4/3EI$ (c) $Pl/3EI$ (d) $3Pl/EI$.

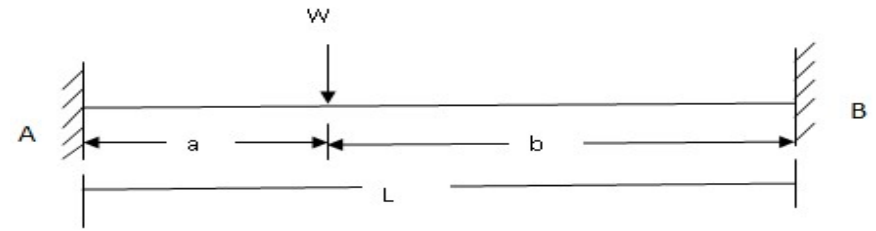
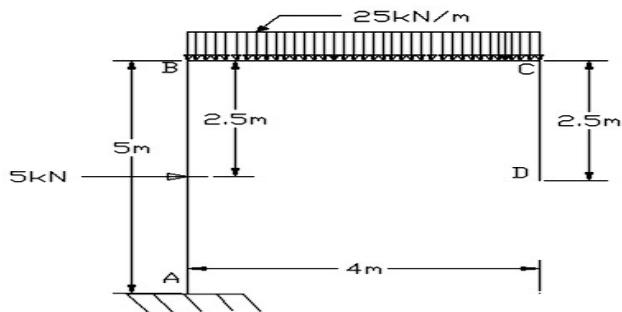
(vi) The beam shown in Fig. is



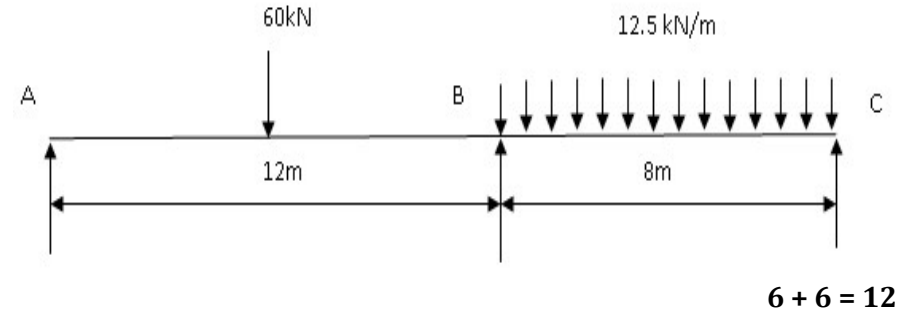
- (a) stable and determinate (b) unstable and indeterminate
 (c) stable but indeterminate (d) unstable but determinate.
- (vii) Castigliano's theorem for deflection i.e. $\frac{\partial U}{\partial P} = \delta$ (deflection) is true for
 (a) linearly elastic structure (b) rigid structure
 (c) non linearly elastic structure (d) any structure.
- (viii) The theorem of three moments expresses the condition of
 (a) equilibrium of forces (b) slope compatibility
 (c) Maxwell's reciprocal theorem (d) superposition of forces.
- (ix) Arch is a
 (a) one dimensional structure (b) two dimensional structure
 (c) three dimensional structure (d) flexible structure.
- (x) Müller Breslau's principle is applicable to
 (a) only statically determinate structure
 (b) only beams
 (c) only statically indeterminate structure
 (d) when principle of superposition is valid.

Group - B

2. Determine the vertical and horizontal displacement of the free end "D" in the following frame. Given, $EI = 12 \times 10^{13}$ N-mm². EI is constant throughout.

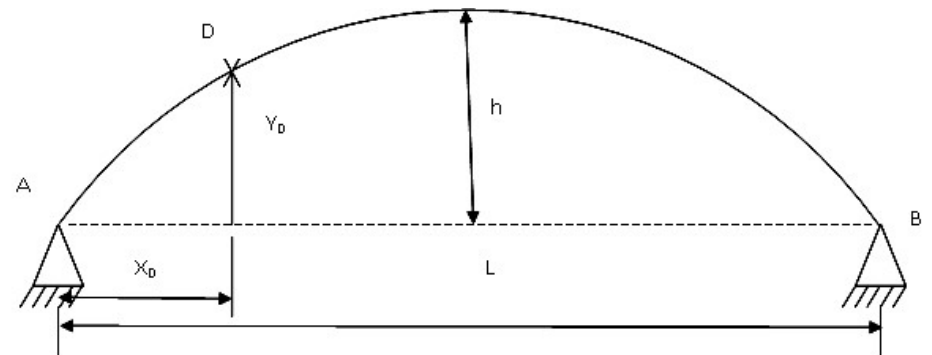


(b) Analyze the continuous beam shown in fig. using the three moment equation if (a) the support does not settle (b) the interior support at B settles by 10mm. Assume for the beam. $E = 200\text{kN/mm}^2$ and $I = 10^8 \text{ mm}^4$. EI is constant throughout. The concentrated load acts at mid span of AB.

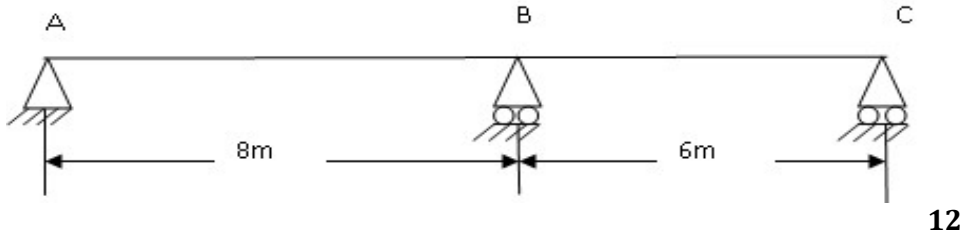


Group - E

8. Consider the typical arch shown in Fig. Draw the influence line diagram for the following:
 (i) Horizontal thrust (ii) Bending moment at D
 (iii) Radial shear at D and (iv) Normal thrust at D.



9. Draw the influence line diagram for moment at B in the continuous beam shown below by plotting ordinates at 2m interval. Assume flexural rigidity EI is constant throughout.



**ANALYSIS OF STRUCTURES - I
(CIVL 2201)**

Time Allotted : 3 hrs

Full Marks : 70

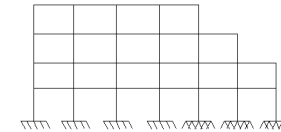
Figures out of the right margin indicate full marks.

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)**

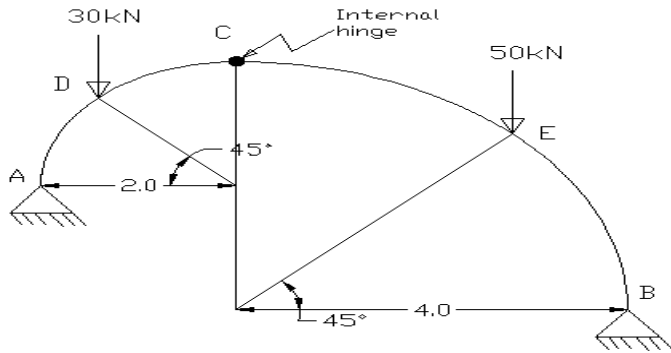
1. Choose the correct alternative for the following: **10 × 1 = 10**

- (i) When a uniformly distributed load, longer than the span of the girder, moves from left to right, then the maximum bending moment at mid-section of span occurs when the uniformly distributed load occupies
 (a) less than the left half span (b) whole of left half span
 (c) more than the left half span (d) whole span.
- (ii) Find out the degree of static indeterminacy of the following frame.

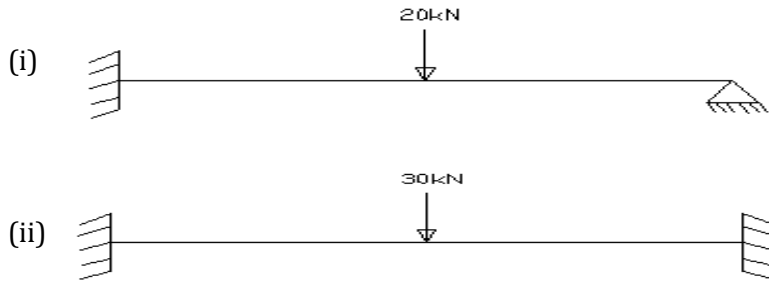


- (a) 52 (b) 42 (c) 63 (d) 68.
- (iii) The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in
 (a) vertical direction
 (b) horizontal direction
 (c) inclined direction
 (d) the direction in which the deflection is required.
- (iv) If in a pin-jointed plane truss $(m + r) > 2j$, then the truss is (Where 'm', 'r' and 'j' are standard notations)
 (a) stable and statically determinate
 (b) stable and statically indeterminate
 (c) unstable
 (d) internally stable but externally unstable.

3. (a) A three hinged arch consists of two quadrantal parts AC and CB of radii 2m and 4m respectively. For the load system acting on the arch, calculate the reactions at the supports and the bending moments under the loads.



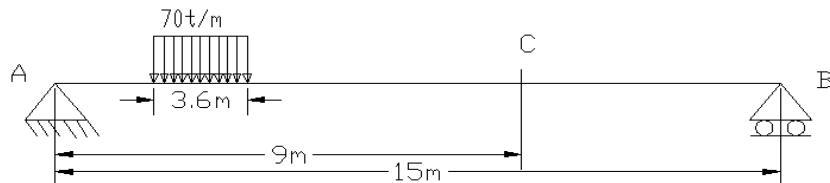
- (b) Find out the degree of Kinematic indeterminacy of the following:



10 + 2 = 12

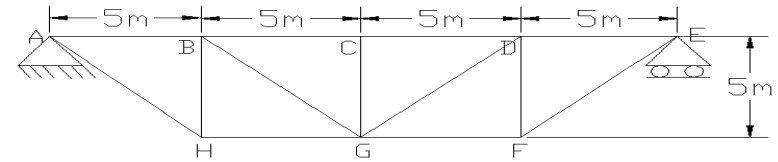
Group - C

4. Prepare the ILD for reaction forces, shear forces and bending moments at section C. Evaluate the maximum value of positive shear and bending moment that can develop at section C under a uniformly moving load of 70t/m of length 3.6m.



12

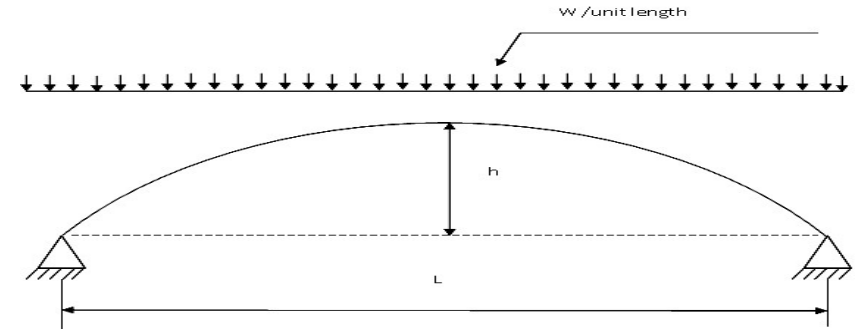
5. Construct the influence line diagram for the force in members BH, BG and CD of the truss shown below.



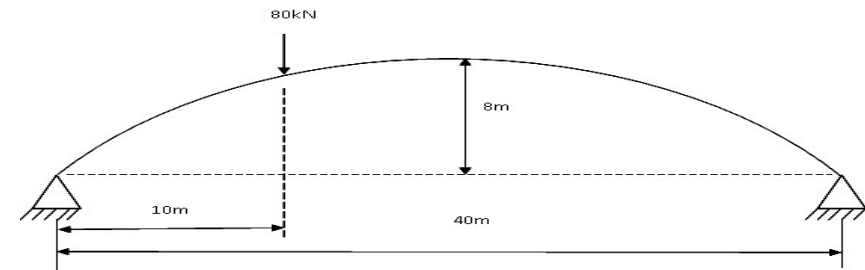
12

Group - D

6. (a) A two hinged parabolic arch of span L and rise h carries a uniformly distributed load of w per unit run over the whole span. Find the horizontal thrust at each support.



- (b) A two hinged parabolic arch of span 40m and rise 8m carries a point load of 80kN at a distance of 10m from the left support. Find the horizontal thrust at each support. Find also the maximum bending moment.



6 + 6 = 12

7. (a) A fixed beam of span L is subjected to a concentrated load W at a distance 'a' from end A as shown in fig. Determine the end moments developed. EI is constant throughout.