Que:no#1 ID:7970, Sec#B

Write a detail note on different types of load that different types of structures are designed to support through out its life, Elabrote with Examples:

Ans: **Loads:***

Once the dimensional requirements for a structure haven bee defined, it becomes necessary to determine the loads the structure must support. Often, it is the anticipation of the various loads that will be imposed on the structure that provide the basic type of structure that endure large lateral loading caused by wind, and so shear walls and tubular frame system is selected.

* The design loading for a structure is often specified in codes.
* The structural engineer works with two types of codes

1. General Building codes
2. Design Codes.

Types of loads on structure –

Buildings And other structure.

*The types of load acting on structure for buildings and other structure can be broadly classified as vertical, Horizontal loads and longitudinal loads. The vertical loads consist of dead load, live load and impact load.

Types of load Acting on the structure.

1. Dead loads.
2. Imposed loads.
3. Wind loads.
4. Snow load.
5. Earthquake loads.
6. Special loads.

* Dead loads *

The first vertical load that is consider * Dead ~~vertical~~ load. Dead loads are permanent or stationary loads which are transferred to structure through the life span.

* Dead load is primarily due to self weight of structural membas, permanent partion walls, fixed pamanent equipments and weight of different material.

Ex: Roof, beam, walls and column etc

Imposed load or live load: *

* Live loads are either movable or moving loads without any acceleration or impact.

* These loads are assumed to be produced by intented use or occupancy of the building including weights of movable partion or furniture etc.

* Live loads keeps on changing from time to time.

* Live loads can vary both in magnitude and location. They may be caused by the weight of object temporarily placed on a structure, moving vehicles, or natural forces.

→ Usually these loads include additional protection against excesive deflection or sudden load.

3. Wind Loads*

→ When structure block the flow of wind, the winds kinetic energy is converted into potential energy of presure. which cause a wind loading.

* For design purposes, winds load can be treated using either a static or a dynamic apporch.

* For low rise buildings up to four or five stories, the wind load is not critical because the moment of resistance provided by the continuity of floor system to column connection and walls provided between columns are sufficient to accomodate the effect of these forces.

4. Snow loads:*

Snow loads constitute to the vertical loads in the building. But these of loads are consida only in the snow fall places. The IS 875 (part 4) - 1987 deals with the snow loads on roff of the building.

→ The minimum snow load on a roof area or any other area above ground which is subjected to snow accumulation is obtained by the expression.

$$S = \mu S_0$$

Where S = Design snow load on plan area of Roof

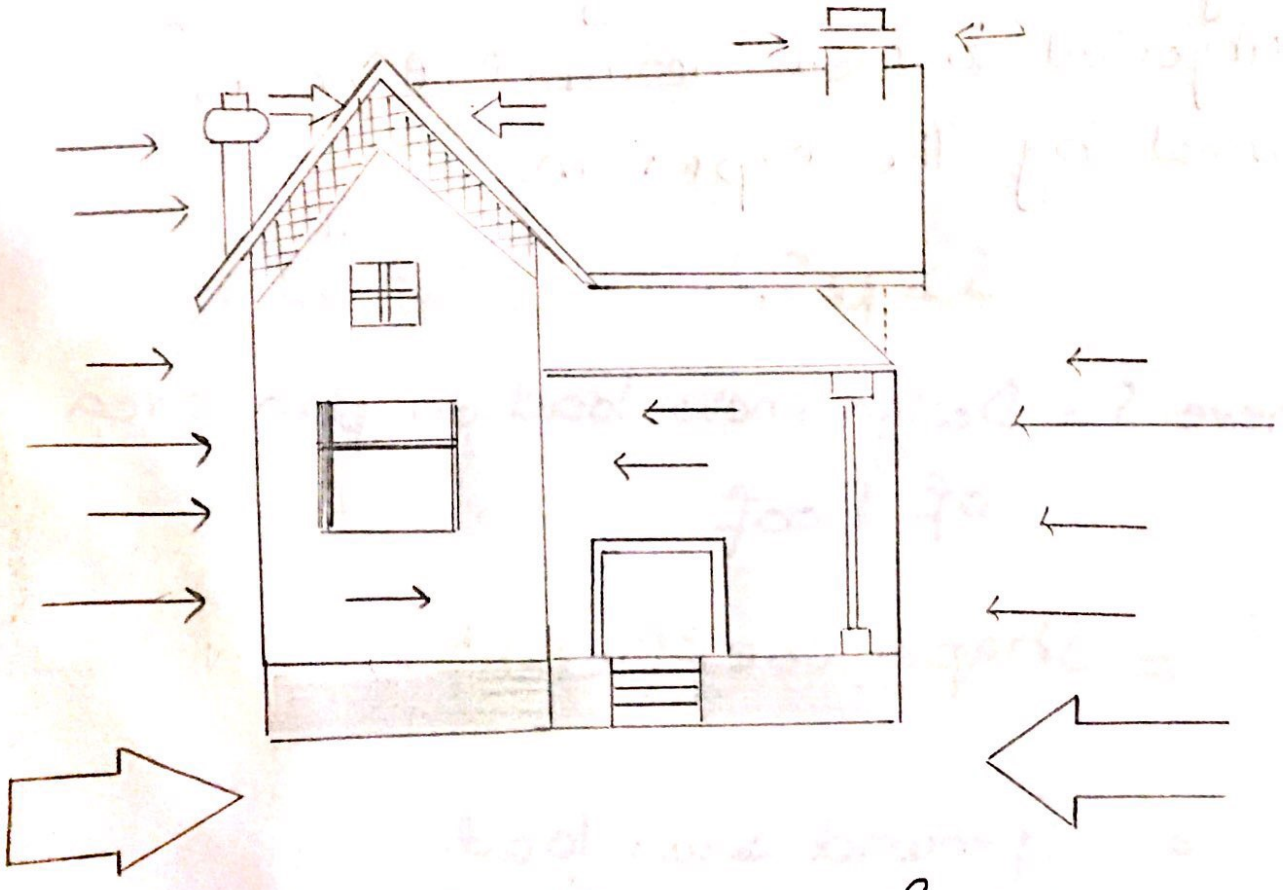
μ = Shape coefficient.

S_0 = Ground snow load.

5. Earth Quake :* loads

Earth quake loads produced loading on a structure through its interaction with the ground and its responce characteristics.

These loading result from structure distorion caused by the magnitude depends upon the type of ground acceleration and the type of mass and stifness of the structure.



Horizontal Earth quakes forces (**Back and forth shaking**) Creat 'whipping' forces of a building.

These forces must transfer between parts of the building to the foundation.

Types of Structure: *

* The combination of structural elements and material called structural system
* The structural system may be composed of one or more of the four basic types of structure

Truss: *

Truss use for structure of large span where the depth is not important.

→ A truss consist of slender elements.

* Arranged in a ~~rectangular~~ triangular shape
* planner truss refers to truss when all elements lie in a same plane.
* plane frequently used for bridges.
* Truss can be used to cover spans from 9m (30ft) to 22m (600ft).

*2. Cables and Arches:-

→ Cables are used to support long span where the using of truss is not feasible and could lead to a significant increase in cost and size of structure,

* Cables carry the load in tension
* And it can be used for span longer than 46m -

2. Arch:-

Arch carry the load in compressions,

* The arch should be rigid
* In order to maintain the rigidity and shape, secondary loading involves shear and moment will generate.

*3. Frames:-

Frames are used in buildings, frames composed of beam, column

* Beam and column may be connected using a pin or fixed connection,

- Frames extend in two or three dimension, for rigid joint connection the structure know as indeterminate.

*4 Surface Structure:-

A surface structure having very small thickness compared to its other dimensions. Sometimes this material is very flexible and can take the form of a tent or air-inflated.

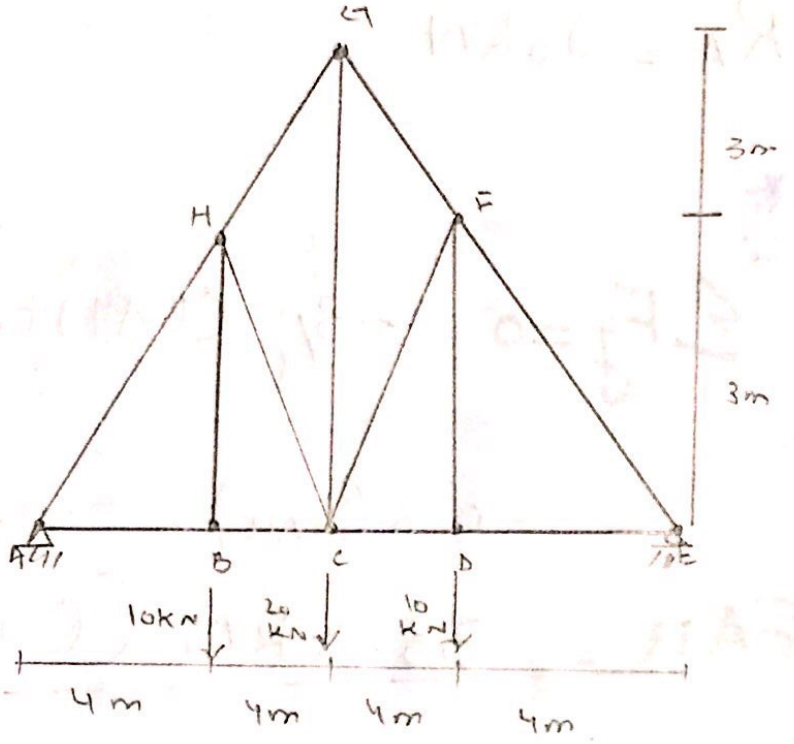
Structure.

* Surface structure may also be made of rigid material such as reinforced concrete.
* As such they may be shaped as folded plats, cylinder or hyperbolic paraboloids.

Ques: no#2

Method of Joint.

:Section Method:-
Also →



Determine the forces:-

:Support Reaction:

$$\Sigma F_y = 0 \quad + \uparrow \downarrow -$$

$$R_A + R_E = 40$$

$$\Sigma M_A = 0 \quad \circlearrowright -$$

$$R_E(16) + 10(12) + 20(8) + 10(4) = 0$$

$$R_E = \frac{320}{16} = 20\ KN.$$

$= 40 - 20$

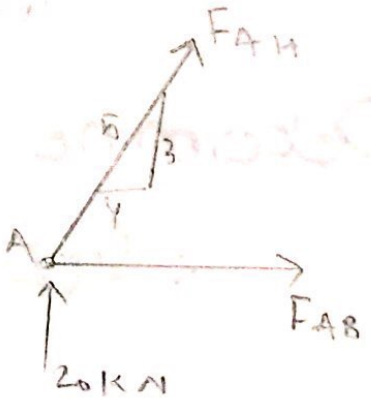
$R_A = 20\,kN$

Joint A:*

$\Sigma F_y = 0 \quad -3/5\,(F_{AH}) + 20\,kN = 0$

$= -0.6\,(F_{AH}) = -20\,kN$

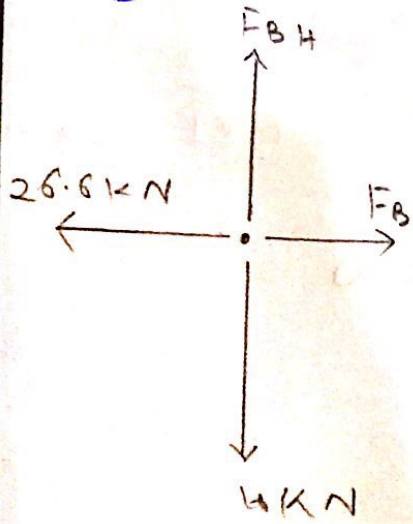
$F_{AH} = 33.3\,kN\ (C)$



$\Sigma F_x = 0 \quad -\frac{4}{5}(33.33) + F_{AB} = 0$

$F_{AB} = 26.6\,kN\ (T)$

Joint B:-*



$\Sigma F_x = 0 \quad F_{BC} = 26.6\,kN\ (T)$

$\Sigma F_y = 0 \quad F_{BH} = 10\,kN\ (T)$

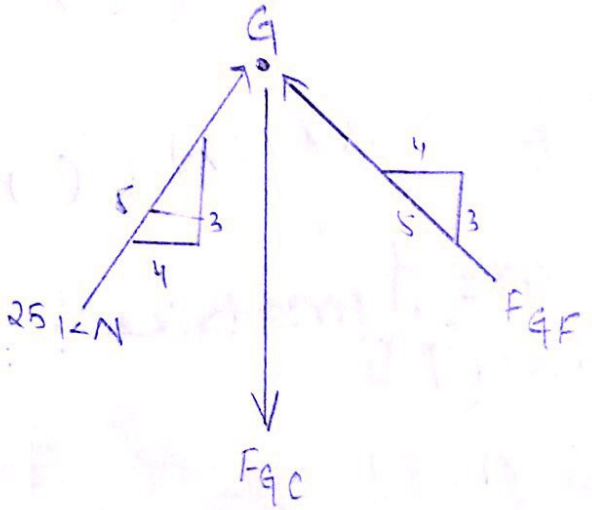
Joint G:

$$\uparrow \Sigma F_x = 0 \quad \frac{4}{5}(25) - \frac{4}{5}(F_{GF}) = 0$$

$$F_{GF} = 25\,kN\ (C)$$

$$\uparrow \Sigma F_y = 0 \quad \frac{3}{5}(25) + \frac{3}{5}(25) - F_{GC} = 0$$

$$F_{GC} = 30\,kN\ (C).$$



Joint H:*

$$\Sigma F_y = 0, \quad \frac{3}{5}(33.33) - 10\,kN + \frac{3}{5}(F_{HC}) - \frac{3}{5}(F_{HG})$$

*1

$$\Sigma F_x = 0, \quad \frac{4}{5}(33.33) - \frac{4}{5}F_{HC} - \frac{4}{5}F_{HG}$$

*2

36.87°

$$19.98 - 10 + 0.6\,F_{HC} - 0.6\,F_{HG} = 0 \quad \text{---} \quad *_1$$

$$\longrightarrow \quad 26.66 - 0.8\,F_H - 0.8\,F_{HG} = 0 \quad \text{------} \quad *_2$$

Multiplying eq (*1) with 1.34
And then adding with eq (*2)

Thus:-

$$F_{HG} = 25\,KN\ (C)$$

$$F_{HC} = 8.34\,KN\ (C)$$

As Struss are Symetrical:

I $F_{AB} = F_{ED} = 26.6\,KN\ (T)$

II $F_{BC} = F_{DC} = 26.6\,KN\ (T)$

III $F_{BA} = F_{DE} = 16\,KN\ (T)$

iv

v $F_{HG} = F_{GF} = 25\,KN\ (C)$

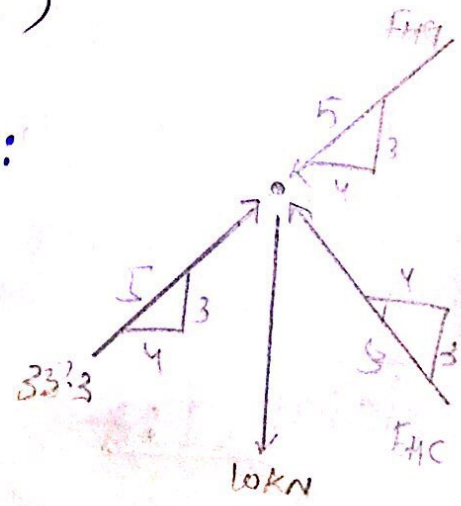
vi

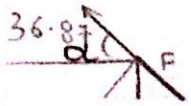
vii $F_{HC} = F_{FC} = 8.34\,KN\ (C)$

viii $F_{AH} = F_{GF} = 33.33\,KN\ (C)$

ix

x





Que:no#02

Determine the forces in each member of a truss. Members are in tension or compresion:

AH = ?

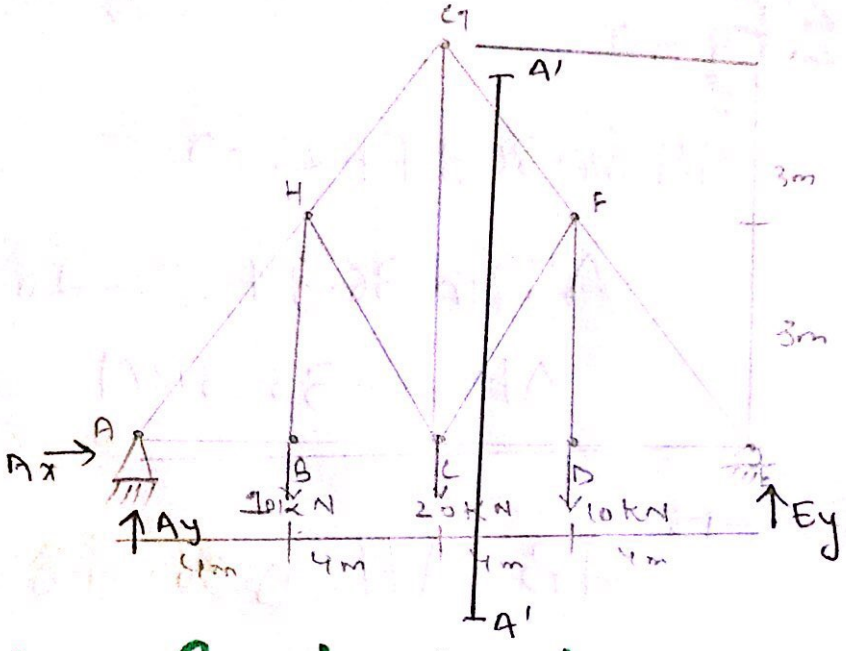
AB = ?

GF = ?

FC = ?

DC = ?

GC = ?



Method of Section:-

$\xrightarrow{+} \Sigma F_x = 0 \quad A_x = 0$

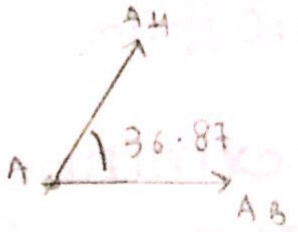
$+\uparrow \Sigma F_y \quad A_y - 10 - 20 - 10 + \Sigma_y = 0.$

$+\circlearrowleft \Sigma M|_A = 0 \quad -10 \times 4 - 20 \times 8 - 10 \times 12 + \Sigma_y \times 16 = 0$

$E_y = 20\,kN \uparrow$

$A_y = 20\,kN$

Joint A:-*



(i) $\Sigma F_x = 0$

$AB + AH \cos 36.78 = 0$

$\theta = \tan^{-1} = \frac{3}{4}$

$\theta = 36.87°$

(ii) $+\uparrow \Sigma F_y = 0$

$AH \sin 36.87 + 20 = 0.$

$AH \sin 36.87 = -20.$

$AH = -33.3 kN.$

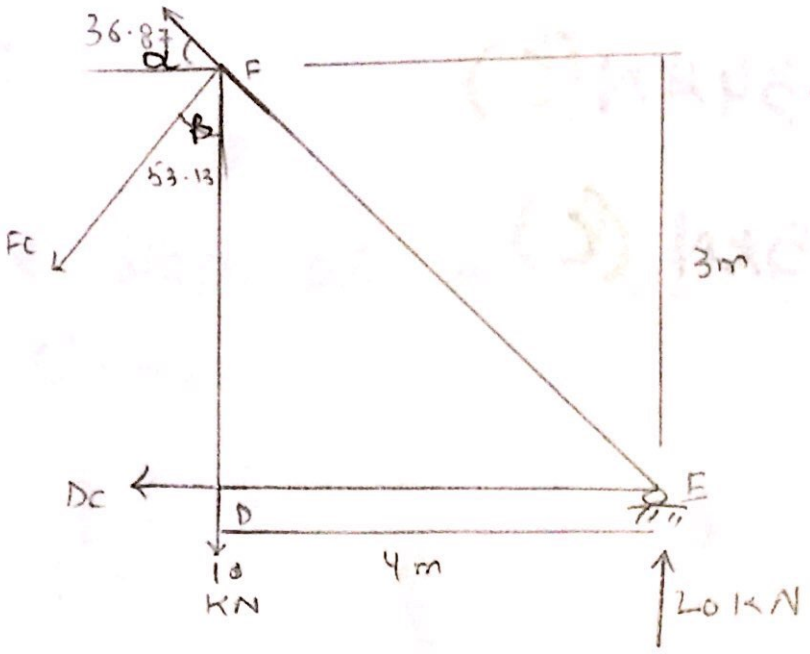
Now ⟶ $AB + AH \cos 36.78 = 0$

$AB + (-33.3) \cos 36.78 = 0.$

$AB = 26 kN$

AH = 33.3 (C)

AB = 26.6 (T)



$$\tan\alpha = 3/4$$

$$\alpha = 33.87$$

$$\tan\beta = \frac{4}{3} \Rightarrow \beta = 53.13^\circ$$

$$\stackrel{+}{\rightarrow} \Sigma F_x = 0$$

$$-DC - FC\sin 53.13 - FG\cos 36.87 = 0.$$

$$+\uparrow \Sigma F_y = 0$$

$$FG\sin 36.87 - FC\cos 53.13 + 20 - 10 = 0.$$

$$+\circlearrowleft M_F = 0$$

$$-DC \times 3 + 20 \times 4 = 0.$$

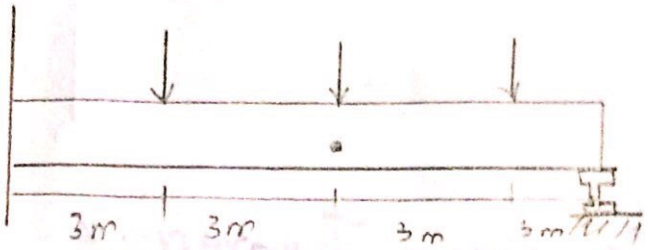
$$DC = 26\,KN\ (T)$$

$F_C = 8.34kN (C)$

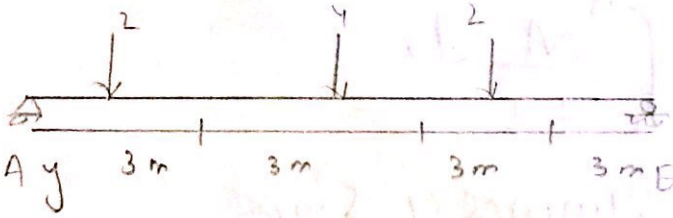
$F_G = 25kN (C)$

Prob:no #03

Determine slope at 'A' and displacement at 'C' Using



Reactions:-



$$+\uparrow \Sigma F_y = 0$$

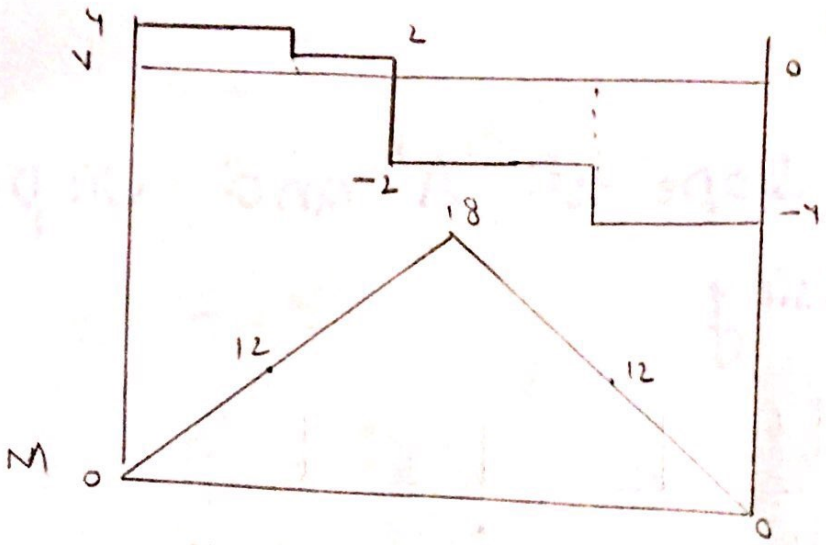
$$A_y + B_y = 8kN$$

$$+\circlearrowleft \Sigma M_A = 0$$

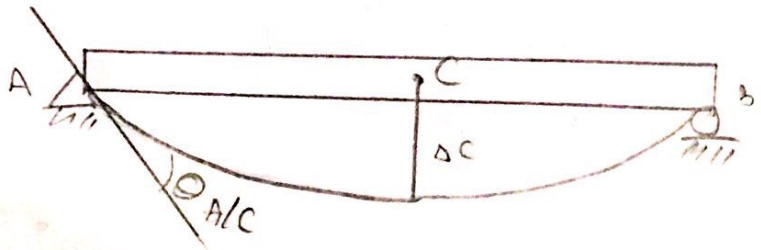
$$-6kNm - 24kNm - 18kNm + B_y(12) = 0$$

$$B_y = 4kN$$

$$A_y = 4kN$$



By Moment Area Theorem:*



$$\longrightarrow \theta_{AC} = \int_C^A \frac{M}{EI}\, dx$$

Due to symmetry slope

at $C \rightarrow \theta_C = 0$

Slope at A:-

$$\theta_{A/C} = \frac{1}{2}\left(\frac{3 \times 12}{EI}\right) + \left(\frac{12 \times 3}{EI}\right) + \frac{1}{2}\left(\frac{6 \times 3}{EI}\right)$$

$$\theta_{A/C} = \frac{63\ kNm^2}{EI}$$

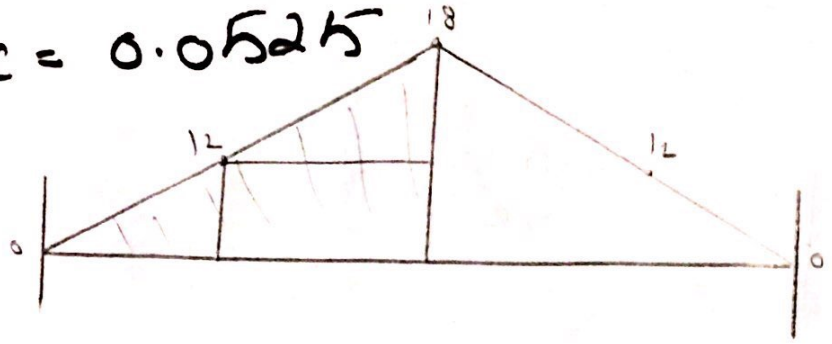
$E = 200\ GPa = 200000000\ kN/m^2$

$I = 6(10)^4\ mm^4 = 0.000006\ m^4$

$EI = 1200\ kNm^2$

$$\theta_{A/C} = \frac{63\ kNm^2}{1200\ kNm^2} = 0.0525$$

$\theta_{A/C} = 0.0525$



Displacement At C :- *

$$\Delta C = \bar{u} \int_C \frac{M}{EI} dx \cdot t_{A/C}$$

$$\Delta C = t_{A/C} = 1/2 \left(\frac{3 \times 12}{EI}\right)\left(\frac{2}{3} \cdot 3\right) + \left(\frac{12 \times 3}{EI}\right)\left(\frac{3+3}{2}\right)$$

$$+ 1/2 \left(\frac{6 \times 3}{EI}\right)\left(3 + \frac{2}{3} \cdot 3\right)$$

$$\Delta C = \frac{36}{EI} + \frac{162}{EI} + \frac{45}{EI}$$

$$\Delta C = 243\ kNm^3$$

$$\Delta C = \frac{243\ kNm^3}{1200\ kN/m^2}$$

$\Delta C = 0.2025m. \downarrow$

$= 202mm$. Ans :- *