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SUBJECT Structure Analysis.

Q) Different Types of Loads :-

① Dead Loads :-

⇒ Dead loads are those loads which are considered to act permanently.

⇒ They are "dead" stationary and unable to be removed.

⇒ The self-weight of the structure members normally provides the largest portion of the dead loads of a building.

② Live Loads :-

⇒ Live loads are not permanent and can change in magnitude.

⇒ They include items found within a building.

⇒ **Types of Live Loads :-**

A) WIND load :- The wind's relatively large projected areas can develop substantial forces in the structure.

B) EARTHQUAKE LOADS :-

⇒ Earthquake loads are another lateral live load.

⇒ They are very complex, uncertain and potentially more damaging than wind loads.

C) HYDROSTATIC AND SOIL PRESSURE :-

⇒ This pressure will consist of two elements.

1) ⇒ Soil pressure :-
⇒ which is a function of the soil depth and type

2) ⇒ Hydrostatic pressure :-
⇒ which will be simply the depth of the wall times the density of water.

3) Snow loads :-
⇒ This type of loads is considered only on the structure which receives snowfall during monsoon.

⇒ Some other types of loads :-
⇒ Some other types of loads that act on the structure which are taken into account in case they are liable to effect materially the safty or serviceability of structure are.

⇒ foundation Movement.
⇒ Erection load.
⇒ Vibration, fatigue
⇒ Stress concentration effect due to point of application of loads and the like.

⇒ Types of Structure :-

① Trusses :- Trusses consist of slinder elements in triangular form. Due to geometrical arrangement of its members bonds are converted into Tensile or compressive forces in members.

⇒ Planar trusses are composed of members lies in same plane and used for bridges and roof support.

⇒ Space trusses have members extending in three dimensions and used for towers.

2) CABLES AND ARCHES :-

⇒ Cable are flexible and carry loads in tension they are commonly used to support bridges, and roofs.

⇒ Arches achieves strength in compression and has a reverse curvature to cable. It mut be rigid to matain its shape. Consist of shear and moment. They are used in bridges structures, & some roofs and openings.

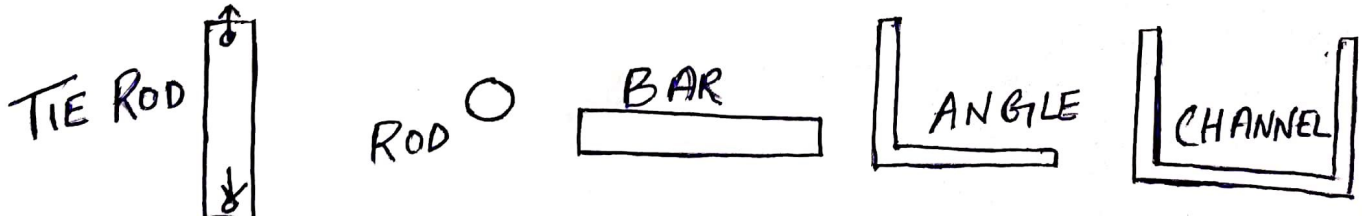
3) FRAMES :-

⇒ Type of structure which are used in buildings and consist of beam and columns, which are fixed or pin connected. The loads on frames causes bending of its members and has rigid joint connections.

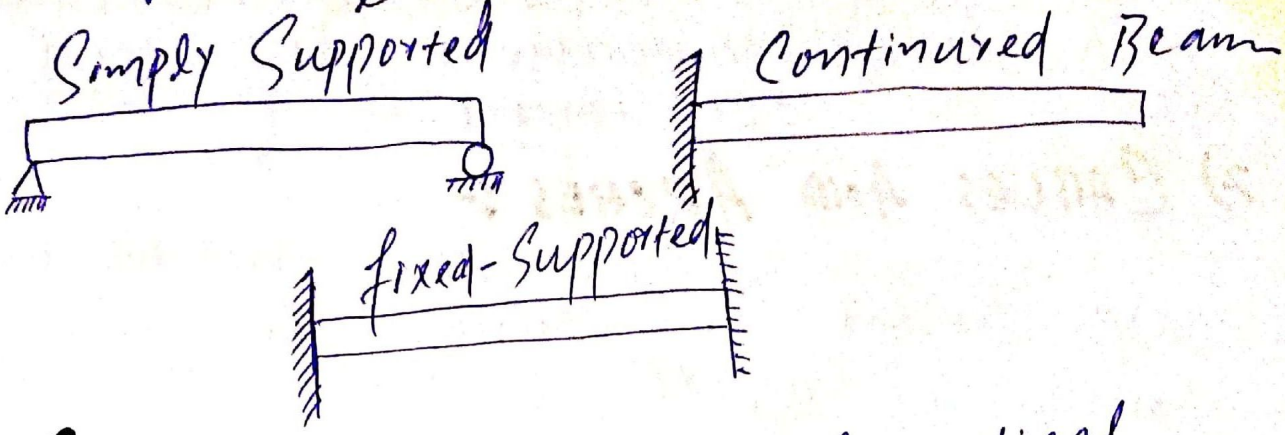
⟹ STRUCTURAL ELEMENTS :-

1) TIE RODS :-

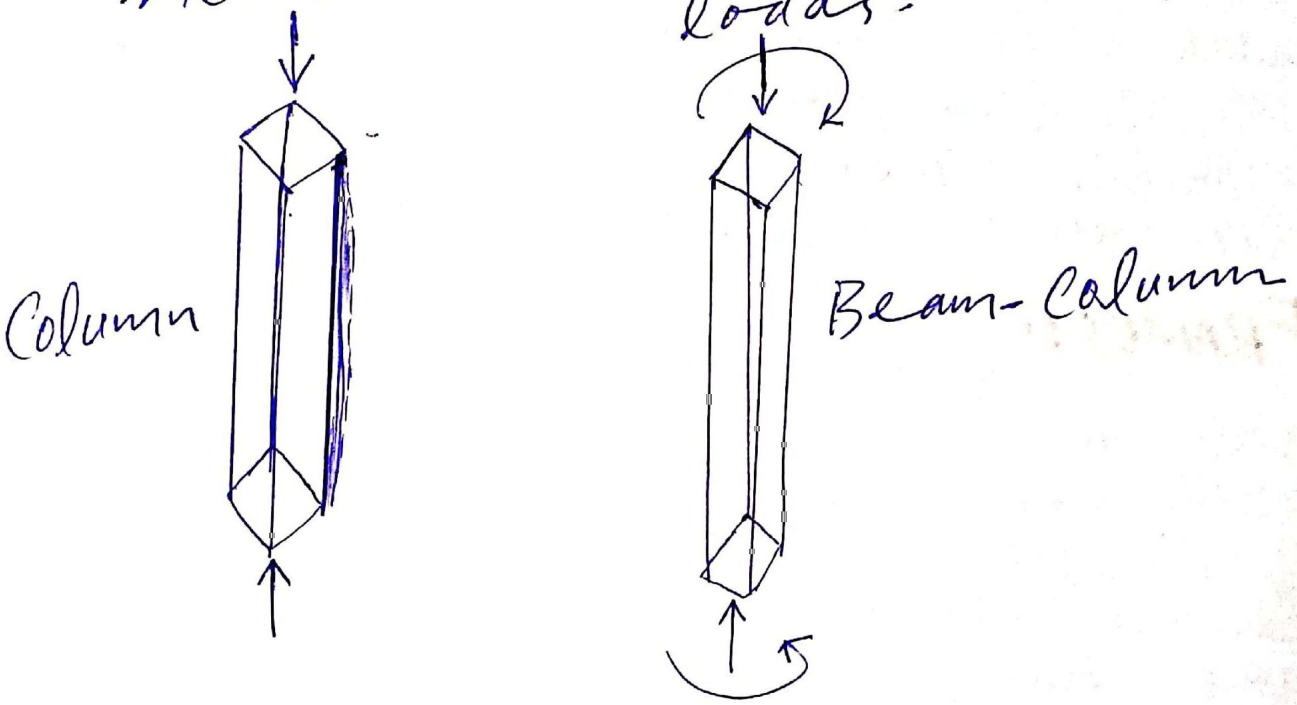
⇒ Consist of tensile force. These members are slender, bars or rods.



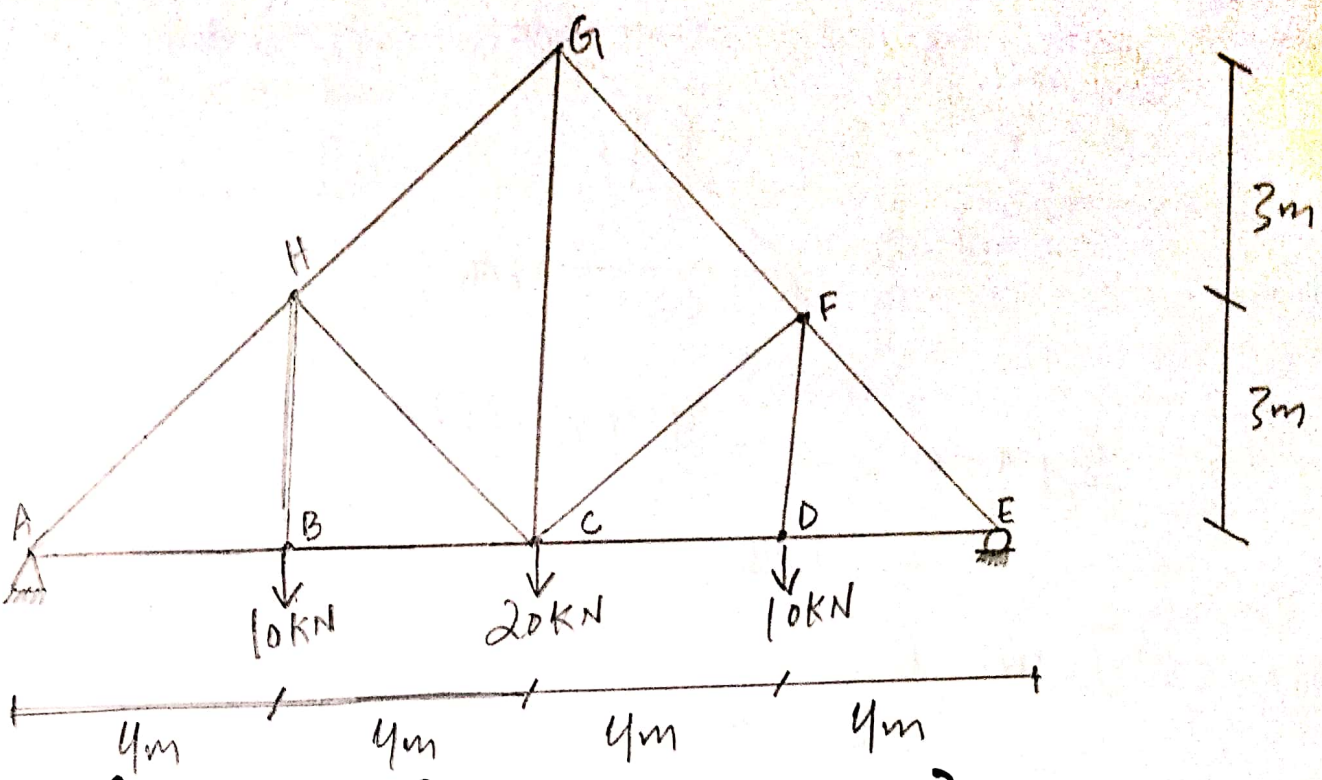
2) BEAME:- ⇒ They are horizontal members and support vertical loads. & resist bending moments. Short beam carry large loads.



3) Columns:- ⇒ They members consist of vertical and resists compressive loads.



Question No 2:- (5)



⇒ force in each member = ?

Solution:-

Support Reaction:-

$\Sigma F_y = 0$ (+ ↑ , − ↓)

$R_A + R_E = 40 \longrightarrow (A)$

$\Sigma M_A = 0$ (Anti-clockwise ⊖)

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

$R_E = 320/16 = 20KN$

Put in eq (A)

$R_A = 40 - 20 \Rightarrow R_A = 20KN$

⇒ Now Determining force in each Member!

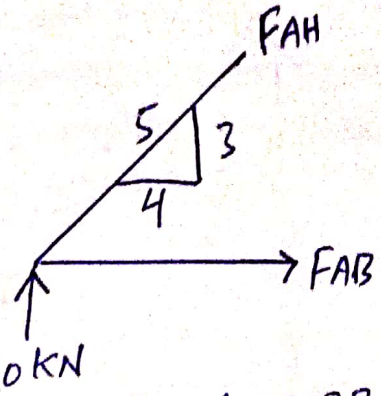
⇒ **JOINT A:-**

$\Sigma F_y = 0; \quad -\frac{3}{5}(F_{AH}) + 20KN = 0$

$= -0.6(F_{AH}) = -20KN.$

$F_{AH} = 33.33\,KN$ (Compressive).

⇒ JOINT A :-



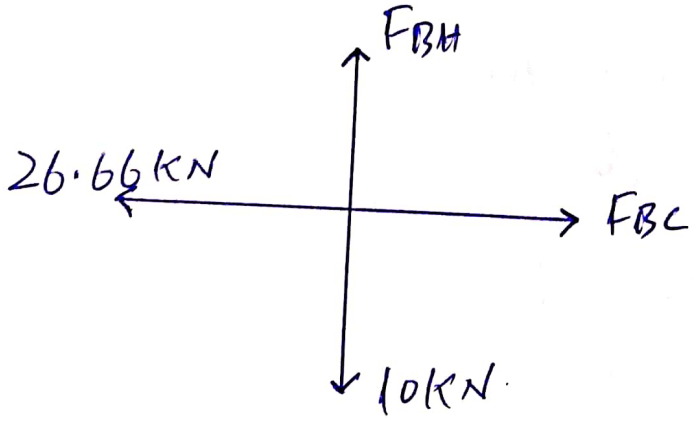
$\Sigma f_x = 0$; $-\frac{4}{5}(33.33) + F_{AB} = 0$

⇒ $F_{AB} = 26.66\,KN$ (Tensile).

⇒ JOINT B :-

⇒ $\Sigma f_x = 0$; $F_{BC} = 26.66\,KN$ (Tensile).

⇒ $\Sigma f_y = 0$; $F_{BH} = 10\,KN$ (Tensile).



⇒ JOINT G :-

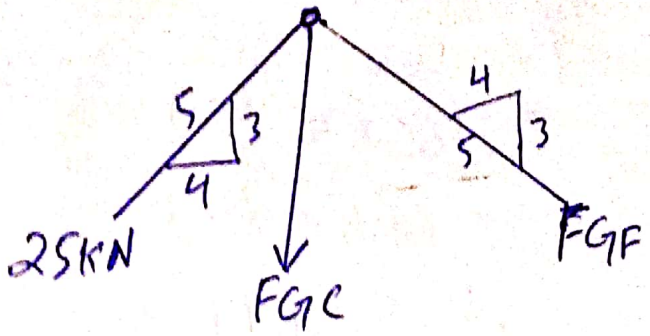
⇒ $\Sigma f_x = 0$; $\frac{4}{5}(25) - \frac{4}{5}(F_{GF}) = 0$

$F_{GF} = 25\,KN$ (Compressive).

⇒ $\Sigma f_y = 0$; $\frac{3}{5}(25) + \frac{3}{5}(25) - F_{GC} = 0$.

$F_{GC} = 30\,KN$ (Compressive).

(7)



⇒ JOINT H :-

$$\Rightarrow \Sigma f_y = 0;$$

$$\tfrac{3}{5}(33.33) - 10\,KN + \tfrac{3}{5}(F_{HC}) - \tfrac{3}{5}(F_{HG}) \rightarrow (A)$$

$$\Rightarrow \Sigma f_x = 0;\ \tfrac{4}{5}(33.33) - \tfrac{4}{5}(F_{HC}) - \tfrac{4}{5}(F_{HG}) \rightarrow (B)$$

Solving eq (1) and (2)

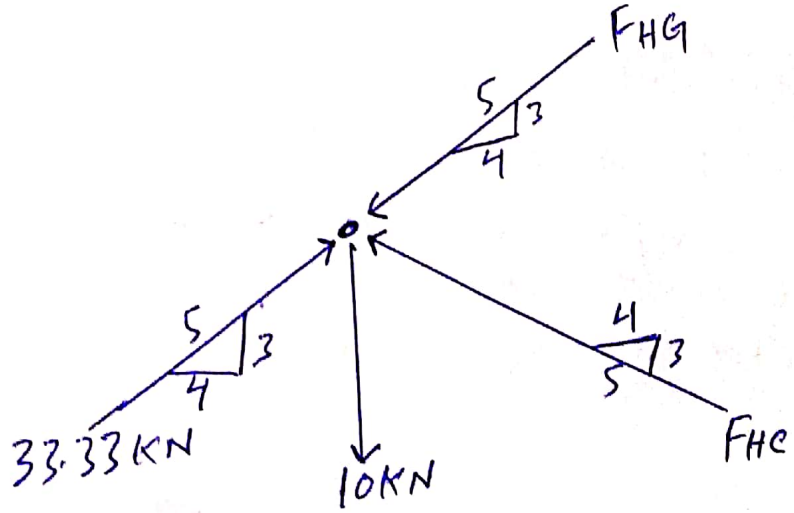
$$19.98 - 10 + 0.6\,F_{HC} - 0.6\,F_{HG} = 0 \rightarrow (A_a)$$

$$26.66 - 0.8\,F_{HC} - 0.8\,F_{HG} = 0 \rightarrow (B_b)$$

Multiplying eq (A) by 1.34 and then add with eq (Bb) we get.

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

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



Due to Symmetrical loading AND Geometry.

$F_{AB} = F_{ED} = 26.66\,KN\ (T)$

$F_{BC} = F_{DC} = 26.66\,KN\ (T)$

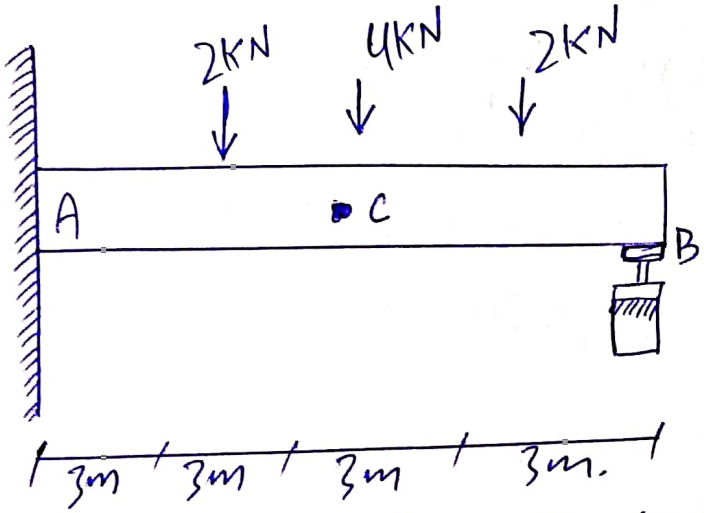
$F_{BH} = F_{DF} = 10\,KN\ (T)$

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

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

$F_{AH} = F_{EF} = 33.33\,KN\ (C).$

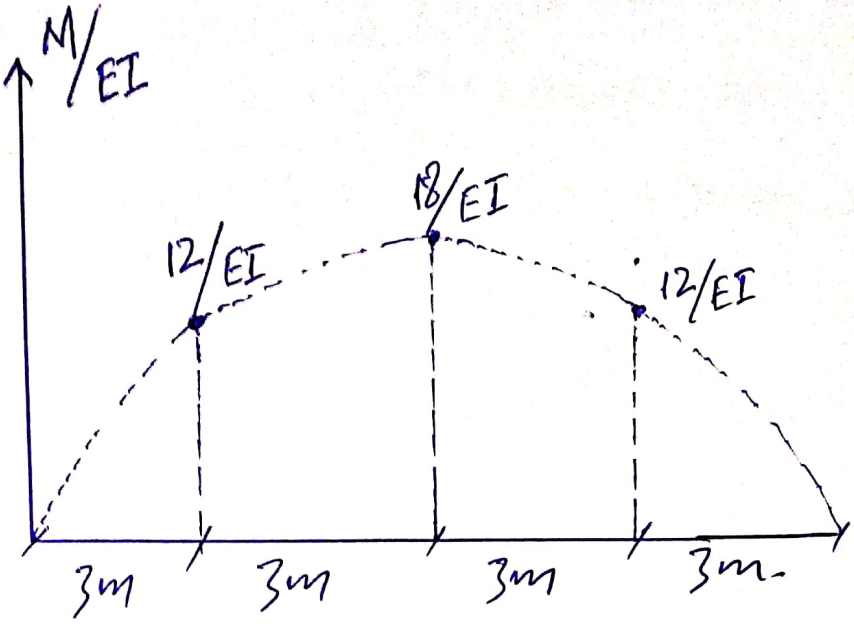
Question No 3:-



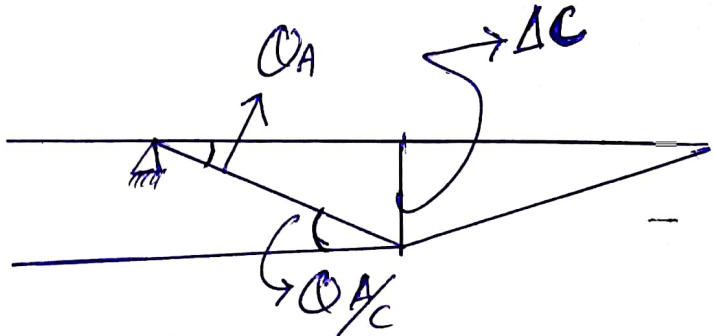
Given:- $E = 200\,Gpa$, $I = 6 \times 10^6\,mm$

Determine Slope At point "A" and displacement at "C" using Moment Area Theorem

Solution:- 1) ⇒ finding out M/EI Diagram of elastic Curve.



⇒ Elastic Curve :-



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

$$\theta_{A/C} = \frac{18}{EI} + \frac{36}{EI} + \frac{9}{EI} = \frac{63}{EI}$$

$$\theta_{A/C} = \frac{63}{(200\times10^6)(6\times10^6)(1000)^{-4}}$$

$$\theta_{A/C} = 0.0525 \text{ rad.}$$

$$\theta_A = 0.0525 \text{ rad.}$$

$$t_{A/C} = \left[\frac{1}{2}\left(\frac{12}{EI}\right)(3)^{(10)}\right]\left(\frac{2}{3}(3)\right) + \left[\frac{12}{EI}(3)\right]\left(3+\frac{1}{2}(3)\right)$$

$$+ \left[\frac{1}{2}\left(\frac{6}{EI}\right)(3)\right]\left(3+\frac{2}{3}(3)\right)$$

$$= 0.202\,m$$

So $\Delta C = t_{A/C} = 0.202\,m$ Ans.