Subject: [redacted] STRUCTURE analysis

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SECTION: A.

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PAPER SOLVED

THANKS.

Question No 1.

Write detail note in your own words on different type of load, that different types of structure are designed to support throughout its life. Elaborate with example?

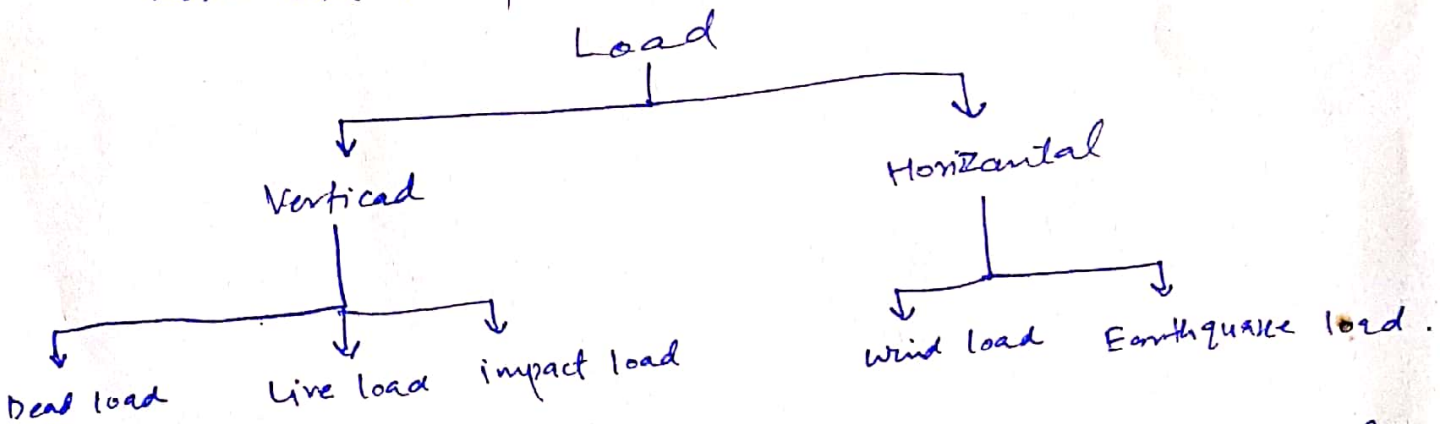
Answer:

Load: Load are forces applied to structure components It is the dimensional requirement for a structure to determine the the load.

Types of load. The types of load can be broadly classified in to two types.

i. Vertical load
ii. Horizantal load.

These can be further divided as under.



Dead load. It is structure member load, that consist of column, beams and girdus. It is permanently attached to the structure.

Live Load Live load varies in magnitude and location This weight is caused by temporarily object like moving vehicle, Natural forces consist of additional

Protection against excess deflection in our load.

Example: moving of human placement of objects like, table, chair, bed, fridge etc.

Impact load: The load applied by a moving object like blow. The application time of this load is negligible, as opposed to other loads, which are applied gradually or over a long period of time.

Wind load. The wind load blows against a building, The resulting forces acting on elevation is called the wind load. The building structure designed must absorb wind forces safely and transfer them to the foundation in order to avoid structural collapse.

Earthquake load Seismic loading is one of the basic concept of earthquake Engineering. which means application of an earthquake generated agitation to a structure.

Types of Structure

There are three basic types of structure.

i. Trusses
ii. cables and arches.
iii Frames.

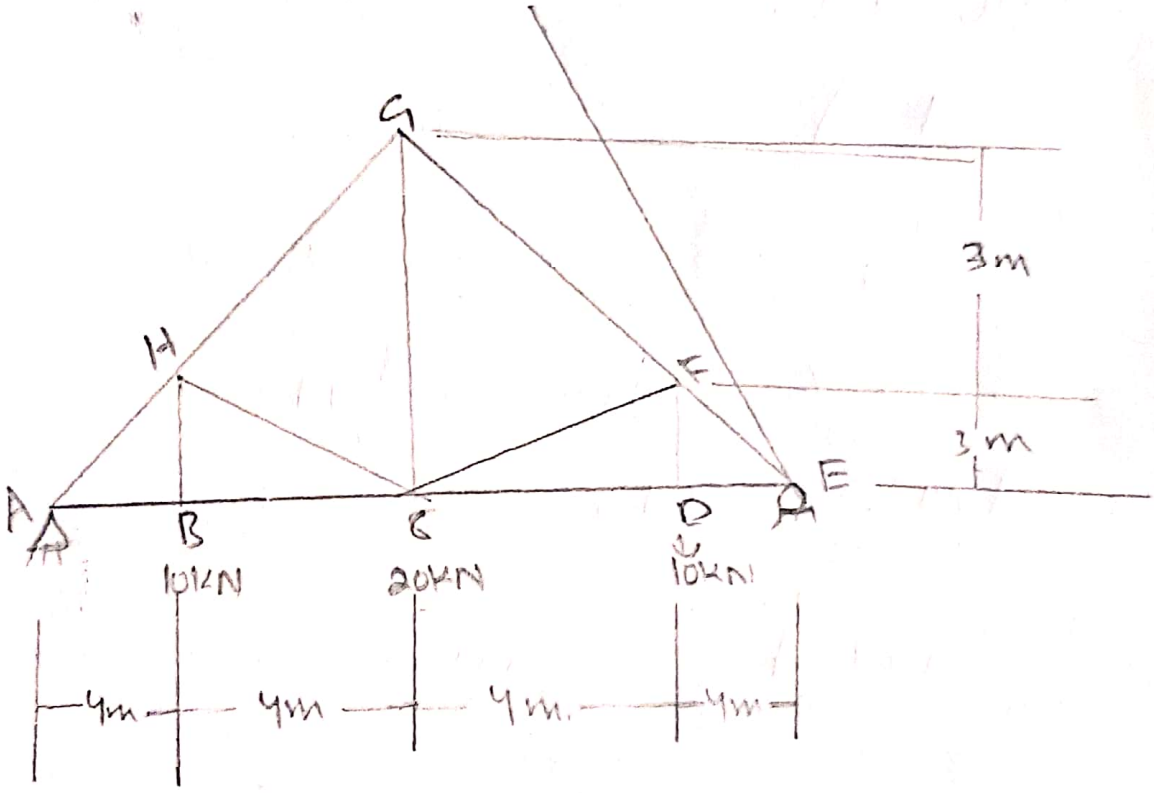
Trusses: It consist of slender members arraged in triangular patterns. It is of two types i- planar truss and ii space truss. They are subject to axial forces only.

cables and arches. They are used to span long distance. They are used to support bridge and building roof.

Frames: They are rigid structure and are used in bridge structure, dome roofs, opening in masonary walls. It is composed of beam and colouumns that are connected together and are used in building structure.

Question No:- 02

Determine the force in each member of the truss. State if the members are in tension or compression. Assume all members are pin connected.



Focus in each member:-

Solution:-

Support reactions:-

$\Sigma f_y = 0 \quad \uparrow^{+} \downarrow -$

$R_A + R_E = 40 \quad -(A)$

$\Sigma M_A = 0$ ↻ +

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

$R_E = 320/16 = 20\ kN$

$R_A = 40 - 20 = \boxed{R_A = 20\ kN}$

Now determining force in each member

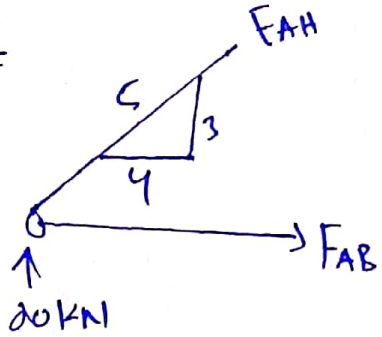
Joint A:-

$\Sigma f_y = 0;\ -3/5\,(F_{AM}) + 20\ kN = 0$

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

$\boxed{F_{AH} = 33.33\ kN} \longrightarrow (c)$

Joint A



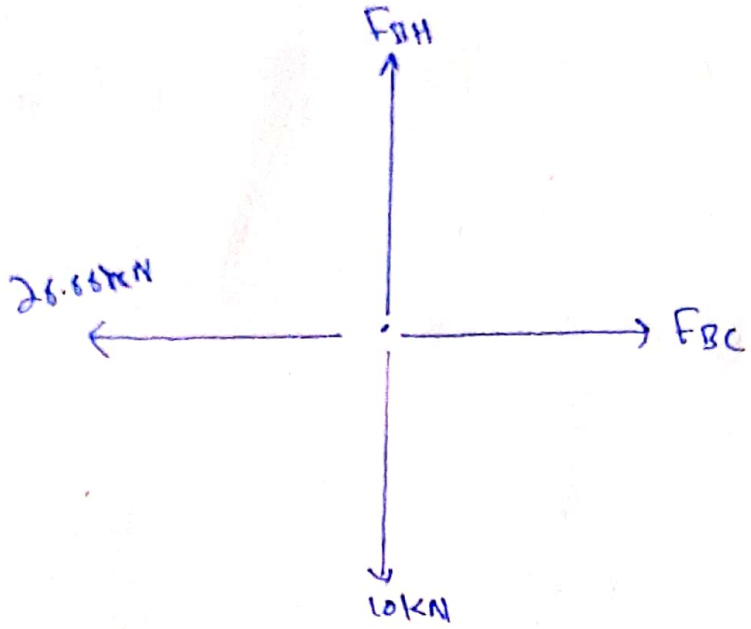
Joint B:-

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

$= F_{AB} = 26.66\ kN\ (T)$

$\Sigma f_x = 0 = F_{BC} = 26.66\ kN\ (T)$

$\Sigma f_y = 0;\ F_{BH} = 10\ kN\ (T)$



Joint B :-

Efx=0

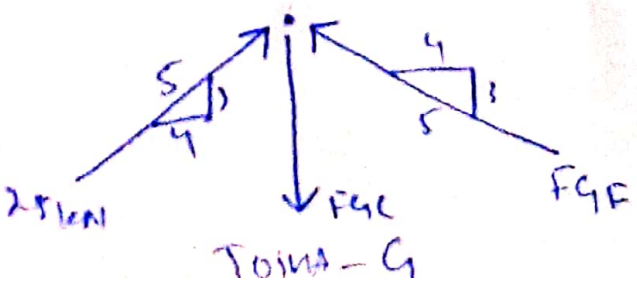
Joint G :-

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

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

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

$$\boxed{F_{GC} = 30\,KN}\ (C)$$



Joint H:-

$\Sigma f_y = 0$; $3/5\,(33.33) - 10kN + 3/5\,(F_{HC}) - 3/5\,(F_{HG})$ — A

$\Sigma f_x = 0$; $4/5\,(33.33kN) - 4/5\,(F_{HC}) - 4/5\,(F_{HG})$ — B

Solving eqn (1) & eqn (2)

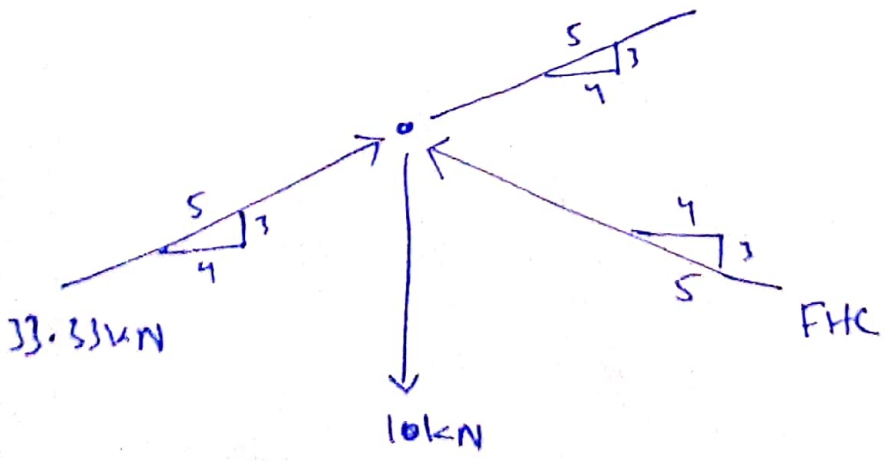
$19.98 - 10 + 0.6\,F_{HC} - 0.6\,F_{HG} = 0$ — A

$26.66 - 0.8\,F_{HC} - 0.8\,F_{HG} = 0$ — B

Multiplying eqn A by 1.34 and then add with eqn (B) we get.

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

$F_{HC} = 8.341kN$ (C)



Joint H

Due to symmetrical loading & Geometry

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

$F_{BC} = F_{DE} = 26.66\ kN\ (T)$

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

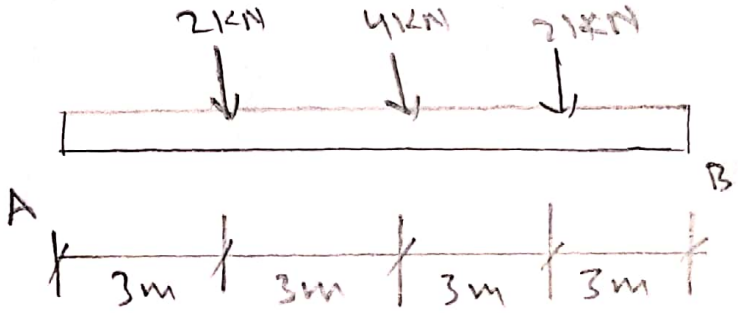
$F_{HG} = F_{FG} = 2.5\ kN\ (C)$

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

$F_{AH} = F_{CF} = 33.33\ kN\ (C).$

Question NO:- 03

Determine the slope at A and displacment at C of the beam in the figure by a)- Moment - Area Theorem and Take $E = 200\,GPA$, $I = 6[10]^6\,mm^4$



Given data

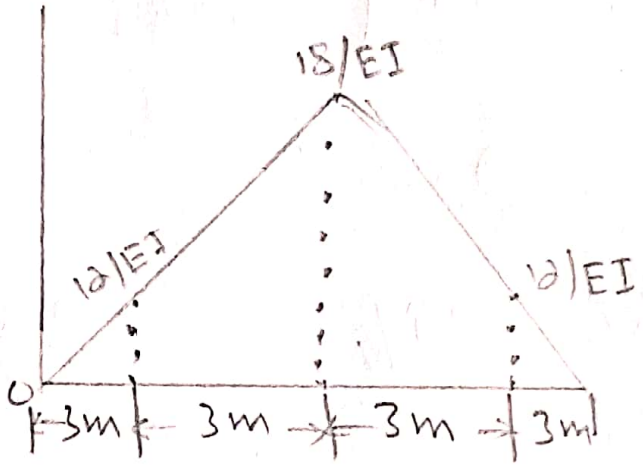
$E = 200\,GPa$, $I = 6 \times 10^6\,mm$

Determine slope at point "A" and displacement at "C" using moment Area theorem.

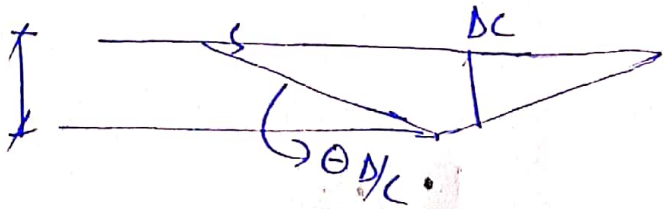
Solution :-

(i) Finding out M/EI Diagram & Elastic curve

Moment diagram :-



Elastic curve :-



$$Q_{A/C} = 1/2\,(12/EI)(3) + (12/EI)(3) + 1/2\,(6/EI)(3)$$

$$Q_{A/C} = (18/EI) + (36/EI) + (9/EI)$$

$$Q_{A/C} = 63/EI \Rightarrow 63/(200\times10^{6})(6\times10^{6})(1000)^{-4}$$

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

$\boxed{\theta_A = 0.0525 \text{ rad}}$ Ans

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

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

$$= 0.202 \text{ m}$$

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

$\boxed{= 202 \text{ mm}}$ Ans.

THE END.