UMAR HADI ID# 7974 sec # B

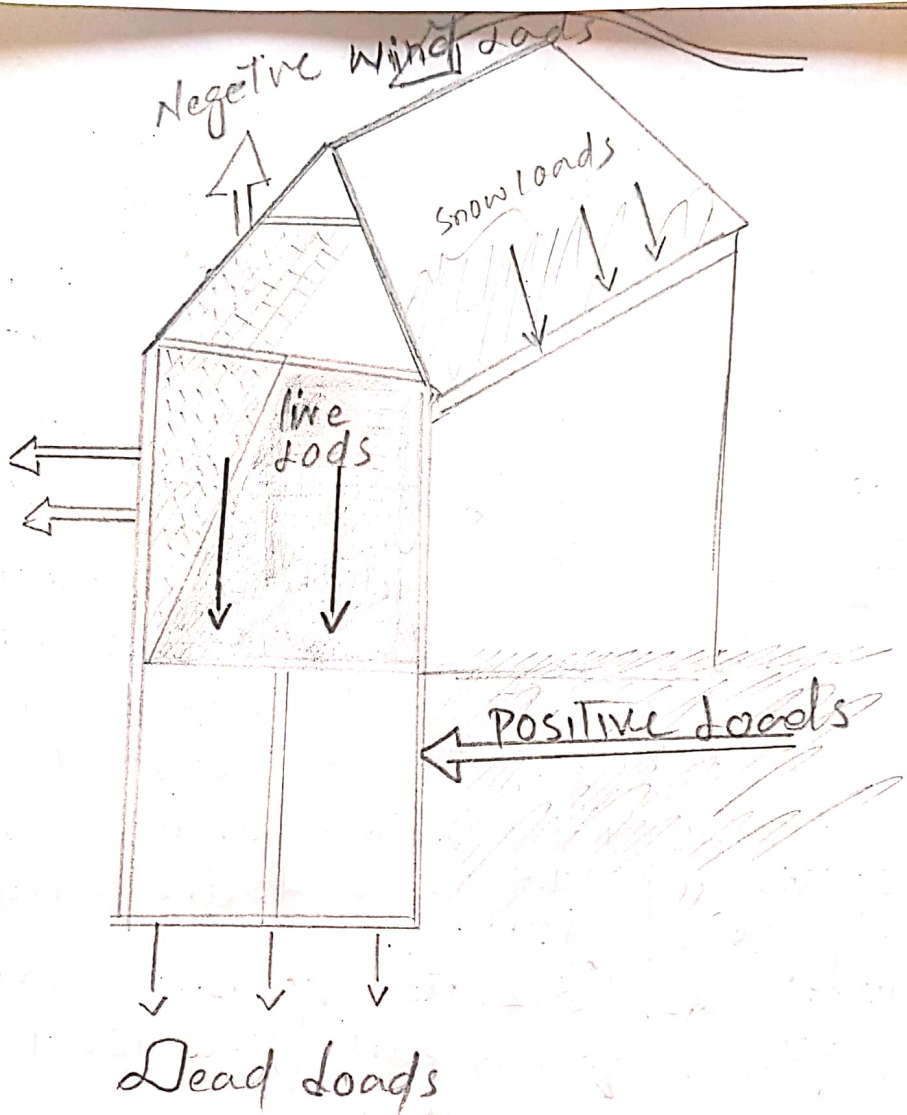
STRUCTURE ANALYSIS

Qus:1:- Write a detail note in your own words on different types of loads that different types of structures are designed to support throughout its life. Elaborate with examples.

Ans:- Types of loads on structure - Buildings and Other Structures:-

The types of loads acting on structures for buildings and other structures can be broadly classified as vertical loads, horizontal loads and longitudinal loads. The vertical loads consist of dead load, live load and Impact load.

The horizontal loads comprises of wind load & earthquake load. The longitudinal loads i-e tractive and braking forces are considered in special case design of bridges, gantry girders etc.



Types of loads acting on structure are:

1- **Dead loads:-** The first vertical load that is considered is dead load. Dead loads are permanent which are transferred to structure throughout the

life span. Dead load is primarily due to self weight of structural members, permanent partitions wall.

2- Live Loads:

The second vertical load that is considerdin design of a structure is Imposed loads or live loads. live loads are even moving loads with out any acceleration or impact. These loads are assumed to be produced by the Intended use or occupay of buildings Including weights of movable partitions or furniture etc.

Types of structures:-

The combination of structura elements and the matirial which functions as a structural system.

Different Types of structure are:-

1- **TRUSSES:~**

Trusses consists of slender elements in Traingular form. Due to geometric arrangment of its members loads are converted into tensile or compressive forces in members.

- Planner trusses are composed of members, lies in some plane and used for bridges and supports.

2- **Arches & Cables:-**

These are used for long distanet structures.

→ They carry loads in tension

→ They are commonly used to support bridges and roofs.

→ They must be rigid to maintain its shape.

→ Used for bridges structures dome and also for opnings.

FRAMES :-

Type of structure which are used in buildings and consists of beam and column. This structure is Indeterminent. Bindings caused by the load on the frame.

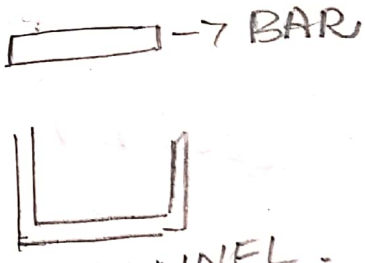
→ STRUCTURE ELEMENTS :

Elements:

① Tie Rods :-

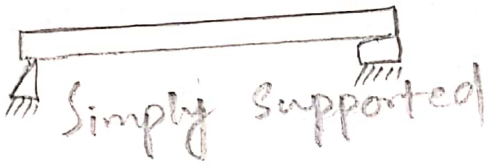
Tie rods are consist of tensile force. These members are bars and rods

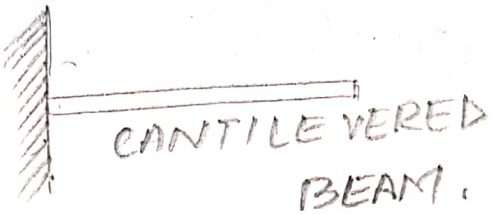
Tie rods

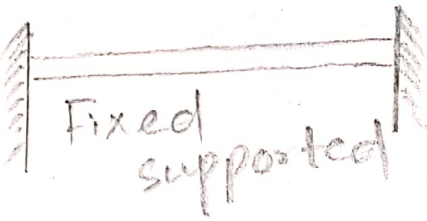


② BEAMS :-

Horizantol members which supports vertical loads.
consists of bending moments.
Short carry large loads.







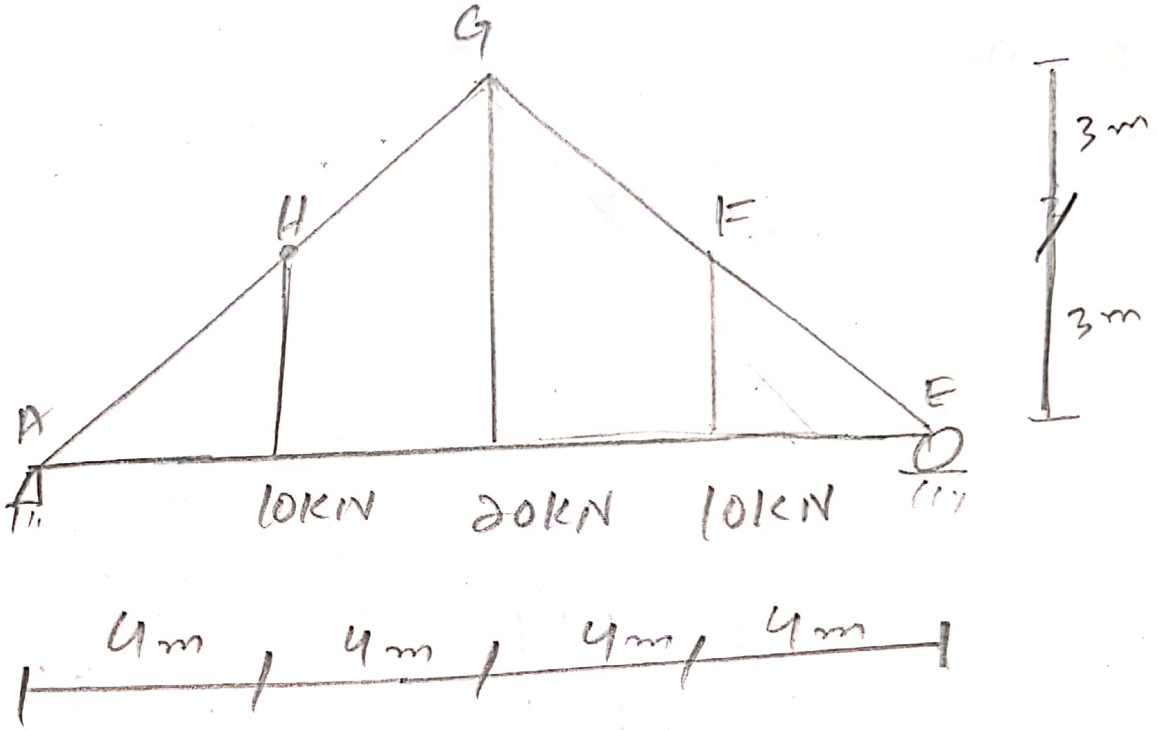
3) Columns:-

They consists of vertical members and resist compressive loads

column

BEAM-COLUMN

(7) QUESTION # 02



Required:-

Forces=?

Sol: Reactions:

$$\xi F_y = 0 \quad \uparrow^{+} \downarrow -$$

$$R_A + R_B = 40 \quad -(i)$$

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

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

$$R_E = 320/16 = 20\,KN$$

(8)

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

Now determining forces in each members.

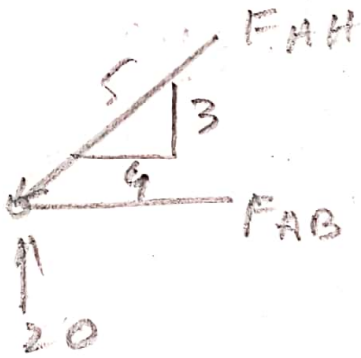
Joint A:

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

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

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

Joint A:



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

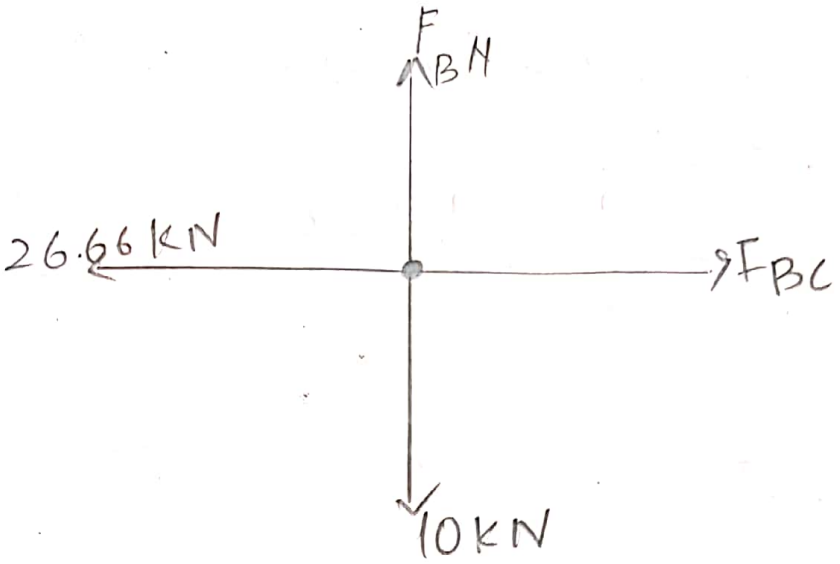
$F_{AB} = 26.66\,KN\,(T)$

Joint B:

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

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

(a)



Joint B:

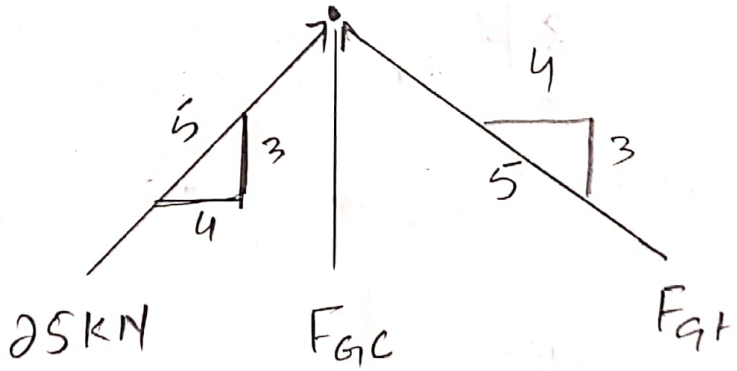
Joint G:

$\Sigma F_x = 0;\ 4/5\,(25) - 4/5\,(F_{GH}) = 0$

$F_{GH} = 25\ KN\ (C)$

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

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



Joint G:

(10)

Joint H:

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

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

solving eq (1) & (2)

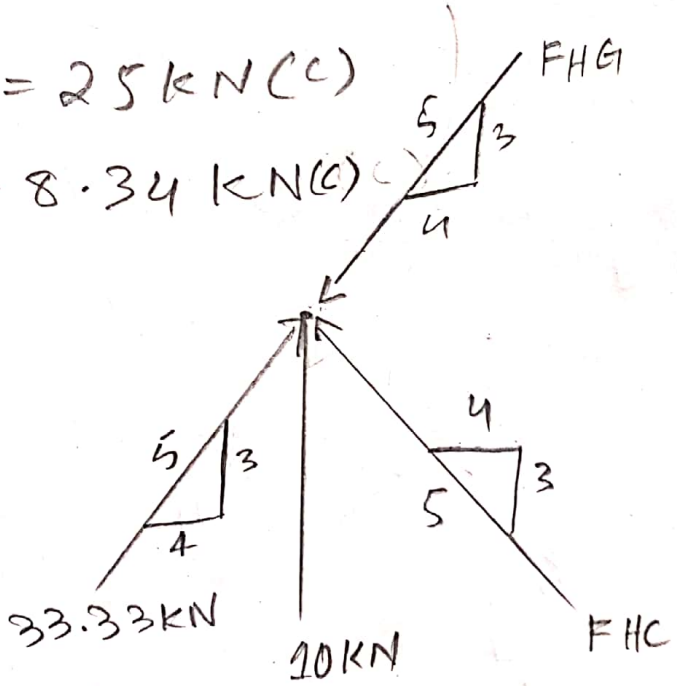
$19.98 - 10 + 0.6\ F_{HC} - 0.6\ F_{HG} = 0$ — (A)

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

multiply eq A by 1.34 and add with eq (B)

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

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



Joint H:

(11) Due to symmetrical loading and geometry.

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

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

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

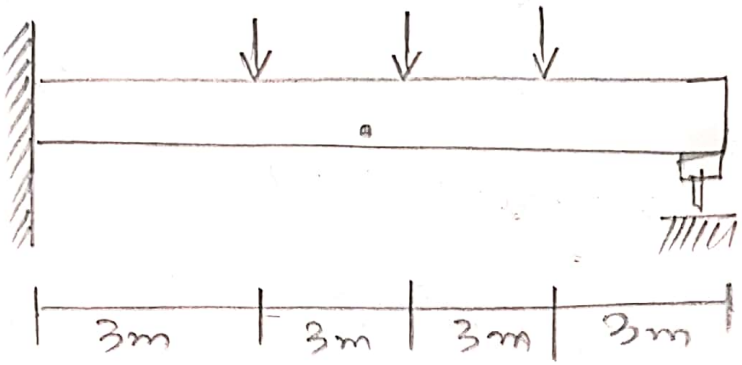
$F_{MG} = F_{FG} = 25\ KN(C)$

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

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

(12)

QUESTION # 03



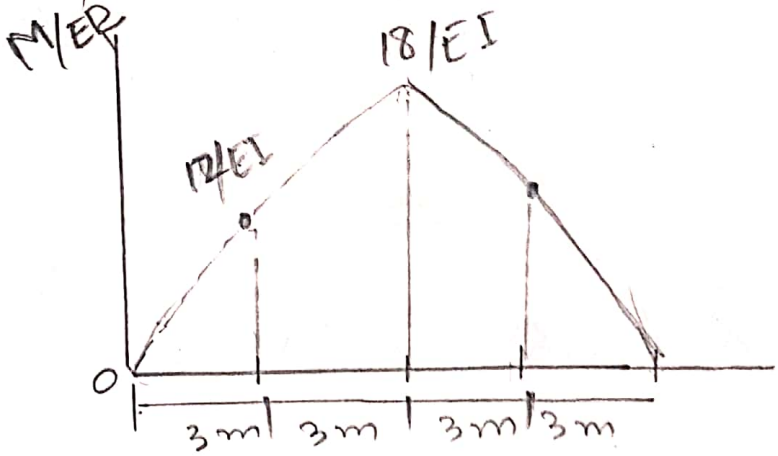
$\Rightarrow$ $E = 200 Gpa$, $I = 6 \times 10^6 mm$.

$\Rightarrow$ slope at point "A" and displacement at 'c' using Moment Area theorem.

Solution :-

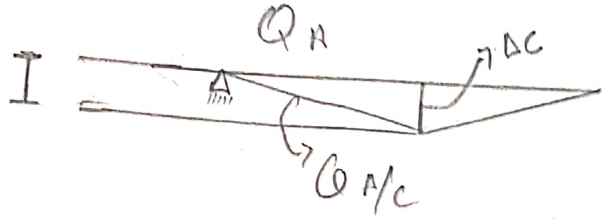
(i) Finding out M/EI Diagram & elastic curve.

Moment Diagrame:



(13)

⇒ Elastic curve :-



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

$$\theta_{A/C} = \left(\frac{18}{EI}\right) + \left(\frac{36}{EI}\right) + \left(\frac{9}{EI}\right)$$

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

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

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

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

$$= 0.202 \text{ m}$$

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

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