Q1. 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.

Answer:

LOADS:

It is the dimensional requirement for a structure necessary to determine the loads the structure

TYPES OF LOADS:

The different types of loads acting on a structure are broadly classified as,

A. Vertical loads B. Horizontal loads

A. Vertical Loads:

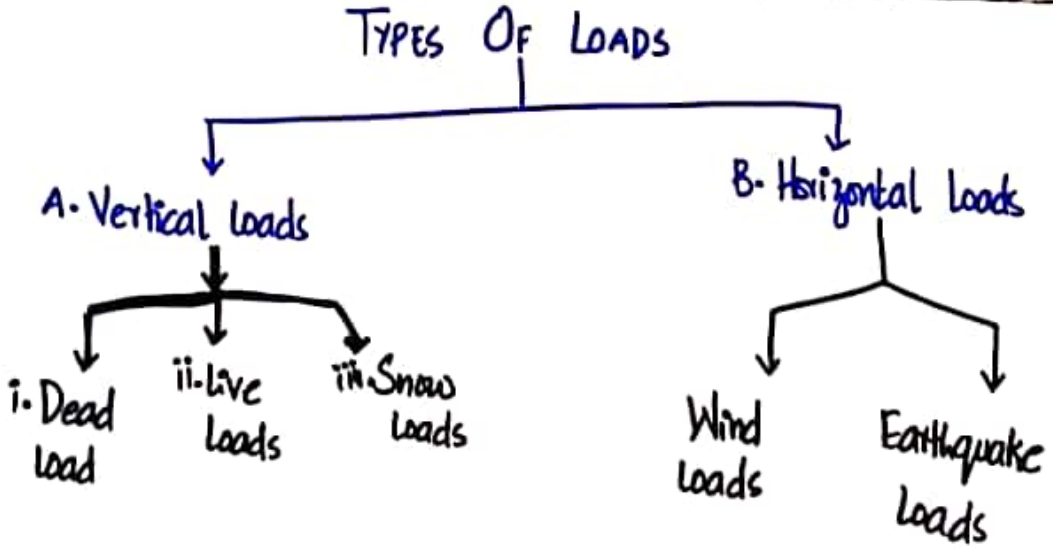
Vertical loads are further classified into the following types:

i. Dead loads
ii. Live loads
iii. Snow loads

B. Horizontal Loads:

They are further classified into the following:

i. Wind loads
ii. Earthquake loads



A. VERTICAL LOADS:

a. Dead loads:

It consists of structural members that are permanently attached to structure. Dead load includes the weight of columns, beams, electrical fixtures and other attachments.

b. Live loads:

Live load can vary both in their magnitude and location. These loads are caused by weights of temporarily objects, moving vehicles, natural forces consists of additional protection against excess deflection and overload.

c. Snow loads:

This type of loads is considered only on the structure which receives snowfall during monsoon. Snow loads are calculated by the projection made by snow at different parts of the structure.

B. HORIZONTAL LOAN:

a. Wind Loads:

This types of loads are considered in design if the height of the building is more than 15m. Wind loads are occured due to horizontal load caused by the wind. As an increase in using lighter materials in the construction, wind load for a building should be considered. Wind load acts horizontally towards roofs, walls and create.

b. Earthquake Loads:

These types of loads causes movement of the foundation structures. Earthquake forces are internal forces that developed on the structure because of ground movements.

EXAMPLE:

The ince floor loading in classroom consists of chair and laboratory equipment.

TYPES OF STRUCTURES:

The combination of structural elements and the material which functions as a structural system. Each system consists of move of ~~four~~ four types of structures.

Different types of structures are:

1. Trusses:

Trusses consists of slinder elements in triangular form. Due to geometric arrangements of its members binds are converted into tensile on 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 durides and towers.

2. Cables and Arches:

It is the type of structures used to span long distances.

⇒ Cables are flexibe and carry loads in tensions. They are commonly used to support bridges, roofs.

⇒ Arches achieves strength in compression and has a revers curvature to cable. It must must be rigid to maintain its shape. Consists of shear and moment. They are used in bridge structures, dome roofs and openings.

3. Frames:

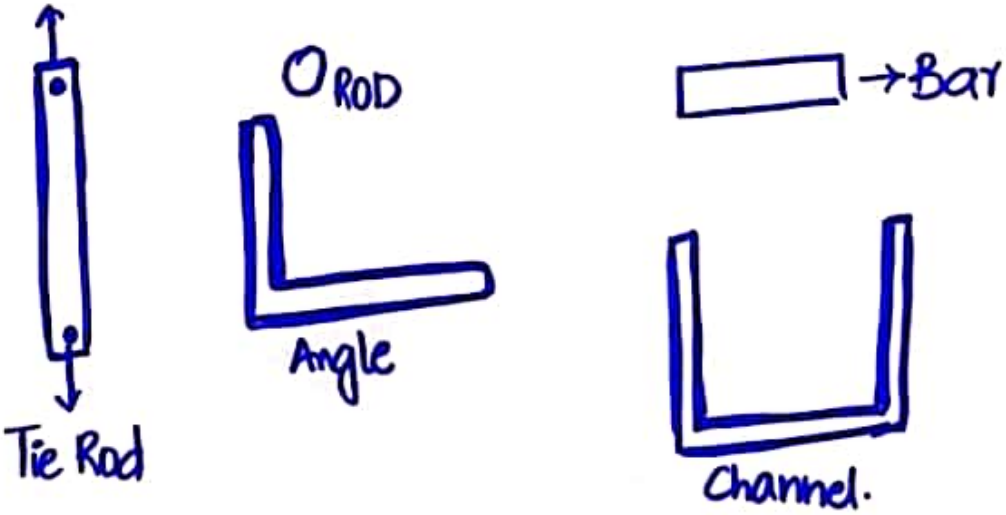
Type of structure which are used in buildings and consists of beam and column, which are fixed or pin connected. The bad on frames causes bindings of its members and has rigid joint connections. This structure is indeterminate.

STRUCTURAL ELEMENTS

Some of the elements are:

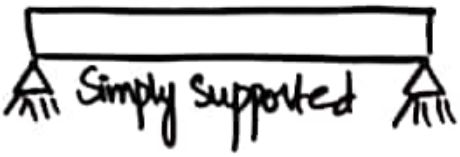
a. Tie Rods

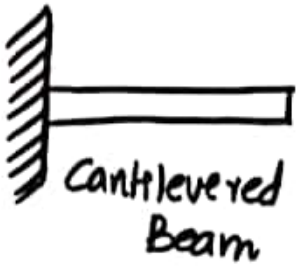
Consists of tensile force. These members are denden, bars or rods.

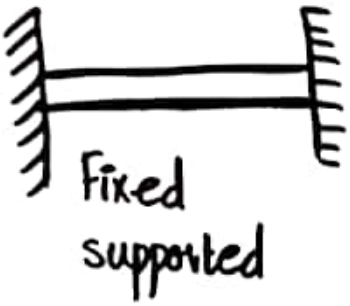


b. Beams:

They are ~~noni~~ horizontal members and supports vertical loads. It resists binding moments, short ~~exxxy~~ large loads.





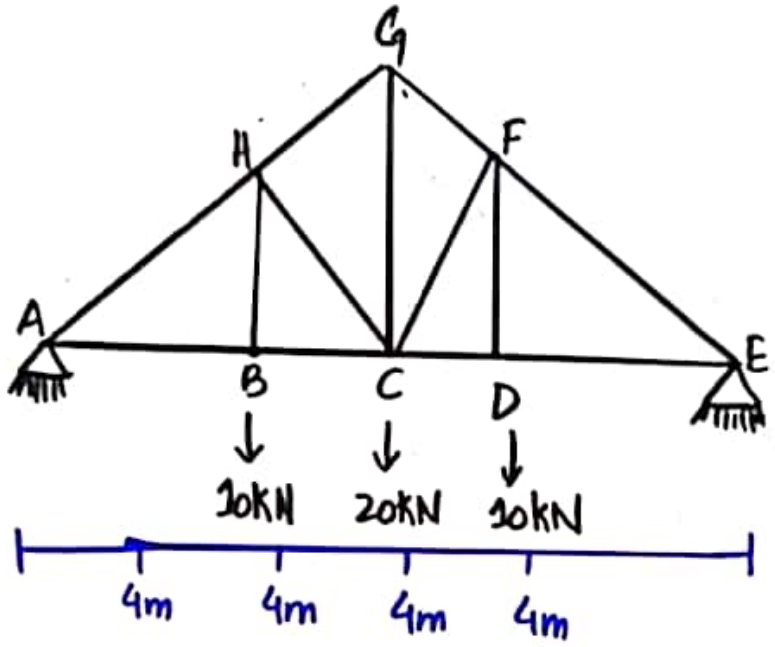


c. Columns:

They consists of vertical members and resists compressive loads.

Tubes and wider range accross sections are used for metal columns and square cross sections rods are used for concete work.

QUESTION NO. 2:



Focus in each number?

SOLUTION:

Support reactions:

$$\Sigma f_y = 0$$

$$R_A + R_E = 40 \quad \uparrow^{+} \downarrow^{-} \quad \text{(A)}$$

$$\Sigma M_A = 0 \quad \circlearrowleft^{-}$$

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

$$R_E = \frac{320}{16} = 20\,kN$$

But $\rightarrow 40 - 20 \Rightarrow R_A = 20\,kN$

Now determining force in each member.

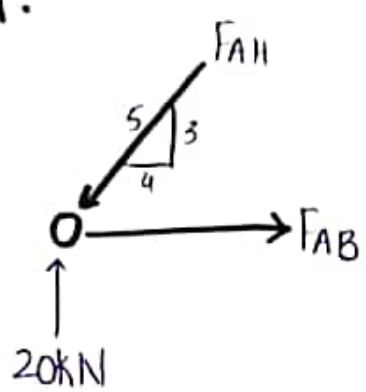
Joint A:

$$\Sigma f_y = 0 \; ; \; -\tfrac{3}{5}(F_{AH}) + 20kN = 0$$

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

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

Joint A:



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

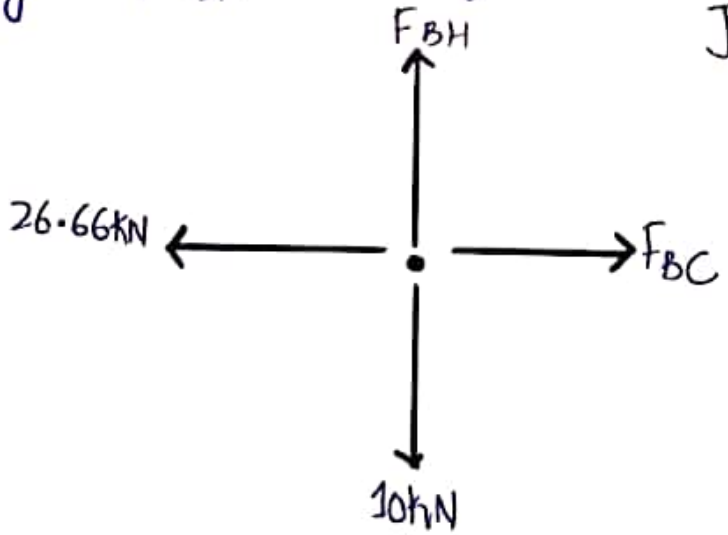
$$\Rightarrow F_{AB} = 26.66\,KN\,(T)$$

JOINT B:

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

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

Joint B:



JOINT G :

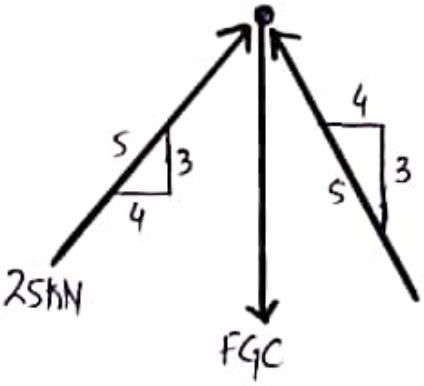
$$\Sigma f_x = 0;\ 4/5(25) - 4/5(F_{GF}) = 0$$

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

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

$$F_{GC} = 30kN(C)$$

Joint G :



JOINT H:

$$\Sigma f_y = 0;\ 3/5(33.33) - 10kN + 3/5(F_{HC}) - 3/5(F_{HG}) \quad -(1)$$

$$\Sigma f_x = 0;\ 4/5(33.33kN) - 4/5(F_{HC}) - 4/5(F_{HG}) \quad -(2)$$

Solving eq (1) and (2)

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

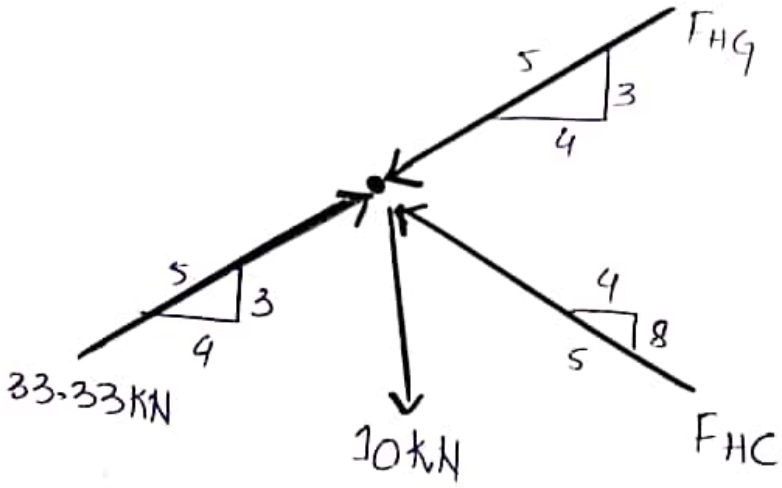
$$26.66 - 0.8F_{HC} - 0.8F_{HG} = 0 \quad -(B)$$

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

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

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

Joint H:



Due to symmetrical loading of Geometry

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

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

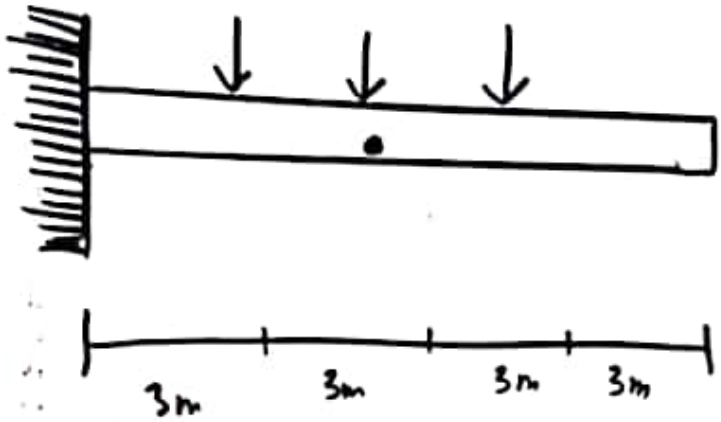
$F_{BH} = F_{BF} = 10\,KN(T)$

$F_{HG} = F_{PG} = 2.5\,KN(C)$

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

$F_{AH} = F_{EP} = 33.33KN(C)$

QUESTION 3



Given:

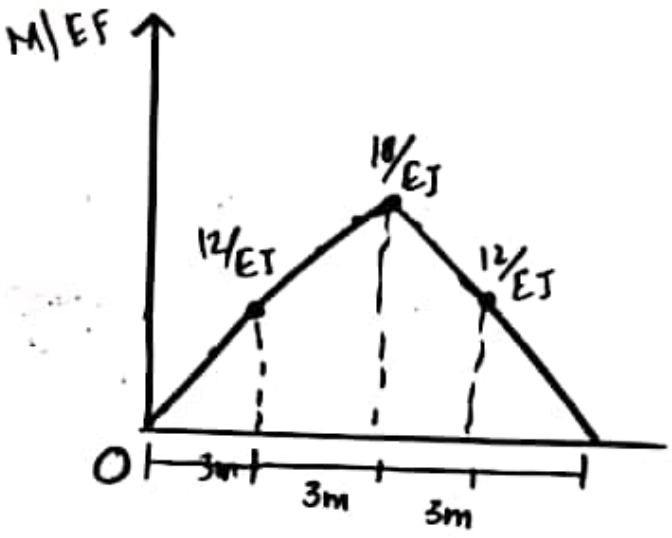
$E = 200 Gpa, I = 6 \times 10^{6} mm.$

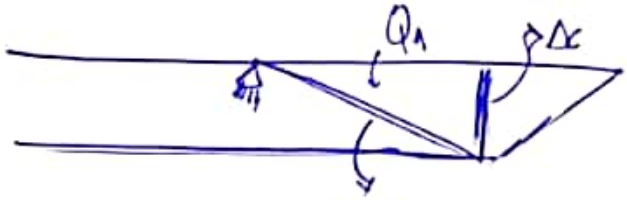
Determine slope at point "A" and displacement at "C" using moment area theorem.

Solution:

(i) Finding out M/EI diagram of elastic curve.

Moment diagram:





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

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

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

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

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

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

$$\Rightarrow 0.202 \text{ m}$$

So,

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

$$\Rightarrow 202 \text{ mm}$$