NAME = M.Atif khan.

ID = 7901

Sec = A.

Subject = Steel structure.

Submitted to Sir Amjad Islam.

Question No. 1

Write a detail note in your own words on different types of load that different type of structures are design to support through out its life. Elaborate with example:-

ANSWER

LOAD:

Load is the external force acting on a very small area on a perpendicular point of a supporting structural elements.

Explanation:

One the diamensional requirment for the structure as been defined it become necessary to determine the load the structure must support.

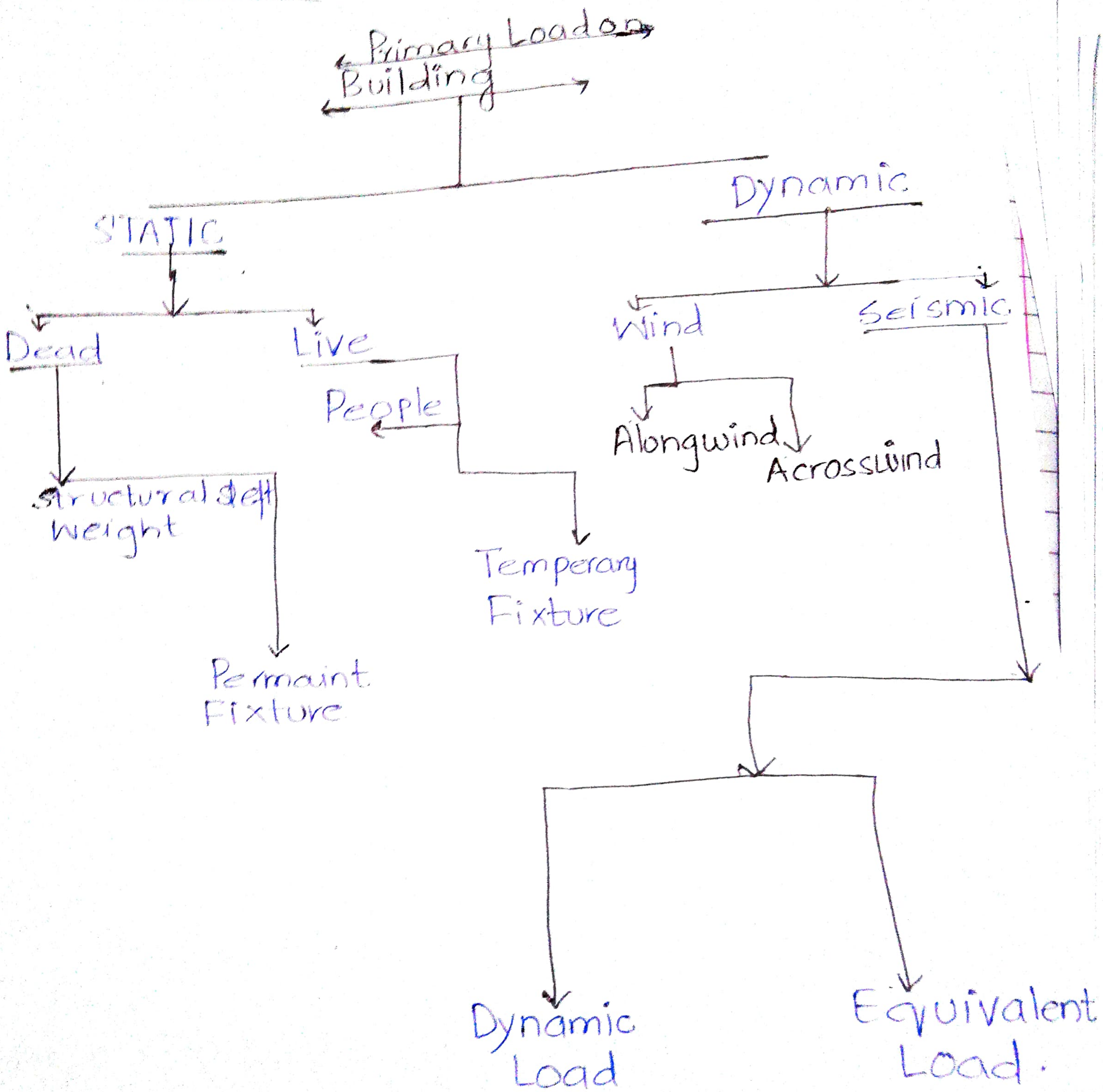
There are various types of loads which will imposed on the structure that provide the basic type of structure that will be chosen for design.

For example:

High-rise-structure must ~~be~~ endure large lateral loading caused by wind and so shear walls and tubular frame system are selected where as buildings located in area prone to earthquakes must be design have ductile frames and connection

Khan.

Types of Loads



(3) " = 10×12 +20×8+10×4=0 (14)

DEAD LOAD: Dead load consist of self weight of structure (beams, colums, slabs etc equipment permently attached to structure such as Furniture home accesories etc.

As Dead load consist of weight of various structure members and the weight of any object which are permently allached

FOR Example:

Weight of ~~coloumbs~~ columns, beams and griders the roof slab, floor slab, windows, Doors electrical fixture and other elements.

Live Loads:

Load caused by contents of objects with in or on a building are called occupancy load. This loads inculdes allowances for the weight of people moveable partitions mechanical equipments etc.

Live loads convay both in their magnitude and location they may be caused by the weight of object temporarily placed on a structure moving verticle - or natural forces.

⟹ VARIOUS Types OF loads Discuss BElOW:

1) WIND LOAD:

When the Speed of the wind is high it cause the massive damage to a structure

Wind exerts three types of Forces on a structure uplift load. wind flow pressure that creat a strong lifting effects, much like the effect on airplane wings shear load. Horizontal wind pressure that could cause racking of wall making a building Tilt. The windy pressure is high to that creat a massive damage. the reason is that the Pressure exerted by wind is Proportional to the Squure of the wind Speed

This effect of lateral loading can be developed by wind can cause searing of a building Frame to resist this effect, engineers often use cross bracing or diagnal braking.

Building loads: A building load is simply a Force that a house frame needs to resists the frame must be designed to with stand eight of the these loads in which wind and snow ets are Present.

The floor of the building are assumed to be subjected to uniform live load which depend on ~~cont~~ which the building is design.

Highway Bridge loads: The Primary live loads on Bridges span are those due to traffic and the heaviest vehicle.

Loading encountored is that caused by a series of truts

The major load components of highway bridges are dead load live (Static dynamic) envrornmental load (temperatue dynamic) envrironmental load (temperature wind earthquakes) and other And other loads (collision, emergency braking) load components are random varibles. Their variation is described by the cumulative distribution function

Impact loads:

An impact load is one whose time of application on a material is less than one third of the natural period of vibration of that material cyclic loads on a structure can lead to fatigue damage, cumulative damage, or failure These load can be repeated loading on a structure or can be due to vibration

The Percentage increase of the line load due to impact is called the impact factor.

SNOW load:

Snow loads constitute to the vertical loads in the building. But there loads are considered only in the snow fall places.

movement of the Building at the time of earth quake is to be considered While designing (7)

Load Transfer:

(6)

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 snowload on plane area or roof

μ = Shape co-efficent and

S_0 = groundsnow load.

In some part of country roof loading due to snow can be quite severe and there fore protection of primary concern.

EARTHQuake loads:

Earth quake force constitude to Both vertical and horizontal on the building. But specially earth quakes. Produced lateral loadings on the structure throught the structure interation with the ground. the magnitude of an earth quake load depend on the amount and type ground acceleration.

The total vibration caused by earthquake may be resoveld into three mutually perpendicular direction usually taken as vertical and two horizontal duration.

The moment in vertical direction do not caused force in super structure to any significant extent. But the horizontal

$-R_B \times 16 + 10 \times 12 + 20 \times 8 + 10 \times 4 = 0$ (14)

$-16R_B + 120 + 160 + 40 = 0$

(7) movement of the Building at the time of earth quake is to be considered while designing.

Load Transfer:

Load.
↓
Roof Surface.
↓
Roof Slab
↓
Beams.
↓
Columns
↓
Foundation
↓
Subsoil.

⟨8⟩- Foundation transfer all the loads. Safley to ground.

(12 a)

Structure:

A Structure refers to a system of connected parts used to support a load is called structure.

Types of structure: (12 a)

1) Trusses

→ A Trusses is a structural comprising one or more tringualar unit constructed with straight members whose ends are connected at joints or nodes.

→ if are the the bars lies in a plane the structure is a planner trusses.

Diagram:

Different types of Trusses:

→ Perfect Trusses ($m = 2j - 3$)

→ Deffiecent Trusses ($m < 2j - 3$)

→ Redundant Trusses ($m > 2j - 3$)

Here m = member.

j = Joints

2) Cables And Arches:

cables and arches are closely each other and hences they are grouped in this course in the same module for example span structure e.g in case of bridges engineers commonly used cable or arch construction due to this efficiency

3) Frames:

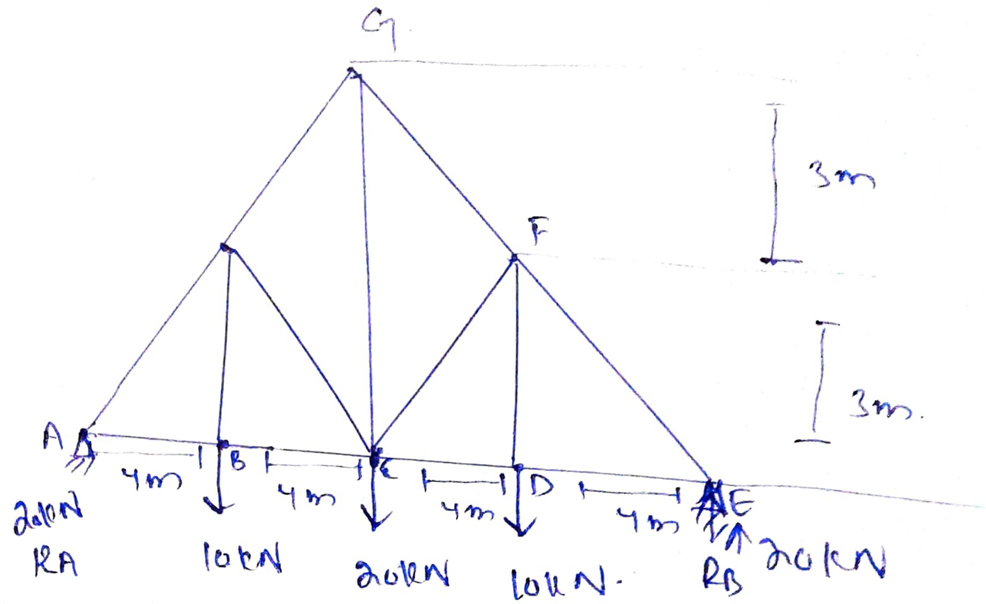
Frames are often in building and are open composed of beams and colums that are either pin or fixed connected the loading on a Frame caused bending of its members and it has a rigid joints connection.

Kro
s
ng

— RD . .

Question No: 2 (13)

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



Solution:

Support reactions:

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

$R_A + R_B = 40$

$\Sigma M = 0 \quad \circlearrowright^{+}$

$-R_B \times 16 + 10 \times 12 + 20 \times 8 + 10 \times 4 = 0$ (i4)

$-16R_B + 120 + 160 + 40 = 0$

$16R_B = 320$

$$\frac{16R_B}{16} = \frac{320}{16}$$

$$\boxed{R_B = 20}$$

As $R_A + R_B = 40$

then $R_A = 40 - 20$

$R_A = 20$

Now we find angle:

As we know that this structure is symmetrical than So,

$R_A = 20, \; R_B = 20$

angle

$\theta_A = \tan^{-1}\left(\frac{3}{4}\right)$

$\theta_A = \tan^{-1}(0.75$

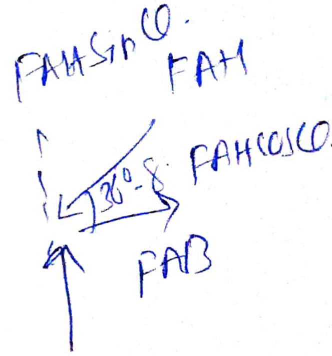
$\theta_A = 36.87^\circ$

Now Analysis of Joints:-

Joint A:-

$\Sigma f_y = 0 \rightarrow \oplus \uparrow$

$20 = FAH \sin 36.87$



$FAH = \frac{20}{\sin 36.87}$

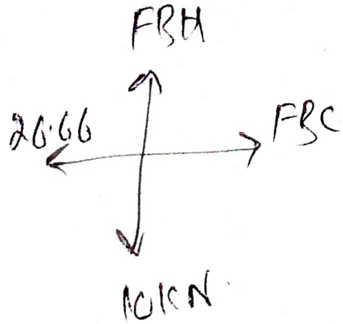
So, $\boxed{FAH = 33.33\, kN}$ (C)

$\Sigma F_x = 0 \rightarrow \oplus$

$FAB = FAH \cos 36.87$

$FAB = 26.66\, kN$ (T).

Joint B:



$\Sigma F x = 0$

As we know that

Directly

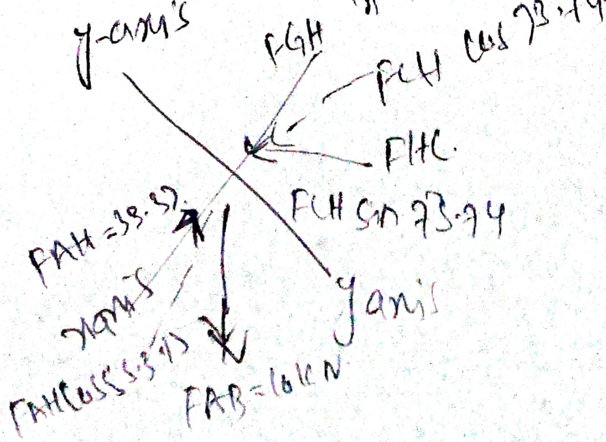
$F_{BC} = 26.66$ KN (T)

$\Sigma F y = 0$

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

Joint "H":

As orientation of x-axis along 'AG' then we get



As the angle b/w FGH & (7)
FCH is $\boxed{73.740}$

And the angle b/w FAH" & FBH"
$\boxed{53.13^\circ}$ ⇒ $\tan^{-1}(1.33) = 53.13^\circ$

Now,

$\Sigma f_y = 0$

$F_{CH} \sin 73.74 = 10 \sin 53.13$

$F_{CH} = \frac{10 \sin 53.13}{\sin 73.34}$ 2)

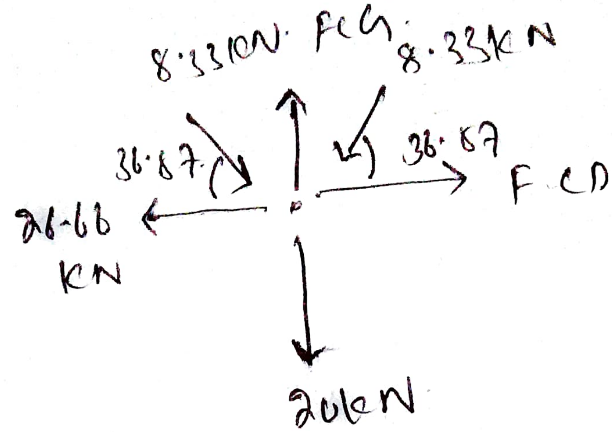
$F_{CH} = 8.33$ kN

$\Sigma f_x = 0$

$33.33 - 10 \cos 53.13 - F_{GH} - 8.33 \cos 73.74 = 0$

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

Joint C



$\Sigma F_x = 0$

$F_{CD} = 26.66\,kN$ (T).

$\Sigma F_y = 0$

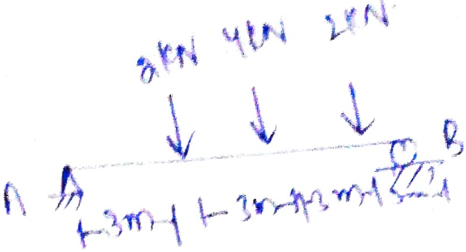
$F_{CG} = +20 + 8.33 \sin(36.87) + 8.33 \sin(36.87)$

$F_{CG} = 30\,kN$ (T)

Q2. 19.

Determine the slope at A & displacement at C of the beam in the figure by (a) moment Area theorem and take $E = 200\,GPa$, $I = 6 \times 10^{6}\,mm^4$

(Ans).



Required: $\theta_A = ?$

$\Delta_C = ?$

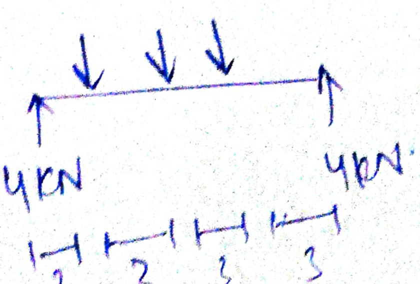
Solution.

$E = 200\,GPa = 200 \times 10^{9}\,Pa.$

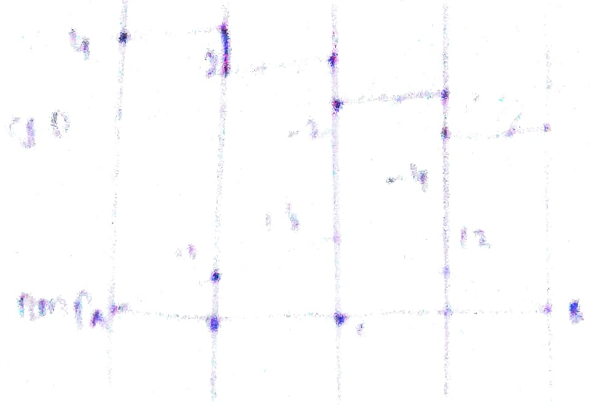
$I = 6 \times 10^{6}\,mm^4 = 6 \times 10^{-6}\,m^4.$

As beam is symmetric. Thus

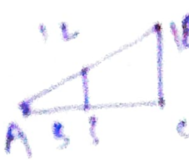
$R_A = R_B = \dfrac{2+4+2}{2} = 4KN.$



p.t.o



θA = Area b/w points A & C.

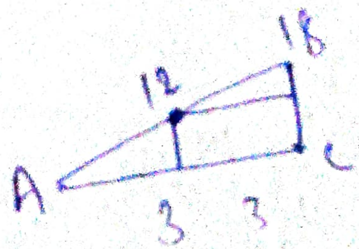


$$\theta_A = \left(\frac{12}{2}\times 3\right) + \left(\frac{12+18}{2}\right)\times 3 = 63/EI \ (\text{kN}\cdot\text{m}^2)$$

$$\theta_A = 63\times10^3 / 200\times10^9 \times 6\times10^{-6}$$

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

Now Δ_C (Deflection at mid span) will be equal to first moment of area b/w points A and C



P.T.O.

$$\Delta c = \frac{2}{3} \times 3 \left(\frac{12 \times 3}{2}\right) + \left[\left(3 + \frac{3}{2}\right)(12 \times 3)\right] + \left[\left(3 + \left(\frac{2}{3} \times 3\right)\right) \cdot \left(\frac{3 \times 6}{2}\right)\right]$$ (21)

$$\Delta c = 36 + 162 + 45 \Rightarrow 243 \ KN \cdot m^3 / EI$$

$$\Delta c = \frac{243 \times 10^3 \ m^3}{200 \times 10^9 \times 6 \times 10^{-6}}$$

$$\boxed{\Delta c = 0.2025 \ m}$$