ID 7904

NAME Altaf Hussain

SECTION A

Subject Structural Analysis

TEACHER : Sir Amjed Islam

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:-

LOAD:-

A weight or source of Pressure borne by SomeOne or something.

TYPES OF LOADS:-

These are different types of loads which are

1) Dead Loads
2) Live loads
3) Snow loads

DEAD LOAD:-

These loads are permanent loads which are carried to the structure throughout their lifespan. Dead loads are also called as stationary loads.

Exm:- The weight of structure itself.

LIVE LOADS:-

As the name itself resembling that these type of loads are real time loads. Live loads are also called as imposed or Sudden loads.
Exm:- Weight of Persons, movable Partitions.

SNOW LOADS:-

This type of loads is considered only on the structure which receives snowfall during projections monsoon.

EARTHQUAKE LOADS:-

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

STRUCTURE

Structure is a building or other object constructed from several parts.

TYPES OF STRUCTURES:

Different types of Structure are:

1) TRUSSES:

Trusses consists of triangular units constructed with straight members. A truss is made up of a web of triangles joined together to enable the even distribution of weight and the handling of changing tension and compression without bending or shearing. Trusses are most commonly used in bridges, roofs and towers.

FRAME STRUCTURE:

A Frame Structure is a structure having the combination of beam, column and slab to

resist the lateral and gravity loads. These structures are usually used to overcome the large moments developing due to the applied loading.

SHELL ROOF.

Shell roof is basically the modification of pitched roof and covers large areas of the building. Moreover, shell roof is three-dimensional structure consisting of thin membrane slabs, curved in one or more directions which transfers the loads on points of supports,

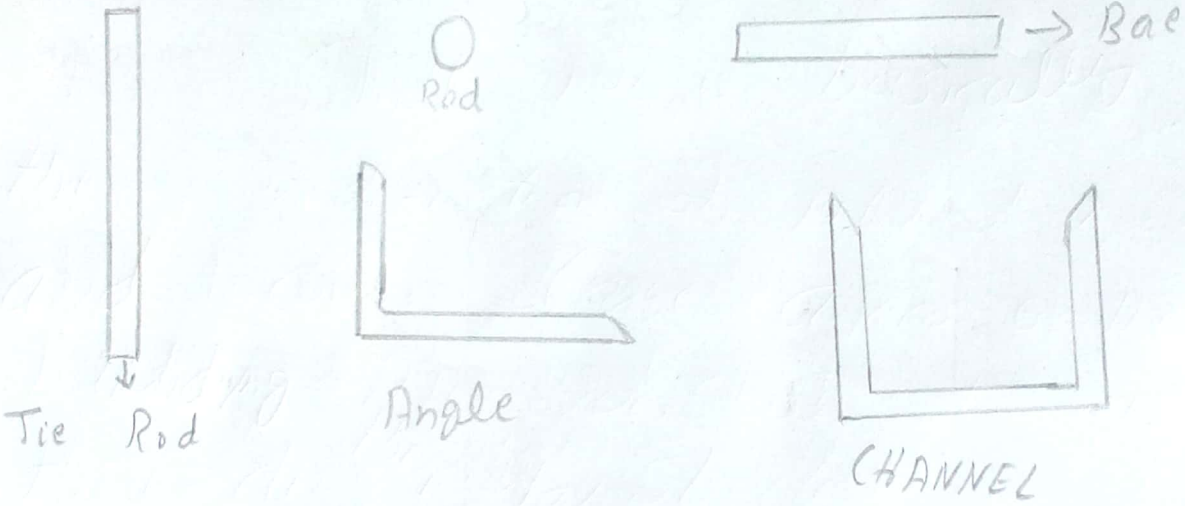
Exm:- Columns, beams, walls etc.

→ STRUCTURE ELEMENTS :-

Some of elements are :

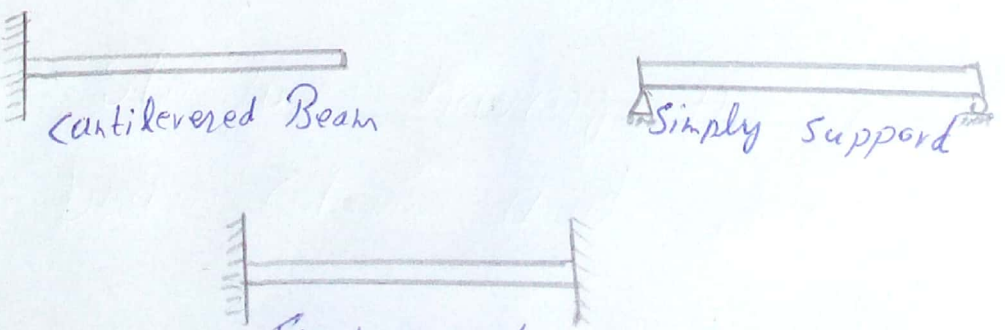
1) Tie Rod :-

Consists of tensile force these membess are bass or rods.



3) BEAMS :-

They are horizental membess and support vertical loads. It resists bending moments, short carry large loads.

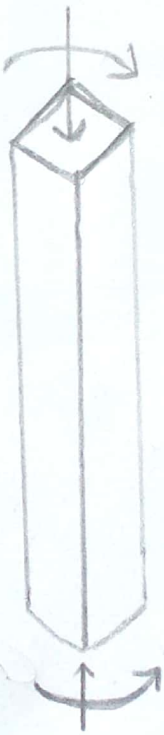


3) COLUMNS :-

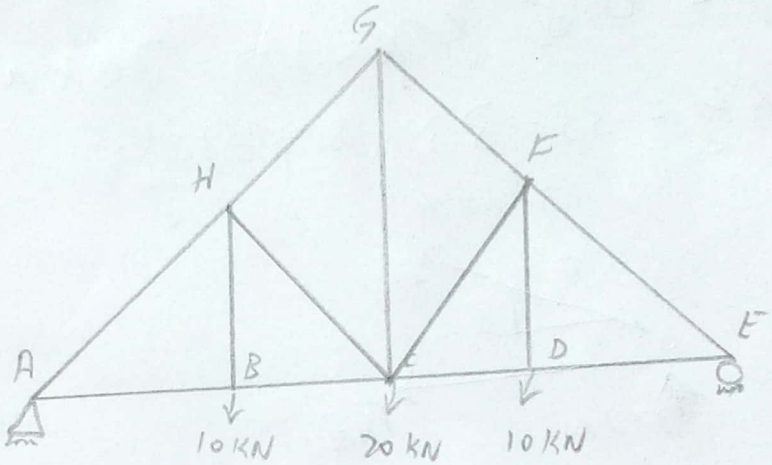
They consists of vertical members and resists compressive Loads.

Tubes and wide-flange across sections are used for metal columns and square rods are used for concrete work.

COLUMN



BEAM-COLUMN



Forces in each member :

Soln

Support reactions :

$\Sigma F_y = 0$ (+ ↑ ↓)

$R_1 + R_5 = 40 \rightarrow (1)$

$\Sigma M_1 = 0$ (↺)

$R_5(16) + 10(12) + 20(8) + 10(4) = 0$

$R_5 = 320/16 = 20\,kN$

$R_5 = 40 - 20 \Rightarrow R_1 = 20\,kN$

Now determing Force in each member:-

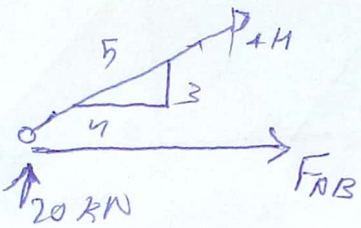
Joint A:-

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

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

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

Joint A:-



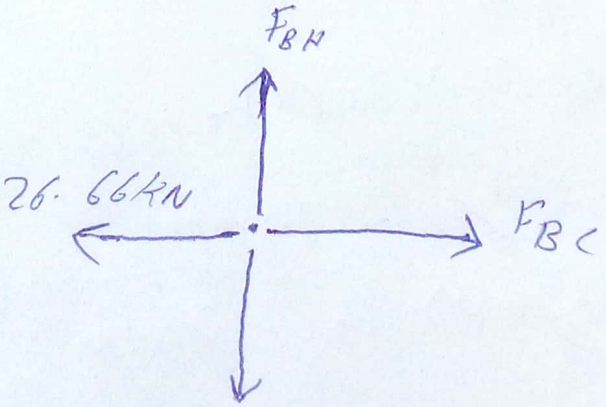
$$\Sigma F_x = 0; -\frac{4}{5}(33.33) + F_{AB} = 0$$

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

Joint B:-

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

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



Joint B

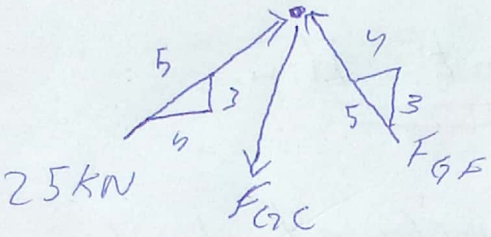
Joint G:

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

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

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

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



Joint G:

Joint H:

$\Sigma F_y = 0;\ 3/5\,(33.33) - 10\,KN + \frac{3}{5}(F_{HC}) - \frac{3}{5}(A+G)$

$\Sigma F_x = 0;\ 4/5\,(33.33\,KN) - 4/5\,(F_{HC}) - 4/5\,(F_{HG}) \rightarrow (B)$

Solving eq (A) & eq (B)

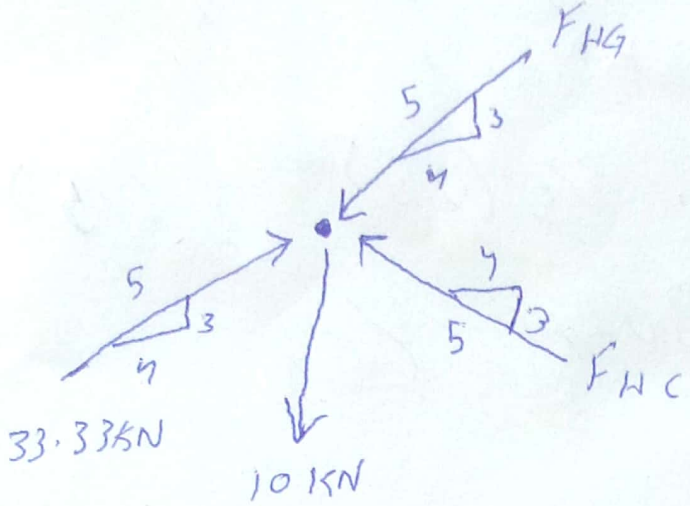
$19.98 - 10 + 0.6\,F_{HC} - 0.6\,F_{HG} = 0 \rightarrow (A)$

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

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 & Geometry

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

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

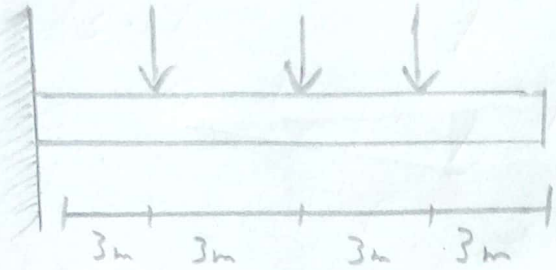
$F_{BH} = F_{DE} = 10\,KN\ (T)$

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

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

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

QUESTION No ③



Given:- $E = 200\ GPa$, $I = 6 \times 10^6\ mm^4$.

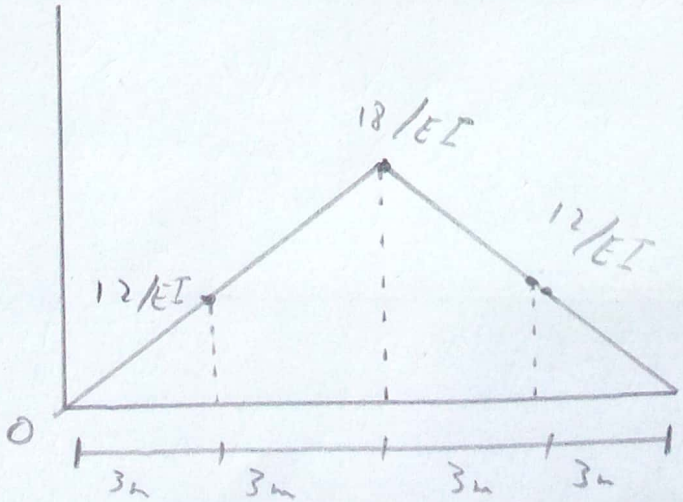
Determine slops at point 'A' and displacement at 'C' Using Moment Area theorem.

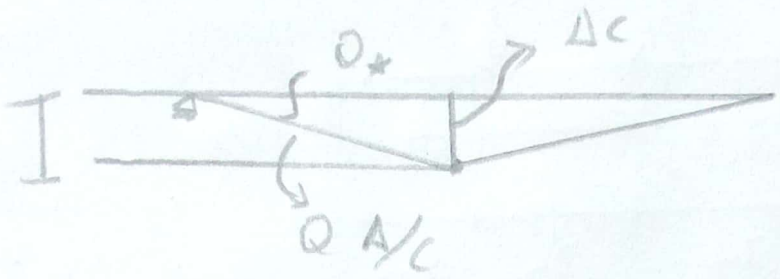
Solution:-

1) Finding at M/EI Diagram of elastic curve

MOMENT DIAGRAM:-

M/EI





$$\theta_{A/C} = \frac{1}{2}\left(\frac{12}{EI}\right)(3) + \left(\frac{0}{EI}\right)(3) + \frac{1}{2}\left(\frac{6}{EI}\right)(3)$$

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

$$\theta_{A/C} = \frac{63}{EI} \Rightarrow \left(\frac{63}{200 \times 10^6}\right)(6 + 10^6)(100)^{-4}$$

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

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

$$= 0.202 \text{ m}$$

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

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