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SECTION B

SEMESTER 10th

PAPER STRUCTURAL ANALYSIS

DATE 17-APRIL-2020

Question No 1:-

Write detail note on your own words on different types of load that different type of structure are designed to support through its life-time. Elaborate with examples?

Answer:

LOADS:

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

TYPES OF LOADS:

There are different types of load which are given below;

1) **DEAD LOADS:**

It consist of structural member that are permenantly attached to structure. Dead loads includes the weight of colomns, beams, girders electrical fixture etc.

2) **LIVE LOADS:**

Live load can vary both in their magnitude and location. These loads are caused by weight of temporarily object, moving

vechiles, natural forces consist of additional Protection against excess deflection and over load.

EXAMPLE:

The inner floor loading in classroom consist of chairs, laboratory, desk & other equipment

TYPES OF STRUCTURES:

The combination of structural elements and the material which function as a structural system. Each system consists of one or more types of structures.

Different types of structures are:

1) TRUSSES:

Trusses consist of slender elements in traingular form. Due to geometric arrangement of its members binds are converted into tensile or compressive forces in members.

→ Planner trusses of composed of members, lies in same plane and used for bridges & roof supported.

→ Space trusses have members extending in three dimension and used for towers.

2) CABLES & ARCHES:-

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

→ Cables are flexible and carry loads in tension they are commonly used to support bridges, roofs.

→ Arches achieve strength in compression and has a reverse curvature to cable. It must be rigid to maintain its shape consists of shear & moment. They are used in bridge structures, dam roofs, & openings.

3) FRAMES:

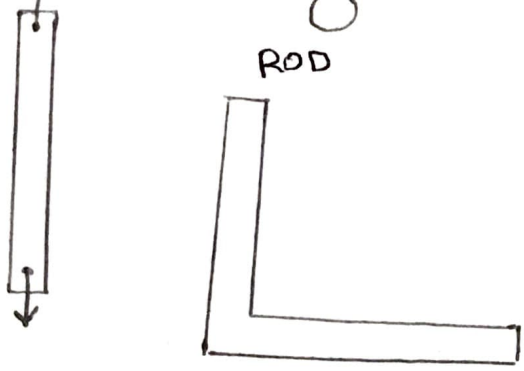
Types of structure which are used in building and consist of beam & column which are fixed or pin connected. The load on frame causes bending of its members and has rigid point connections. This structure is indeterminate.

STRUCTURAL ELEMENTS:

Some of elements are;

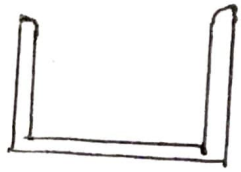
1) TIE LOADS:

Consist of tensile force. These members are slender, bars or rods.



TIE ROD

ANGLE



CHANNEL

2) **BEAMS:**

They are horizantal members and support vertical loads. It resist bending moment short carry large loads.

Simply supported

cantilevered beam

Fixed Supported

3) **COLUMNS:**

They consist of vertical members and resist compressive loads.

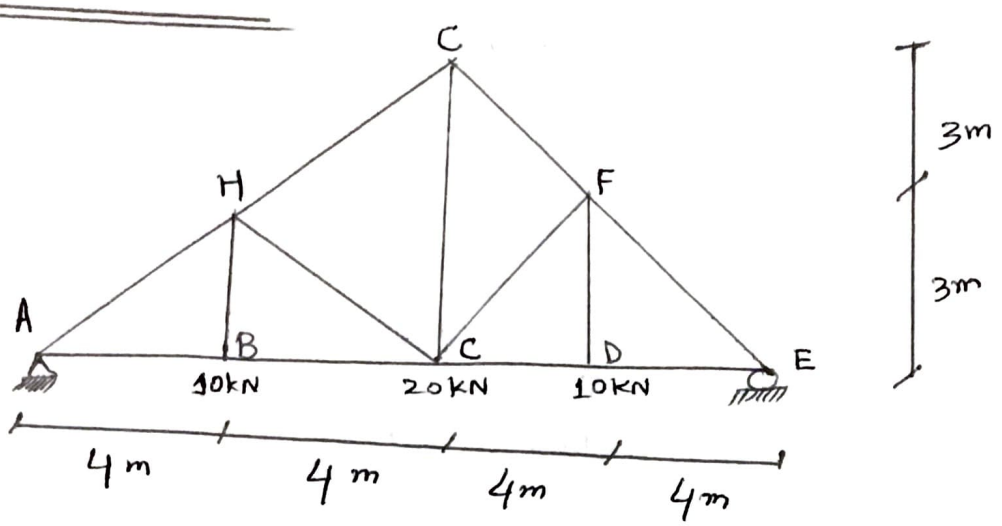
Tubes & wide flange across section are used for metal columns and square cross-sections rods are used for concrete work.

Column

BEAM-column

(P.T.O)

QUESTION NO: 2



Forces in each member = ?

Solution:

Support reactions:

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

$$R_A + R_E = 40 \text{ — eqn (A)}$$

$$\Sigma M_A = 0 \quad \circlearrowleft -$$

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

$$R_E = 320 / 16 = 20 \text{ KN}$$

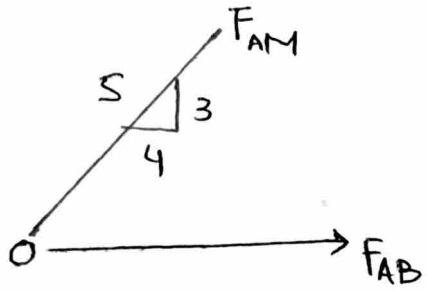
Now determining force in each member.

JOINT A:

$$\Sigma F_y = 0 \; ; \quad -3/5\,(F_{AN}) + 20\,KN = 0$$

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

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



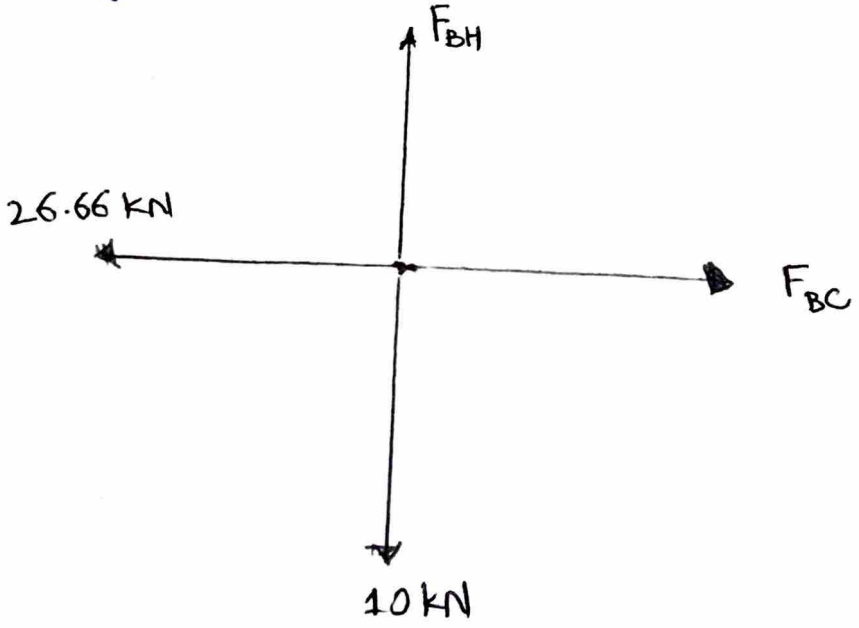
$$\Sigma F_x = 0 \; ; \quad -4/5\,(33.33) + F_{AB} = 0$$

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

JOINT B:

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

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



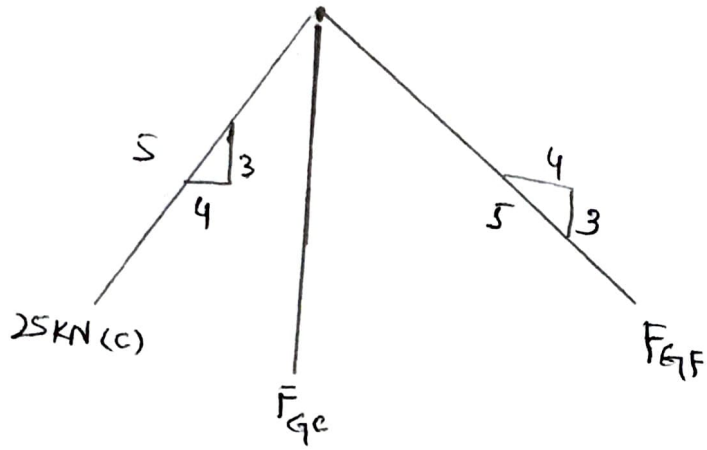
JOINT G:

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

$F_{GF} = 25\ kN\ (c)$

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

$F_{Gc} = 30\ kN\ (c)$.



JOINT H:

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

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

Solving eq (1) & eq (2)

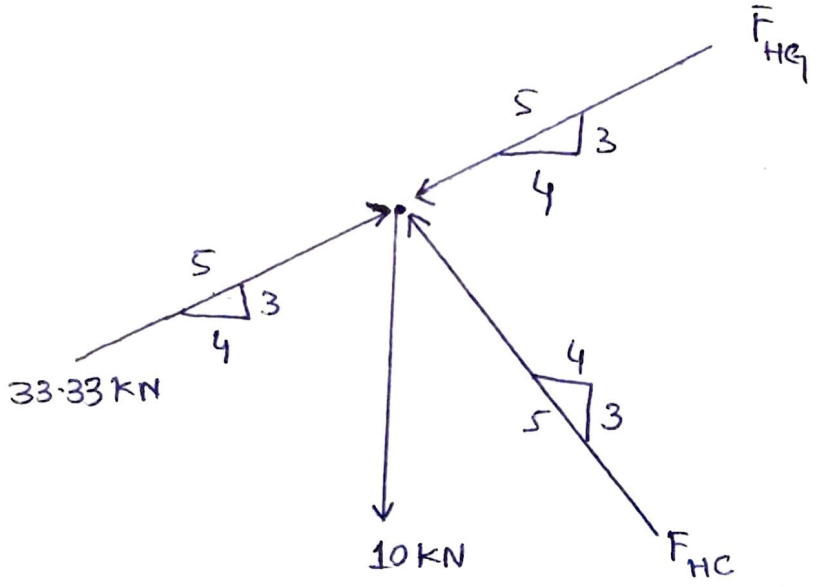
$19.98 - 10 + 0.6\,F_{HC} - 0.6\,F_{HG} = 0 \longrightarrow (X)$

$26.66 - 0.8\,F_{HC} - 0.8\,F_{HG} = 0 \longrightarrow (Y)$

Multiplying eq (X) by 1.34 And then add with eq (B) we get;

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

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



Due to Symmetrical loading & Geometry

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

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

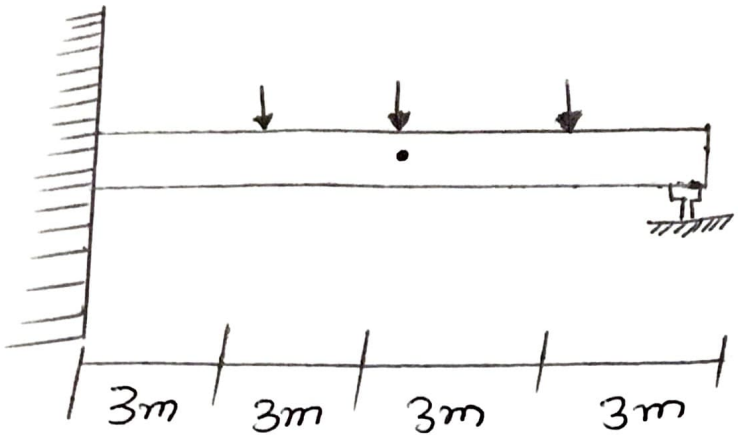
$F_{BH} = F_{DE} = 10\ KN\ (T)$

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

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

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

QUESTION NO 3:

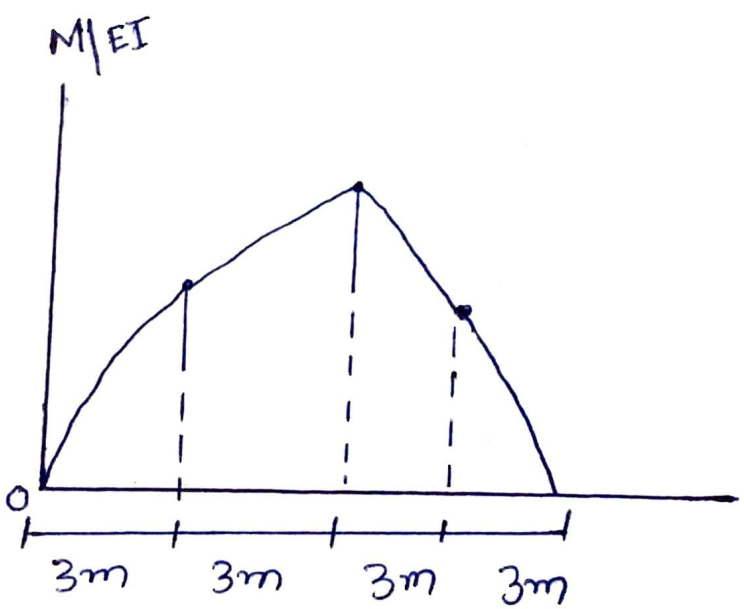


$E = 200\ Gpa$, $I = 6 \times 10^{6}\ mm$

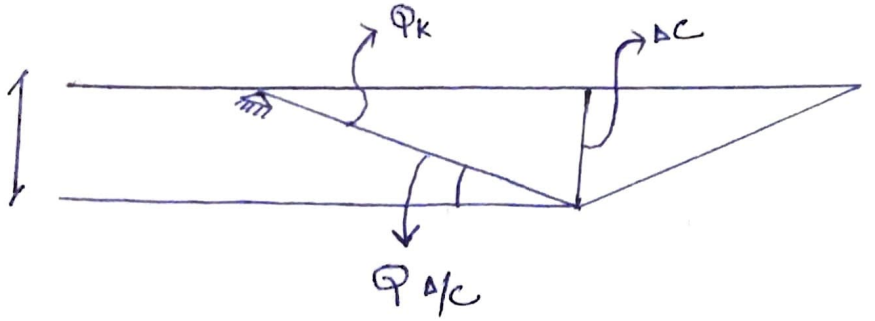
Determine slope at point A and displacement at "C" Using Moment Area theorem.

(i) Finding M/EI Diagram of elastic Curve.

MOMENT DIAGRAM:



Elastic Curve:



$$\theta_{A/C} = \tfrac{1}{2}\left(\tfrac{12}{EI}\right)(3) + \left(\tfrac{9}{EI}\right)(3) + \tfrac{1}{2}\left(\tfrac{6}{EI}\right)(3)$$

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

$$\theta_{A/C} = 63/EI$$

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

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

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

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

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

$$= 0.202 \text{ m}$$

So

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

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