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I.D # 7902

Section :- 'A'

Paper :- Structure Analysis

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Question No # 01

Ans:- It is the dimensional requirement for a structure necssary is determine the loads the structure must support.

Type of loads:-

There are different type of load which are.

① Live load:-

Live load can be very both in their magnitude and location. These loads are caused by weights of tempararil objects, moving vehicles, natural forces. consists of additional Protection againts excess deflection and overload.

② Dead load:-

It consist of sturcture members that are permenently attached to structure. Dead load includes the weight of columns, beams, electrical fixtures and other attachments.

Examples:- The live load floor locating in classroom consists of duskes, chairs and laboratory equipments.

Types of structure :-

The combination structural elements and the material which functions as a structural ~~sym~~system. Each system consist of one are more of four types of structure.

① Trusses :-

Trusses consist of slender elements in Iringular form. Due to geometric arrangements of its members bends are converted into tensile or compressive forces in members.

Planar trusses are comperseed of members, lines in same plane and used for bridge and roof supports.

Space trusses house members extending in there dimension and used for duricks and towers.

② Cables or Arches :-

It is the type of structure to span long distances.

→ Cables are flexible and carry loads in tension. They are commonly used to supports brigdes . roofs.

→ Arches achive strength in compression and has a reuses cervature to cable.

It is must be rigid to maintain. They are used in bridge structure. dams. roofs. and openings.

③ Frames :-

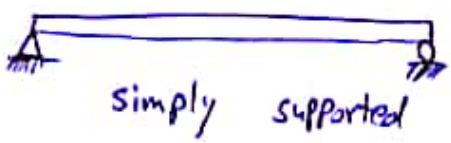
Type of structure which is used in building and consists of beams. and columns which are fixed or Pin connected. The loads on fixed frames causes bendings of its members and has rigid joint conneted. This structure is indeterminent.

⇒ **Structur Elements :-**

Some important structral elements are.

① Beams :-

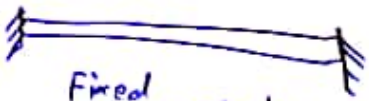
The horizental member of structure which supports vertical loads. It resist bending moments short carry large loads.



simply supported

[one end roller and other is hige supports]

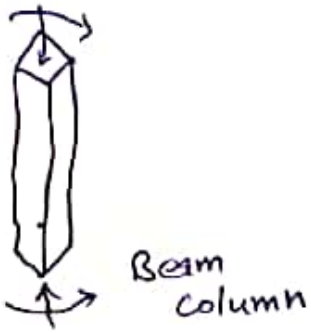
Contilever Beam



Fixed supports.

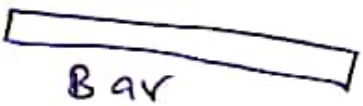
② Columns :- The vertical member of structure that support horizontal loads. and resist compressive loads.

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



③ Tie Rods :-

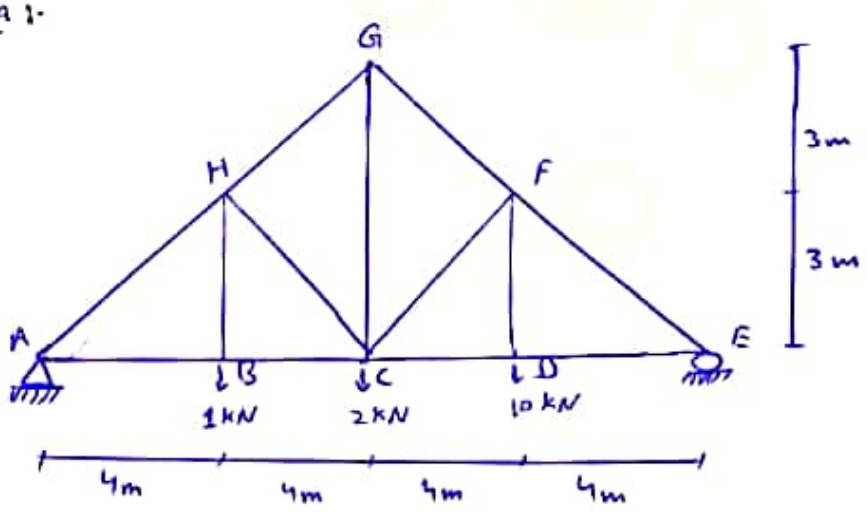
Consist of tensile force. These members are dender. bars or rods.



Question No 2

Ans:

Given Data:-



Required:-

Forces in each members.

Solution:-

support reactions:-

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

$$R_A + R_E = 0 \quad (\circlearrowleft \; \circlearrowright)$$

$$R_E(16) + 10(2) + 20(8) + 10(4) = 0$$

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

$$40 - R_E = 40 - 20 = \boxed{R_A = 20\,kN}$$

Now determing the force in each members.

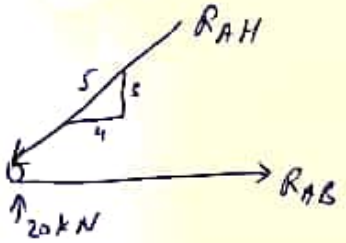
Joint A :-

$$\Sigma f_y = 0 \; : \; -\tfrac{3}{5}(FAM) + 20\,kN = 0$$

$= -0.6\,(FAH) = -20\ kN$

$FAH = 33.33\ kN.\ (c)$

Joint A



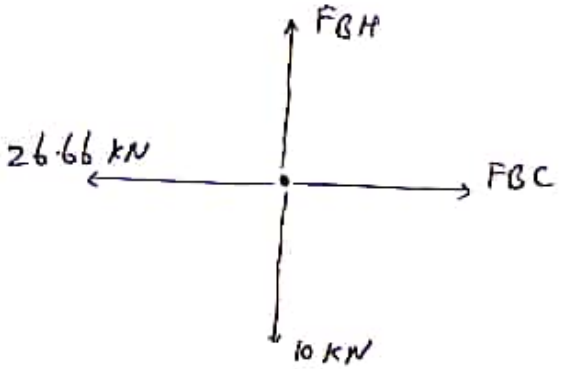
$\Sigma f_x = 0 \;;\quad -4/5\,(33.33) + FAB = 0$

$FAB = 26.66\ kN\ (T)$

Joint B

$\Sigma f_x = 0 \;;\quad FBC = 26.66\ kN\ (T)$

$\Sigma f_y = 0 \;;\quad FBH = 10\ kN\ (T)$



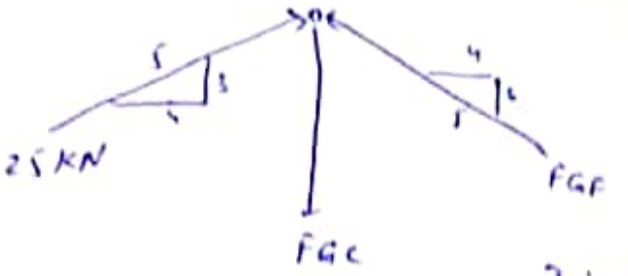
Joint G :-

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

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

$\Sigma F_y = 0 \;;\quad 3/5\,(25) + 3/5\,(25) - FGC = 0$

$FGC = 30\ kN\ (c)$



Joint G

Joint H :-

$$\Sigma F_y = 0 \; ; \quad \tfrac{3}{5}(33.33) - 10\,kN + \tfrac{3}{5}(FHC) - \tfrac{3}{5}(FHG) \longrightarrow (A)$$

$$\Sigma F_x = 0 \; ; \quad \tfrac{4}{5}(33.33) - \tfrac{4}{5}(FHC) - \tfrac{4}{5}(FHG)$$

Solving eq (1) and (2)

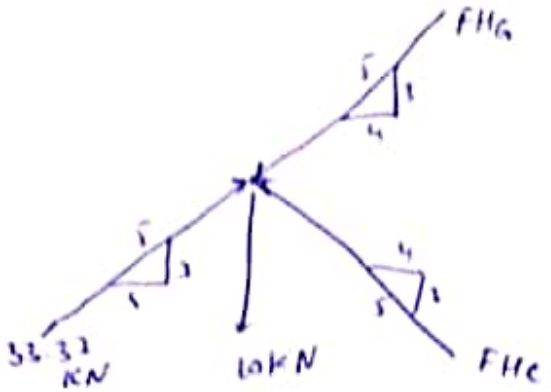
$$19.98 - 10 + 0.6\,FHC - 0.6\,FHG = 0 \longrightarrow (A)$$

$$26.66 - 0.8\,FHC - 0.8\,FHG = 0 \longrightarrow (B)$$

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

$$FHG = 25\,kN\,(c)$$

$$FHC = 8.34\,kN\,(c)$$



Joint H

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)

$F_{HG} = F_{GF} = 25$ KN (T)

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

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

Compt Question (2)

Q No 3

Ans :-

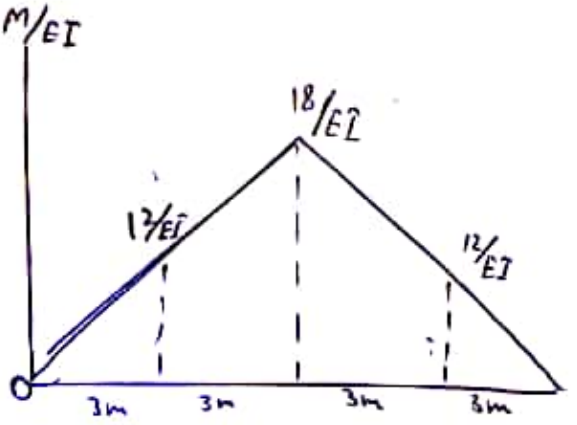
Given :- $E = 20\ GPa$, $I = 6 \times 10^6\ mm$

Required :- Determine the slope at point 'A' and displacement at 'c' using moment area theorm.

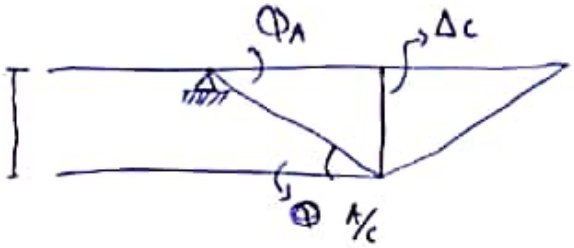
Solution :-

① Finding out M/EI Diagram of elasti curve.

Moment Diagram.



Elastic curve :-



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

$$\theta_{A/C} = \frac{18}{EI} + \frac{36}{EI} + \frac{9}{EI}$$

$$\theta_{A/C} = \frac{63}{EI} \Rightarrow \frac{63}{(200 \times 10^6)(6 \times 10^{-4})(1000)^{-4}}$$

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

$$\theta_A = 0.0525 \text{ m Ans}$$

$$t_{A/C} = \left[\frac{1}{2}\left(\frac{12}{EI}\right)3\right]\left[\frac{2}{3}(3)\right] + \left[\frac{12}{EI}(3)\right]\left[3 + \frac{1}{2}(3) + \left[\frac{1}{2}(6/EI)(3)\right] \times 3 + \frac{2}{3}(3)\right] \Rightarrow \boxed{0.202 \text{ m}}$$

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

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