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Section = A

Paper = Structure Analysis I

Q No 1

①

Write detail note on your own words on different types of loads that different types of structures are designed to support through its life.

Elaborate with example:

Loads :- It is the dimensional requirement for a structure necessary its determine the loads the structure must support.

Types of loads :- There are different which are:

① DEAD loads :- It consist of structural members that are permanently attached to structure. Dead load included

②
The weight of columns, beams, girders, electrical fixtures and other attachments.

2) Live loads: Live loads can vary both in their magnitude and location. These loads are caused by weights of temporarily objects, moving vehicles & natural forces. Consist of additional protection against excess deflection and over load.

Example: The 1st floor loading in classroom consists of desks, chairs and laboratory equipment.

of Structural elements and the material
in which functions as a structural system.
Each system consists of one or more
of four types of structures.

Different types of structures are:

①

Trusses:

Trusses consists of slender
elements in triangular form.
Due to geometric arrangements
of its members loads are converted
into tensile or compressive
forces in members.

→ Planar trusses are composed of members,
lies in same plane and used for bridges
and roof supports.

④

→ Space Trusses have members extending in three dimensions and used for direct and Truss.

2) Cables & Arches

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

→ Cables are flexible and they loads in tension.

They are commonly used to support bridges, roofs.

→ Arches achieves strength in compression and has a reverse curvature is called. It must be rigid to maintain its shape.

Consist of Chord and moment.
They are used in bridge structures,
dome roofs and openings.

3) FRAMES :-

Type of structures

Which are used in buildings
and consist of beam and
column. Which are fixed or
pinned connected.
The load on frames causes

binding of its members and has
rigid joint connections.

This structures is indeterminate.

→ Structure Elements :-

Some of elements are :-

①

TIE Rods:

②

Consist of Tensile force. These members are under, bars or rods.



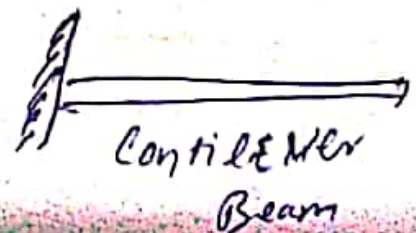
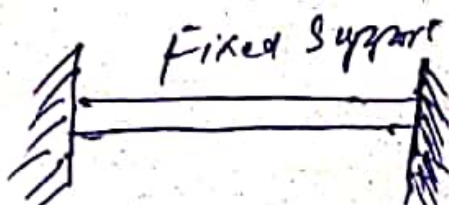
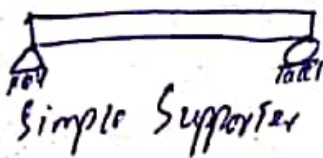
TIE Rod



CHANNEL

2) BEAMS;

They are horizontal members and supports vertical loads. It consists bending moments short essy large loads.



③ Columns;

⑦

They consist of vertical members and resist compressive loads.

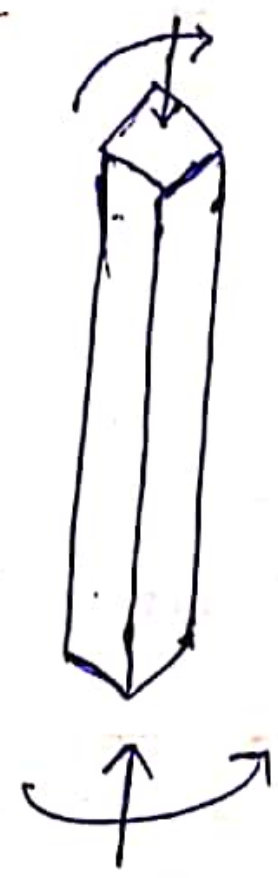
Jubes & wide-flange across

Sections are used for metal columns & square cross

Sections & reeds are used for concrete work.



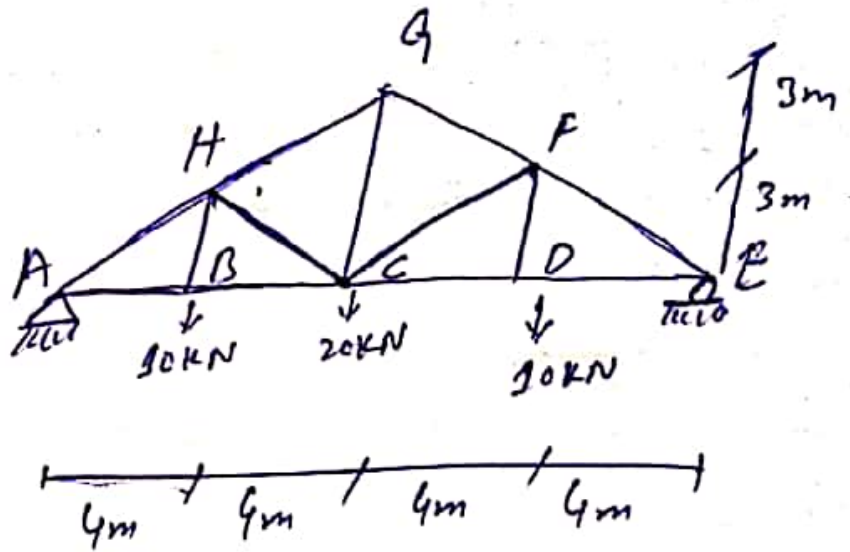
Column



BEAM-Column

Q NO 2 :

(8)



Force in each member?

Solus-

Support reactions :

$$\sum F_y = 0 \quad \uparrow^+ \downarrow^-$$

$$R_A + R_B = 40 \quad \rightarrow \text{A}$$

$$\sum M_A = 0 \quad \curvearrowright^-$$

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

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

$$R_{ut} = 40 - 20 \Rightarrow R_A = 20 \text{ kN}$$

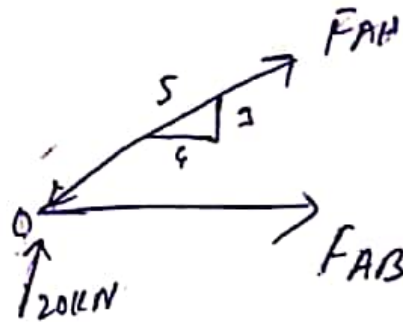
Now determining force in each member.

Joint A :

$$\begin{aligned} \sum F_y = 0; \quad -\frac{3}{5}(F_{AM}) + 20 \text{ kN} &= 0 \\ &= -0.6(F_{AH}) = -20 \text{ kN} \end{aligned}$$

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

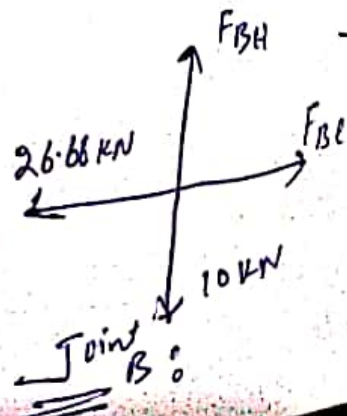
Joint A :



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

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

$$\sum F_y = 0; \quad F_{BH} = 10 \text{ kN (T)}$$



Joint G:

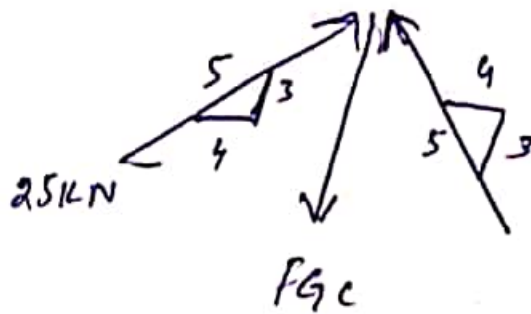
(10)

$$\sum F_x = 0; \frac{4}{5}(25) - \frac{4}{5}(F_{GF}) = 0$$

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

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

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



Joint G:

Joint H:

$$\sum F_y = 0; \frac{3}{5}(33.33) - 10 \text{ kN} +$$

$$\frac{3}{5}(F_{HC}) - \frac{3}{5}(F_{HG}) \rightarrow \text{A}$$

$$\sum F_x = 0; \frac{4}{5}(33.33 \text{ kN}) - \frac{4}{5}(F_{HC}) - \frac{4}{5}(F_{HG}) \rightarrow \text{B}$$

Solving eq (1) & eq (2)

(11)

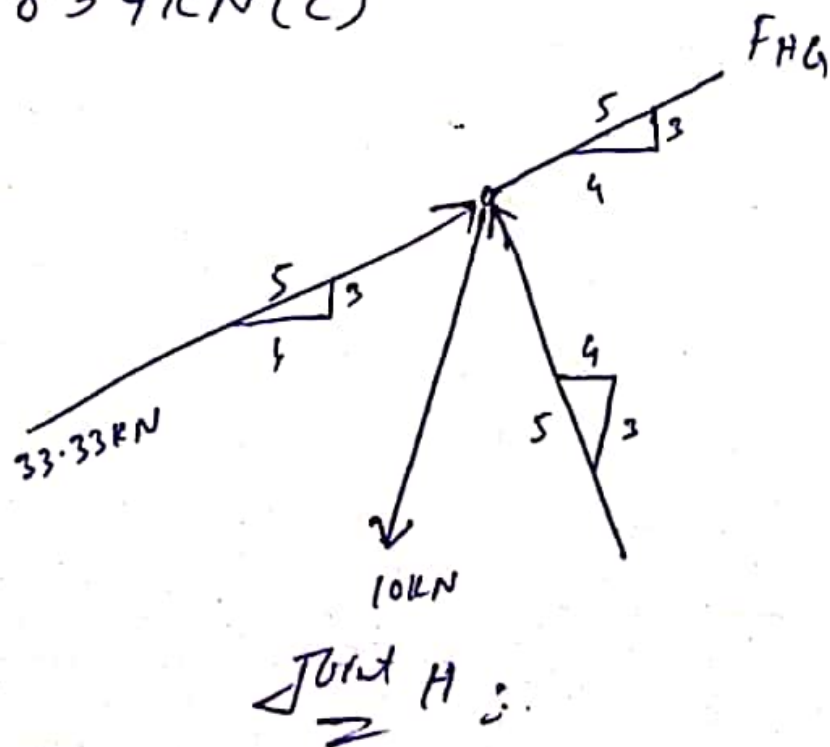
$$19.98 - 10 + 0.6 F_{HC} - 0.6 F_{HG} = 0 \rightarrow (A)$$

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

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

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

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



(12)

Due to Symmetrical loading &
Geometry.

$$F_{AB} = F_{ED} = 26.68 \text{ kN (T)}$$

$$F_{BE} = F_{DC} = 26.68 \text{ kN (T)}$$

$$F_{BU} = F_{DP} = 26.68 \text{ kN (T)}$$

$$F_{HG} = F_{Fg} = 2.5 \text{ kN (C)}$$

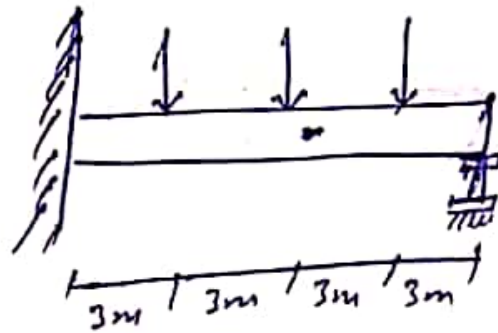
$$F_{AC} = F_{FC} = 8.34 \text{ kN (C)}$$

$$R_{AH} = R_{CP} = 33.33 \text{ kN (C)}$$



Q No 3

(13)



Given: $E = 200 \text{ GPa}$, $I = 6 \times 10^6 \text{ mm}^4$
Determine Slope at point 'A' &

Displacement at 'C' using

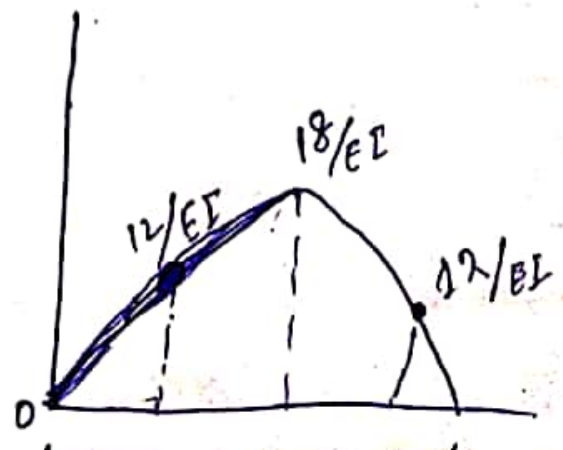
Moment Area theorem.

Solution:

(i) Finding out M/EI Diagram
& elastic curve.

Moment Diagram

Elastic Curve



(14)

$$Q_{A/C} = \frac{1}{2} (R/EI) (3) + (R/EI) (3) + \frac{1}{2} (6/EI) (3)$$

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

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

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

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

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

$$= 0.202 \text{ m}$$

So

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

$$= 202 \text{ mm}$$

Ans