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Section :- B

Subject :- Structural analysis

Deptt :- CED

Semester :- 4th

Teacher :- Amjad Islam

Q:-1:- write detail note on your own words on different type of loads that different type of structure are design to support throughout its life- ela borate with example:-

Ans:- **Loads:-** It is a dimensional requirment for a structure neccesary to determine the loads the structure must support.

Types of loads:- there are different types of loads which are the following:-

1. **Live load :-** Live load can vary both in their magnitude and location. these loads are caused by weights of temeroliy objects, moving vehicals, natural forces.

consists of additional protection against excess deflection and overloa

Example :- The live floor loading in classroom consists of peples - chairs and laboratory equipments

② Dead load :- It consists of structural members that are permanently attached to structure - dead loads includes the weight of colomns, beams, electrical fixtures and other attachements.

Types of structures :- The combination of structural and materials which function as a structural system, each system consists of one or more of four types of structures:-

1) Trusses :- Trusses consists of slenders elements in triangular form due to geometric arrangments of its members bonds are converted into tensile or compressive force in members

→ planar trusses are composed of members, lies in same plane and use for Bridges and roof supports-

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

② **cables and arches:-** It is the types of structures used to span long distances.

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

→ Arches achieves strength in compression and has a reverse curvature to cable, it must be rigid to maintain its shape. consists of shear and moment, they are used in bridge structures, dome, roofs and opening.

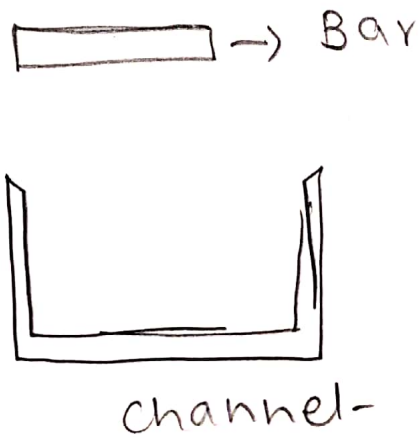
③ Frames :-

Types of structure which are used in buildings and consists of beams and column which are fixed or pin connected. The bad on frames causes bendings of its members and has rigid joints connections this structure is indeterminate.

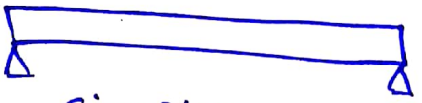
→ Structural elements :-

1) Tie rods :- consists of tensile force. These members are bars and rods. and angles.

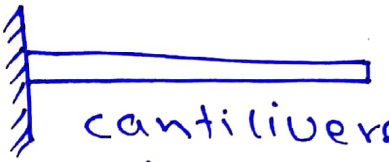
Tie rod



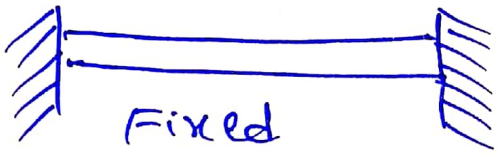
2) **Beams**:- they are horizantal members and supports vertical loads - It resists bending moments, short carry large loads-



Simply supported Beam



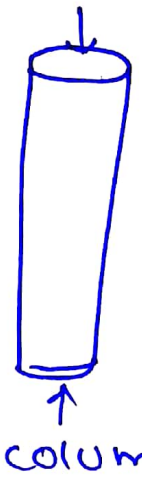
cantilivered Beam



Fixed supported Beam

3) **column**:- They consists of vertical members and resists compressive loads -

Jobs and wide-flange accross section are used for metal columens, and squvare cross section rods are used for concrete work-



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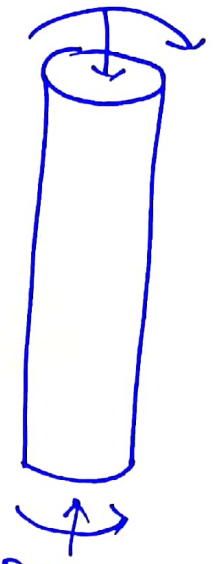
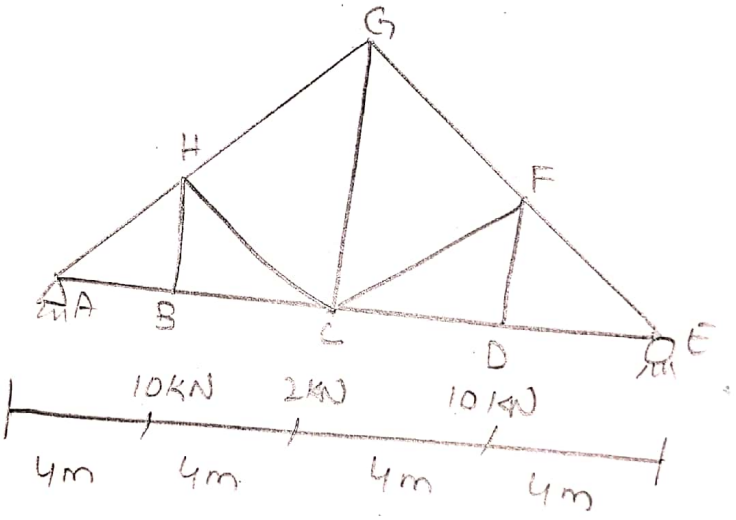


Q:- 2



forces in each member = ?

Solve:- Support reactions:-

$$\Sigma fy = 0 \uparrow^{+} \downarrow_{-}$$

$$R_A + R_B = 40 \quad \text{---} (1)$$

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

$$R_B = 320/16 = 20\ KN$$

Now determining force in each member

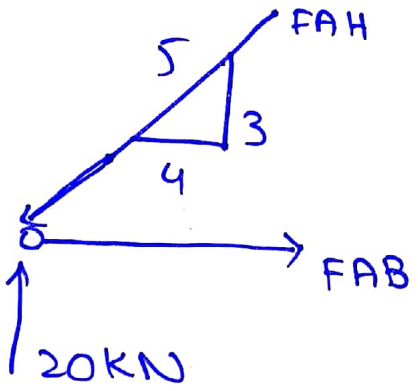
Joint A:-

$$\Sigma f_y = 0 \; ; \quad -3/5 (F_{AH}) + 20 \text{ kN} = 0$$

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

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

Joint A:-

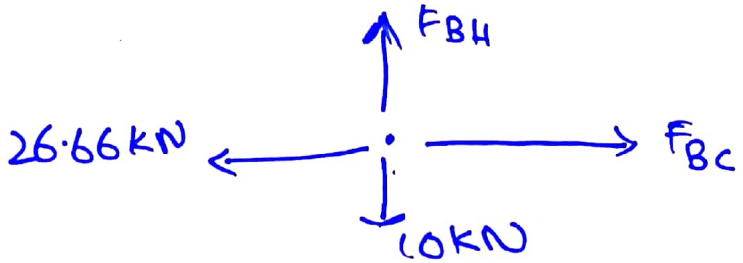


$$\Sigma f(x) = 0 \; ; \quad -4/5 (33.33) + F_{AB} = 0$$

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

Joint B:- $\Sigma f(x) = 0 \; ; f_{BC} = 26.66 \text{ kN (T)}$

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

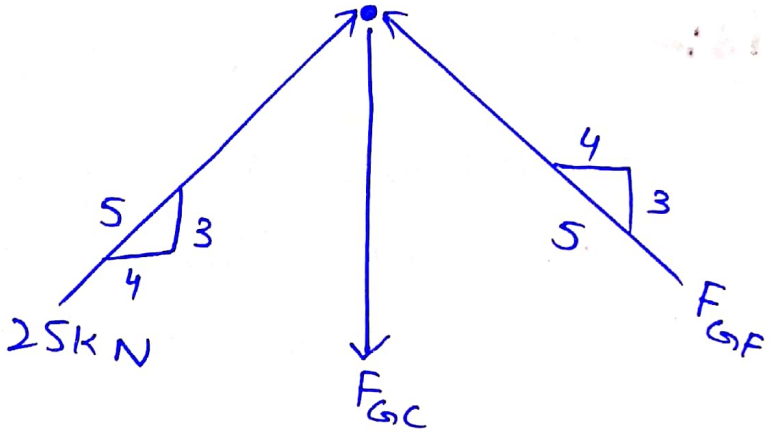


Joint G:- $\Sigma f(x) = 4/5\,(25) - 4/5\,(R_{GF}) = 0$

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

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

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



Joint G

Joint H:-

$\Sigma f_y = 0;\ 3/5\,(33.33) - 10kN + 3/5\,(F_{HC}) - 3/5\,(A$

$\Sigma f_x = 0;\ 4/5\,(33.33kN) - 4/5\,(F_{HC}) - 4/5\,(F_{HG})$ — (B) (A)

Solving eq (1) and eq (2)

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

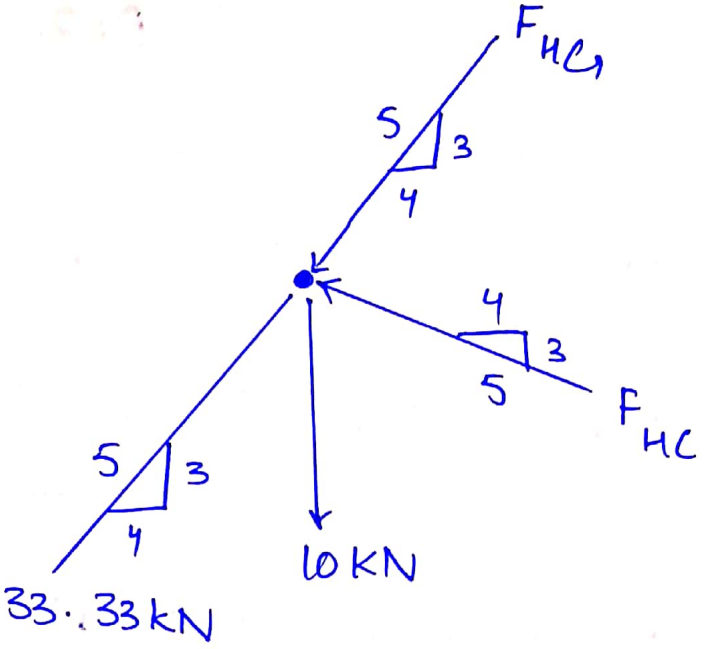
$26.66 - 0.8\,F_{HC} - 0.8\,F_{HG} = 0$ — (B)

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

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

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

P = 10



Joint H

Due to Symmetrical loading and geometry

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

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

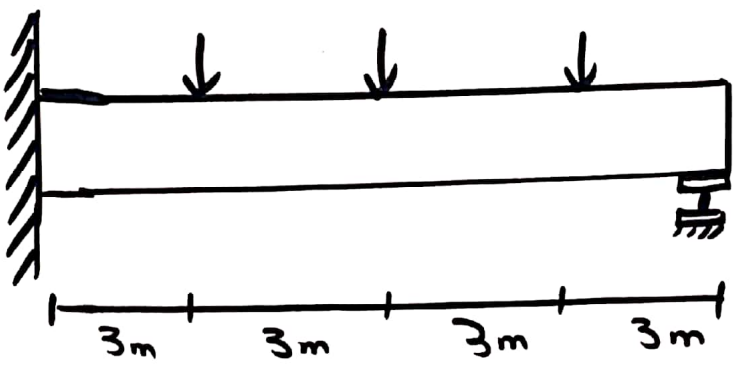
$F_{BH} = F_{DF} = 10\,kN\,(T)$

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

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

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

Question No 3:-



P : 11

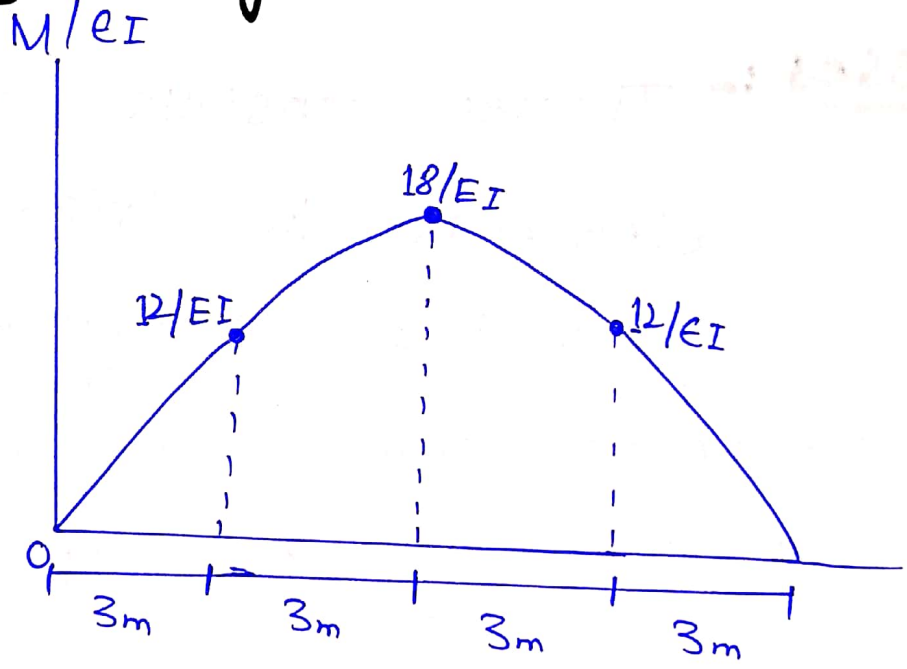
Give :: E = 200 GPa, I = 6×10^6 mm

Determine Slope at Point "A" and displacement at "C" Using Moment Area Theorm.

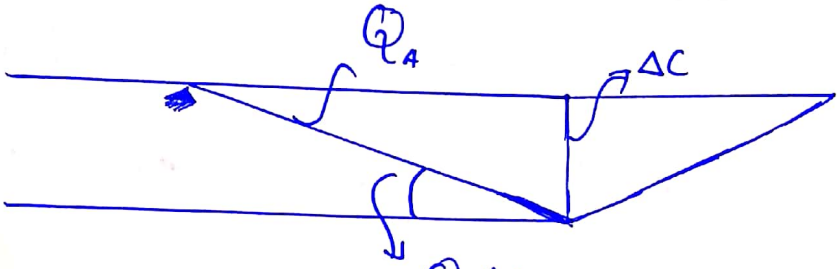
⇒ Solution:-

(i) Finding out M/EI Diagram and elastic Curve

⇒ **Moment diagram:-**



⇒ **Elastic Curve**



$$Q_{A/C} = \frac{1}{2}\left(\frac{18}{EI}\right)(3) + \left(\frac{Q}{EI}\right)(3) + \frac{1}{2}\left(\frac{6}{EI}\right)(3)$$

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

P = 12

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

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

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

$$t_{A/C} = \left[\frac{1}{2}\left(\frac{18}{EI}\right)(3)\right]\left(\frac{2}{3}(3)\right) + \left[\frac{12}{EI}(3)\right]\left(3+\frac{1}{2}(3)\right) + \left[\frac{1}{2}\left(\frac{6}{EI}\right)(3)\right]\left(3+\frac{2}{3}(3)\right).$$

$$= 0.202 \text{ m}$$

So

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

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