Fic No:/

(اوروں کے استعمال کیلئے)

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Subject # Structural Analysis

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peshawar

(1)

Q#01 :- Write detail note on your own words on different types of loads that different type of structure are designed to support throughout its life. Elaborate with examples ?

Ans ⇒ **Loads** :- It is the dimensional requirments for a structure necessary to determine the load the structure must support.

Types Of Loads :- It consist of structural members that are permanently attached to structure. Dead load includes the weight of columns, beams, girdus, electrical fixtures and other attachments.

(2m)

(2) **Live Loads**

Live loads can vary both in their magnitude & location. These loads are caused by weights of temporarily objects, moving vehicles, natural forces consist of additional protection against excess deflection & overload.

Example :- The inner floor loading in classroom consists of disks, chairs & laboratory equipment.

TYPES Of Structure :- The combination of structural elements and the material which functions as a structural system. Each system consists of one or more of four types of structure.

Different Types of structure are:

1) **Trusses** :- Trusses consist 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 member, lies in some plane and used for bridges and roof support.

⇒ Space Trusses in three dimensions and used for derricks & towers.

(4)

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.

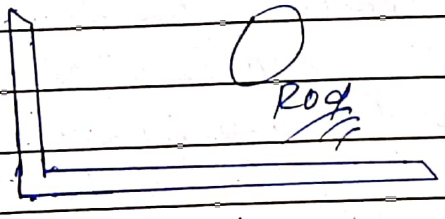
→ Arches achieves strength in compression and has a severe curvature to cable. it must be rigid to maintain its shape. Consist of shear and moment. They are used in bridge structure, dams, roofs and openings.

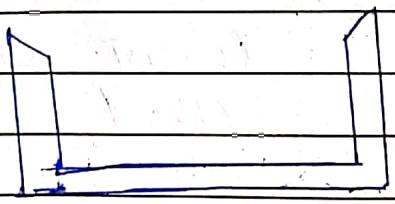
Frames :- Type of structure which are used in buildings and consist of beam and column, which are fixed or pin connected. The load on frames causes bindings of its members and has rigid joint connections. This structure is intermidiate.

Structural Elements :-

1) **TIE RODS** :- Consist of Tensile force. These member are slender, bars or rods.

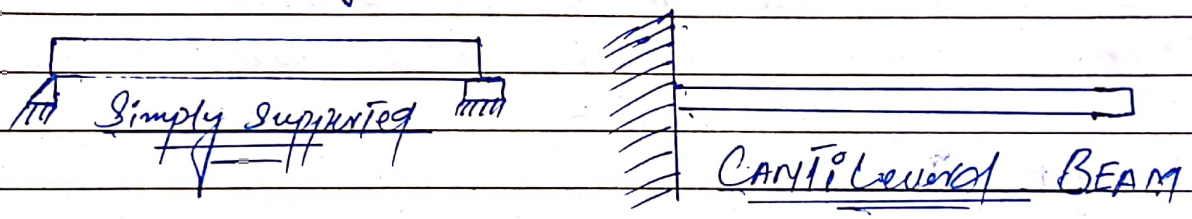
TIE ROD

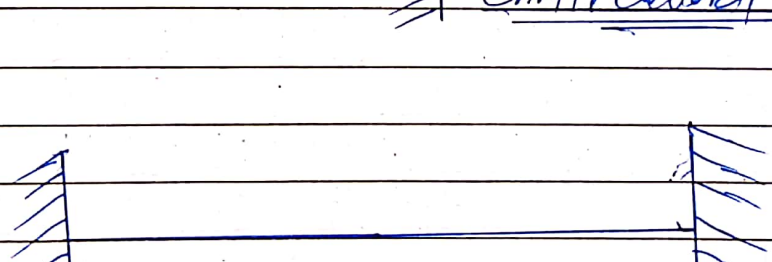




CHANNEL

② **BEAMS** :- They are horizontal members and supports vertical loads - It resist bending moments, shall carry large loads -

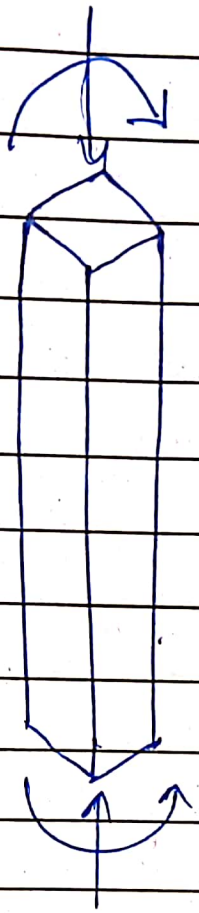




③ **Columns** :- They consist of vertical members and resist compressive loads -

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

Column



BEAM - Column

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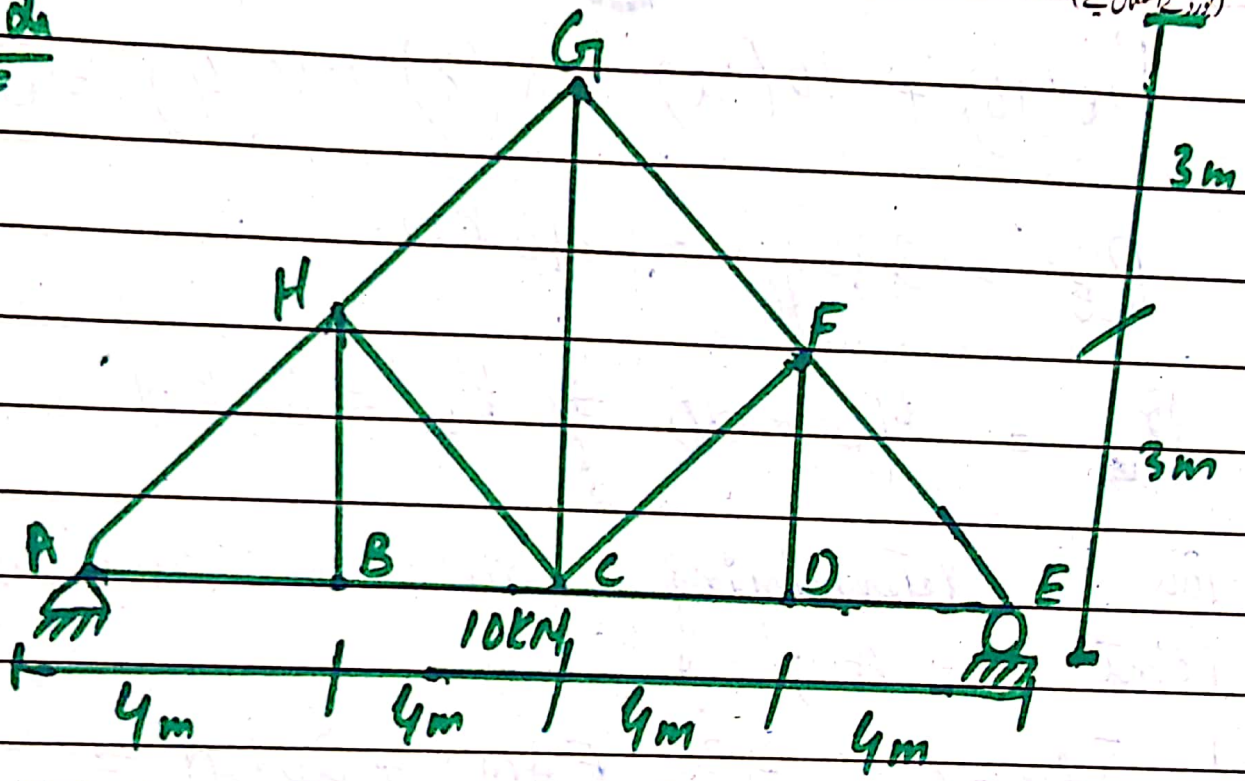
Q # 02



Forces In each Member ?

Sol :→ Support reactions

$\Sigma F_y = 0$ ↑(+) ↓(−)

$R_A + R_E = 40 \rightarrow (1)$

$\Sigma M_4 = 0$ ⟲(−)

(10)

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

$R_E = 320/10 = 20\ KN$

put $R_A = 40 - 20 \Rightarrow R_A = 20\ KN$

Now determining force in each member,

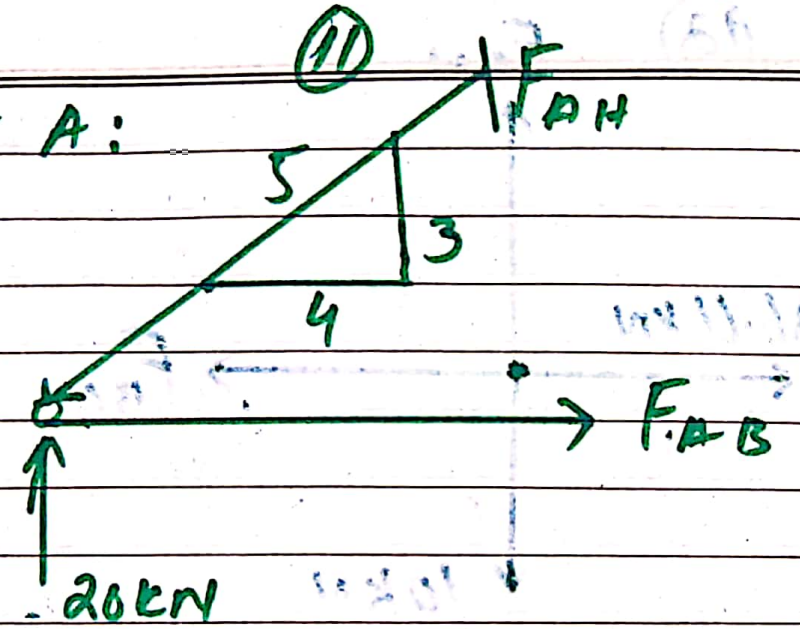
Joint A;

$\sum f_y = 0; \quad -\frac{3}{5}(F_{AM}) + 20KN = 0$

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

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

Joint A:



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

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

Joint B:

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

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

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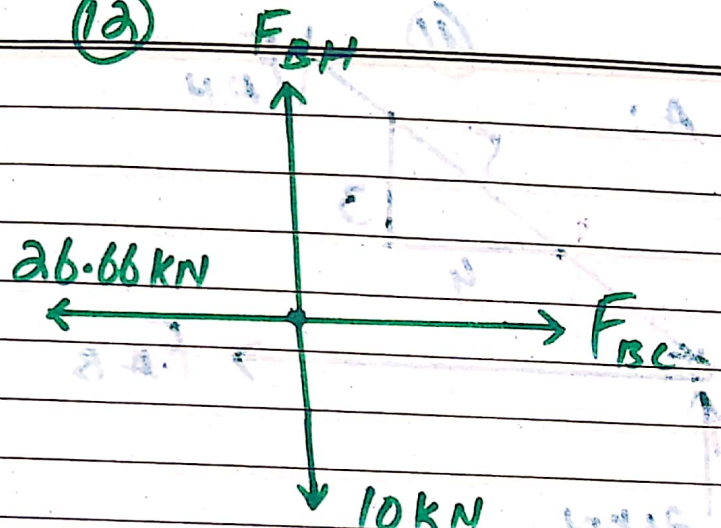

Joint B :-

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Supdt:

Conti

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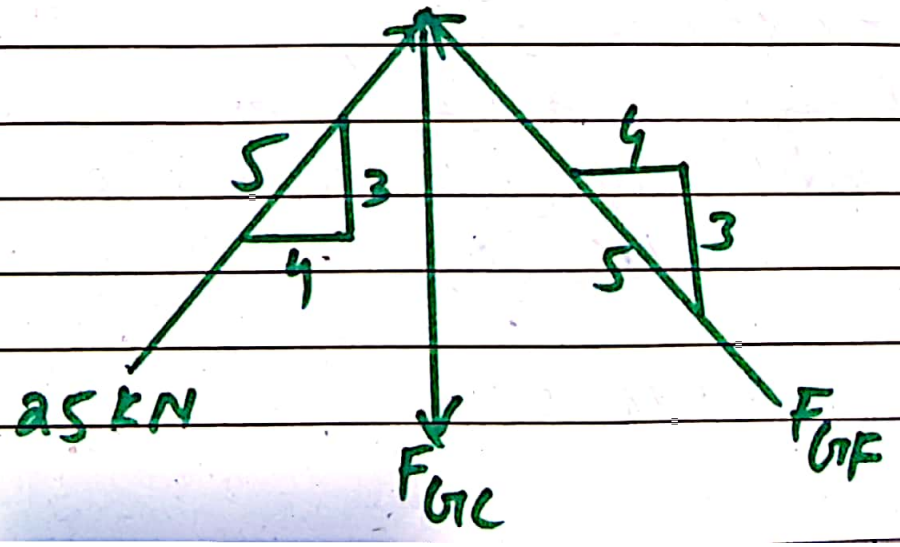
Joint G :-

$$\Sigma f_x = 0 \; ; \; \tfrac{4}{5}(25) - \tfrac{4}{5}(F_{GF}) = 0$$

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

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

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



Joint H:

$\Sigma f_y = 0$; $\frac{3}{5}(33.33) - 10\,KN + \frac{3}{5}(F_{HC}) - \frac{3}{5}(F_{HG}) \rightarrow (A)$

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

Solving eq (A) & (B)

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

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

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

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

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

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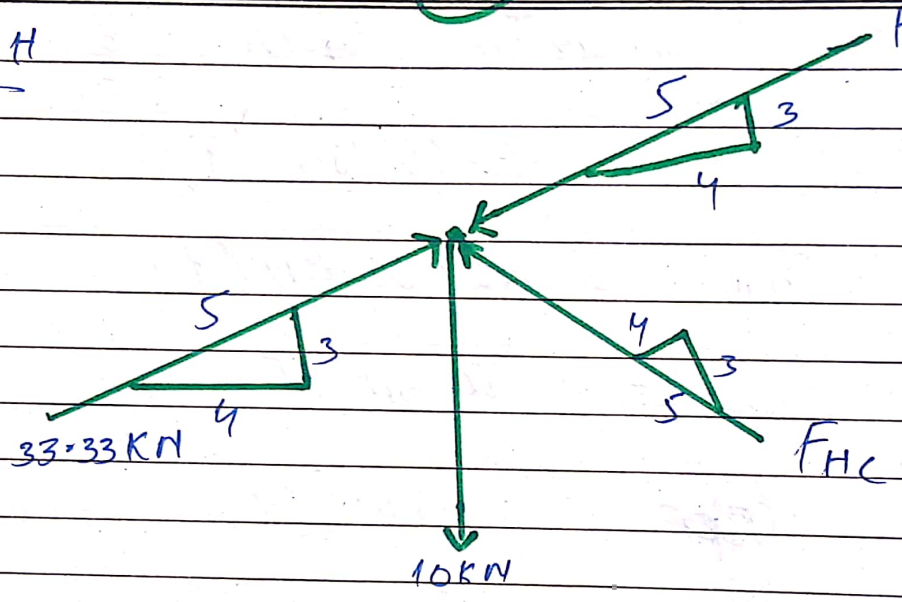
Joint H



Due to Symmetrical loading & Geometry

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

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

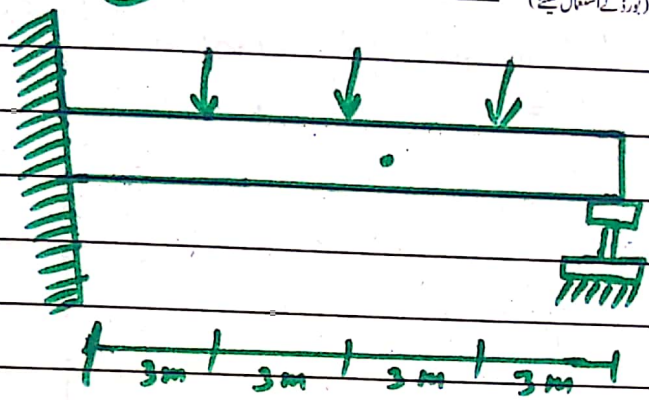
$F_{BH} = F_{DF} = 10\ KN\ (T)$

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

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

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

Q#03



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

Determine slope at point "A" & displacement at "C" by using moment Area Theorm –

Sol :- (i) Finding out M/EI Diagram of elastic Curve –

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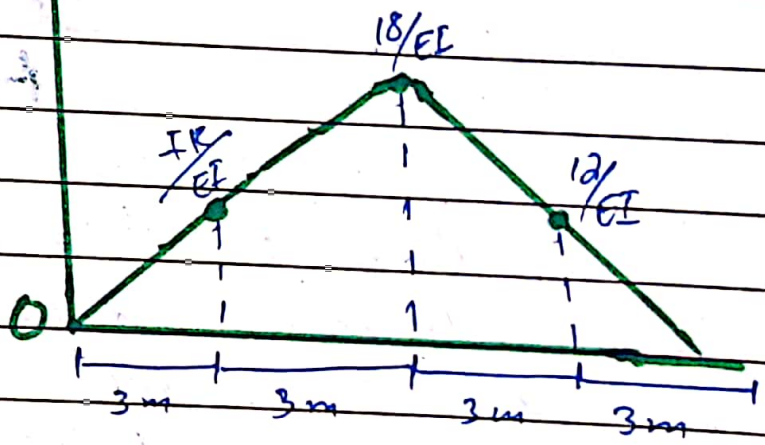
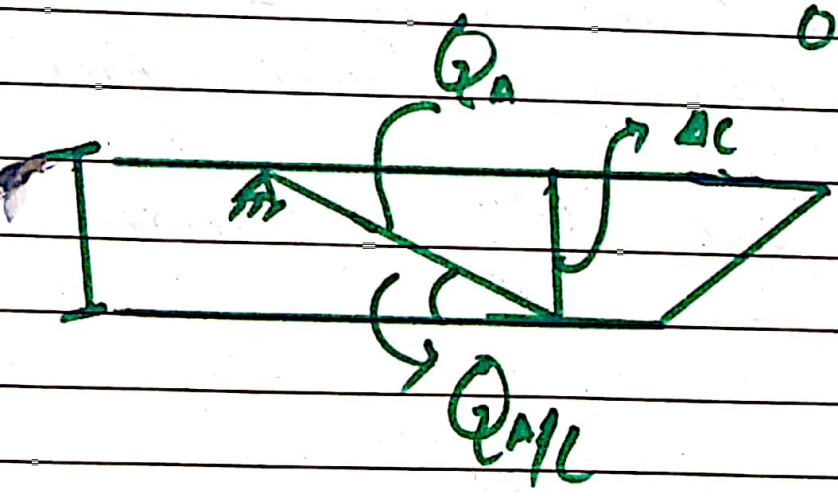
Moment Diagram

M/EI

Elastic curve





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

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

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

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

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

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

$$= 0.202 \text{ m}$$

(20)

So

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

$$= \boxed{202\ mm \quad \text{Answer}}$$