NAME = TALHA khan

SECTION = "B"

ID = 7982

Subject = Structure I

Teacher = Amjad Islam

Question #01

Ans

Loads:-

It is a dimensional requirement for a structure necessary to determine the loads that structure must support. There are differents of loads-

TYPES Of loads: Dead load

The first vertical load that is considered is dead laad. Dead loads are permant or stationary loads which are transferred to structure throughout the life span. Dead load is primarily due to selfweight of structure member, Permanent partion wall, fixed permanent equipments and weight of different material. It majorly consist of the weight of roof, beam, wall and column etc which are ~~outer~~ otherwise

Part of the building.

The calculation of dead loads of each structure are calculated by the volume of each section and multiplied with the unit weight.

Unit weight of some materials:

(i) Brick Masonry (18.8 kN/m³)

(ii) Plain cement concrete (24 kN/m³)

(iii) Stone Masonry (20 - 26 kN/m³)

⟹ Imposed load or live loads:

The Second vertical load is considered in design of a structure is imposed load or live loads. live loads or either movable or moving load with out any acceleration or impact. These loads are assumed to be produced by the intended use or occupancy of the building including weight of movable partitions.

⇒ Types of Structure:

The combination of structure element and the material from which they are composed is referred to as a structure system. Each system is constructed of one or more of four basic types of structure.

Trusses:

When the span of a struct is required to be large and its depth is not an important criterion for design, a truss may be selected. Trusses consist of slender element, usally arranged in triangular fastion.

=> Plancar trusses are composed of member that lie in the same plan.

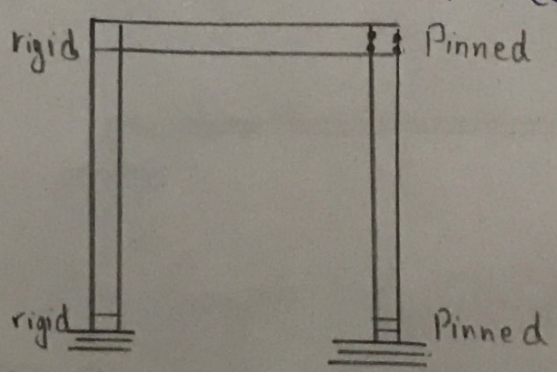
while space trusses have members extending in three dimensions.

Cables and Arches:

Cables and arches are used in long distances. It may be flexible and carry loads in tension. They are commonly used to support bridges, roofs. while arches achives stvength in compression it has a reverse curvature to that of the cable. The arches must be rigid.

Frames:

It is a type of structure which are used in building and it consist of beam and column which may be fixed or pin connected.

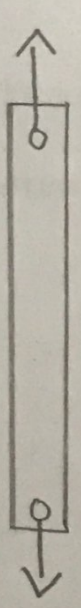


=> Structure Example :

Some of the more common element from which structure are composed are as follow-

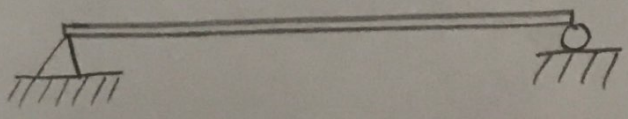
Tie rod :

Structure member subjected to a tensile force are often reffered to as tie rod or bracing struts- Due to the nature of this load, these member are rather slender-

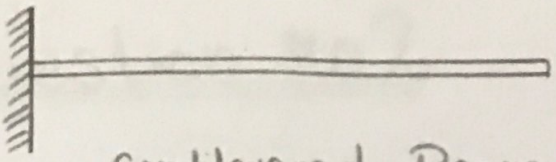


Tie rod

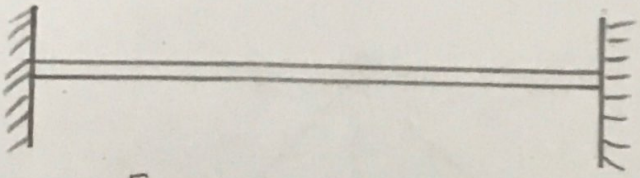
Beams : Thy are horizontal member and support vertical loads- To resist bending movement -



Simple supported Beam-



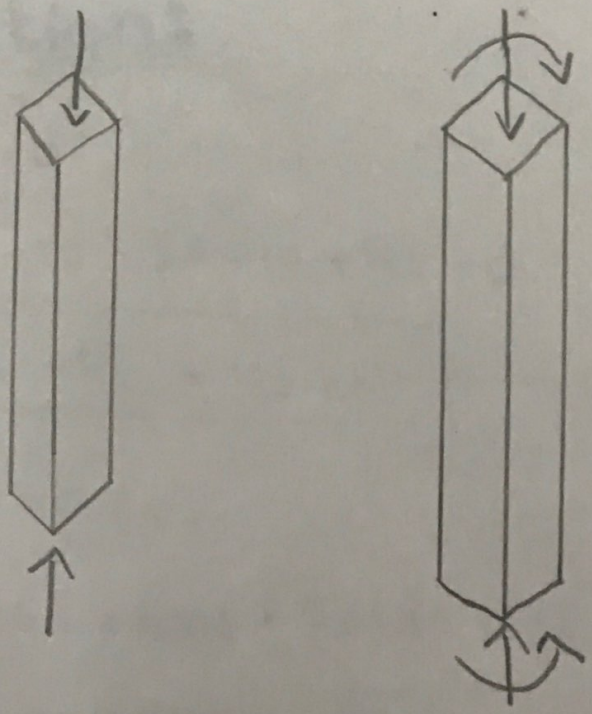
Contilevered Beam-



Fixed-Supported Beam

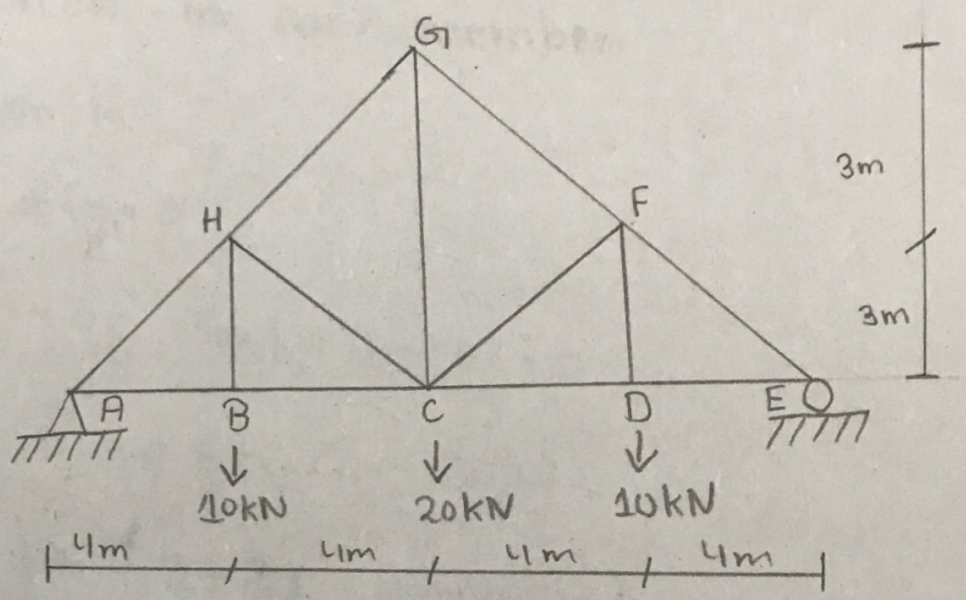
Columns:

Column is a member that are generally vertical and resist axial compremive loads are refferred to as column-



Question #02

Free body diagram :



Solution:

$+\uparrow \Sigma F_y = 0$

$R_A - 10 - 20 - 10 + R_E = 0$

$$\boxed{R_A + R_E = 40\ kN} \quad \text{(i)}$$

$\Sigma M = 0 \ \circlearrowright +$

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

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

Put R_E value in eq (i)

$R_A = 40 - 20$

$\boxed{R_A = 20\ kN}$

forces in each member.

Join A

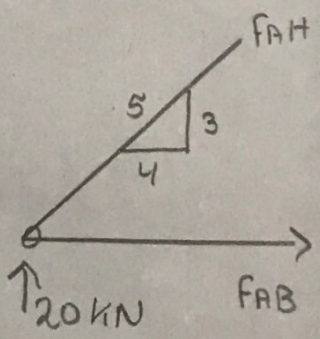
$\Sigma f_y = 0$

$-3/5\ (F_{AH}) + 20kN = 0$

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

$F_{AH} = 33.31$ (compression)

Now for $f_x = 0$



$f_x = 0$

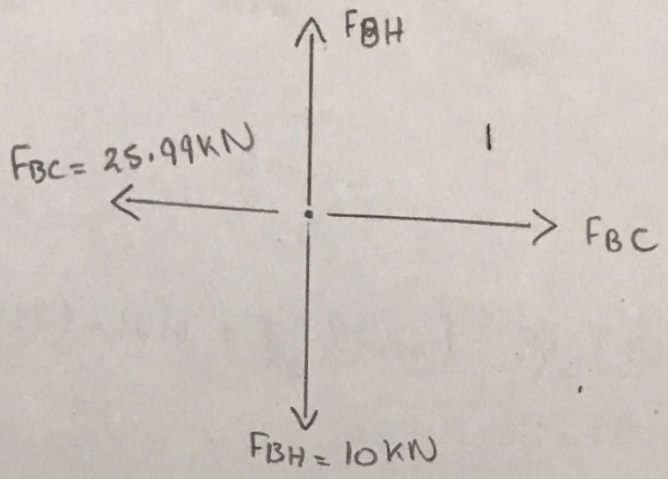
$-4/5\ (33.31) + F_{AB} = 0$

$\Rightarrow F_{AB} = 25.99\ kN$ (Tension)

Joint B

$\Sigma f_x = 0$; $F_{BC} = 25.99$

$\Sigma f_y = 0$; $F_{BH} = 10\,kN$



Joint G:

$\Sigma f_x = 0$;

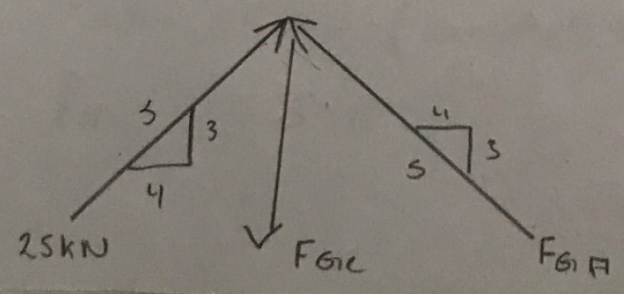
$4/5\,(25) - 4/5\,(F_{GH}) = 0$

$F_{GH} = 25\,kN$ (compression)

$\Sigma F_y = 0$;

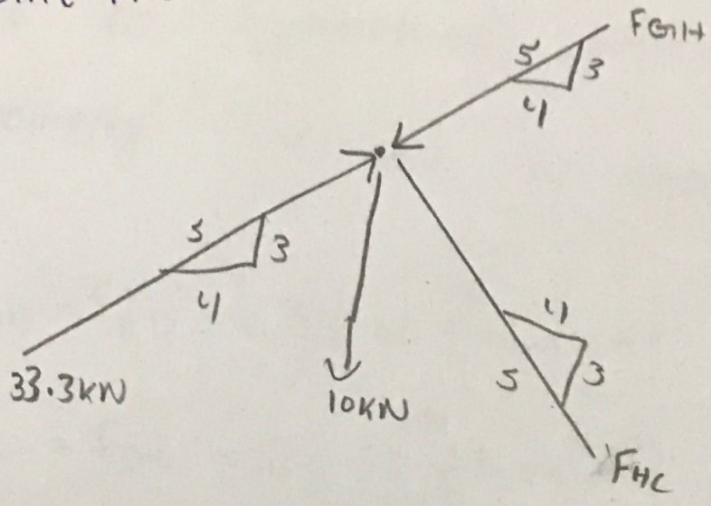
$3/5\,(25) + 3/5\,(25) - F_{GC} = 0$

$F_{GC} = 30\,kN$ (compression)



Page 10

Joint H :



Σ

$\Sigma f_y = 0$

$3/5\,(33.33) - 10^{k}N + 3/5\,(F_{HC}) - 3/5\,(F_{HG}) - (\star)$

$\Sigma f_{xc} = 0$

$4/5\,(33.33) - 4/5\,(F_{HC}) - 4/5\,(F_{HG}) \text{ —— } (i\star)$

Solving $\star$ and $(i\star)$

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

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

Multiplying eq $\star$ by 1.34 and then add with $(i\star)$ eq.

So we Get

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

$F_{HC} = 8.34^{k}N$ (")

Due to Symmetrical loading and Geometry we Get the answers

$F_{AB} = F_{ED} = 26.66$ KN (Tension)

$F_{BC} = F_{DC} = 26.66$ KN (Tension)

$F_{BH} = F_{DF} = 10$ kN (Tension)

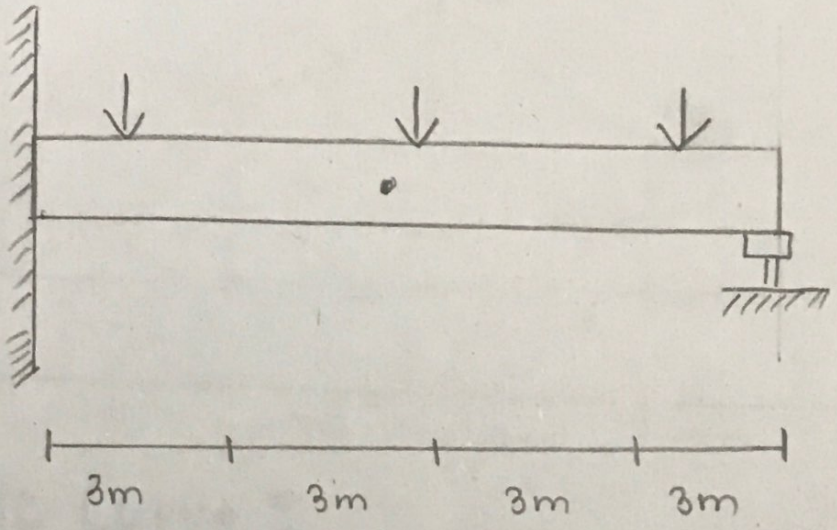
$F_{AH} = F_{CF} = 33.33$ kN (compression)

$F_{HC} = F_{FC} = 8.34$ kN (compression)

$F_{HG} = F_{FG} = 25$ kN (compression)

Question #03

free body diagram



Given :

$E = 20\ Gpa$

$I = 6 \times 10^6\ mm$

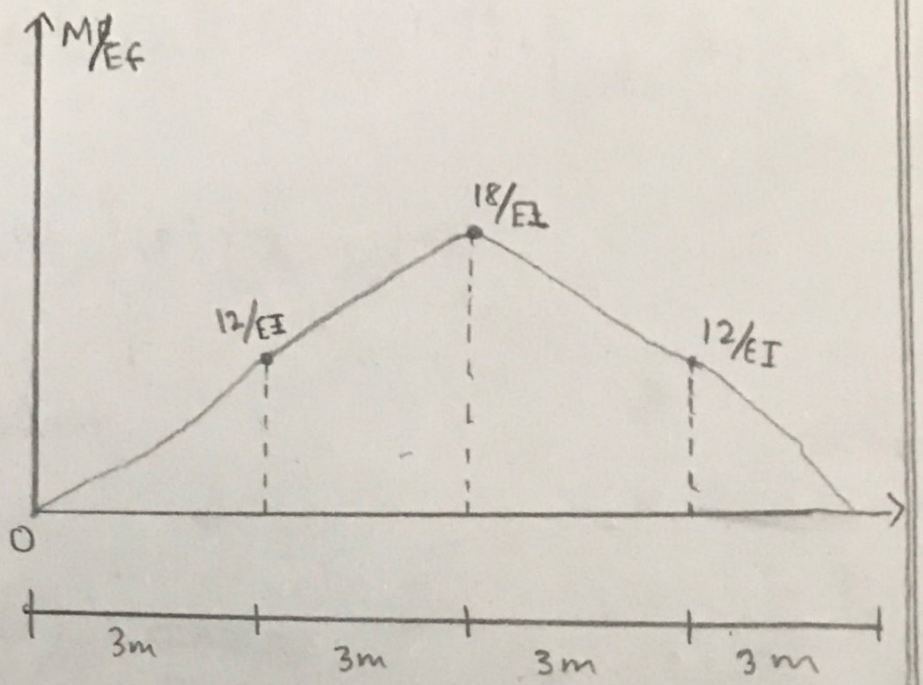
Required :

Determine slop at point (A) and displacement at point (C) using Moment area theorm

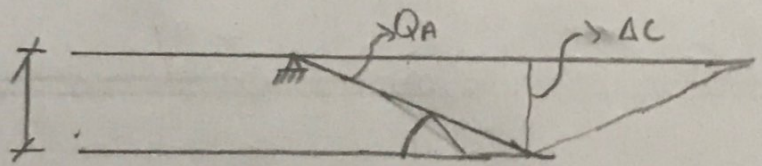
Solution :

Finding out M/EI Diagram of elastic curve-

Moment Diagram :



Elastic Curve :



$Q_{A/C}$

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

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

$$Q_{AC} = \frac{63}{EI} \Rightarrow \frac{63}{(200\times10^{6})(6\times10^{6})(1000)^{-4}}$$

$$Q_{A/C} = 0.0525$$

$$Q_A = 0.0525$$

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

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

$$= 0.202\,m$$

So

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

$$= 202\,mm \text{ Ans}$$