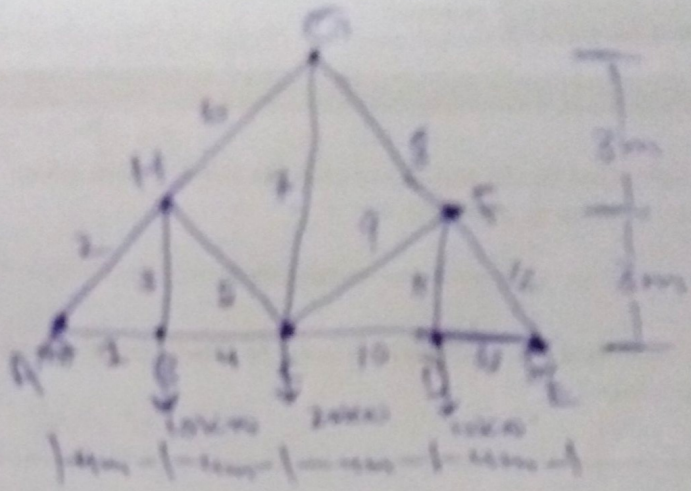
NAME ASAD-ullah

ID 7938

Section B

Assignment Structural Analysis.

Q.NO 2.5




Sol:-

Take moment At A By method of Joints.

$\curvearrowright +$

$10\times4 + 20\times8 + 10\times12 = RE\times16$

$\Rightarrow \boxed{RE = 20kN}$

$\Sigma Fy = 0 \quad \uparrow +\ \downarrow -$

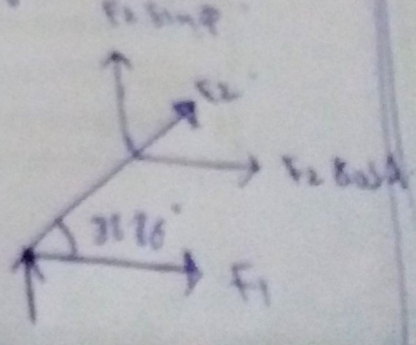
$RA + RE = 10 + 20 + 10$

$RA = 40 - RE$

$\boxed{RA = 20kN}$

Joint at A:-

Free body diagram:-




$\theta = \tan^{-1}[3/4]$

$\boxed{\theta = 36.86^\circ}$

$\Sigma F_x = 0 \rightarrow (+)$

$F_1 + F_2 \cos 36.86^\circ = 0 \rightarrow (1)$

$\Sigma F_y = 0 \quad \uparrow (+)$

$20 + F_2 \sin 36.86^\circ =$

$F_2 = \frac{-20}{\sin 36.86}$

$\boxed{F_2 = -33.34\ kN} \Rightarrow$ -ve sign show compression Toward Joint A.

From eq (1)

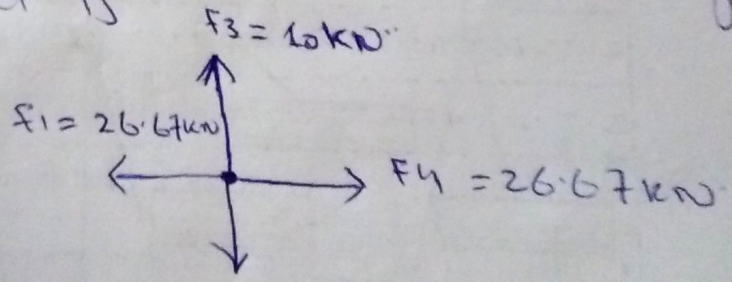
$F_1 = -F_2 \cos 36.86^\circ$

$F_1 = -(33.34)(\cos 36.86)$

$\boxed{F_1 = 26.67\ kN} \rightarrow$ Tension Assume direction is Right.

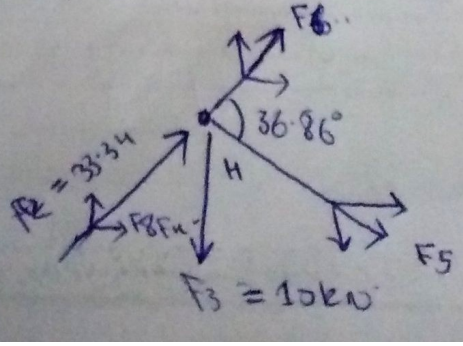
Free body diagram:

Take Joint B.




Freebody diagram.

Next take joint H.



$\Sigma F_x = 0 \rightarrow (1)$

$33.34\cos 36.86 + F_6\cos 36.86 + F_5\cos 36.86 = 0$

$F_6\cos 36.86 + F_5\cos 36.86 = -26.67\,kN \rightarrow (1)$

Now $\Sigma F_y = 0 \uparrow (+)$

$20 + F_6\sin 36.86 - F_5\sin 36.86 - 10 = 0$

~~$0.59F_6 + 0.8F_5 = 26.67\,kN$~~

$0.59F_6 - 0.59F_5 = -10 \rightarrow (2)$

eq (1) $\Rightarrow 0.59[0.80F_6 + 0.8F_5 = -26.67]$

$\Rightarrow 0.472F_6 + 0.472F_5 = -15.73 \rightarrow (3)$

eq (2) $\Rightarrow 0.80\times[0.59F_6 - 0.59F_5 = -10]$

$\Rightarrow 0.472F_6 - 0.472F_5 = -8 \rightarrow (4)$

Subtract eq 4 from eq 3

$+\ 0.472F_6 + 0.472F_5 = -15.73 \rightarrow (3)$

$\pm\ 0.472F_6 \mp 0.472F_5 = \mp 8$

$0.944F_5 = -7.73$

$F_5 = -8.18\,kN$

-ve sign show compression

Eq ⇒ (4)

$$0.472F_6 - 0.472F_5 = -8$$

$$0.472F_6 - 0.472(-8.18) = -8$$

$$0.472F_6 + 3.8609 = -8$$

$$0.472F_6 = -8 - 3.8609$$

$$\boxed{F_6 = -25.12\,kN}$$ -ve sign means compression.

Truss is symmetrical so

$F_1 = F_{13}$

$F_4 = F_{10}$

$F_5 = F_9$

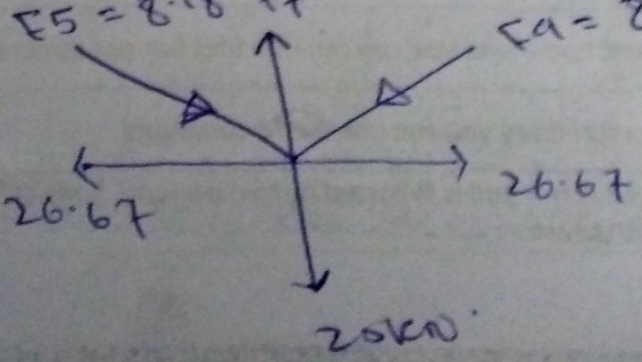
$F_6 = F_8$

$F_2 = F_{12}$

$F_3 = F_{11}$

Now Joint Co.

Free body diagram:

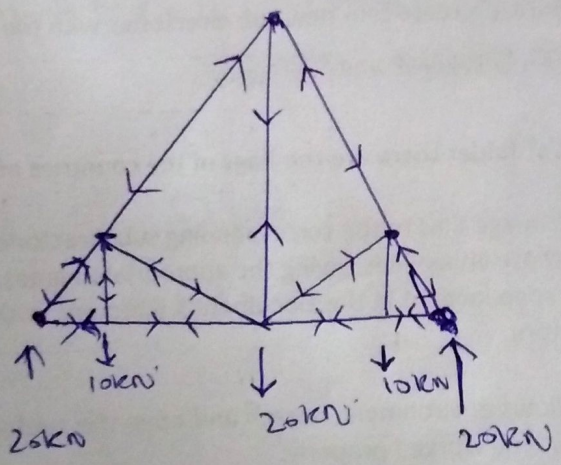


$\Sigma F_y = 0$ ↑(+)

$-20 + F_7 - 8.18 \times \sin 36.86 + 8.18 \times \sin 36.86$

$\boxed{F_7 = 29.8\,kN}$

Final sketch:

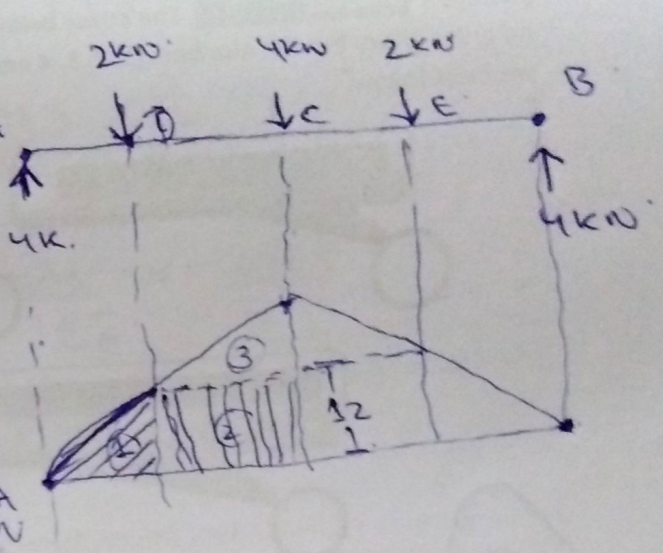



Arrow toward Joint shows compression Arrow away From Joint shows tenshion in members.

# QNo 3½

Given: $E = 200 GPa$

$I = 6 \times 10^6 mm$




Sol:

$M_A = 0$

$M_D = 4 \times 3 = 12 KNm$

$M_C = 4 \times 6 - 2 \times 3 = 18$

$M_E = 4 \times 9 - 2 \times 6 - 4 \times 3 = 12 KN$

1) Deflection At C = Area x coresponding center of Area from point A

So

Area of first Δ shaded portion =

$\frac{1}{2} \times 12 \times 3 = 18 = \frac{18}{EI}$

Center $= \frac{2}{3} \times 3 = 2$

Area of second Shaded Area $= 12 \times 3 = \frac{36}{EI}$

Centriod $= 3 + 3/2 = 4.5$

Area of ~~Period~~ 3 shaded portion Area

$\frac{1}{2}(18-12)3 = 9 = 9/EI$

centriod $= 3 + \frac{2}{3} \times 3 = 5$

So deflection At C =

$$\frac{18}{EI} \times 2 + \frac{36}{EI} \times 4.5 + \frac{9}{EI} \times 5$$

$$\Delta c = \frac{36}{EI} + \frac{162}{EI} + \frac{4}{EI} = \frac{243}{EI}$$

So puting E & I value.

$$= \frac{243}{(200\times10^6)(6\times10^6)(1000)^{-4}}$$

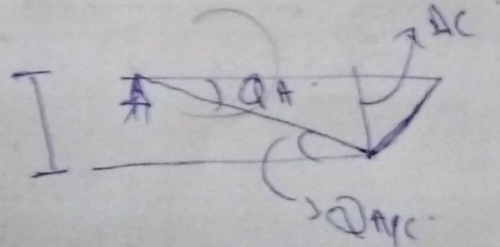
$$= 243/1200 = 0.202\,m.$$

So $\Delta c = t_{A/C} =$ 202 m $\downarrow$ m.

To Find slope.

Solp. = Ac

$A_{AC}$ = Area under the curve




$$= \frac{1}{2}\times12\times3 + 12\times3 + \frac{1}{2}\times(18-12)\times3.$$

$$AC = 18 + 36 + 9 = 63/EI \Rightarrow \frac{63}{(200\times10^6)(6\times10^6)(1000)^{-4}}$$

$$\theta_{A/C} = \theta_A = \frac{63}{1200} = 0.525R.$$

Q No 1:

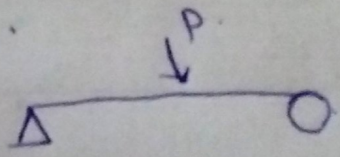
Ans: **load:** It's the dimensional requirment for the structure necessary to determine the loads the structure must support.

**Types of load:**

1. Pointed load.
2. Distributed load.
3. couple load.

**Point load:** (concentrated load)

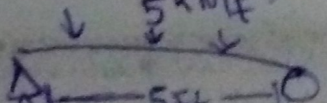
Point load is that type of load which acts over small distance this load can may be considered as acting on a point denoted by P.




**Distributed load:**

Distributed load is measured per unit length

eg. means 5kN acting on 5ft = equale to 25kN/ft



they are further Divide into 2 types uniformly Distributed load (UDL) uniformly varying load (non uniformly distributed load)

## couple load:

couple load is that type of load in which two equal & opposite force acts on the same span the lines of action of both the forces are Parrallel to each other but opposite in directions. This types of loading creats couple load.

It can be express in kip·m, kg·m., N·m etc

## Types of structure:

There are four basic types of structure are.

1. Trusses
2. Cables and Arches
3. Frames
4. surface structure.

## Trusses:-

① Consist of slender member Arrange in triangular pattern.

② It is of two types - planer truss & space truss

③ They are subjected to axial force only.

## Cables:-

① They are used to span long Distance

② They are used to support bridges & building roof.

eg Golden Gate bridge.

## Arches:-

They are rigid structure and are used in brudge structure, dome roofs, opening in masonary walls.

## Frames:-

It is composed of beam & ~~couple~~ column that are connected together and are use in building structure

## surface structure :-

① Member, plates type structure with much less thickness as compare to it's other ~~structure~~ dimension.

② The structure is subjected to tension or compression ~~only~~ force only.

③ They may be of rigid materials such as reinforcement concrete.

They are various types:-

① tension member.
② columns or struts
③ Beams.
④ members subjected to combined loading beam-columns.