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Section	B
exam	mid term
Assignment	structural Analysis.

Q1

load

gtis the dimensional requirment for the structure necessary to determine the loads the structure must support.

Types of load

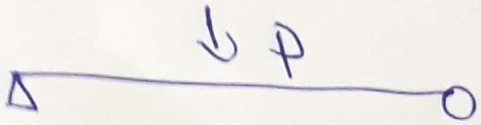
(1) couple load
(2) pointed load
(3) Distributed load

couple load

couple load is that type of load in which two equal and opposite force act on the same span. The lines of action of both the forces are parallel to each other but opposite in directions. They

Pointed load

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

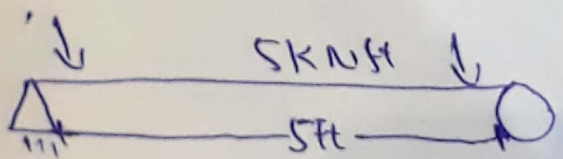


Distributed load

is measured per unit length is called Distributed load.

eg:

Means 5kg acting on 5ft equall to 25KNK.



Types of Structure

There are four basic types of structure.

(1) Surface Structure
(2) Frames Structure
(3) Cables and Arches structure
(4) Trusses structure

Frames structure

It is composed of beam and column that are connected together and are used in building structure.

Cables

⇒ They are used to long Distance.

⇒ They are used to support bridges and building Roof.

Arches

They are rigid structure and are used in bridge structure, dome roofs, opening in masonry walls.

Surface structure

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

⇒ They structure is subjected to tension or compression force only.

⇒ Member, plates types structure with much less thickness as compared to its other dimension.

They are various types

(1) colums or struts
(2) Beams
(3) tension member
(4) Member subjected to combined load beam - columns.

Trusses

=> consist of slender member arrange in triangular pattern.

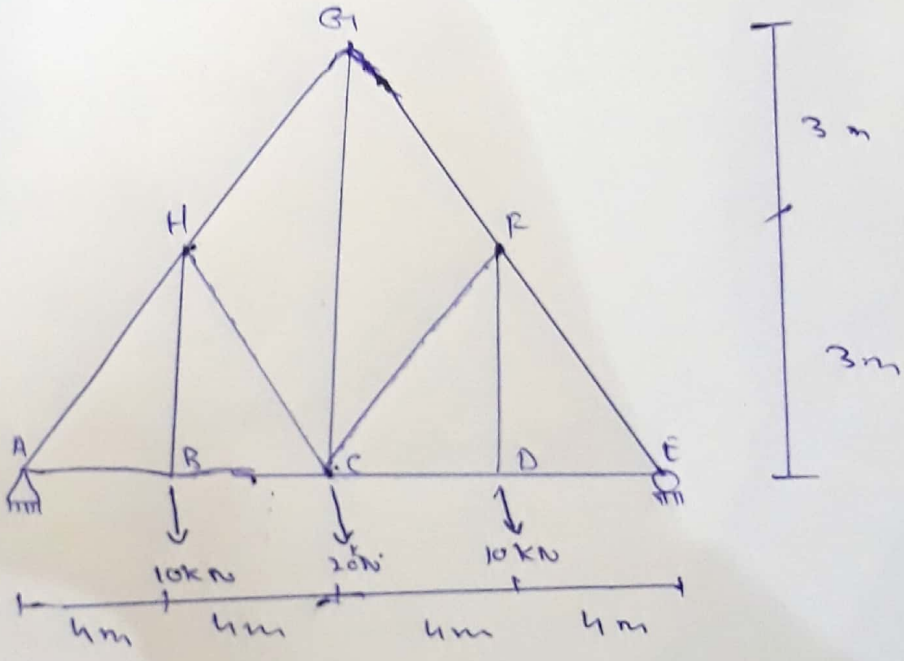
=> They are subjected to axial force only.

=> Trusses are two types

(1) Planer truss

(2) Space Trusses.

Q2



Force in each member

Solution

Take moment at A By method of Joints.

$10 \times 4 + 20 \times 8 + 10 \times 12 = RE \times 16$

$\Rightarrow$ **RE = 20KN**

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

$RA + RE = 10 + 20 + 10$

$RA = 40 - RE$

RA = 20KN

Joint at A

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

$\theta = 36.86^\circ$

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

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

$\Sigma Fy = 0 \uparrow (+)$

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

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

F2 = -33.34KN -ve sign show compressing towered Joint A.

For eqn (1)

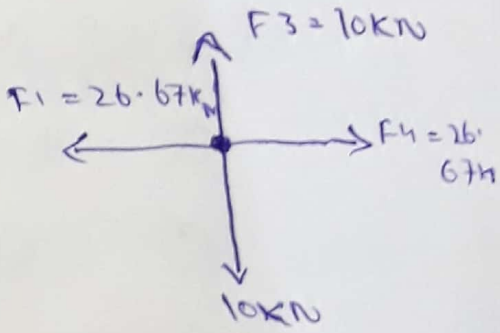
$$F1 = -F2 \cos 36.86^\circ$$

$$F1 = -(33.34)(\cos 36.86)$$

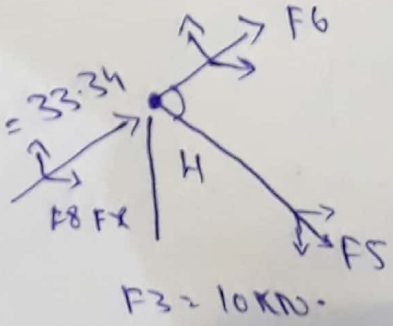
$$\boxed{F1 = 26.67 kN}$$ -Tension Assume direction is right.

Free body diagram.

Take Joint B



Freebody diagram Next take Joint H



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

$$33.34 \cos 36.86^\circ + F6 \cos 36.86 + F5 \cos 36.86^\circ = 0$$

$$F6 \cos 36.80^\circ + F5 \cos 36.86^\circ = -26.67 kN \rightarrow (1)$$

Now $\Sigma Fy = 0$? (1)

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

$0.59F_6 - 0.59F_5 = -10$ (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)

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

$\pm 0.47256 \mp 0.472F_5 = \mp 8$

$0.944F_5 = -7.73$

$F_5 = -8.18\,kN$

-ve sign show compression.

eq $\Rightarrow$ (4)

$0.472F_6 - 0.472F_5 = -8$

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

$0.472F_6 + 3.8609 = -8$

$0.4725F_6 = -8 - 3.8609$

$\boxed{F_6 = -25.12\ KN}$ -ve sign mean compression.

Truss is symmetrical so

$F_1 = F_{13}$

$F_4 = F_{10}$

$F_5 = F_9$

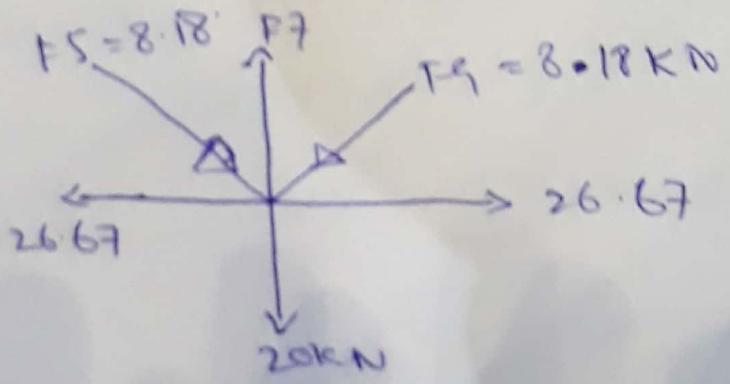
$F_6 = F_8$

$F_2 = F_{12}$

$F_3 = F_{11}$

Now Joint C

Free body diagram.

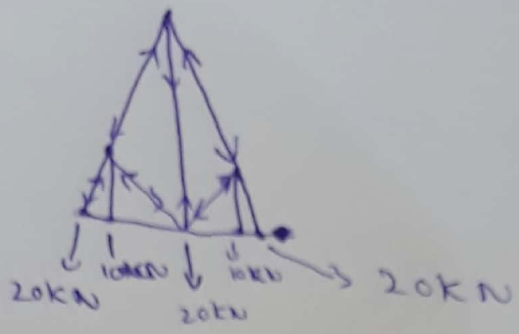


$\Sigma F_y = 0 \uparrow +$

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

$F_7 = 29.8\,kN$

Final sketch



Arrow towards joint shows compression Arrow away from joint show tenshion in members.

Q3

Given

$E = 200\,GPa$

$I = 6 \times 10^{6}\,mm$

Solution

$M_A = 0$

$M_D = 4 \times 3 = 12\,kNm$

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

$ME = 4\times 9 - 2\times 6 - 4\times 3 = 12\,kN$

Deflection At c = Area x corresponding 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 3 shaded portion Area $1/2$

$(18-12) = 9 = 9/EI$

Centriod $= 3 + 2/3 \times 3 = 5$

So deflection At $c = \frac{18}{EI} \times 2 + \frac{36}{EI} \times 4.5 + \frac{9}{EI} \times 5$

$\Delta c \; \frac{36}{EI} + \frac{162}{EI} + \frac{45}{EI} = \frac{243}{EI}$

So puting E and I value

= ~~243~~ / /

(12)

(12)

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

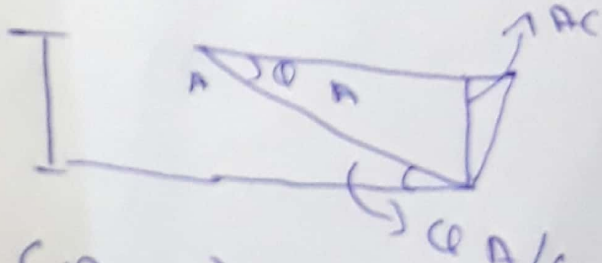
$$= 243/1200 = 0.202\ m$$

$$SO\ \Delta c = t_A/c = 202\ m$$

To find slope

Solp = Ac

Area under the curve



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

$$Ac = 18+36+9 = 63/t\ I \Rightarrow$$

$$Q\ A/c = \Phi_A = \frac{63}{1200} = \boxed{0.525R}$$