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Section B

Subject Structure Analysis.

Q = 1:- {P → 1}

Loads:-

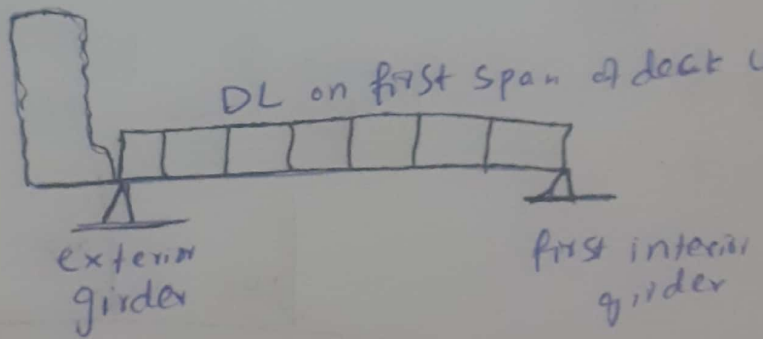
loads are same sort of force.

major types of loads are following.

Types of loads:-

Dead Loads:-

Dead loads are those load which are considerd to act permanently and unable to be removed-



Live loads:-

Live loads are not permanent and can change in magnitude.

→ They include items found within a building.

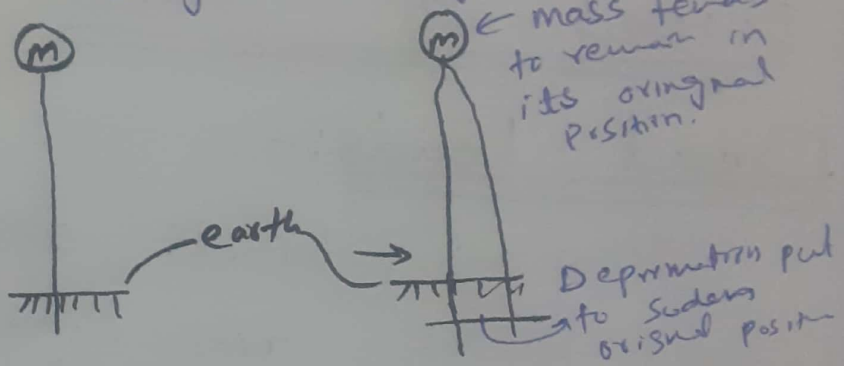
Earthquake loads :-

Earthquake loads are another lateral live load.

⇒ They are very comlex, uncertain and Portentially more damging Than wind load.

Example :-

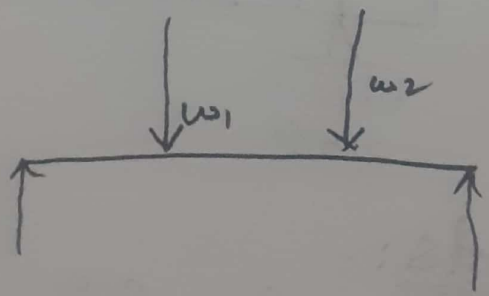
Earthquake loads are mostly used in a large bridge, clock mn & building.



Point load :-

The load Concentrated at one Point is called Point load.

unit of P is N or kN

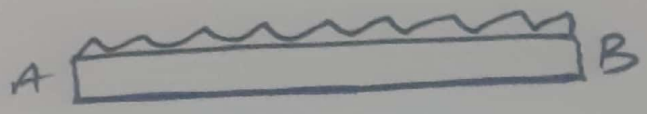


Uniformly distributed Load :-

Load uniformly distributed on certain length of a beam.

⇒ it is written by U.d.I

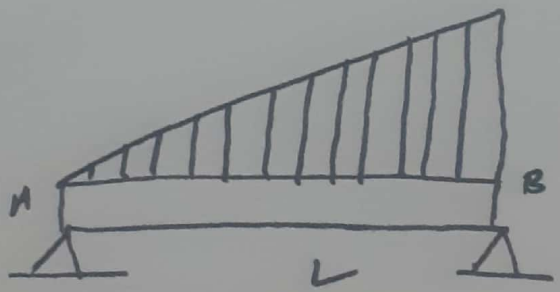
⇒ it is shown by w.



Uniformly varying Load :-

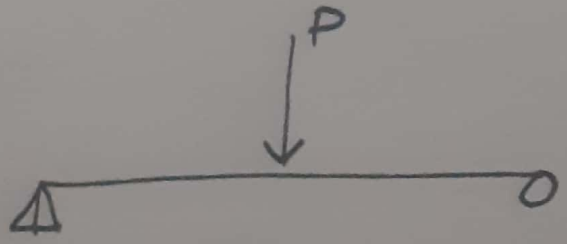
This type of load gradully increase on the length of the beam.

⇒ it is also called triangular Load.



Point load :-

Point load is that load which act over a small distance.



Distributed Load :-

Distributed load is that act over a considerable length.

⇒ it is measure as per unit L

Example :-

⇒ 10k/ft ⇒ ten kips of load is acting per foot.

⇒ 10' ⇒ 100kips over length.

Types of distributed Load.

⇒ UDL

⇒ UVL

Trapezoidal load :-

Trapezoidal load is that which is acting on the span length in the form of trapezord.

Coupled Load :-

Coupled load is that in which two equal and ~~couple~~ opposite forces act on the same span.

⇒ This type of load creates a couple load.

Types of Structures:-

The Combination of structure element and materials from which they are composed is referred to as a structural system.

⇒ The four basic types of structures are:

⇒ Trusses
⇒ Cables & Arches
⇒ Frames
⇒ Surface Structure.

Trusses:-

⇒ Consist of slender member, arranged in triangle pattern
⇒ it is of two types. plane truss and space truss.
⇒ They are subjected to axial force only.

Surface Structures -

⇒ Members, plates or shell types structures with much less thickness as compared to its other dimension.

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

⇒ May be made of rigid material such as rainforced concrete.

⇒ May be shaped as folded plastic etc.

Cables :-

⇒ They are used to span long distance.

⇒ They are used to support bridges and building roof

⇒ E.g Golden Gate bridge.

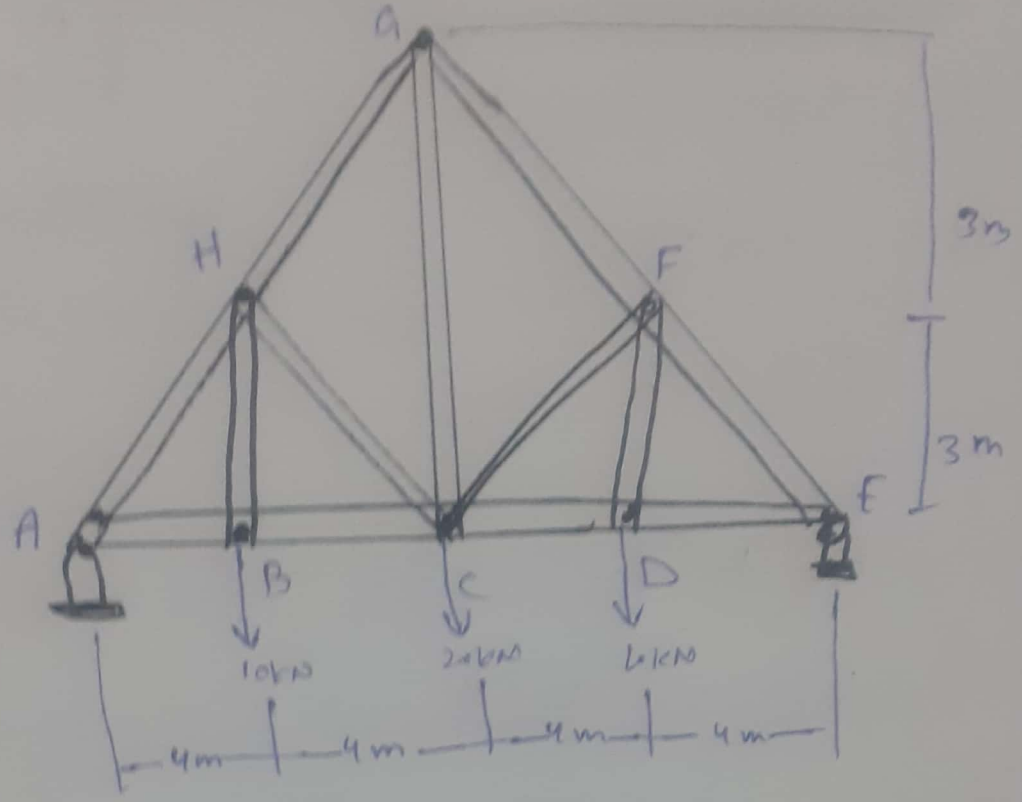
Arches :-

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

Frames :-

⇒ Composed of beam and columns that are connected together and are used in building structure.

Q = 2 :-



Solution :-

Take moment at A ↻ ↺+

By method of Joints :-

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

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

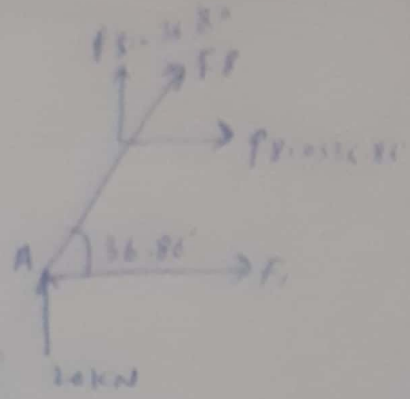
$\Sigma Fy = 0 \quad \uparrow + \downarrow -$

$RA + RE = 10 + 20 + 10$

$RA = 10 + 20 + 10 - RE$

$RA = 40 - 20 \Rightarrow \boxed{RA = 20kN}$

Joint A :-



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

$\theta = 36.86°$

$\Sigma F_x = 0 \rightarrow +$

$F_1 + F_8 \cos 36.86° = 0$

$\Sigma F_y = 0 \uparrow +$

$20 + F_8 \sin 36.86 = 0$

$F_8 = \frac{-20}{\sin 36.86}$

$F_8 = -33.34\,kN$ → compression

Toward Joint A

From eq ①

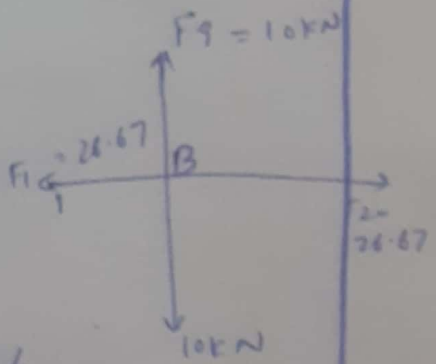
$\Rightarrow F_1 = -F_8 \cos 36.86°$

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

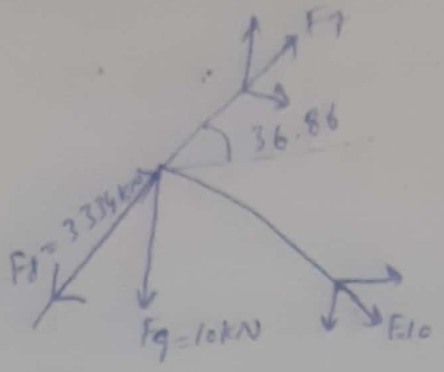
$F_1 = 26.67\,kN$ → Tension

Assume direction is right

Take joint B.



Next Take joint H:-



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

$33.34\cos 36.86 + F_7 \cos 36.86^\circ + F_{10}\cos 36.86^\circ = 0$

$F_7\cos 36.86^\circ + F_{10}\cos 36.86^\circ = -26.67\,kN$

$0.80F_7 + 0.8F_{10} = \underline{26.67\,kN} \rightarrow (1)$

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

$20 + F_7 \sin 36.38 - F_{10}\sin 36.86^\circ - 10 = 0$

$0.59F_7 - 0.59F_{10} = \underline{-10} \rightarrow (2)$

eq (1) $\Rightarrow 0.59 \times [0.80F_7 + 0.8F_{10} = 26.67]$

$\Rightarrow 0.472F_7 + 0.472F_{10} = \underline{-15.73} \rightarrow (3)$

eq (2) $\Rightarrow 0.80 \times [0.59F_7 - 0.59F_{10} = -10]$

$\Rightarrow 0.472F_7 - 0.472F_{10} = \underline{-8} \rightarrow (4)$

Subtract eq (4) from eq (3)

$$+0.472F7 + 0.472F10 = -15.73 \quad \text{---(3)}$$
$$+0.472F7 - 0.472F10 = -8$$

$$0.944F10 = -7.73$$

$$F10 = -8.18\,kN \quad \text{Compression.}$$

Eq 4 $\Rightarrow$

$$0.472F7 + 0.472F10 = -8$$

$$0.472 \times F7 - 0.472 \times [8.18] = -8$$

$$0.472F7 + 3.8609 = -8$$

$$0.472F7 = -8 - 3.8609$$

$$F7 = -25.12\,kN \quad \text{Compression.}$$

Truss is symmetrical so

$F_1 = F_4$

$F_2 = F_3$

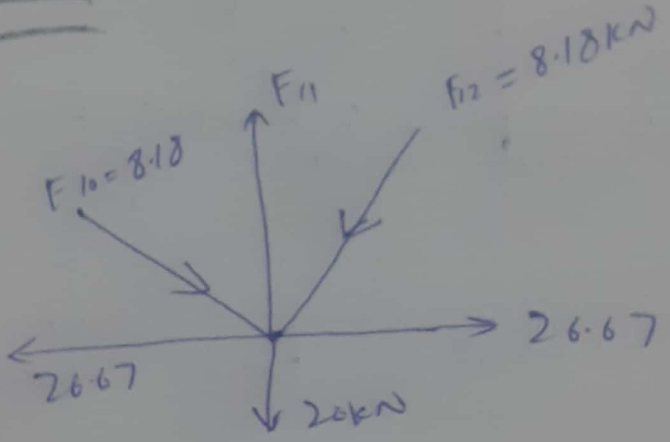
$F_{10} = F_{12}$

$F_7 = F_6$

$F_8 = F_5$

$F_9 = F_{13}$

No Joint C

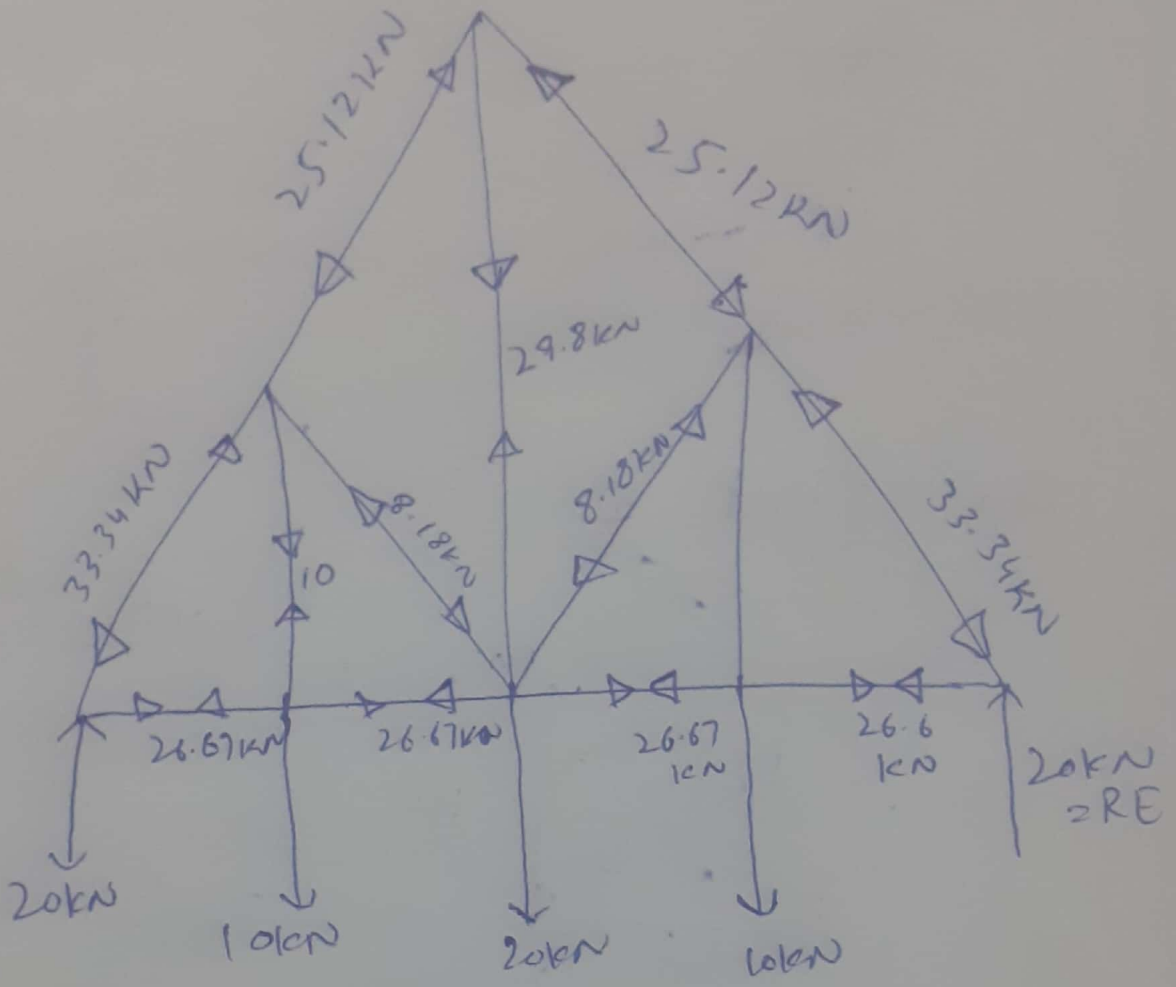


$\Sigma F_y = 0$ ↑ (+)

$-20 + F_{11} - 8.18 \times \sin 36.86 + 8.18 \times \sin 36.86 = 0$

$\Rightarrow F_{11} = 29.8\,KN$

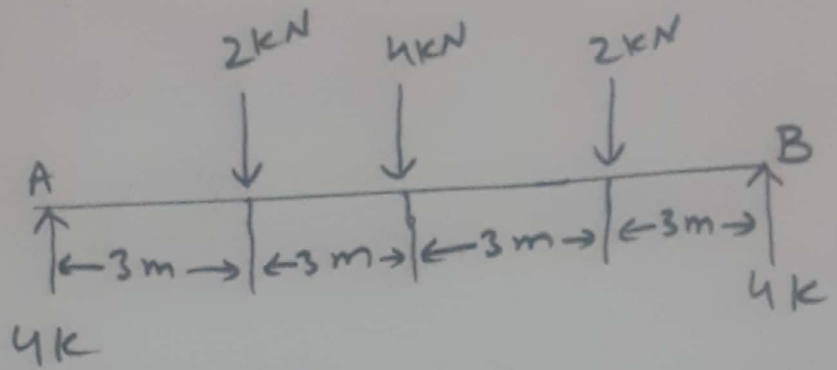
Final Sketch :-

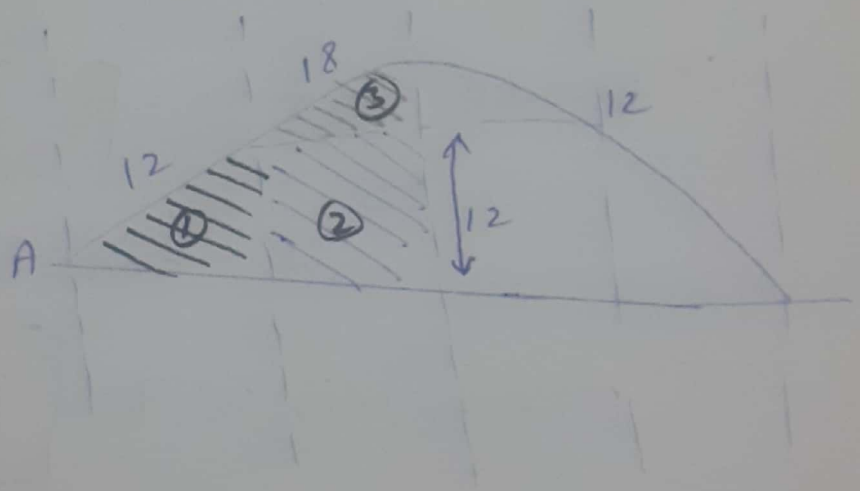


Arrow Toward Joint Shows Compression Arrow. Away from Joint Shows Tension in member.

Q = 3 :-

Solution:-





$M_A = \underline{0}$

$M_D = 4 \times 3 = \underline{12\ kN}$

$M_C = 4 \times 6 - 2 \times 3 = \underline{18}\ kN$

$M_E \quad 4 \times 9 - 2 \times 6 - 4 \times 3 = \underline{12\ kN.m.}$

deflection at C = Area x corresponding center of area from point A

So,

⇒ Area of first black sheet portion = $\frac{1}{2} \times 12 \times 3 = 18 = \boxed{18/EI}$

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

⇒ Area of 2nd blue sheet portion = $12 \times 3 = 36 = \boxed{36/EI}$

Centriod = $3 + 3/2 = \boxed{4.5}$

⇒ Area of 3rd pencil portion =

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

Centriod = $3 + \frac{2}{3} * 3 = \boxed{5}$

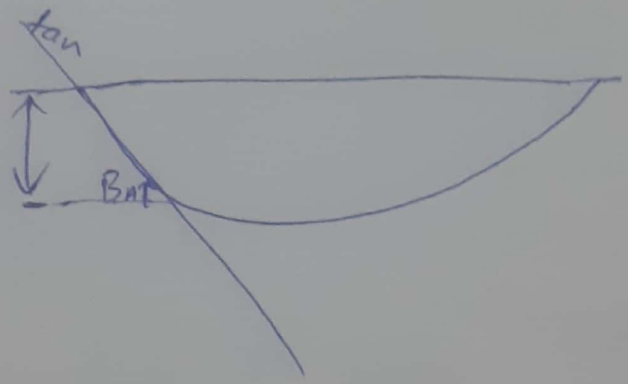
So

Deflection at C =

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

$$\Delta_C = \frac{36}{EI} + \frac{162}{EI} + \frac{45}{EI} = \left\{\frac{243}{EI}\right\}$$

To find **Slope**:-



Slop = BA

BA = Area under curve

$$BA = \frac{1}{2} \times 12 \times 3 + 12 \times 3 + \frac{1}{2} \times (18-12) \times 3$$

$$BA = 18 + 36 + 9 = \{63/EI\}$$