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Section	B
Subject	Structure analysis
Exam	Mid-Term
Department	Civil
Semister	4th

Question No # (1)

Load :

A weight or source of pressure born by some one or something. construction load are defined as. load imposed on a completed or temporary structure during and as a result of the construction process.

Types of load:-

There are different types of load

=> Dead load:-

It consist of structural member that are permenently attached to structure Dead load includes the weight of column, beam, electrical flexure and other attachment

=> Live load:-

Live load can very both in their magnitude and location. These load are caused

by weight of temporily object, moving vehicle, natural forces consist of additional protection against accels deflection and overload.

Examples

The floor loading in classroom consist of disks, chair and laboratory equipment

⇒ Wind load:

wind load is the "load" placed by the wind speed and its air density onto a building. with high velocity wind, low pressure area are created on the building which created suction pressure.

(4)

=> impact load:

Its mean the load applied by a moving object (like a blow). The application time of this load is negligible, as opposed to other load which are applied gradually or over a long period of time.

☆ Structure:

A structure is a series of connected, inter related element that form together a system that can resist a series of external load effect applied to it.

(5)

Different types of Structures:-

⇒ Trusses:-

Trusses consist of slender element in triangular form. Due to geometric arrangement of its member bend are converted into tensile or compressive force in member.

1) Planer trusses are composed of member. lies in some plane and used for bridge and roof supported.

2) Space trusses have member extended in three dimension and its used for tower.

16)

=> Cables and Arches:

It is the types of structure used to span long distance

1) Cable are flexible and carry load in tension they are commo-nly used to support bridge, and roofs.

2) Arches achieve strength in compression and has a curvature to cable. It must be rigid to maintain its shape consist of chear and moment. They are used in bridge structure

(7)

=> Frames :-

A frame structure is a structure having the combination of beam, column and slab to resist the literal and gravity load. Thes structure are usually used to overcome the large moment developing due to the applied load.

→ Structure of element :-

Some of the element are

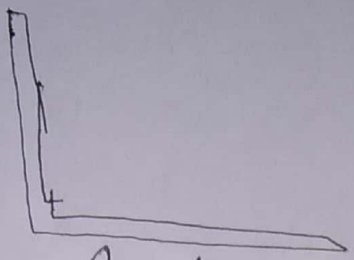
=> Tie rods :-

consist of tensile force. these members are bar or rods

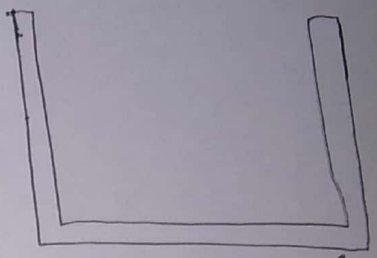
(8)

Tie bar

Rod



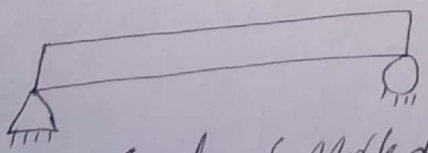
Angle



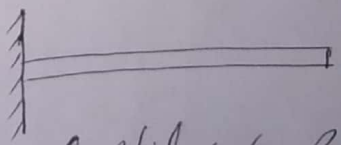
Channel

⇒ Beams :-

They are horizontal member and support vertical load. It resist bending moment.



Simply supported



Cantilever Beam

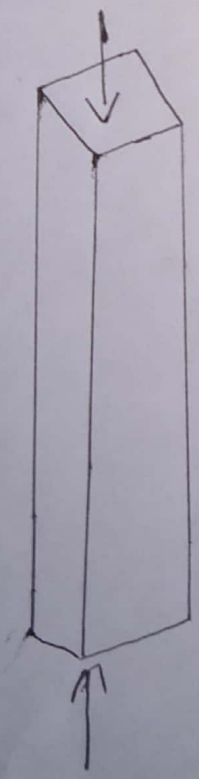
Fixed supported

(9)

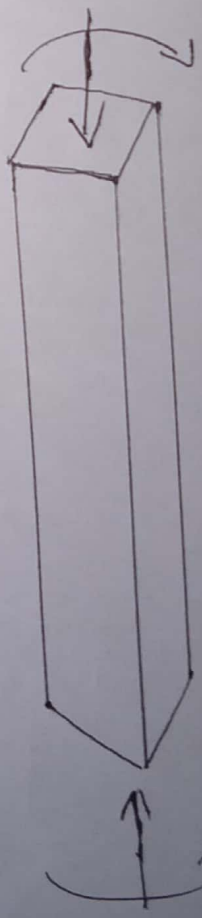
Column:

They consist of verticle member and resist compressive load

Tube and wide flange across section are used for metal column and square cross section rods are used for concrete work



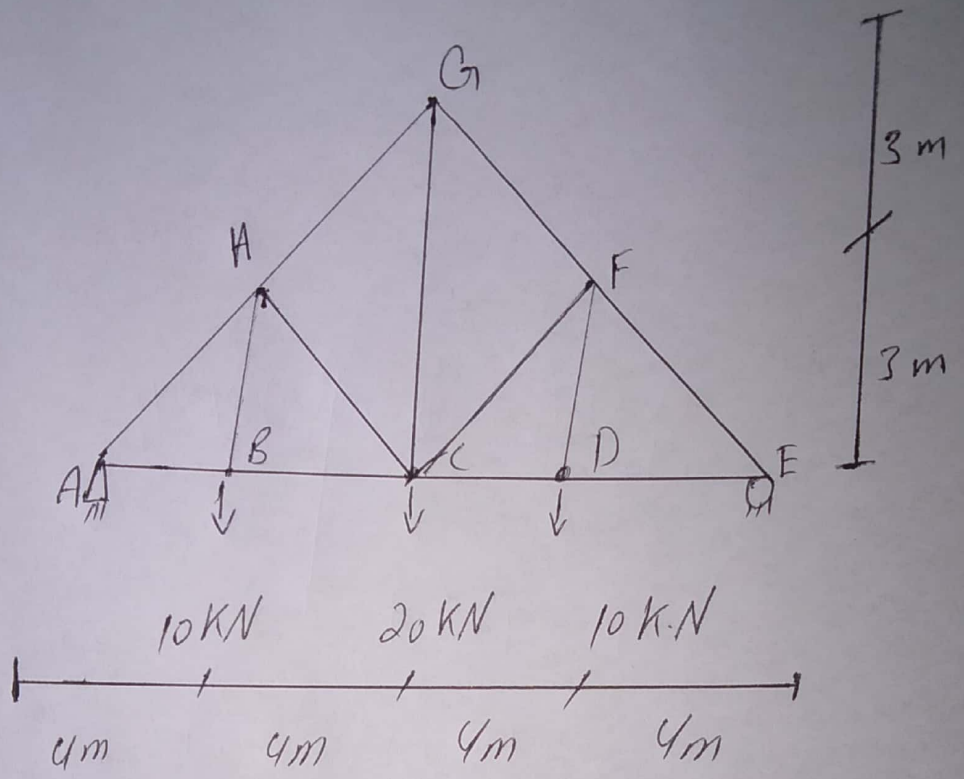
Column



Beam column

(10)

Question No # 2



Forces in each members

Sol:

Suppor reaction:

$\Sigma F_Y = 0$ $\uparrow^{+}$ $\downarrow^{-}$

$R_A + R_E = 40 \longrightarrow (A)$

$\Sigma M_4 = 0 \circlearrowright^{-}$

11

$$R_E(16) + 10(12) + 20(8) + 10(4) = 0$$

$$R_E = \frac{320}{16} \Rightarrow \boxed{20\ K.N}$$

Put 20 in eq (A)

$$R_A + R_E = 40$$

$$R_A = 40 - R_E$$

$$R_A = 40 - 20$$

$$\boxed{R_A = 20\ KN}$$

Now determine force in each member

Joint A:

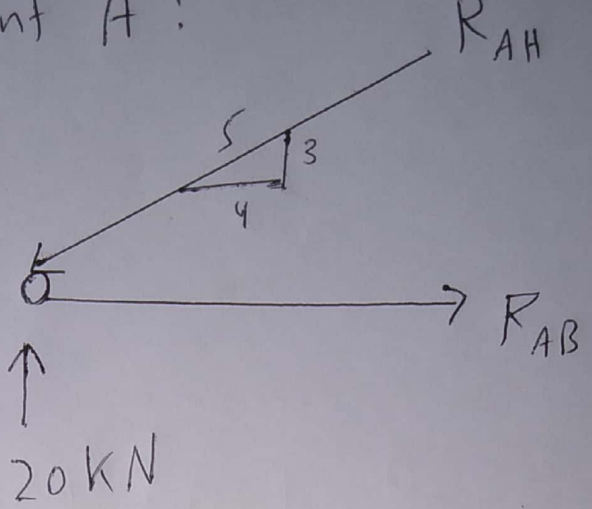
$$\Sigma F_Y = 0; \quad \frac{-3}{5}(F_{AH}) + 20\ k.N = 0$$

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

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

12

Joint A :



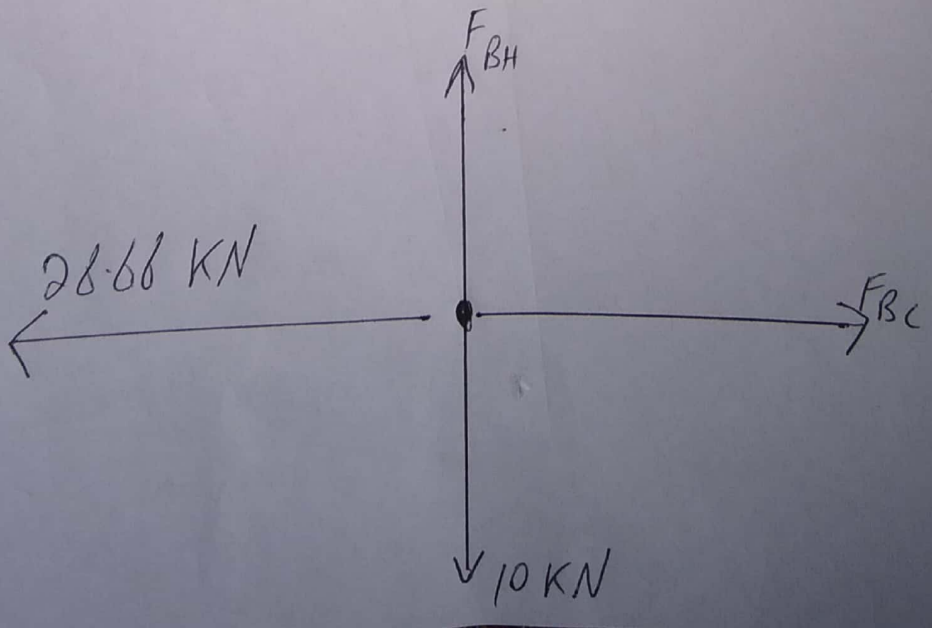
$$\Sigma F_x = 0 \; ; \; -4/5\,(33.33) + R_{AB} = 0$$

$$\Rightarrow F_{AB} = 26.66 \text{ kN}_{(T)}$$

Joint B :

$$\Sigma F_x = 0 \; ; \; F_{BC} = 26.66 \text{ kN}_{(T)}$$

$$\Sigma F_Y = 0 \; ; \; F_{BH} = 10 \text{ kN}_{(T)}$$



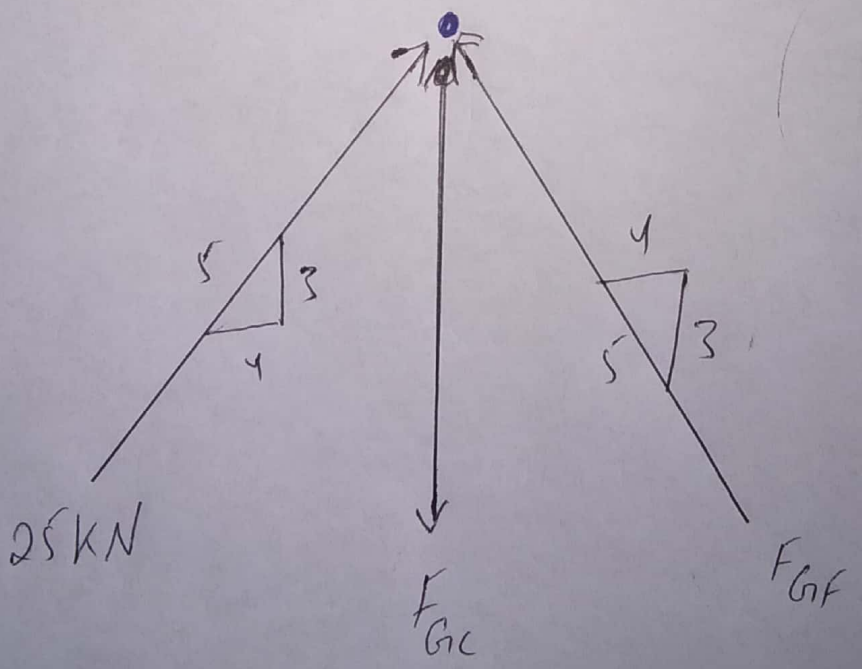
Joint G:

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

$$F_{GF} = 25\,kN_{(C)}$$

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

$$F_{GC} = 30\,kN_{(C)}$$



(14)

Joint H:

$$\Sigma F_Y = 0 \; ; \; \frac{3}{5}(33.33) - 10 + \frac{3}{5}(F_{HC}) - \frac{3}{5}(F_{HG}) \rightarrow (1)$$

$$\Sigma F_{xy} = 0 \; ; \; \frac{4}{5}(33.33) - \frac{4}{5}(F_{HC}) - \frac{4}{5}(F_{HG}) \rightarrow (2)$$

Sol eq (1) and (2)

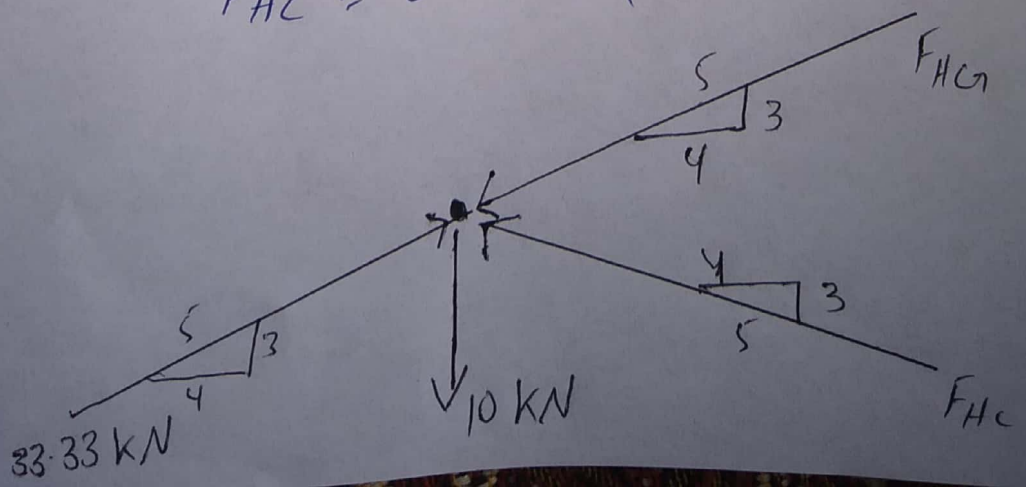
$$19.98 - 10 + 0.6F_{HC} - 0.6F_{HG} = 0 \rightarrow (1)$$

$$26.66 - 0.8F_{HC} - 0.8F_{HG} = 0 \rightarrow (2)$$

Multiplying eq (1) by 1.34 and then add with eq (2) we get.

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

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



(15)

Due to Symmetry loading and Geometry:-

$F_{AB} = F_{EB} = 26.66\ kN_{(T)}$

$F_{BC} = 26.66\ kN_{(T)}$

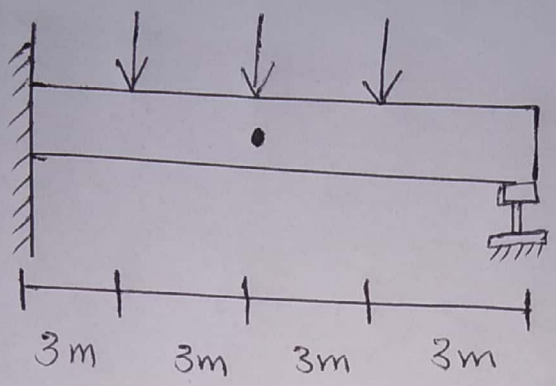
$F_{BH} = 10\ kN_{(T)}$

$F_{HG} = 25\ kN_{(C)}$

$F_{HC} = 8.34\ kN_{(C)}$

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

Question No # 03



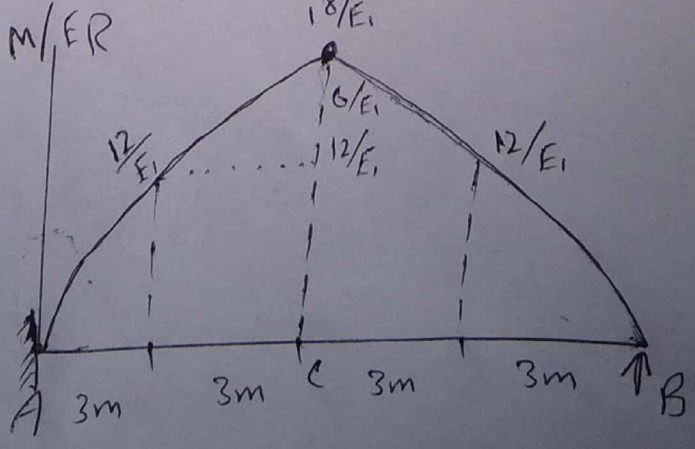
Given:

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

Determine slope at point "A" and displacement at "C" using moment area theorm

Sol:

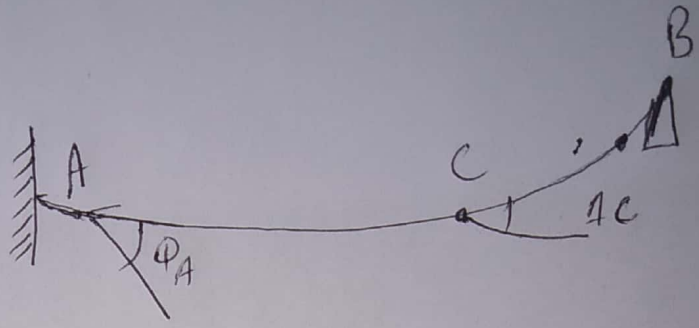
Step 1: moment diagram



17

Step 2:

Elastic curve:



Slope at Point A $\theta_A = \theta_{A/C}$

Displacement at Point C Δ_C

Step 3:

Moment area theorm

$$\theta_A = \theta_{A/C} = \frac{1}{2}\left(\frac{12}{E_1} \times 3\right) + \left(\frac{12}{E_1} \times 3\right) +$$

$$\frac{1}{2}\left(\frac{6}{E_1} \times 3\right)$$

$$\Rightarrow \frac{18}{E_1} + \frac{36}{E_1} + \frac{9}{E_1}$$

$$\Rightarrow \frac{63\ kN.m^2}{E_1}$$

18

$$\frac{Q}{A/L} = \frac{63\ kN.m^2}{[200\times10^6\ kN.m^2][6(10^6)(10^{-12})]}$$

$$\frac{Q}{A/L} = \frac{63}{200\times6\times10^6\times10^6\times10^{-12}}$$

$$\frac{Q}{A/L} = \frac{63}{1200} \Rightarrow \boxed{0.0525\ rad}$$

$$\Delta C = \left[\frac{1}{2}\left(\frac{12}{E_1}\times3\right)\right]\frac{2}{3}(3) + \left(\frac{12}{E_1}\times3\right)\left(3+\frac{1}{2}(3)\right)$$

$$+\left(\frac{1}{2}\left(\frac{6}{E_1}\times3\right)\right)\left(3+\frac{2}{3}(3)\right)$$

$$\Delta C = \frac{36+162+45}{E_1}$$

$$\Delta C = \frac{243\ kN.m^3}{[200\times10^6\ kN/m^2][6(10^6)(10^{-12})\ m^4}$$

$$\Delta C = \frac{243}{200\times6\times10^6\times10^6\times10^{-12}\ kN/m^2.m^4}$$

19

$$\Delta C = \frac{243}{1200}$$

$$\Delta C = 0.202 m$$

or

$$\Delta C = 202 mm$$

Ans.