MID TERM EXAM

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ID NO ⇒ 7965

SUBJECT ⇒ STRUCTURE ANALYSIS

SECTION ⇒ "B"

SUBMITTED TO ⇒ SIR AMJAD ISLAM

DEPART ⇒ BE (CIVIL)

SEMESTER ⇒ "4"

DATE ⇒ 19-04-2020

QUESTION NO 1 :

Write down detail note on your own words on different types of Loads that different types of structure are designed to support throughout its life. Elaborate with examples.

* LOADS :

It is the dimensional requirement for a structure necessary to determine the loads, The structure must support.

TYPES OF LOADS :-

There are different types of Loads which are :-

① DEAD LOADS :

It Consists of structural members that are permanently attached to structure. Dead load includes the weight of Columns, Beams, girders electrical fixtures and other attachments.

(2) Live Loads :

Live load can carry both in their magnitude and location. These loads are caused by weights of temporarily objects, moving vechicles, natural forces. Consist of additional protection against excess deflection and over load.

Example :

The live floor loading in classroom consist of chairs, dice & laboratory equipments.

Types of structures : (carry load)

The combination of structural elements and the materials which functions as a structural system. Each system consists of one or more of four types of structores. Different types of structures are,

(1) Trusses :

Trusses consist of slender elements in triangular form. Due to geometric arrangments of its members bends are converted into tensile or compressive forces in members.

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* **planar Trusses :**

planar trusses are Composed of members, Lies in same plane and used for bridges and roof Support.

* **Space Trusses :**

Space trusses have members extending in three dimensions and used for derrick and towers.

(2) CABLES AND ARCHES :

It is the type of structures used to span long distances.

* Cables are flexible and Carry Loads in Tension. They are Commonly used to support bridges, roofs.

* Arches achieve strength in Compression and has a revers Curvature to Cable. It must be rigid to maintain its shape. Consists of shear and moment. They are used is bridge structures, Dome roofs and Openings.

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(3) FRAMES :

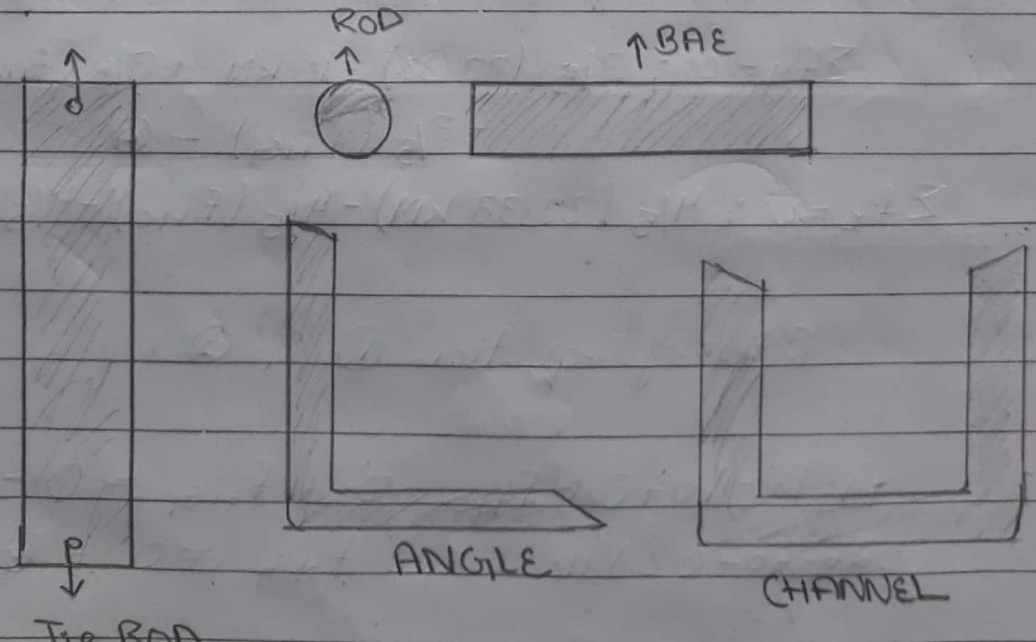
Type of structure which are used in buildings and Consists of beam and Column, which are fixed or pinned Connected. The Loads on frames Causes bending of its members and has a rigid joint Connections. This Structure is Indeterminate.

STRUCTURAL ELEMENTS :

Some of elements are;

(i) Tie Rods :-

Consist of tensile force. These members are Slender, Bars or Rods.



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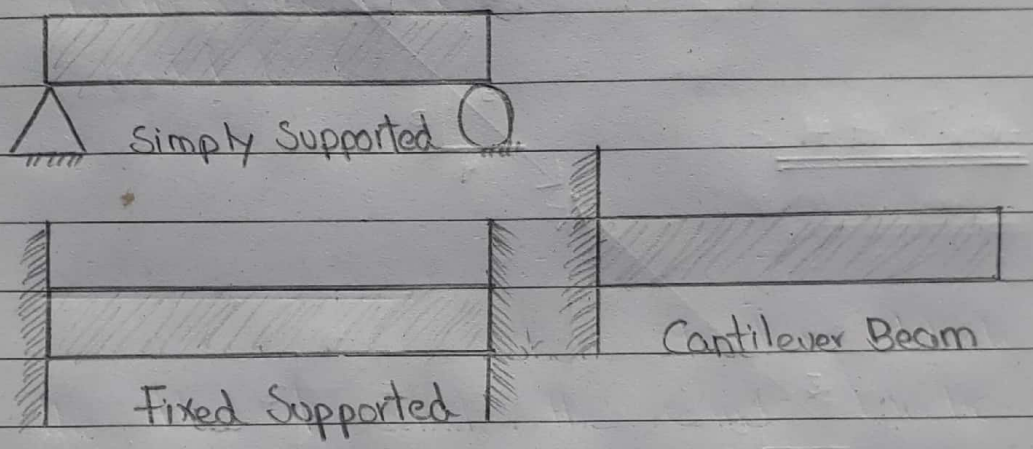
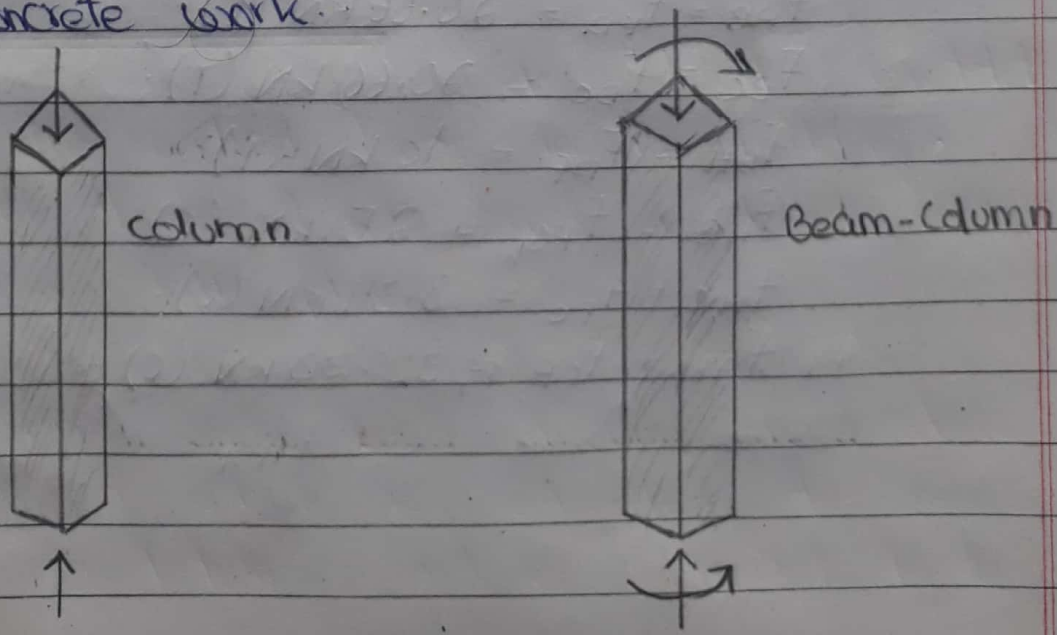
(ii) Beams :

They are horizontal members and support vertical loads. It resist Bending moments; short carry large loads.



(iii) Columns :

They consists of vertical members and resist Compressive loads. Tubes and wide-flange across sections are used for metal columns. And Square Cross Sections rods are used for Concrete work.



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★ OTHER TYPE of LOADS :

- ★ ~~Imposed loads~~
- ★ Wind loads.
- ★ Snow load.
- ★ Earth Quake Loads.
- ★ Special loads.

(i) Wind Loads:

When structure block the flow of wind, the winds kinetic Energy is Converted into potential Energy of pressure which Cause a wind loading.

→ For Design purpose, wind Load Can be treated using either a static or a dynamic approach.

(ii) Snow Loads :

Snow loads Constitute to the vertical loads in the building. But these loads are Considered in Snow fall places.

→ Minium Snow load on any area above ground which is subjected to Snow accumulation, and is obtained by the

expression,

$$S = \mu S_0$$

where S = Design Snow load on plan Area of roof.

μ = Shape Coefficient.

S_0 = Ground Snow Load.

(iii) Earth Quakes Load :-

Earth Quake produce loadings on a structure through its interaction with the ground and its response characteristics.

→ These loadings result from structure's distortion caused by the ground's motion and the lateral resistance of the structure.

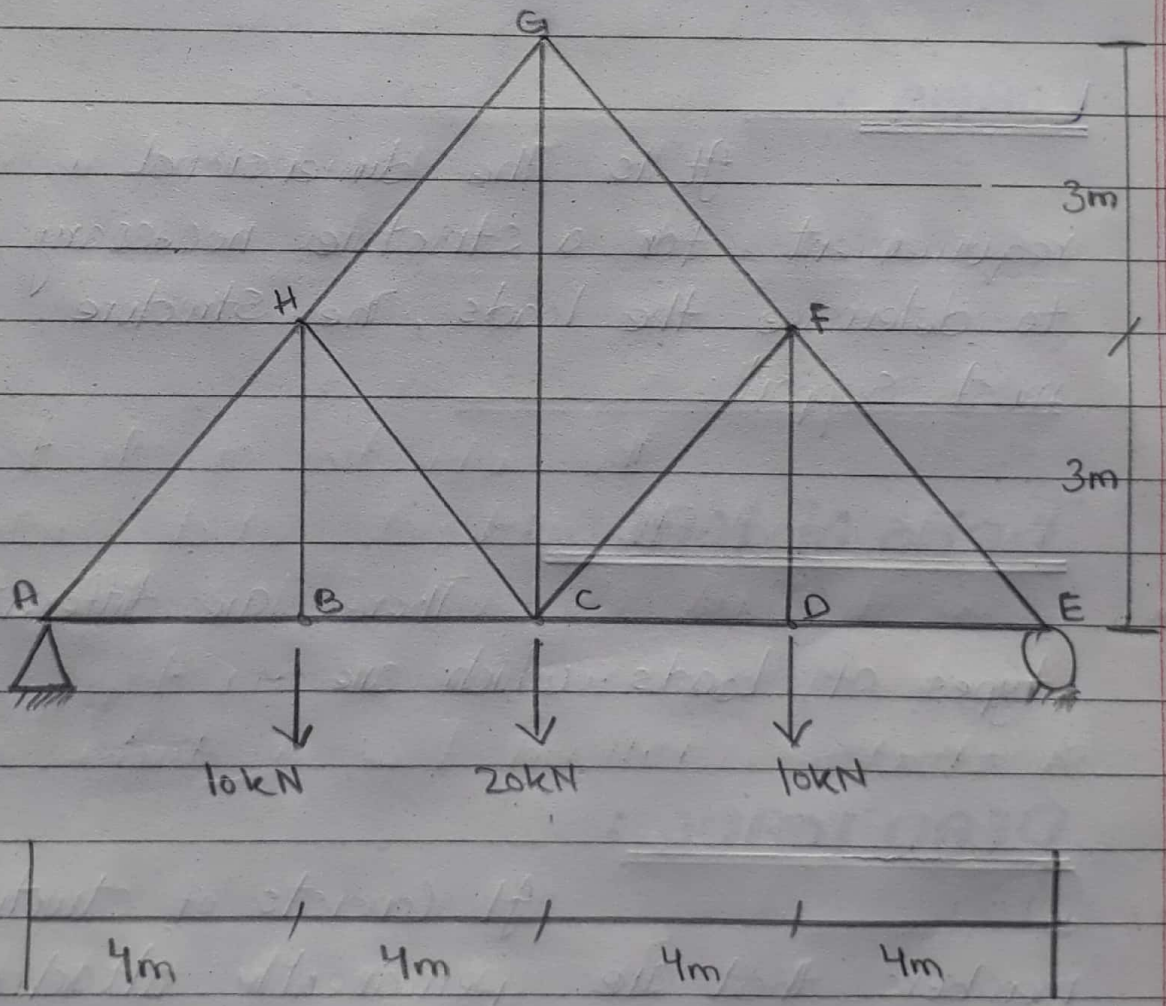
→ Their Magnitude deperds on the amount ground accelerations and the mass and Stiffness of the structure.

(iv) Special Loads :

Special load falls due to; Dangerous goods, Live Animals, Human Remains, Food Stuffs, Human Living Organs etc.

QUESTION NO: 02

Determine the force in each member of the truss. State if the members are in tension or compression. Assume all the members are pin connected.



Solution :-

Support Reactions :

$$\Sigma f_y = 0 \quad (+\uparrow \downarrow -)$$

$$R_A + R_E = 40 \quad -(A)$$

$$\Sigma M_A = 0 \quad (\circlearrowright -)$$

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

$$R_E = \frac{320}{16}$$

$$R_E = 20kN$$

put in Eq (A)

$$R_A = 40 - 20$$

$$R_A = 20kN$$

Now Determining Force in each member.

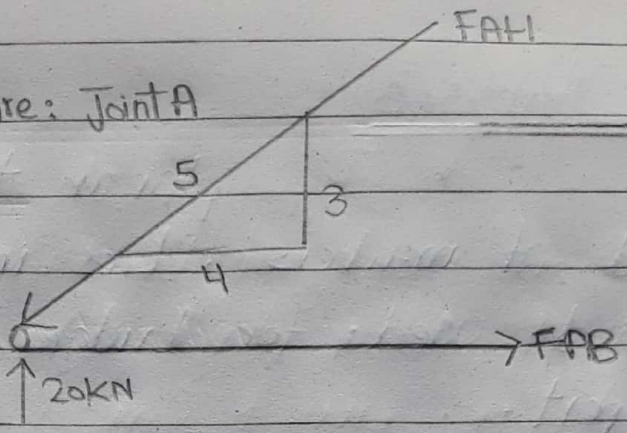
Joint A :

$$\Sigma f_y = 0 \; ; \; -3/5\,(f_{AH}) + 20kN = 0$$

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

$$f_{AH} = 33.33kN\,(C)$$

figure: Joint A



$\Sigma f_x = 0$; $-4/5\ (33.33) + f_{AB} = 0$

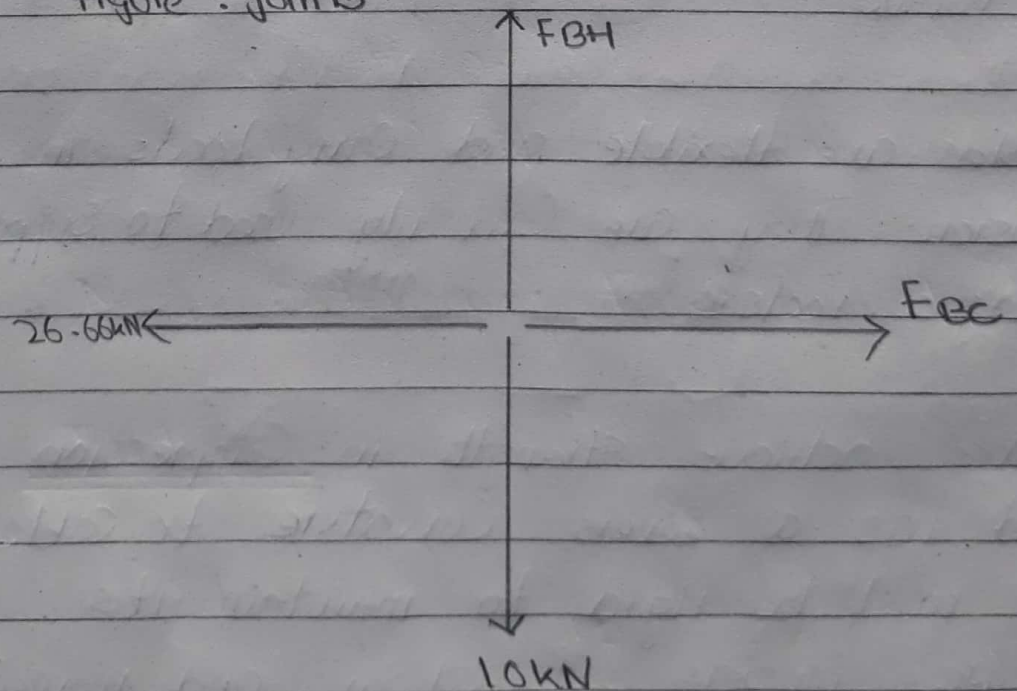
$= f_{AB} = 26.66 kN\ (T)$

JOINT B :-

$\Sigma f_x = 0$; $f_{BC} = 26.66\ kN\ (T)$

$\Sigma f_y = 0$; $f_{BH} = 10\ kN\ (T)$

figure : Join B



JOINT G :-

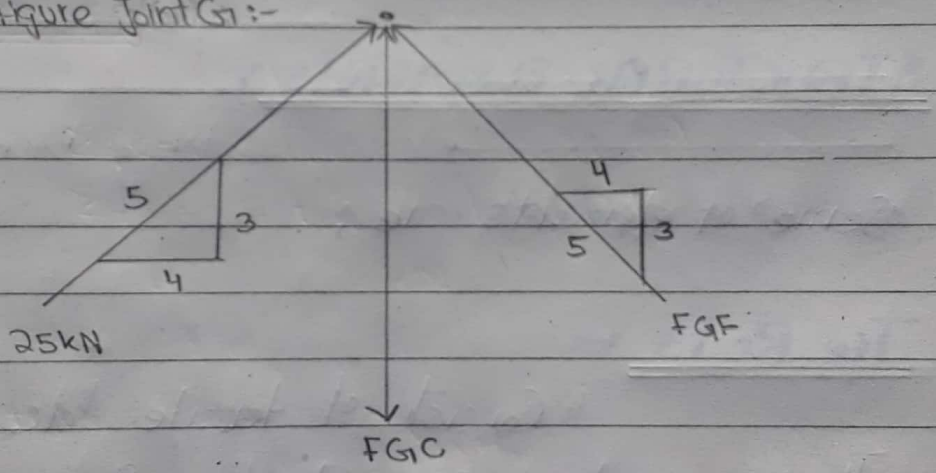
$\Sigma f_x = 0$; $4/5\,(25) - 4/5\,(f_{GF}) = 0$

$f_{GF} = 25\,kN\,(c)$

$\Sigma f_y = 0$; $3/5\,(25) + 3/5\,(25) - f_{GC} = 0$

$f_{GC} = 30\,kN\,(c)$

figure Joint G :-



JOINT H :-

$\Sigma f_y = 0$; $3/5\,(33.33) - 10\,kN + 3/5\,(f_{HC}) - 3/5\,(f_{HG})$ - (A)

$\Sigma f_x = 0$; $4/5\,(33.33\,kN) - 4/5\,(f_{HC}) - 4/5\,(F_{HG})$ - (B)

Soliving equation (1) & (2)

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

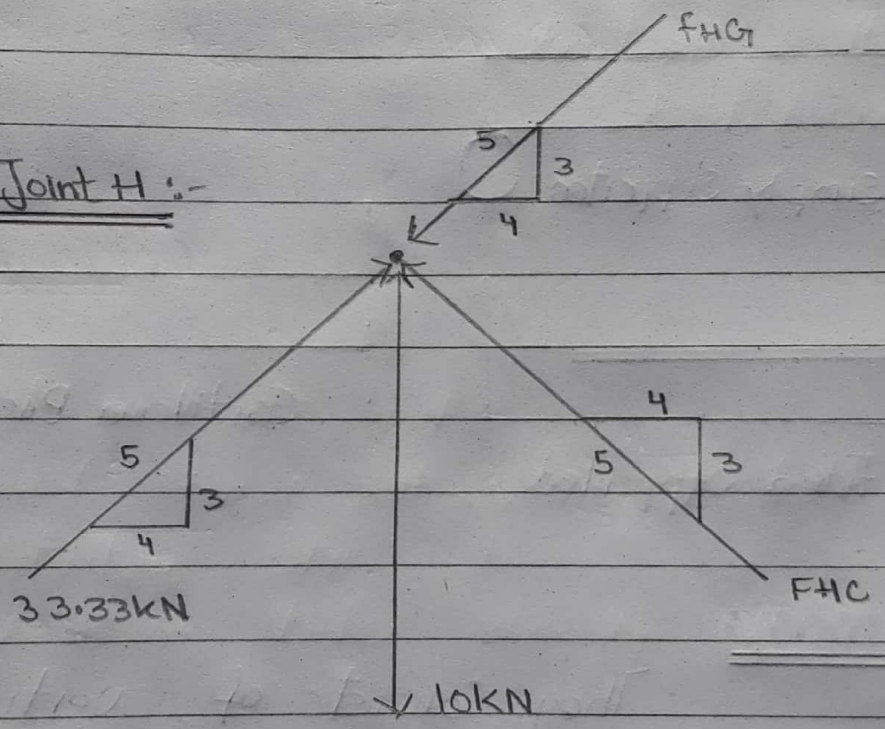
$26.66 - 0.8\,F_{HC} - 0.8\,F_{HG} = 0$ - (B)

Multiplying equation (A) by 1.34 and then add with equation (B) we get,

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

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

Figure Joint H :-



Due to Symmetrical Loading and Geometry.

$F_{AB} = F_{ED} = 26.66\ kN\ (T)$.

$F_{BC} = F_{DC} = 26.66\ kN\ (T)$.

$F_{BH} = F_{DF} = 10\ kN\ (T)$.

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

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

$F_{AH} = F_{CF} = 33.33\ kN\ (C)$.

QUESTION :- 03

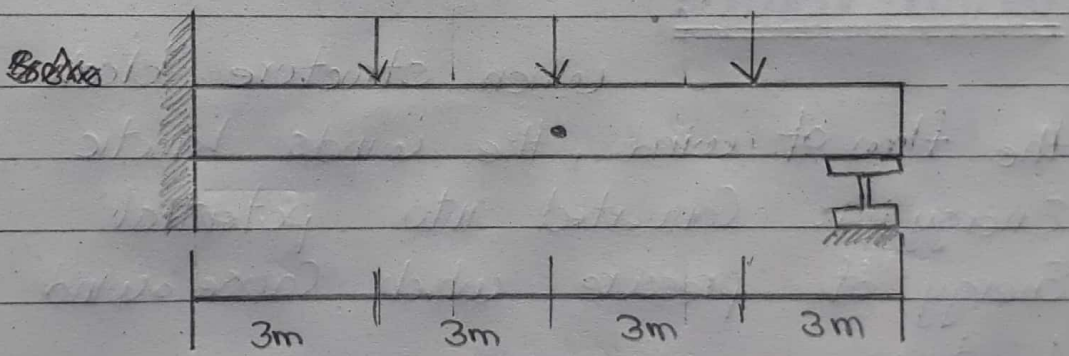
Determine the slope at A and displacement at C of the beam in the figure.

(a) Moment Area Theorem.

Given :-

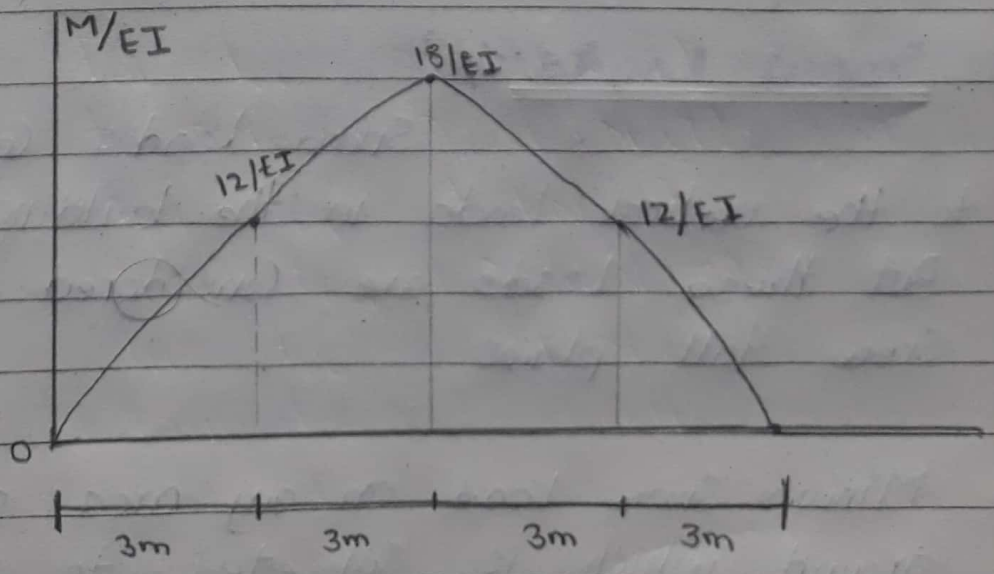
$E = 200 Gpa$

$I = 6 \times 10^6 mm^4$.

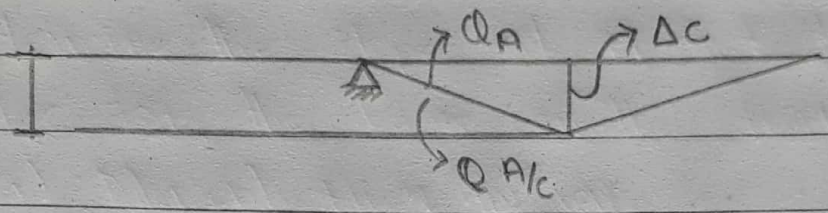


Solution :-

Moment Diagram :-



ELASTIC DIAGRAM :-



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

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

$$\theta_{A/C} = \frac{63}{EI} \Rightarrow 63/(200\times10^6)(6\times10^6)(100)^{-4}$$

$$\theta_{A/C} = 0.0525 \text{ rad.}$$

$$\theta_A = 0.0525 \text{ rad.}$$

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

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

$$= 0.202 \text{ m}$$

so,

$$\Delta C - t_{A/C} = 0.202\text{m}$$

$$= 202\text{mm}$$