MID TERM

Summer

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Section: "B"

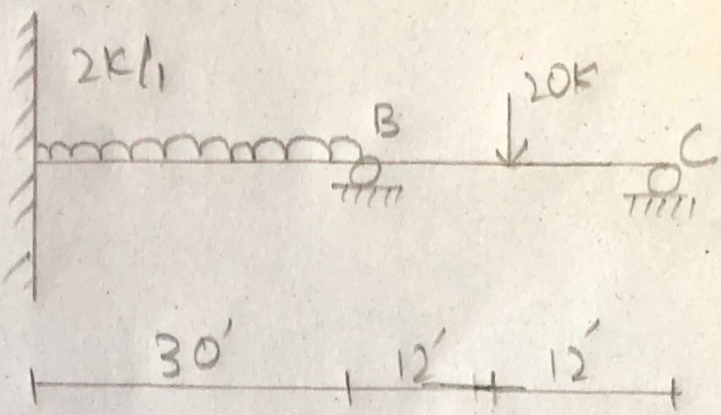
Semester: 6th

Subject: Structure Analysis – II

Instructor: Engr' Adeel Khan

Question # 01

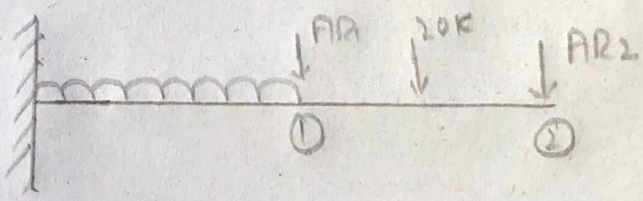
1:



EI constant

S.I = 2°

Step # 01 Select redundant Actions



$$\begin{bmatrix} DRS_1 \\ DRS_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix} \cdot \begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}$$

$$[DRS] = [DRL] + F \cdot AR$$

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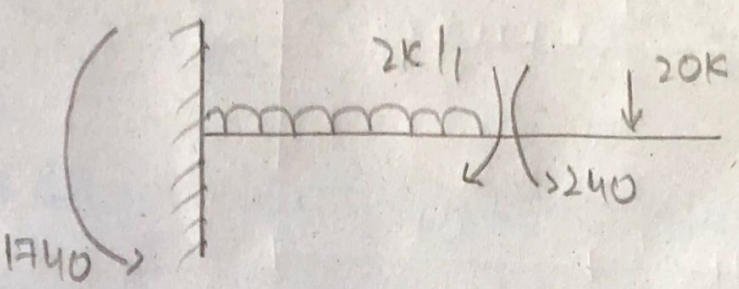
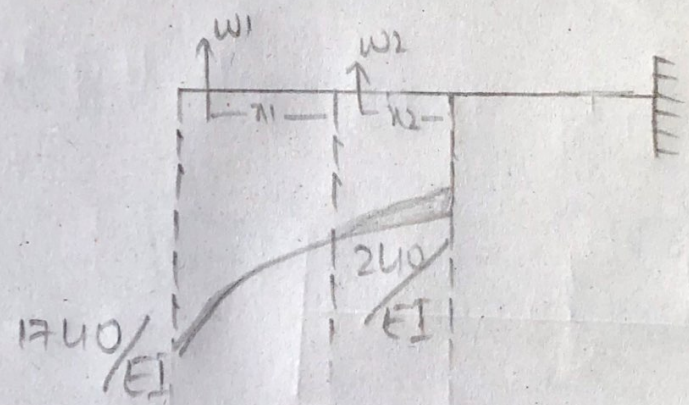
Step #02 compute the values of [DRL]





$$W_1 = \left(\frac{240+0}{2EI}\right) \times 12 = 1440/EI$$

$$W_2 = \frac{1}{n+1} \times (b \times h) = \frac{1}{2+1}\left(\frac{1100}{EI}\right) \times 30 = 11$$

$$x_1 = \frac{L}{3}\left(\frac{a+2b}{a+b}\right)$$

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$$x_1 = \frac{12}{3}\left(\frac{240 + 2(0)}{240 + 0}\right) = 4$$

$$x_2 = \frac{3}{n+2} \times 6 = \frac{3}{2+2}(30) = 22.5'$$

$$DRL_1 = w_1(x_1 + 30) = 1440(4+30) = 48960$$

$$DRL_2 = w_1(x_1 + 40) + w_2(x_2 + 12)$$

$$= 1440(4+40) + 11050(22.5+12)$$

$$DRL_2 = 442860$$

$$[DRL] = \frac{1}{EI}\begin{bmatrix} 48960 \\ 442860 \end{bmatrix}$$

Step # 03

Construct Flexibility co-efficient matrix

$$F_{2\times 2} = \begin{bmatrix} F_{11} & F_{12} \\ F_{21} & F_{22} \end{bmatrix}$$

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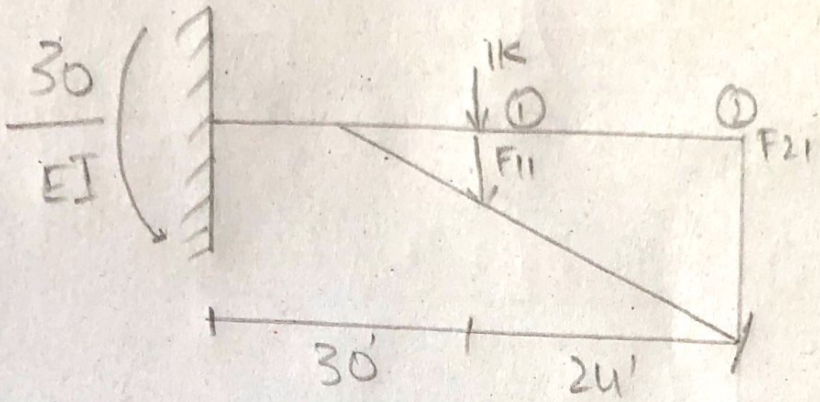
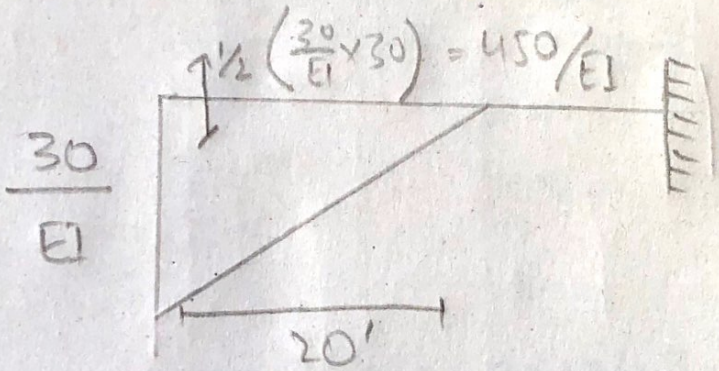
a) Apply a unit value of AR_1 at reference point 1- complete the value of F_{11} and F_{21}





$\frac{2}{3}(30) = 20'$

$$F_{11} = \frac{450}{EI}(20) = \frac{9000}{EI}$$

$$F_{21} = \frac{450}{EI}(20+24) = \frac{19800}{EI}$$

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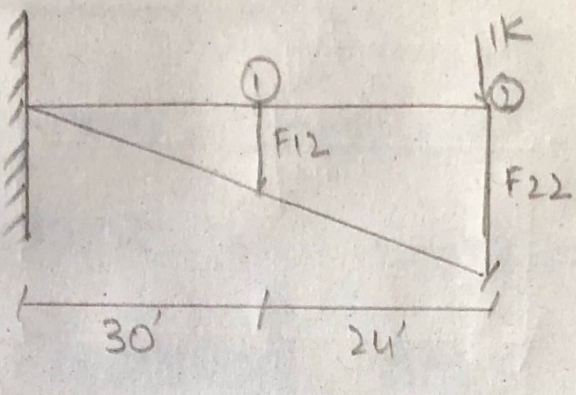
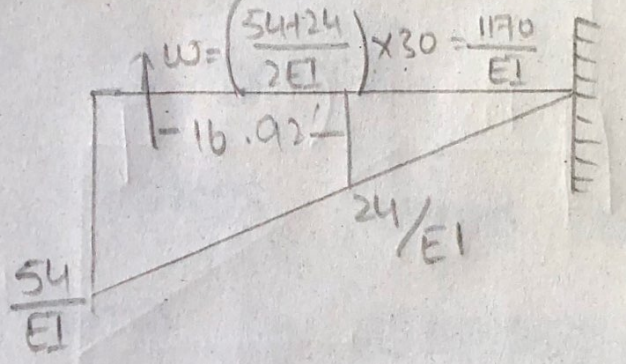
b) Apply a unit of AR_2 at reference point (2)

ii- Compute the value of F_{12} & F_{22}





$$x = \frac{30}{3}\left[\frac{24+2(54)}{54+24}\right] = 16.92'$$

$$F_{12} = \frac{1170}{EI} \times 16.92 = \frac{19800}{EI}$$

$$F_{22} = \frac{1}{2}(54 \times 54) \times \frac{1}{3}(30) + 24 = \frac{49572}{EI}$$

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Question #02

Answer:

Force method:

In force method forces are redundant or unknowns

Force method starts with equilibrium of forces.

Forces bound by compatibility equation of displacement

no of redundants = Ds

not suitable for compute.

It strain energy method.

Ds < Dk

know as flexibility method.

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Displacement Method:

Also known as stiffness matrix method slop deflection method
moment distribution method
DS > DF

Displacement are redundants are unknowns.

Starts with compitable deformations Displacement bound by equilibrium equation of forces.

No of redundants = DF
Not suitable of Frame.

Suggest:

Displacement method is better and suitable because it is used globally and is easy too.

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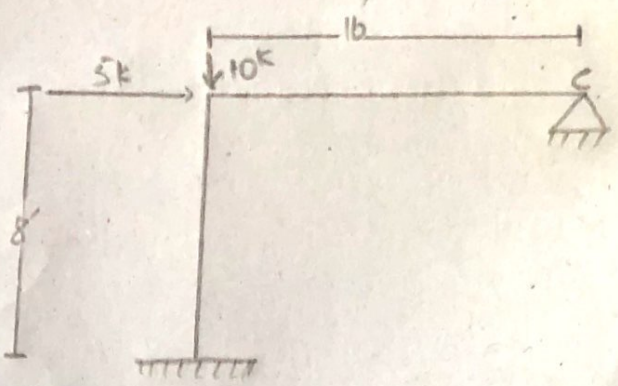
Pb#



E = constant

I = I

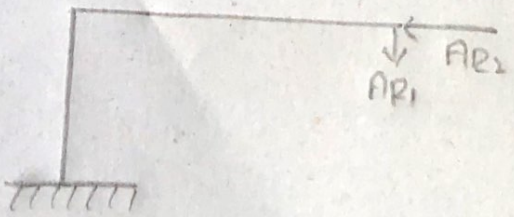
I_B = 2I

Solution:

Total statical indeterminancy

=> R-3 = 5-3 = 2°

Step # 01 Identify Redundant Actions



$$\begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix} \quad , \quad \begin{bmatrix} DRS_1 \\ DRS_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

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Step #02 compute value of [DRL]

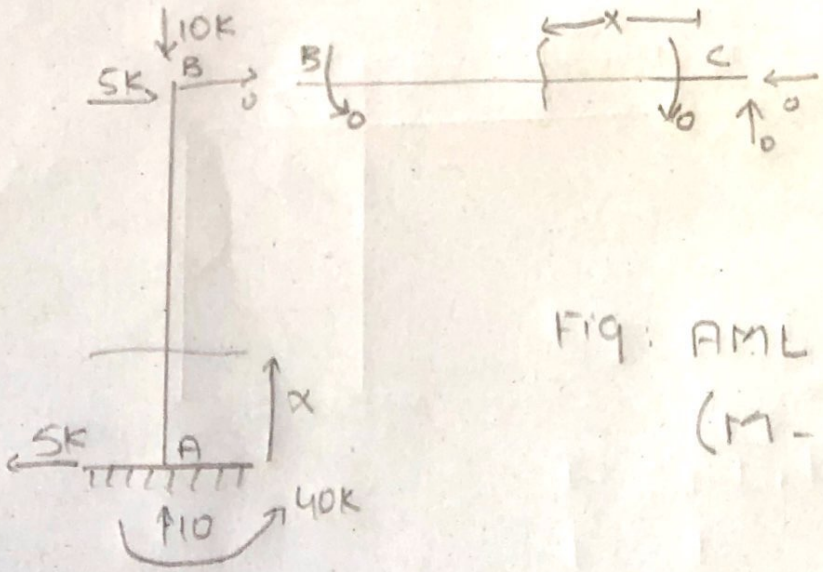
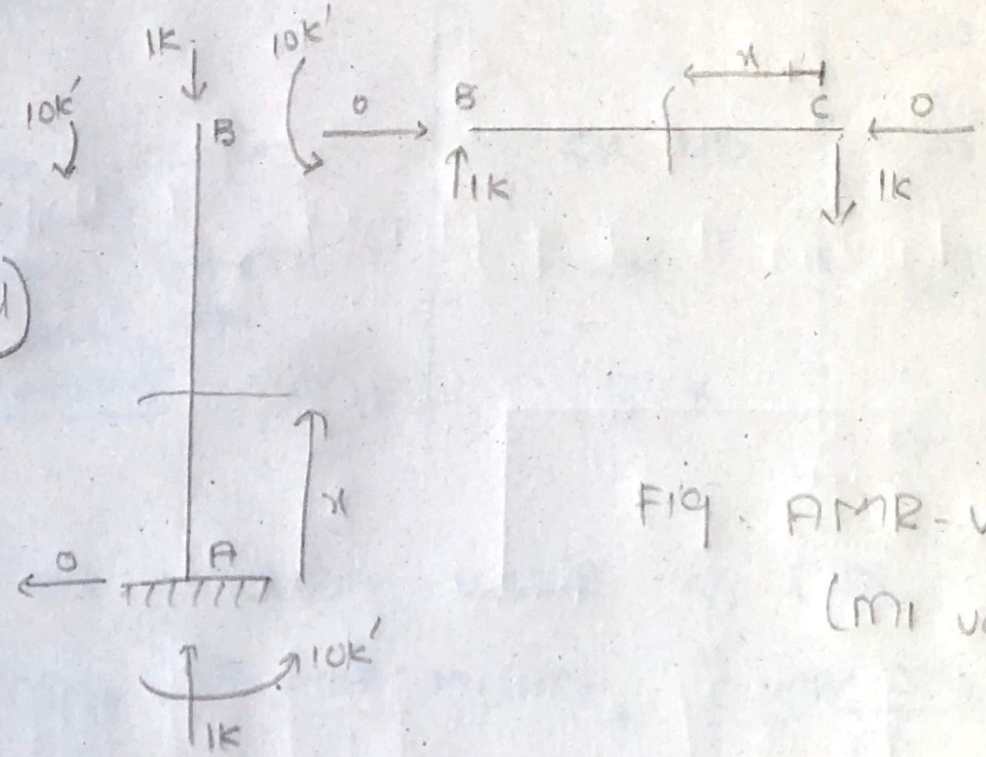


Fig: AML values
(M - values)

Step #03 compute value of [F] or [AMR]



a)

Fig. AMR - values
(M1 values)

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b)

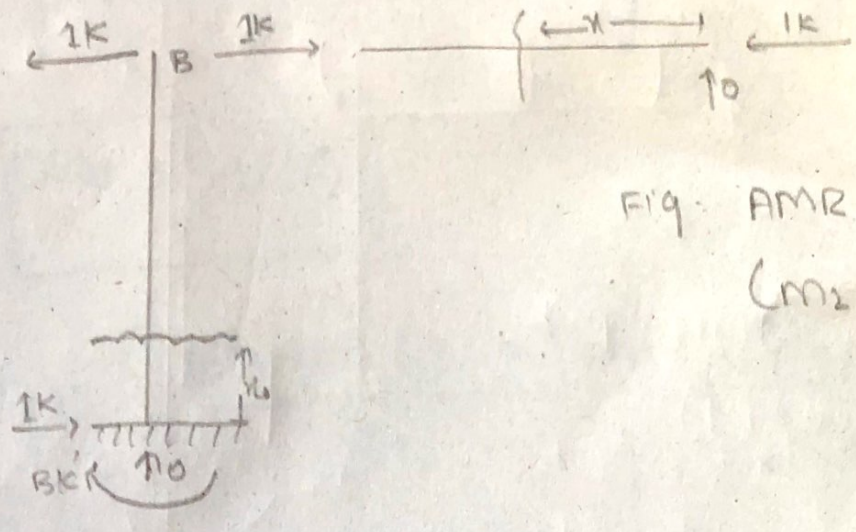

Fig: AMR values (m_2 values)

Member	AB	BC
select ← Origin	A	C
Origin (should be select the support) Limits	0 ; 8	0 - 16
I	I	2I
Take x-section on AML Fig and Find moment ← M	5x - 40	0
from origin m_1	-16	x → Take x-section on m_1 Fig from the origin
m_2	8 - x	0

=> For finding value of DRL:

$$DRL_1 = \int_0^8 \frac{M_{AB} \cdot m_1(AB)}{EI} + \int_0^{16} \frac{M_{BC} \cdot m_2(BC)}{EI}$$

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$$= \int_0^8 \frac{(5x-40)(-18)}{EI}\,dx + \int_0^{16} \frac{0 \cdot x}{E(2I)}\,dx$$

$$\boxed{DRL_1 = \frac{2560}{EI}}$$

$$DRL_2 = \int_0^8 \frac{(5x-40)(8-x)}{EI}\,dx + \int_0^{16} \frac{0 \cdot 0}{E(2I)}\,dx$$

$$\boxed{DRL_2 = \frac{-853.33}{EI}}$$

=> compute Flexibility Matrix:

$$F_{2\times 2}^{\rightarrow 2} = \begin{bmatrix} F_{11} & F_{12} \\ F_{21} & F_{22} \end{bmatrix}$$

$$\Rightarrow F_{11} = \int_0^8 \frac{m_1^2 (AB)}{EI} + \int_0^{16} \frac{m_1^2 (BC)}{EI} = \int_0^8 \frac{(-16)^2}{EI}\,dx + \int_0^{16} \frac{x^2}{E(2I)}$$

$$\boxed{F_{11} = \frac{2730.67}{EI}}$$

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$$F_{12} = F_{21} = \int_0^8 \frac{m_1(AB) \cdot m_2(AB)}{} + \int_0^{16} m_1(BC) \cdot m_2(BC)$$

$$= \int_0^8 \frac{(-16)(8-x)}{EI} dx + \int_0^{16} \frac{(x)(0)}{2EI} dx$$

$$\boxed{F_{12} = F_{21} = \frac{-512}{EI}}$$

$$F_{22} = \int_0^8 (m_2)^2_{AB} dx + \int_0^{16} (m_2)^2_{BC} dx$$

$$= \int_0^8 \frac{(8-x)^2}{EI} dx + \int_0^{16} \frac{0^2}{2EI} dx$$

$$F_{22} = 170.67$$

As we know that

$$[DRS] = [DRL] + [AR] \times [F]$$

$$\Rightarrow [AR] = \frac{[DRS] - [DRL]}{(F)}$$

$$2)\ [AR] = [F]^{-1} \times [DRS - DRL]$$

$$= \begin{bmatrix} 2730.67 & -512 \end{bmatrix}^{-1} \times \begin{bmatrix} 0 - 2560 \\ 0 + 853.33 \end{bmatrix}$$

$$\begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} -0.00005 \\ 4.997 \end{bmatrix} = \begin{bmatrix} 0 \\ 5 \end{bmatrix}$$