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ID :- 7863

SECTION :- "B"

SMSTER :- "SUMMER"

SUBJECT :- Structure Analysis II.

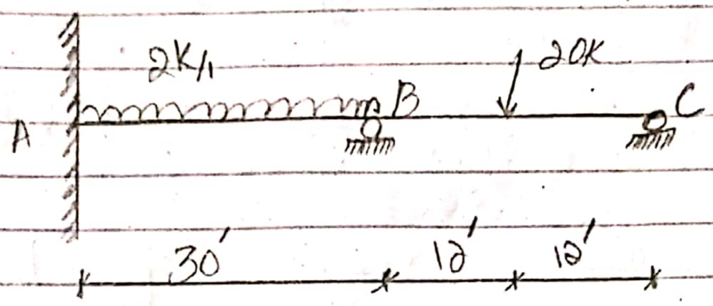
SUBMITTED TO :-

Sir Engr. Aaked Khan.

Q No. 1

→ Analyze the given beam shown in FIG-I by flexibility method. EI is constant.

Ans/:-



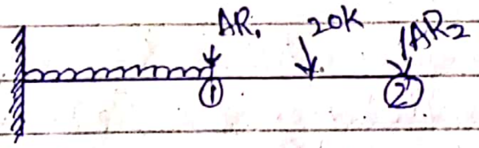
Solution:-

E-I constant

S-I = 2"

Step # 01:-

Select redundant actions

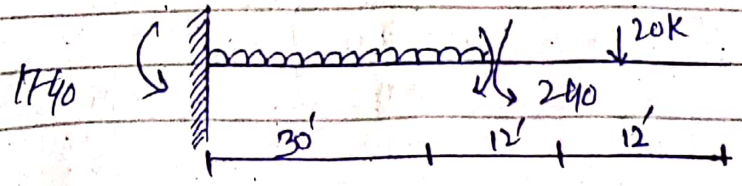


$$\begin{bmatrix} DRS_1 \\ DRS_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}, \quad \begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}$$

$$[DR_S] = [DRL] + F * AR$$

Step # 02:-

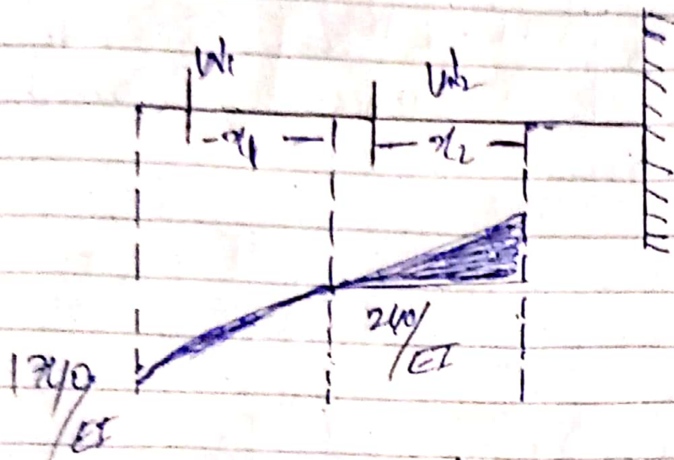
Compute the values of [DRL]



$20 \times 12 = 240$

$(20 \times 42) \times 2 \times 30 \times 15$

$= 1740$



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

$w_2 = \frac{1}{n+1} \times (b \times h) = \frac{1}{2+1}\left(\frac{1100}{EI}\right) \times 30 = 1100/EI$

$x_1 = 4/3 \; \left(\frac{a+2b}{a+b}\right)$

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

$x_2 = \frac{3}{n+2} \times b = 3/_{2+2}(30) = 22.5'$.

$DRL_1 = W_1\,(x_1+30) = 1440\,(4+30) = 48960$

$DRL_2 = W_1\,(x_1+40) + W_2\,(x_2+12)$

$= 1440\,(40+4) + 11000\,(22.5+12)$

$DRL_2 = 442860$

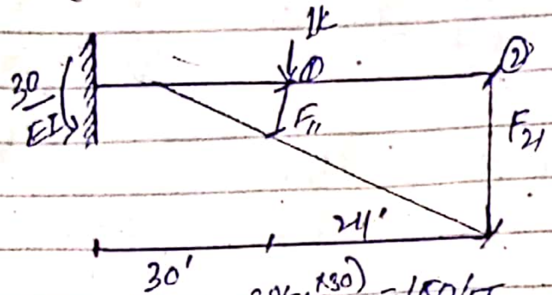
$$[DRL] = \frac{1}{EI}\begin{bmatrix} 48960 \\ 442860 \end{bmatrix}$$

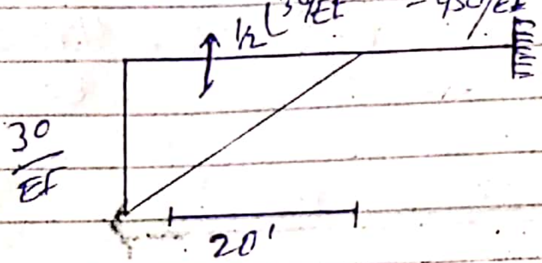
Step#03

Construct felexibility cofficient matrix.

$$F_{2\times2} = \begin{bmatrix} F_{11} & f_{12} \\ f_{21} & f_{22} \end{bmatrix}$$

(A) Apply a unit value of ΔR_1 at reference point 1 & compute the value of F_{11} & F_{21}.



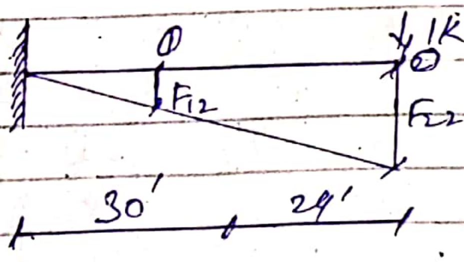


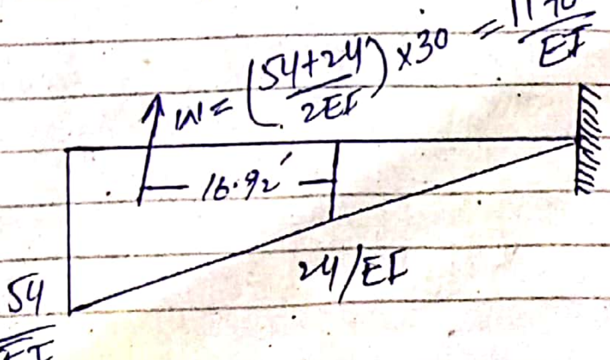
$\frac{2}{3}(30) = 20'$

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

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

(B) Apply a unit of ΔR_2 at reference point ② (ii) compute the value of F_{12} & F_{22}.





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

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

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

(5)

Q.No 2:-

→ Differentiate B/w force method and displacement and suggest which method is more suitable for structure analysis of matrix approach.

Ans/:-

Differentiate B/w force method and displacement method, is follows.

Force method	Displacement method.
→ $D_s < D_k$	$D_s > D_k$
→ Forces are reduadent or unknown	Displacement are redunt or unknown:
→ starts from equilibrium of forces.	Starts with compatible deformations.
→ Forces found by compatibility eqn's of displacements	displacement found by equilibrium eqn's of forces.
→ No. of redeutants $= D_s$	No. of redundants $= D_k$
→ Not suitable for compute.	Not suitable for truss.

(6)

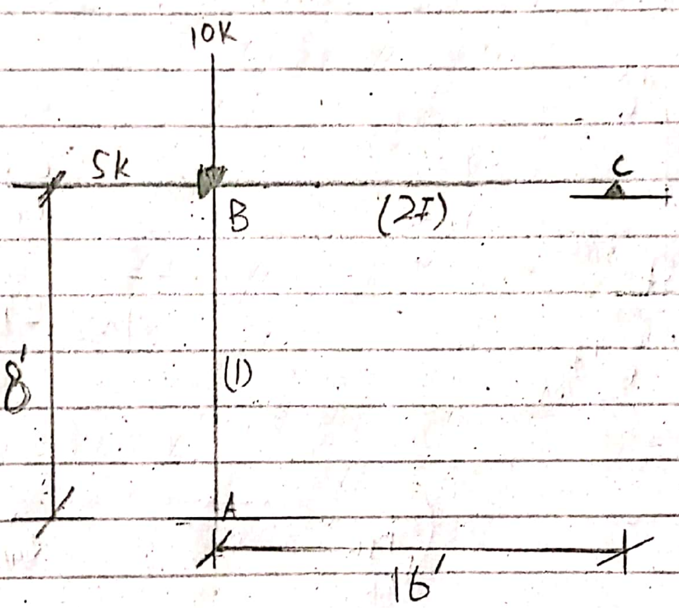
SUGGEST:

⇒ Displacement method is Better and Suitable Because it is used gllobally and easy too.

Q.No. 3

⇛ Analyze the rigid-Joint frame shown in fig-2 by flexibility method. Assume EI is constant for all members.

Ans/ **FRAMES:-**
The combination of column, beam & having rigid Joint.

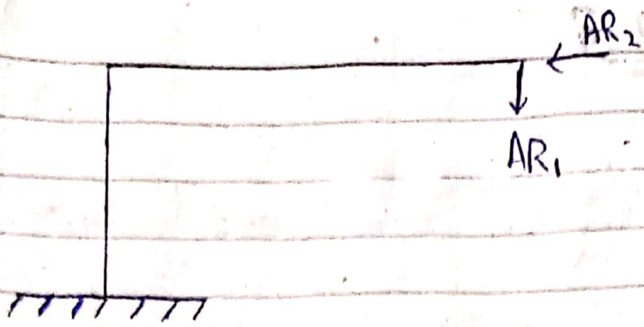


Solution:-

$$S.I = R-3$$
$$= 5-3$$
$$= 2^\circ$$

Step:- 01:

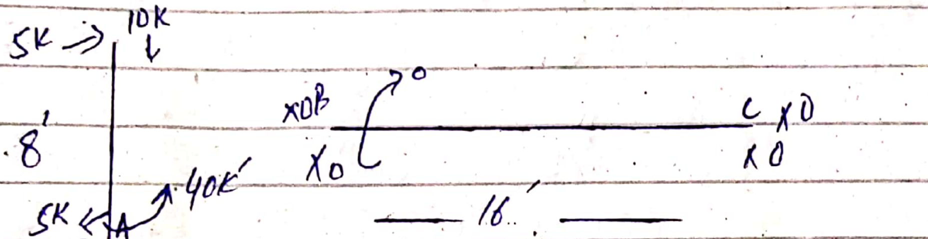
Identify the redundant Action.



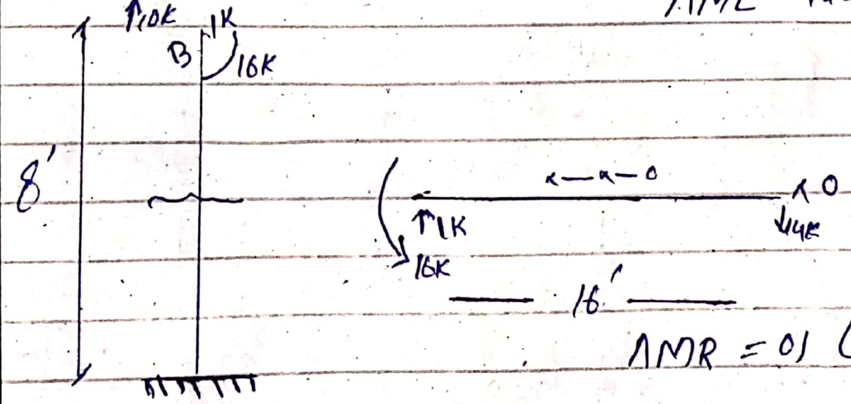
$$\begin{bmatrix} DRS_1 \\ DRS_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \quad \begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}$$

Step #02 :

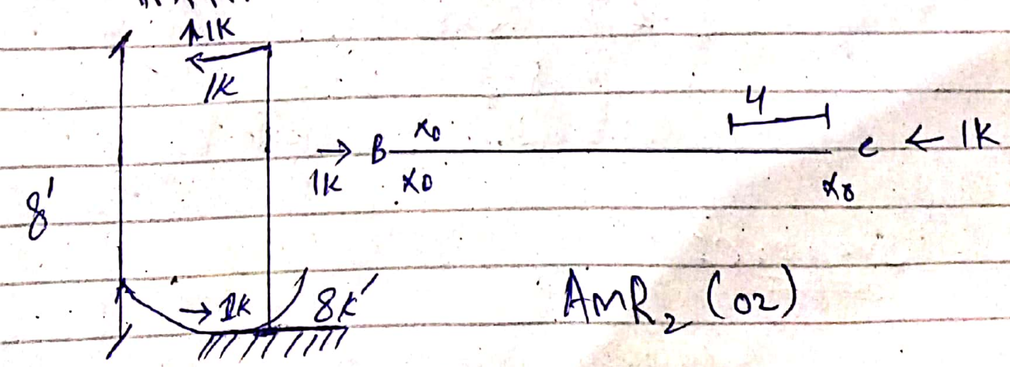
Compute the value of DRL & F



AML - Values (M)



AMR = 01 (M)



AMR_2 (02)

Members	AB	BC
Origin	A	C
Limit	0-8	0-16
I	I	2I
M	5x-40	0
m_1	-16	x
m_2	8-x	0

DRL4z

$\int 5x-40 + \int x$

$$DRL_1 = \int_0^8 \frac{(5x-40)(-16)\,dx}{EI} = \frac{2560}{EI}$$

$$DRL_2 = \int_0^8 \frac{(5x-40)(8-x)}{EI} = \frac{-853.32}{EI}$$

$$F_{11} = \int_0^8 \frac{-(16)^2 dx}{EI} + \int_0^{16} \frac{x^2}{2EI}\,dx = 2730.67/EI$$

$$F_{12} = \int_0^8 \frac{-(16)(8-x)\,dx}{EI} = -512/EI$$

$$F_{22} = \int_0^8 \frac{(8-x)^2\,dx}{EI} = 170.67/EI$$

$$\begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} F_{11} & F_{12} \\ F_{21} & F_{22} \end{bmatrix}^{-1} \begin{bmatrix} DRS_1 - DRL_1 \\ DRS_2 - DRL_2 \end{bmatrix}$$

$$= \begin{bmatrix} 2730.31 & 512 \\ -512 & 170.0 \end{bmatrix} \begin{bmatrix} 0 & -2560 \\ 0 & -853.33 \end{bmatrix}$$

"THE END"