Submitted TO = Engr Adeed Khan.

Submitted By = Abdullah Aziz

I-D = 7671

Section = Senior.

Semester = Summer (Final)

Subject Name = Structure II.

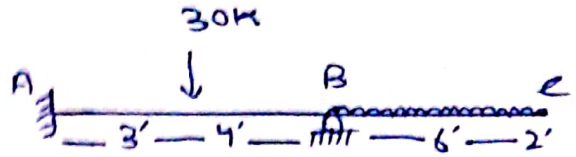
Exam = Summer (Final)

Date = 25-09-2020

IQRA NATIONAL

UNIVERSITY.

Q NO# 01 :-



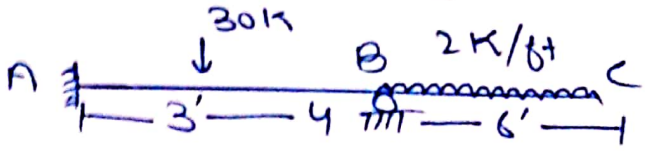
Sol :-

Step # 01 :-

Determining kinamatic interterminancy :-

$$K.I = 5^\circ$$

So we have to reduce the extended portion.



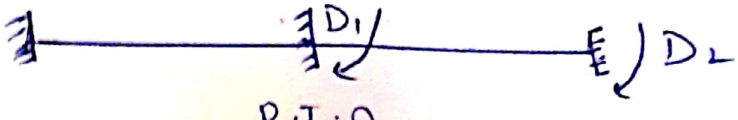
$$\Rightarrow \frac{2(2)}{1} = 4\,K/ft .$$

Now

$$K.I = 2^\circ$$

Step # 02 :-

Determine unknown Joint displacement.

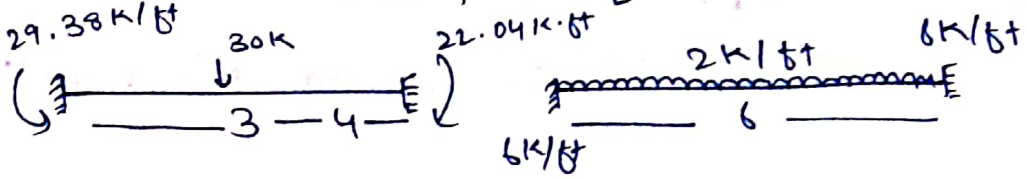


P.T.O

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix} \quad \begin{bmatrix} AD_1 \\ AD_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 4 \end{bmatrix}$$

Step # 03:-

Compute [ADL] Matrix.



⇒ For point load (Not at mid) :-

For left end :-

$$\frac{Pab^2}{L^2} = \frac{(30)(3)(4)^2}{(7)^2} = 29.38 K/ft$$

For Right End :-

$$\frac{Pa^2b}{L^2} = \frac{(30)(3)^2(4)}{(7)^2} = 22.04 K/ft$$

⇒ For UDL :-

$$\frac{WL^2}{12} \rightarrow \frac{(2)(6)^2}{12} = 6 K/ft.$$

$$ADL_1 = +22.04 - 6 = 16.04 K/ft$$

$$ADL_2 = 6 K/ft.$$

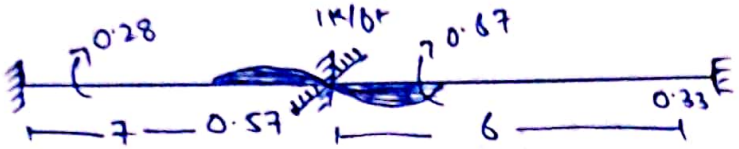
P.T.O

Step#04:-

Compute [S] matrix

$$S = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}$$

a) $D_1 = 1K$, $D_2 = 0$



$$\frac{4EI}{7} = 0.57 \quad \Big| \quad \frac{2EI}{6} = 0.33$$

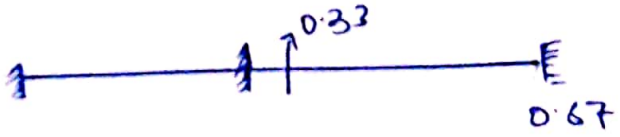
$$\frac{4EI}{6} = 0.67 \quad \Big| \quad \frac{2EI}{7} = 0.28$$

$$S_{11} = 0.57 + 0.67$$

$$= 1.24EA.$$

$$S_{21} = 0.33EA.$$

(b) $D_1 = 0$, $D_2 = 1K$



P.T.O

$$\frac{4EI}{6} = 0.67$$

$$\frac{2EI}{6} = 0.33$$

$$S = \begin{bmatrix} 1.24 & 0.33 \\ 0.33 & 0.67 \end{bmatrix}$$

Step # 05:-

Compute [D] matrix

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}^{-1} \times \begin{bmatrix} AD_1 \\ AD_2 \end{bmatrix} - \begin{bmatrix} ADL_1 \\ ADL_2 \end{bmatrix}$$

$$= \frac{1}{\begin{bmatrix} 1.24 & 0.33 \\ 0.33 & 0.67 \end{bmatrix}} \times \text{adj } A \times \begin{bmatrix} 0 \\ 4 \end{bmatrix} - \begin{bmatrix} 16.04 \\ 6 \end{bmatrix}$$

P.T.O

$$|S| = (1.24 \times 0.67) - (0.33 \times 0.33)$$

$$= 0.8308 - 0.1089.$$

$$|S| = 0.7219.$$

$$\text{Adj } A = \begin{bmatrix} 0.67 & -0.33 \\ -0.33 & 1.24 \end{bmatrix}$$

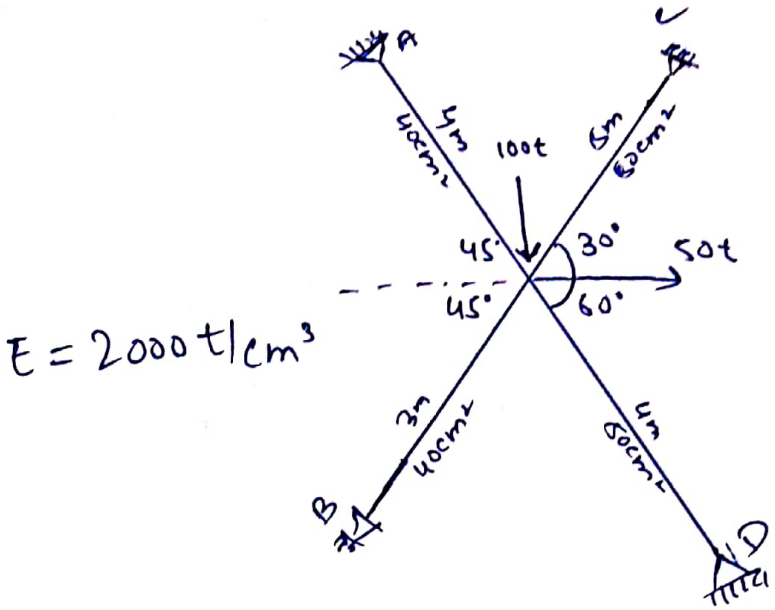
Now.

$$\begin{bmatrix} AD_1 - ADL_1 \\ AD_2 - ADL_2 \end{bmatrix} = \begin{bmatrix} 0 - 16.04 \\ 4 - 6 \end{bmatrix} =$$

$$\begin{bmatrix} 16.04 \\ -2 \end{bmatrix} E.$$

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} -13.915 \\ 3.894 \end{bmatrix}$$

Q NO#03 :-



Solution :-

For A :-

$$\sin 45^\circ = \frac{P}{h} = \frac{P}{4}$$

$$\Rightarrow P = 2.828\ m.$$

$$\cos 45^\circ = \frac{b}{4}$$

$$\Rightarrow b = 2.828\ m.$$

For B :-

$$\sin 45^\circ = \frac{P}{3}$$

$$\cos 45 = \frac{b}{h}$$

$$= b = 2.12\ m$$

For C :-

$$\sin 30^\circ = \frac{P}{h=5} \Rightarrow D = 2.5m$$

$$\cos 30^\circ = \frac{b}{5}$$

$$\Rightarrow b = 4.33m.$$

Now

$$EA_{(A)} = 2000 \times 40 = 80,000\ t.$$

$$EA_{(B)} = 2000 \times 40 = 80,000\ t.$$

$$EA_{(C)} = 2000 \times 50 = 100,000\ t.$$

$$EA_{(D)} = 2000 \times 50 = 100,000\ t.$$

Step # 01

K.I

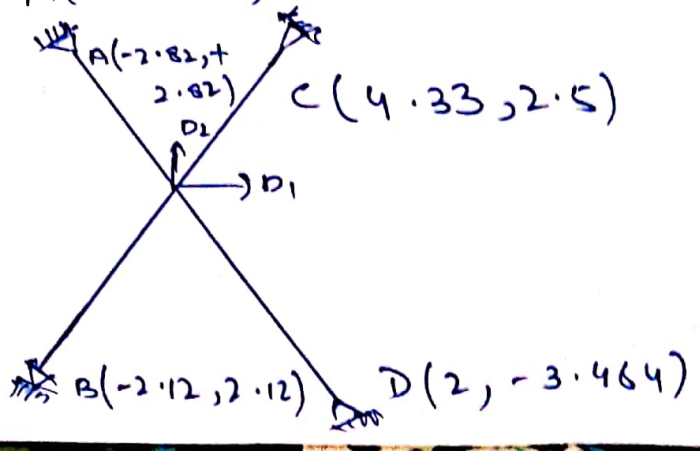
$$K.I = 2j - r.$$

$$= 2(5) - 8 = 2^\circ.$$

Step # 02

Select unknown joint Displacement.

A(-2.82, +2.82).



$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}, \quad \begin{bmatrix} AD_1 \\ AD_1 \end{bmatrix} = \begin{bmatrix} 50 \\ -100 \end{bmatrix}.$$

Step # 03:-

$$[AMD]_{4\times 2} = [S]_{2\times 2}$$

i) $D_1 = 1 \;,\; D_2 = 0.$

$$AMD = \frac{EA}{L^2}(\alpha_K - x_j)$$

$$AMD_{11} = \frac{80,000}{(400)^2} \times (0 + 282) = 14$$

$$AMD_{21} = \frac{80,000}{(300)^2} \times (0 + 212) = 188.44$$

$$AMD_{31} = \frac{100,000}{(500)^2} \times (0 - 433) = -173.2$$

$$AMD_{41} = \frac{100,000}{(4000)^2} \times (0 - 200) = -125.$$

$$S_{11} = \sum_{121}^{m} \frac{EA}{L^3}(x_K - x_j)^2$$

$$= \frac{80,000}{400^3}(282)^2 + \frac{80,000}{300^3}(212)^2 + \frac{100,000}{500^3}(-433)^2$$

P.T.O

$$+ \frac{10,000}{400^3}(-200)^2$$

$$S_{11} = 99.405 + 133.107 + 149.991 + 62.5$$

$$S_{11} = 445.063$$

$$S_{12} = S_{21} = \sum_{121}^{m} \frac{EA}{L^3}(x_k - x_j)(y_k - y_j)$$

$$= \frac{80,000}{400^3}(282)(-282) + \frac{80,000}{300^3}(212)(212$$

$$+ \frac{10,000}{500^3}(-433)(0.250) + \frac{100,000}{400^3}$$

$$(-200)(0+346)$$

$$S_{12} = S_{21} = 12.237.$$

(ii) $D_1 = 0$, $D_1 = 1$ k'

$$AMD = \frac{EA}{L^3}(x_k - x_j)$$

$$AMD_{12} = \frac{80,000}{400^2}(-282) = -141$$

P.T.O

$$AMD_{22} = \frac{80,000}{300}(212) = 188.44.$$

$$AMD_{32} = \frac{100,000}{800^2}(-250) = -100$$

$$AMD_{42} = \frac{100,000}{400^2}(346) = 216.25$$

Now,

$$S_{22} = \sum_{i=1}^{n} \frac{EA}{L^3}(x_{ik} - x_{jj})^2$$

$$\frac{80,000}{400^3}(-282)^2 + \frac{80,000}{300^3}(212)^2 + \frac{100,000}{500^3}$$

$$(-250)^2 + \frac{100,000}{400^3}(346)^2$$

$$S_{22} = 469.628$$

Step#04:-

$$[D] = [S]^{-1} \times [AD].$$

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} 445.063 & 12.237 \\ 12.237 & 469.628 \end{bmatrix}^{-1} \times \begin{bmatrix} 50 \\ -100 \end{bmatrix}.$$

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} 0.1183 \\ -0.0216 \end{bmatrix}.$$

P.T.O

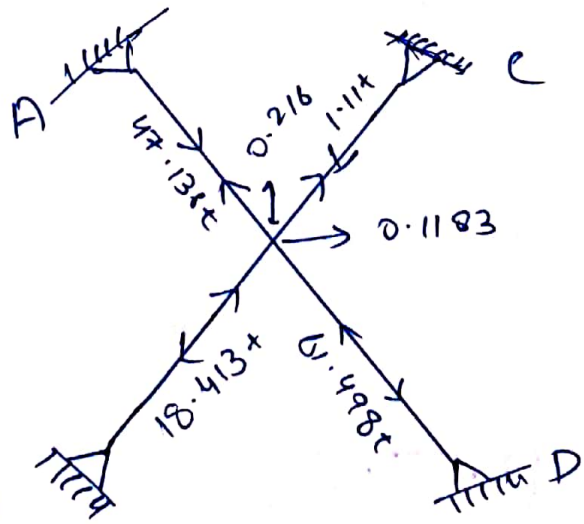
Step #05 :- [AM]

$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 141 & -141 \\ 188.44 & 188.44 \\ -173.2 & -100 \\ -125 & 216.25 \end{bmatrix} \times \begin{bmatrix} 0.1183 \\ -0.216 \end{bmatrix}.$$

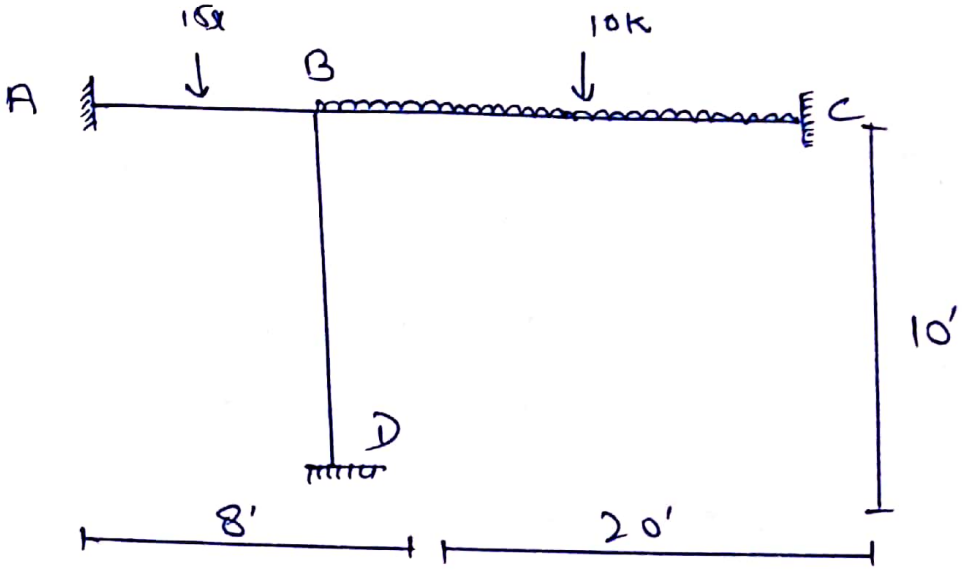
$$\begin{bmatrix} 141 \times 0.1183 + (-141) \times (0.216) \\ 188.44 \times 0.1183 + 188.44 \times (-0.216 \\ -173.2 \times 0.1183 + (-100) \times (-0.210) \\ -125 \times 0.1183 + 216.25 \times (0.216) \end{bmatrix}$$

$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 16.68 + 30.46 \\ 22.29 - 40.70 \\ -20.49 + 21.6 \\ -14.79 - 46.71 \end{bmatrix}.$$

$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 47.136\,t \\ -18.413\,t \\ 1.11\,t \\ -61.498\,t \end{bmatrix}.$$



Q NO # 02:-

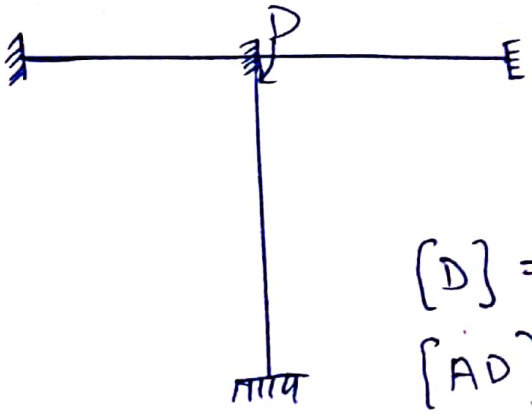


Solution:-

Step No 01 :- Determine Kinematic indeterminancy.

$$K.I = 1^{\circ}.$$

Step NO 02: Determine unknown Joint ~~determen~~ Displacement.

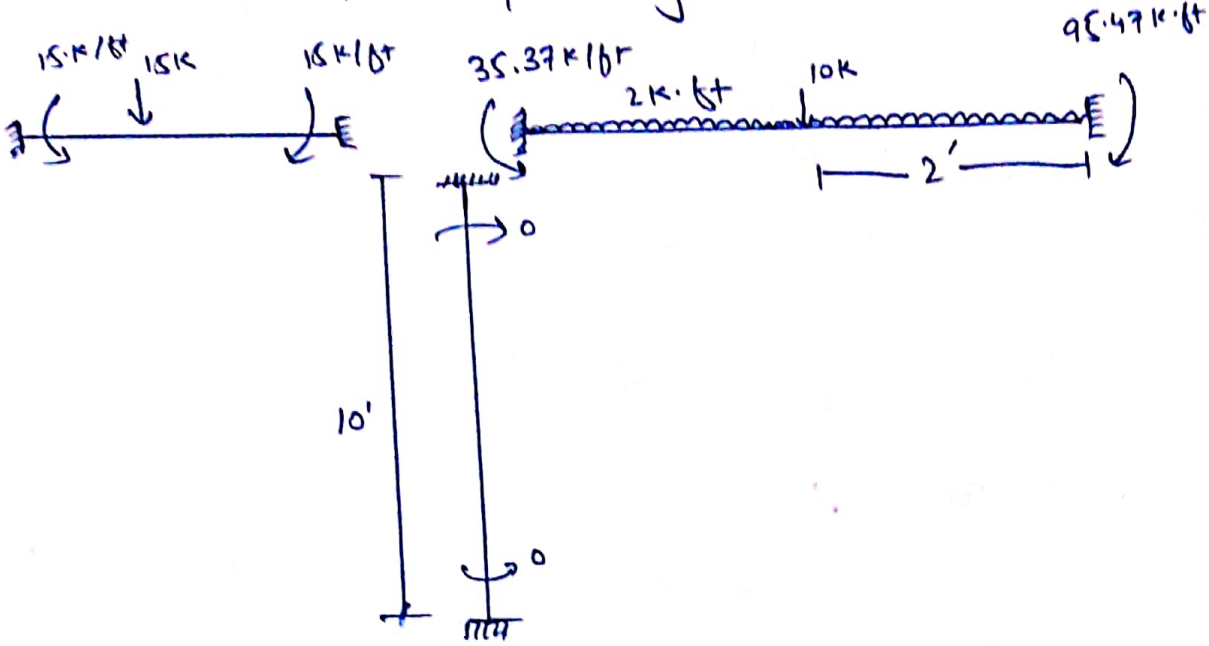


$$\begin{bmatrix} D \end{bmatrix} = \begin{bmatrix} ? \end{bmatrix}$$
$$\begin{bmatrix} AD \end{bmatrix} \quad \begin{bmatrix} 0 \end{bmatrix}$$

P.T.O

Step # 03

Compute [AIX] matrix.



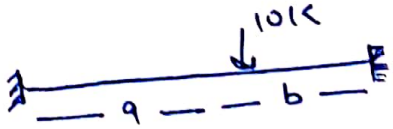
⇒ point load at Center :- $\frac{PL}{8} = \frac{(15)(8)}{8} = 15\ K\cdot ft$

⇒ uniformly Distributed load :- $\frac{WL^2}{12}$

$= \frac{2(20)^2}{12} = 66.67\ K/ft.$

⇒ point load (Not at mid) :-

Suppose :-



For left end :- $\frac{Pab^2}{L^2} = \frac{(10)(12)(8)^2}{(20)^2} = 19.2\ K\cdot ft$

For right end :- $\frac{Pab^2}{L^2} = \frac{(10)(12)^2(8)}{(20)^2} =$

$28.8\ K\cdot ft.$

P.T.O.

So total moment at left end:-

$$19.2 + 66.67 = 85.87 \text{ K.ft}$$

Similarly at right end:-

$$28.8 + 66.67 = 95.47 \text{ K.ft}$$

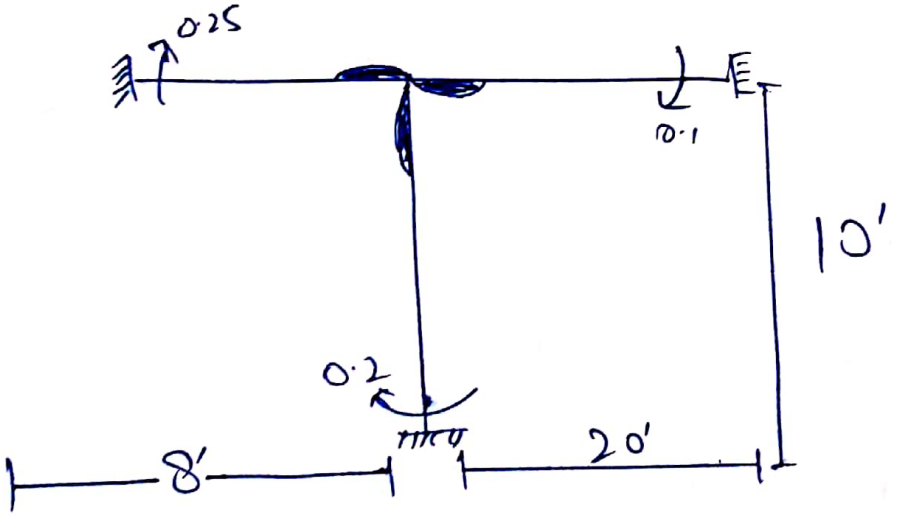
$$\text{So } [ADL] = -85.87 + 15 = -70.87 \text{ K.ft}$$

Step # 04:-

Determine $[s]$ matrix.

$$[s] = [S_{11}]$$

Now, $D = 1 K$.



$$\Rightarrow \frac{4EI}{8} = 0.5 \qquad \frac{2EI}{8} = 0.25 \Rightarrow \frac{4EI}{10} = 0.4$$

$$\Rightarrow \frac{4EI}{20} = 0.2 \qquad \frac{2EI}{20} = 0.25 \qquad \frac{2EI}{10} = 0.2$$

P.T.O

$$[S] = (0.5 + 0.4 + 0.2)EI$$

$$= 1.1\ EI.$$

$$[S] = 1.1\ EI$$

Step # 05:

Compute [D] Matrix.

$$[D] = [S]^{-1} \times [AD] - [ADL].$$

$$[D] = \frac{1}{1.1} \times [0] - [-70.81].$$

$$= \frac{70.87}{1.1}$$

$$[D] = [64.42]\ 1/EI.$$

XX XX

the End :-