10-12

F → Flexi
M → mom
S →
T → theory
N → not mention.

10-12

1 ⓐ → theory
ⓑ → Flexi
2 ⓐ → T
ⓑ → F/N.
3 ⓐ → F/N
ⓑ → F
4 ⓐ → S
5 ⓐ → M.
ⓑ → M
6 ⓐ → M
ⓑ → M
7 ⓐ → M
ⓑ → S
8 ⓐ → S
ⓑ → S

S → 4
F → 4
M → 5

15-16

1 ⓐ → M
ⓑ → M
2 ⓐ S
ⓑ S
3 ⓐ S
ⓑ M
4 ⓐ M
ⓑ S
5 ⓐ F
ⓑ F
6 ⓐ F
ⓑ F
7 ⓐ F
ⓑ S
8 ⓐ N
ⓑ S

S → 5
F → 5
M → 4

14-15

1 ⓐ F
ⓑ F
2 ⓐ F
ⓑ F
3 ⓐ S
ⓑ S
4 ⓐ S
ⓑ → T
5 ⓐ T
ⓑ M
6 ⓐ M
ⓑ M
7 ⓐ S
ⓑ F
8 ⓐ S
ⓑ S

S → 6
F → 5
M → 3

13-14

1 ⓐ M
2 → F
3 → M
4 → F
5 → M
6 → F
7 → M
8 → S
9 → S
10 → S
11 → S
12 → S
13 → S
14 → F

S → 6
F → 4
M → 4

12-13

1 ⓐ M
2 ⓐ M
ⓑ S
3 ⓐ S
ⓑ S
4 ⓐ S
5 ⓐ F
ⓑ F/T
6 ⓐ F
ⓑ F
7 ⓐ F
ⓑ F
8 ⓐ F

S → 4
F → 6
M → 2

11-12

1 ⓐ F
ⓑ S
2 ⓐ F
ⓑ S
3 ⓐ N
ⓑ S
4 → S
5 ⓐ M
ⓑ F
6 ⓐ Scope
ⓑ M
7 ⓐ M
8 ⓐ Scope
ⓑ —

S → 4
F → 3
M → 3

13-14

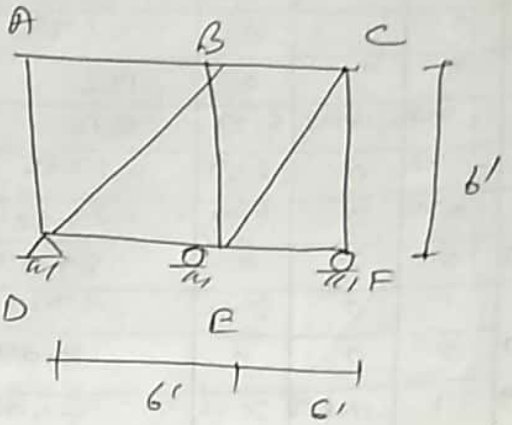
11 12
10 11
8 9

Nothing is certain.

2016-17

Taurs

(5) (6)



AB BC

$\Delta\theta = 50°C$

$\alpha = 13 \times 10^{-6}/°C$

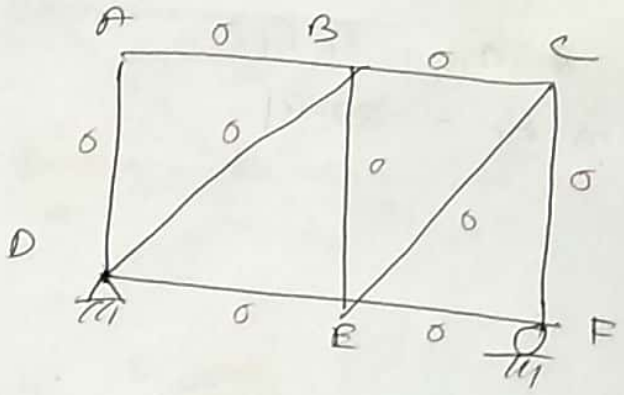
$E A = 300^{k}$.

$DOI = m + r - 2j$

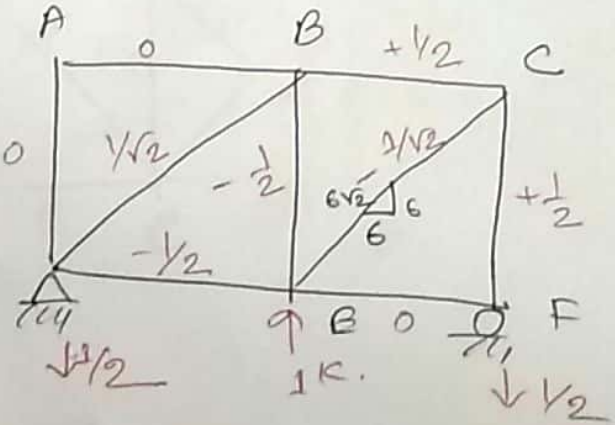
$= 9 + (2+1+1) - 2\times 6 = 13 - 12 = 1°$

Remove support (E) $\rightarrow R_1$

no



n1



Bar	L	n_0	n_1	$n_0 n_1 L$	$n_1^2 L$	$\alpha \Delta T L$	$n_1 \alpha \Delta T L$	$n = n_0 + n_1 R_1$
AB	6	0	0	0	0	0.0039	0	0
BC	6	0	1/2	0	$0.25 \times 6 = 1.5$	0.0039	0.00195	-0.0202
DE	6	0	-1/2	0	$0.25 \times 6 = 1.5$	0		0.0202
EF	6	0	0	0	0	0		0
AD	6	0	0	0	0	0		0
BE	6	0	-1/2	0	$0.25 \times 6 = 1.5$	0		0.0202
CF	6	0	+1/2	0	$0.25 \times 6 = 1.5$	0		-0.0202
BD	$6\sqrt{2}$	0	$\sqrt{2}/2$	0	$0.5 \times 6\sqrt{2} = 4.24$	0		-0.0285
EC	$6\sqrt{2}$	0	$-\sqrt{2}/2$	0	$0.5 \times 6\sqrt{2} = 4.24$	0	0	+0.0285
				0	14.48		0.00195	

$\alpha = 13 \times 10^{-6}$

$$\Delta_{10} = \sum \frac{n_0 n_1 L}{AE} + \sum n_1 \alpha \Delta T L$$

$$= 0 + 0.00195 = 0.00195$$

$$\delta_{11} = \sum \frac{n_1^2 L}{AE} = \frac{14.48}{300} = 0.04827$$

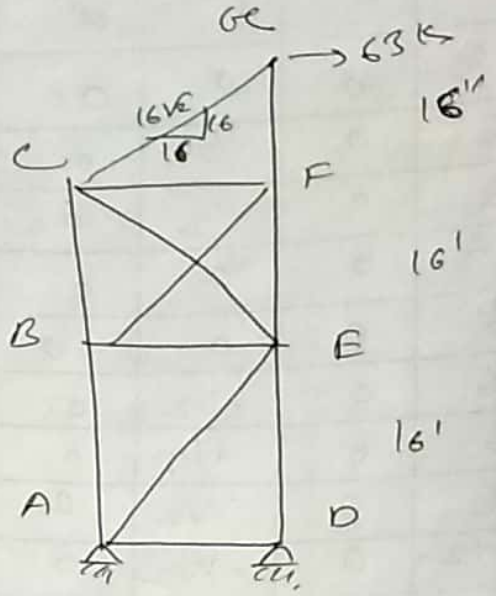
$$\Delta_1 = \Delta_{10} + \delta_{11} R \Rightarrow R = -0.04037$$

$\Delta_1 \to 0 \quad \Delta_{10} \to 0.00195$

2015-16

5 (a)

Eita vul
onno pdf e kore deoa ase
thik vabe



DOI = b+r-2j

= 12+4-2×7

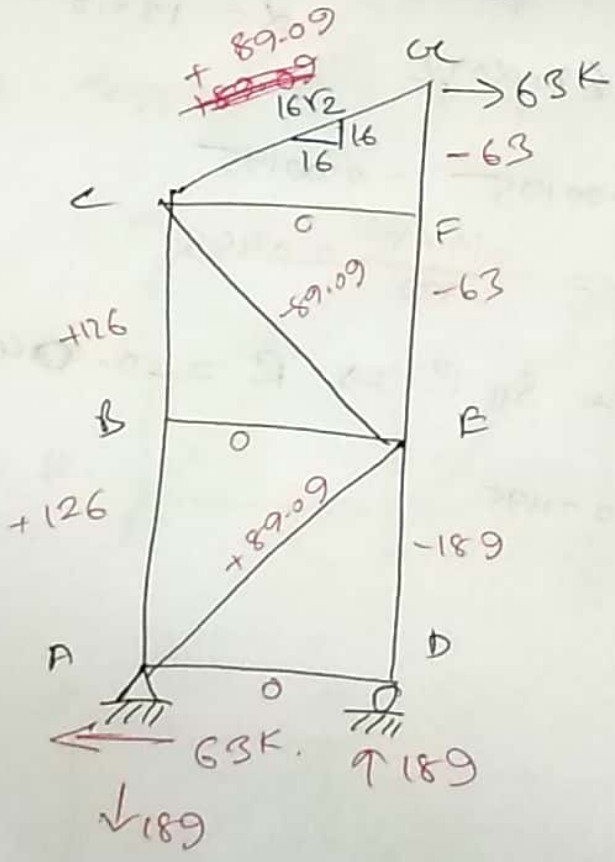
= 16-14 = 2°.

R_1 → take bar BF

R_2 → horizontal reaction at (D) 16'

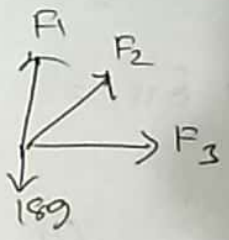
(→)

no



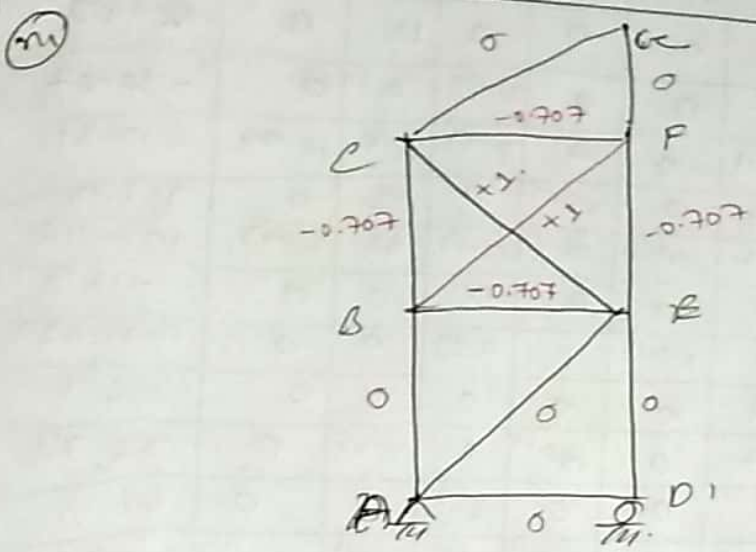
$F \times \frac{16}{16\sqrt{2}} = 63$

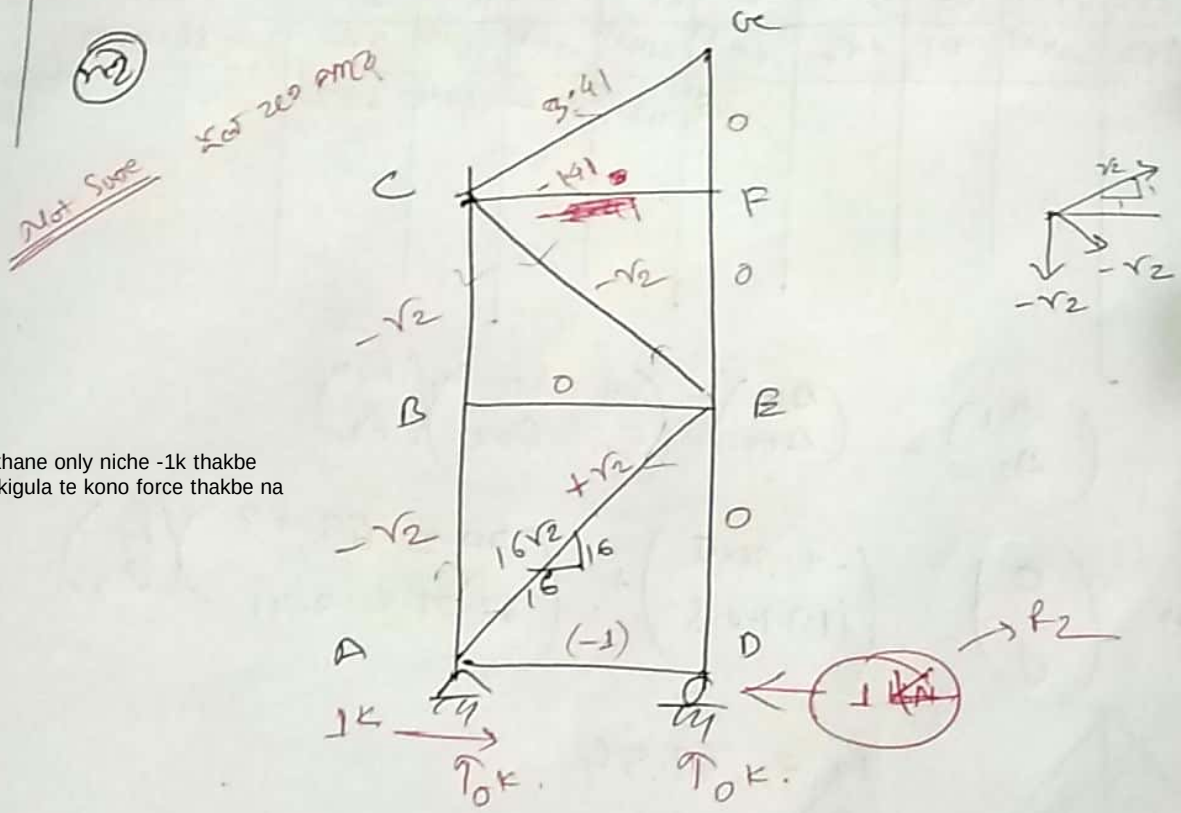
$F = 89.09$



$F_1 + F_2 \times \frac{1}{\sqrt{2}} = 189$

$F_2 \frac{1}{\sqrt{2}} = 63$





Not Sure

Eikhane only niche -1k thakbe bakigula te kono force thakbe na

Bar	L	n_0	n_1	n_2	$n_0 n_1 L$	$n_0 n_2 L$	$n_1^2 L$	$n_2^2 L$	$n_1 n_2 L$	$n = n_0 + n_1 R_1 + n_2 R_2$
AD	16	0	0	−1	0	0	0	16	0	8.69
BE	16	0	−0.707	0	0	0	7.99	0	0	−30.07
CF	16	0	−0.707	−1.41	0	0	7.99	31.8	15.94	−17.81
AB	16	126	0	$-\sqrt{2}$	0	−2851.05	0	32	0	138.29
BC	16	126	−0.707	$-\sqrt{2}$	−1425.3	−2851.05	7.99	32	15.99	108.246
DB	16	−189	0	0	0	0	0	0	0	−189
EF	16	−63	−0.707	0	712.66	0	7.99	0	0	−93.07
FC	16	−63	0	0	0	0	0	0	0	−63
AE	$16\sqrt{2}$	89.09	0	$\sqrt{2}$	0	2850.88	0	45.25	0	76.79
BF	$16\sqrt{2}$	0	+1	0	0	0	22.62	0	0	42.54
CE	$16\sqrt{2}$	−89.09	+1	$-\sqrt{2}$	−2015.87	−2850.88	22.62	45.25	32	−34.25
					−2725.51	1172.03	77.2	447.41	63.93	

$$\begin{pmatrix} \Delta_1 \\ \Delta_2 \end{pmatrix} = \begin{pmatrix} \Delta_{10} \\ \Delta_{20} \end{pmatrix} + \begin{pmatrix} \delta_{11} & \delta_{12} \\ \delta_{21} & \delta_{22} \end{pmatrix} \begin{pmatrix} R_1 \\ R_2 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} 0 \\ 0 \end{pmatrix} = \begin{pmatrix} -2725.51 \\ 1172.03 \end{pmatrix} + \begin{pmatrix} 77.2 & 63.93 \\ 63.93 & 447.41 \end{pmatrix} \begin{pmatrix} R_1 \\ R_2 \end{pmatrix}$$

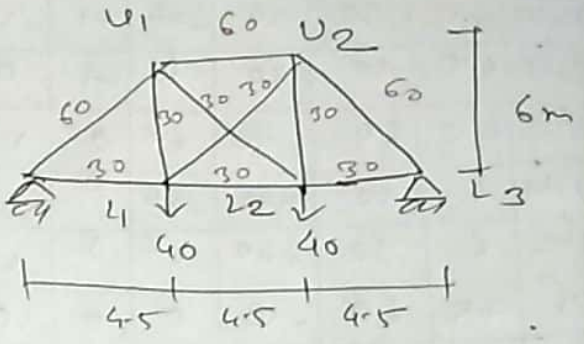
$$R_1 = 42.54$$

$$R_2 = -8.699$$

2014-15

1 (c)

$E = 2000$ ton/cm²



DoI

$= b + r - 2j$

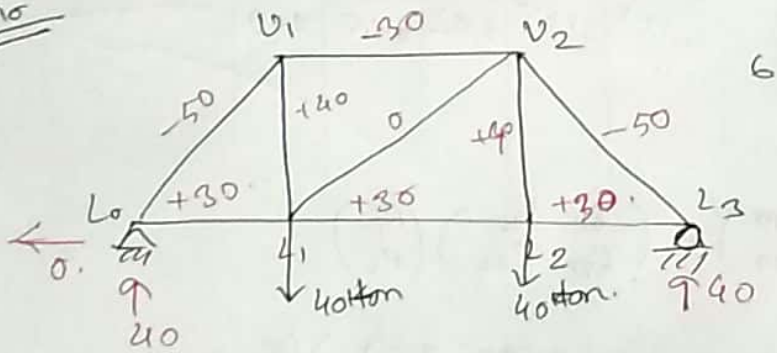
$= 10 + 4 - 2 \times 6$

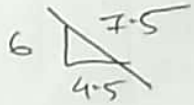
$= 14 - 12 = 2°$.

$F_1 \rightarrow$ Bar U_1L_2

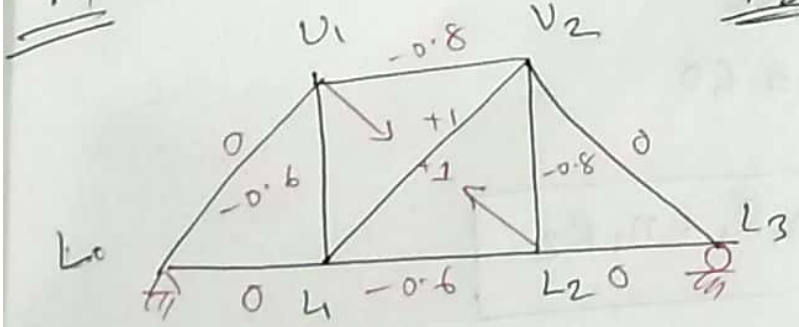
$R_2 \rightarrow$ horizontal Reaction at L_3

no

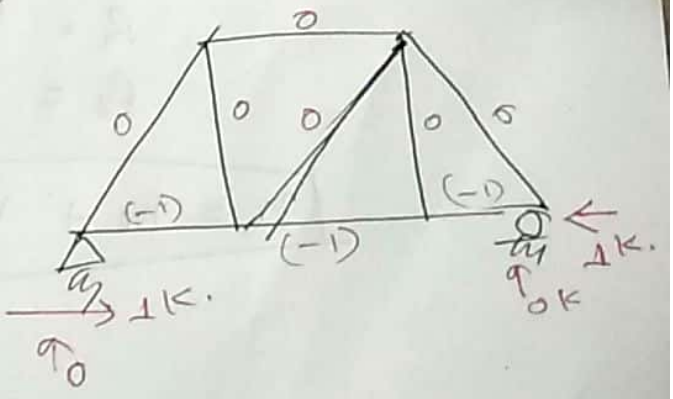




n1



n2



Bar	L	A	n_0	n_1	n_2	$n_1 n_0 \frac{L}{A}$	$n_0^2 \frac{L}{A}$	$n_1^2 \frac{L}{A}$	$n_2^2 \frac{L}{A}$	$n_1 n_2 \frac{L}{A}$	n
L_0L_1	4.5	30	30	0	-1	0	-4.5	0	0.15	0	2.4
L_1L_2	4.5	30	30	-0.6	-1	-2.7	-4.5	0.054	0.15	0.09	-4.78
L_2L_3	4.5	30	30	0	-1	0	-4.5	0	0.15	0	2.4
U_1U_2	4.5	60	-30	-0.8	0	1.8	0	0.048	0	0	-39.58
U_1L_1	6	30	+40	-0.6	0	-4.8	0	0.072	0	0	32.8
U_2L_2	6	30	+40	-0.8	0	-6.4	0	0.128	0	0	30.4
L_0U_1	7.5	60	-50	0	0	0	0	0	0	0	-50
U_1L_2	7.5	30	0	1	0	0	0	0.25	0	0	11.98
L_1U_2	7.5	30	0	1	0	0	0	0.25	0	0	11.98
U_2L_3	7.5	60	-50	0	0	0	0	0	0	0	-50
						-12.1	-13.5	0.802	0.45	0.09	

$$\begin{pmatrix} \Delta_1 \\ \Delta_2 \end{pmatrix} = \begin{pmatrix} \Delta_{10} \\ \Delta_{20} \end{pmatrix} + \begin{pmatrix} \delta_{11} & \delta_{12} \\ \delta_{21} & \delta_{22} \end{pmatrix} \begin{pmatrix} R_1 \\ R_2 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} 0 \\ 0 \end{pmatrix} = \begin{pmatrix} -12.1 \\ -13.5 \end{pmatrix} + \begin{pmatrix} 0.802 & 0.09 \\ 0.09 & 0.45 \end{pmatrix} \begin{pmatrix} R_1 \\ R_2 \end{pmatrix}$$

$$R_1 = 11.98$$

$$R_2 = 27.60$$

$$\boxed{n = n_0 + n_1 R_1 + n_2 R_2}$$

2013+14

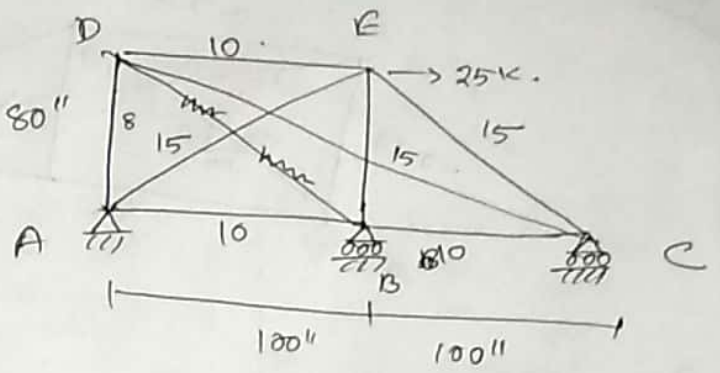
②

DOI → member, reaction, joint

$= b + r - 2j$

$= 8 + (2+1+1) - 2\times 5$

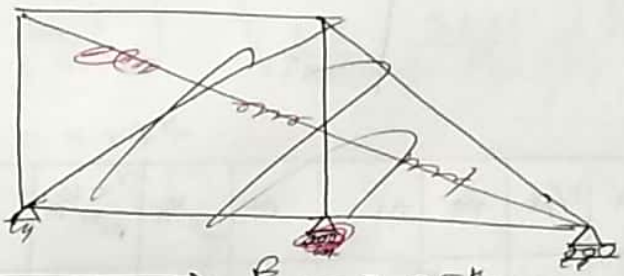
$= 2°$

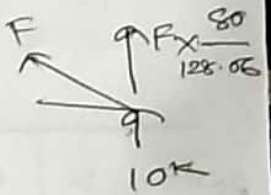


no

$R_1 \rightarrow$ at B

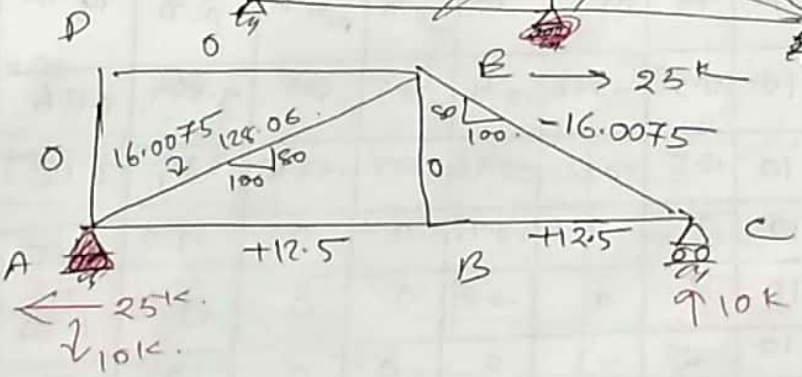
$R_2 \rightarrow$ member CD.



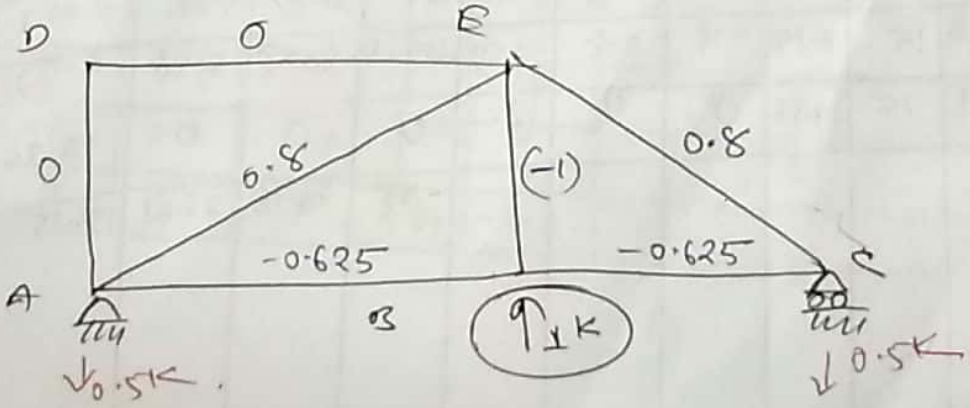


$\Rightarrow F = -16.0075$

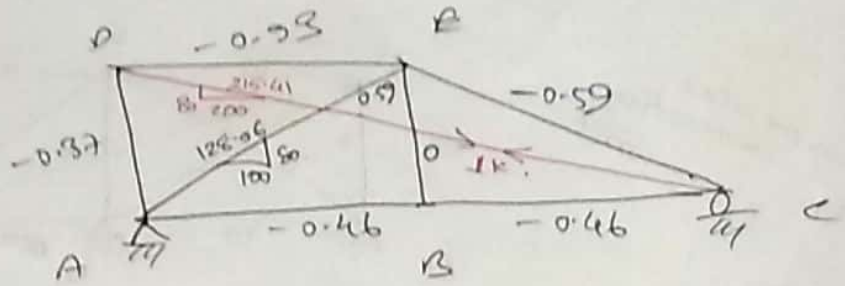
no

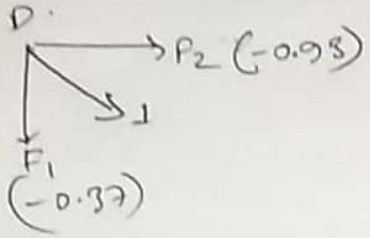


n1



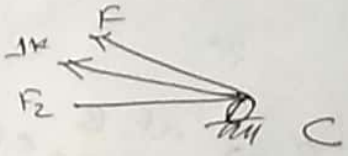
n_2





$$F \times \frac{100}{128.06} + 1 \times \frac{200}{215.91} + F_2 = 0$$

$$\Rightarrow F_2 = (-0.46)$$



$$\Rightarrow \frac{80}{215.41} \times 1 + F \times \frac{80}{128.06}$$

$$\Rightarrow F = -0.59$$

Bar	L	A	L/A	n_0	n_1	n_2	$n_0 n_1 L/A$	$n_0 n_2 L/A$	$n_1^2 L/A$	$n_2^2 L/A$	$n_1 n_2 L/A$
AB	100	10	10	12.5	-0.62	-0.46	-77.5	-57.5	3.844	2.116	2.852
BC	100	10	10	12.5	-0.62	-0.46	-77.5	-57.5	3.84	2.12	2.85
DE	100	10	10	0	0	-0.98	0	0	0	8.65	0
AD	80	8	10	0	0	-0.37	0	0	0	1.37	0
BE	80	8	10	0	-1	0	0	0	10	0	0
AE	128.06	15	8.54	16	0.8	0.59	109.28	80.59	5.46	2.97	4.03
CE	128.06	15	8.54	-16	0.8	-0.59	-109.28	80.59	5.46	2.97	-4.03
CD	215.41	15	14.36	0	0	1.	0	0	0	14.36	0
Σ							-155	46.18	28.62	34.55	5.7

$$\begin{Bmatrix} \Delta_1 \\ \Delta_2 \end{Bmatrix} = \begin{bmatrix} \Delta_{10} \\ \Delta_{20} \end{bmatrix} + \begin{pmatrix} \delta_{11} & \delta_{12} \\ \delta_{21} & \delta_{22} \end{pmatrix} \begin{pmatrix} R_1 \\ R_2 \end{pmatrix}$$

$$\Delta_{10} = \sum \frac{n_0 n_1}{AE} L = -\frac{155}{E}$$

$$\Delta_{20} = \sum \frac{n_0 n_2 L}{AE} = \frac{46.18}{E}$$

$$\delta_{11} = \sum \frac{n_1 n_1 L}{AE} = \frac{28.62}{E}$$

$$\delta_{12} = \delta_{21} = \sum \frac{n_1 n_2 L}{AE} = \frac{5.7}{AE}$$

$$\delta_{22} = \sum \frac{n_2 n_2 L}{AE} = \frac{34.55}{AE}$$

$$\therefore \begin{Bmatrix} 0 \\ 0 \end{Bmatrix} = \begin{bmatrix} -\frac{155}{E} \\ \frac{46.18}{E} \end{bmatrix} + \begin{pmatrix} \frac{28.62}{E} & \frac{5.7}{E} \\ \frac{5.7}{AE} & \frac{34.55}{E} \end{pmatrix} \begin{pmatrix} R_1 \\ R_2 \end{pmatrix}$$

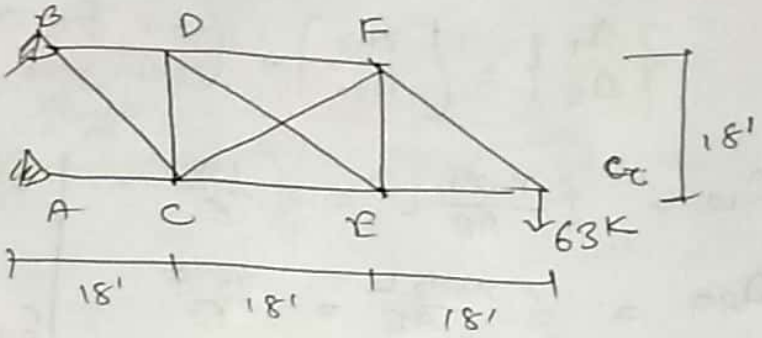
$$\Rightarrow \quad R_1 = 5.87^K$$
$$R_2 = -2.3^K.$$

Bar force $\quad n = n_0 + n_1 R_1 + n_2 R_2$

Bar	n_0	n_1	n_2	R_1	R_2	$n =$
AB	12.5	-0.62	-0.46	5.87	-2.3	9.92
BC	12.5	-0.62	-0.46	5.87		9.92
DB	0	0	-0.93			2.14
AD	0	0	-0.37			0.85
BE	0	-1	0			-5.87
AE	16	0.8	0.59			19.34
CE	-16	0.8	-0.59			-7.95
CD	0	0	1	5.87	-2.3	-2.3

2012-13

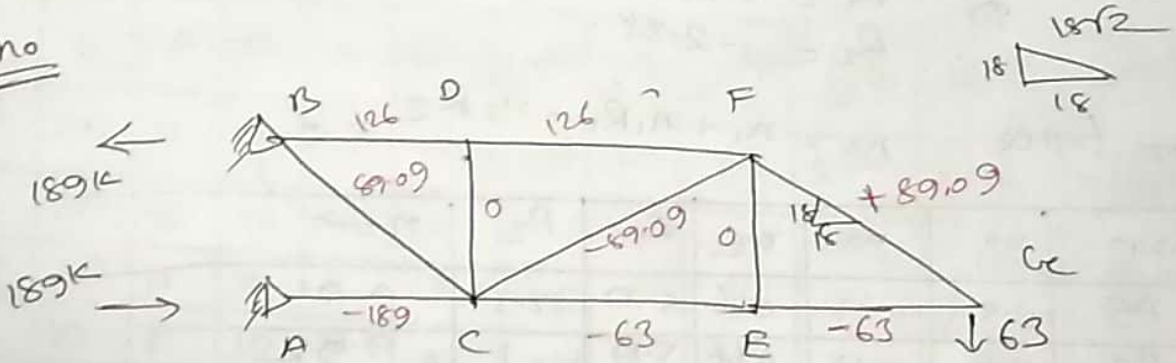
8(a)



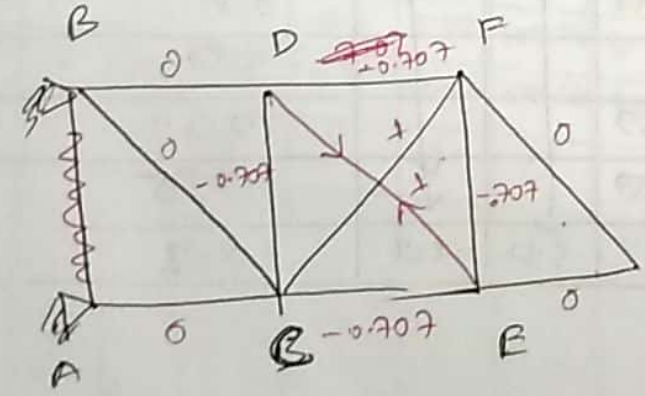
DOI = b + r − 2j
= 11 + 4 − 2×7 = 1°.
(r → reaction; b → bar; j → joint)

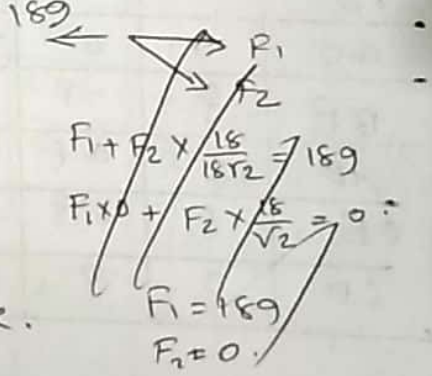
R → R_1 → remove bar (DE)

no



n1





Bar	L	n_0	n_1	$n_0 n_1 L$	$n_1 n_1 L$	$n_0 + n_1 R_1$
AC	18	-189	0	0	0	-189
CE	18	-63	-0.707	801.74	0	-90.66
EG	18	-63	0	0	0	-63
BD	18	126	0	0	0	126
DF	18	126	-0.707	-160348	8.99	96.14
CD	18	0	-0.707	0	8.99	-27.86
EF	18	0	-0.707	0	8.99	-27.86
BC	25.46	89.09	0	0	0	89.09
DE	25.46	0	1	0	25.46	39.41
FG	25.46	89.09	0	0	0	89.09
CF	25.46	-89.09	1	-2268.28	25.46	-49.68
				-3069.97	77.89	

$$\Delta_{10} = \sum \frac{n_0 n_1 L}{AE} = -\frac{3069.97}{AE}$$

$$\delta_{11} = \sum \frac{n_1 n_1 L}{AE} = \frac{77.89}{AE}$$

$$\Delta_1 = \Delta_{10} + \delta_{11} R_1$$

$$\Rightarrow R_1 = 39.41$$