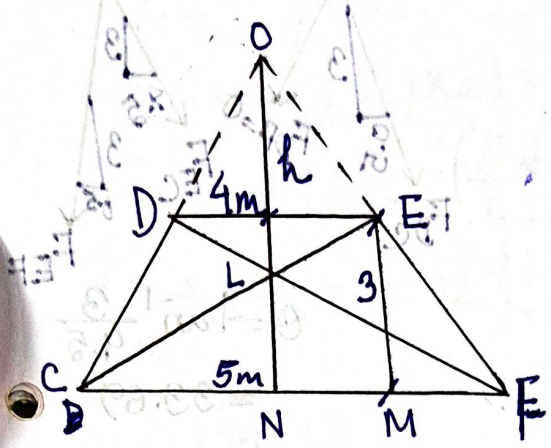
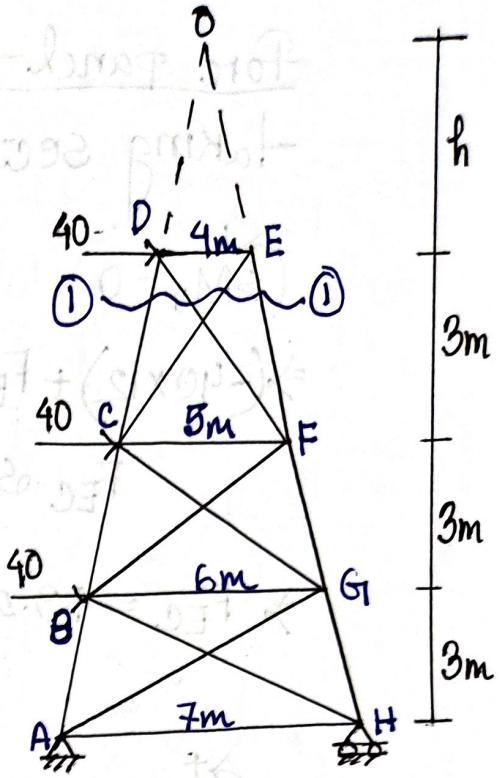
① According to method, 1

Compression zone = 0

$\Rightarrow F_{DF} = F_{CG} = F_{BH} = 0$





$\triangle ODE$ and $\triangle OCF$, $\frac{h}{4} = \frac{h+3}{5}$

$\Rightarrow h = 12m$

$CN = \frac{5}{2} = 2.5\,m$

$CM = 2.5 + \frac{4}{2} = 4.5\,m$

$CE = \sqrt{EM^2 + CM^2}$

$= \sqrt{3^2 + 4.5^2}$

$= 5.41\,m$

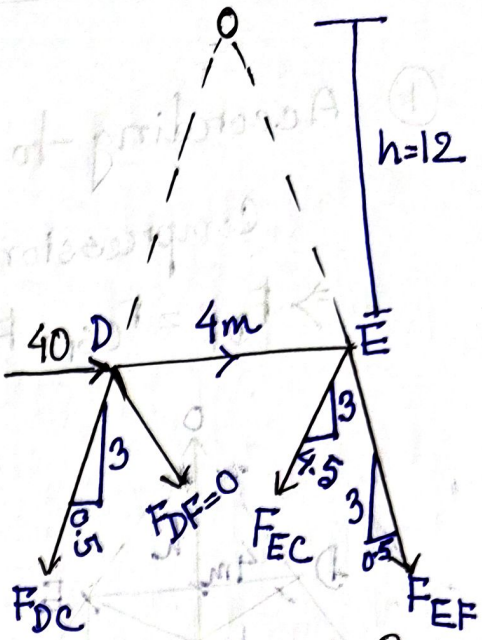
$MF = 5 - 4.5 = 0.5\,m$

$CD = EF = \sqrt{3^2 + 0.5^2}$

$= 3.04\,m$

For panel-1

taking section ①-①,



$\theta = \tan^{-1}\frac{3}{4.5}$

$= 33.69$

$\theta = \tan^{-1}\frac{3}{0.5}$

$= 80.54$

$\overset{+}{\circlearrowright}\sum M_O = 0$

$\Rightarrow (-40\times 12) + F_{EC}\cos\theta \times 12 + F_{EC}\sin\theta \times \frac{4}{2} = 0$

$\Rightarrow F_{EC} = 43.27\ (KN)\ (T)$

$\overset{+}{\circlearrowright}\sum M_D = 0$

$\Rightarrow F_{EC}\sin\theta \times 4 + F_{EF}\sin\theta \times 4$

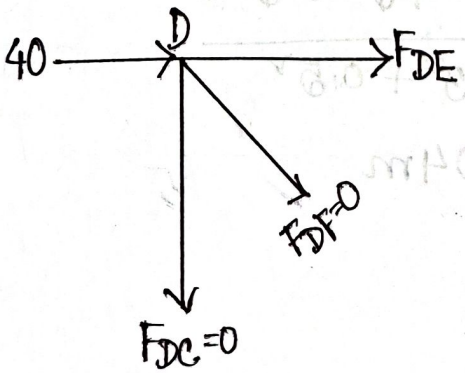
$\Rightarrow F_{EF} = -24.33\ KN\ (C)$

$\overset{+}{\uparrow}\sum F_y = 0$

$\Rightarrow -F_{DC}\sin(80.54) - F_{EC}\sin(33.69) + F_{EF}\sin(80.54) = 0$

$\Rightarrow F_{DC} = 0\ KN$

at joint, D

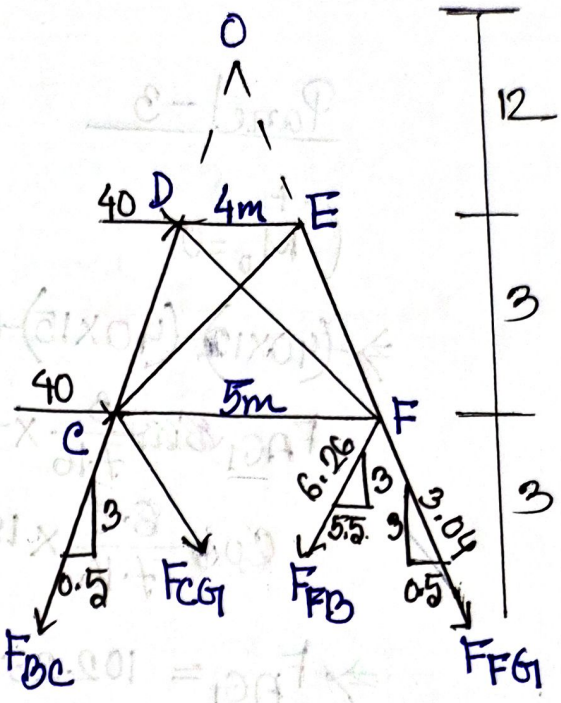


$\overset{(+)}{\rightarrow}\sum F_x = 0$

$\Rightarrow 40 + F_{DE} = 0$

$\Rightarrow F_{DE} = -40KN\ (C)$

For panel -2:



$\overset{+}{\circlearrowleft} M_O = 0$

$\Rightarrow (-40\times12) - (40\times15) + F_{FB}\sin\left(\frac{3}{6.26}\right)\times25 + F_{FB}\times\cos\left(\frac{5.5}{6.26}\right)\times15 = 0$

$\Rightarrow F_{FB} = 75.12\ (T)$

$\overset{+}{\circlearrowleft} M_C = 0$

$\Rightarrow (40\times3) + F_{FB}\sin\frac{3}{6.26}\times5 + F_{FG_1}\sin\frac{3}{3.04}\times5 = 0$

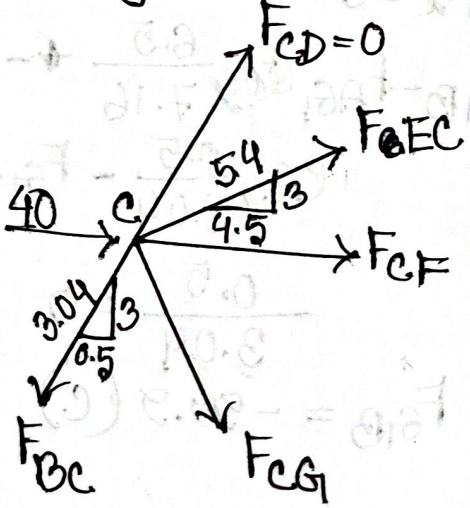
$\Rightarrow F_{FG_1} = -60.8\ (C)$

$\overset{+}{\circlearrowleft} M_F = 0$

$\Rightarrow (40\times3) - F_{BC}\sin\frac{3}{3.04}\times5 = 0$

$\Rightarrow F_{BC} = 24.32\ (T)$

At joint C,

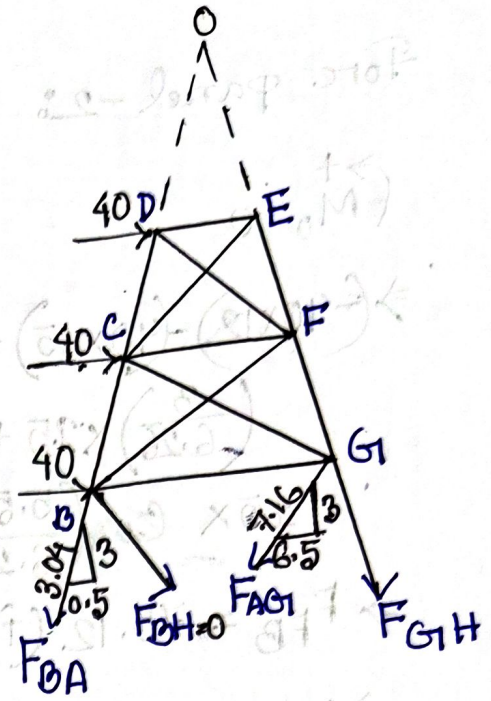


$\overset{(+)}{\rightarrow} \Sigma F_x = 0$

$\Rightarrow F_{CF} + 40 + F_{EC}\cos\left(\frac{4.5}{5.4}\right) - F_{BC}\cos\left(\frac{0.5}{3.04}\right) = 0$

$\Rightarrow F_{CF} = -72\ (C)$

Panel - 3



$\overset{+}{\circlearrowright} M_O = 0$

$\Rightarrow -(40\times12)-(40\times15)-(40\times18)+ F_{AG1}\cos\frac{3}{7.16}\times\frac{6}{9} + F_{AG1}\cos\frac{6.5}{7.16}\times18 = 0$

$\Rightarrow F_{AG1} = 102.28\ (T)$

$\overset{+}{\circlearrowright} M_B = 0$

$\Rightarrow (40\times6)+(40\times3)+F_{AG1}\cos\frac{3}{7.16}\times6+6F_{G1H}\cos\frac{3}{3.04}=0$

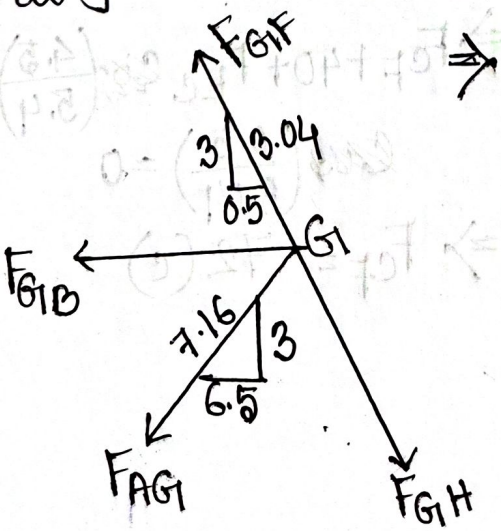
$\Rightarrow F_{G1H} = -104.23\ (C)$

$\overset{+}{\circlearrowright} M_{G1} = 0$

$\Rightarrow (40\times6)+(40\times3)-F_{AB}\cos\frac{3}{3.04}\times6=0$

$\Rightarrow F_{AB} = 60.8\ (T)$

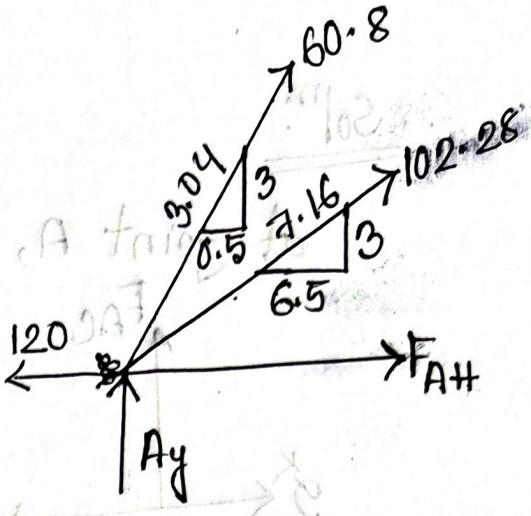
at joint G1,



$\overset{(+)}{\rightarrow} \Sigma F_x = 0$

$\Rightarrow -F_{G1B}-F_{AG1}\cos\frac{6.5}{7.16}+-F_{G1F}\cos\frac{0.5}{3.04}-F_{G1H}\cos\frac{0.5}{3.04}=0$

$\Rightarrow F_{G1B} = -99.9\ (C)$



$$\overset{(+)}{\uparrow} \Sigma F_y = 0$$

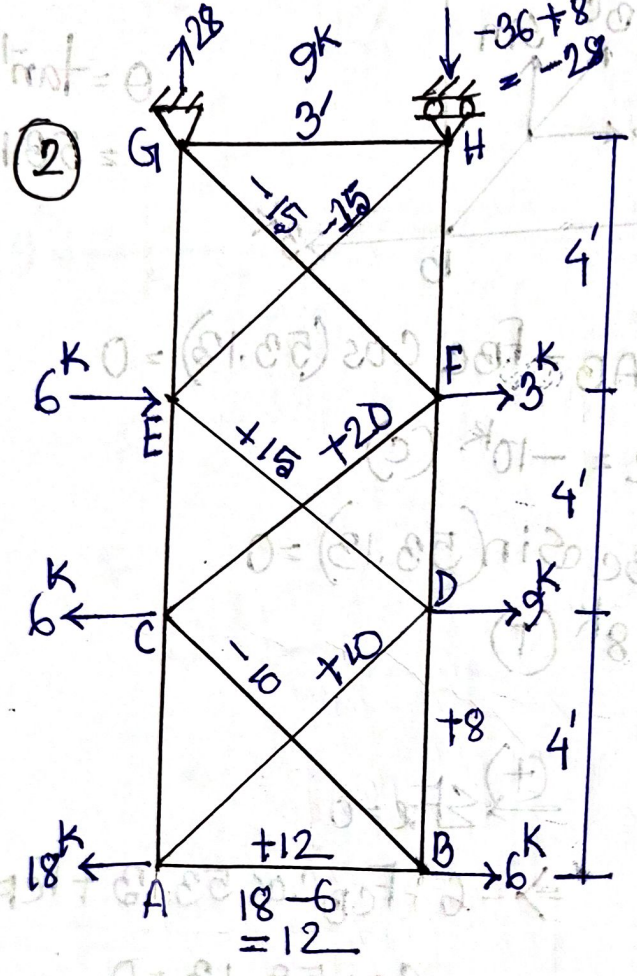
$$\Rightarrow Ay + 60.8 \frac{3}{3.04} + 102.28 \frac{3}{7.16} = 0$$

$$\Rightarrow Ay = -102.85 \ (\downarrow)$$

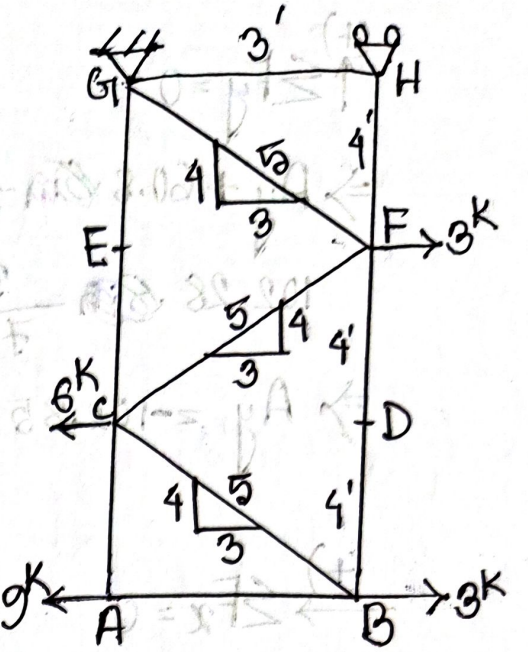
$$\overset{(+)}{\rightarrow} \Sigma F_x = 0$$

$$\Rightarrow F_{AH} - 120 + 60.8 \frac{0.5}{3.04} + 102.28 \frac{6.5}{7.16} = 0$$

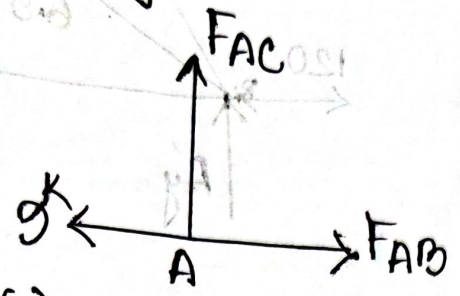
$$\Rightarrow F_{AH} = 17.13 \ (\rightarrow)$$



Soln:



at joint A,



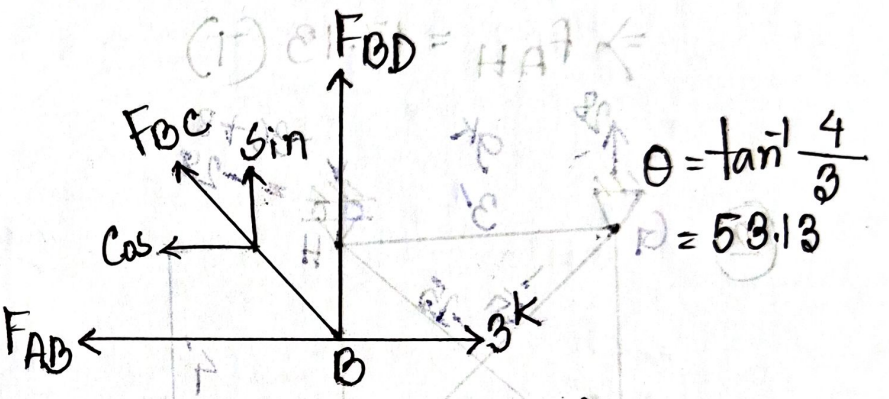
$\overset{(+)}{\rightarrow} \Sigma F_x = 0$

$\Rightarrow F_{AB} - 9 = 0$

$\Rightarrow F_{AB} = 9^K$

$(+)\uparrow \Sigma F_y = 0$

$\Rightarrow F_{AC} = 0$



at joint B,

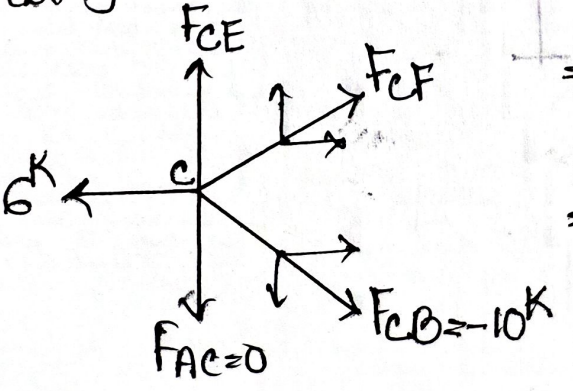
$\overset{(+)}{\rightarrow} \Sigma F_x = 0 \Rightarrow 3^K - F_{AB} - F_{BC}\cos(53.13) = 0$

$\Rightarrow F_{BC} = -10^K$ (C)

$\overset{(+)}{\uparrow} \Sigma F_y = 0 \Rightarrow F_{BD} + F_{BC}\sin(53.13) = 0$

$\Rightarrow F_{BD} = 8^K$ (T)

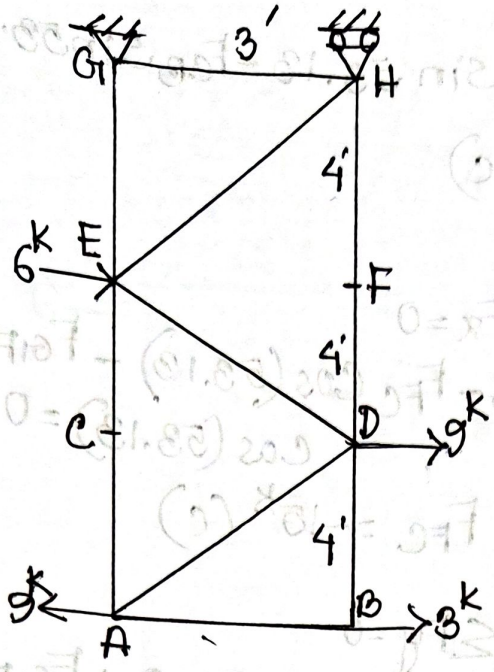
at joint C,



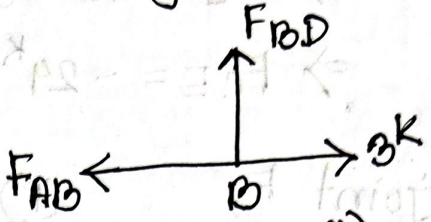
$\overset{(+)}{\rightarrow} \Sigma F_x = 0$

$\Rightarrow -6 + F_{CB}\cos 53.13 + F_{CF}\cos 53.13 = 0$

$\Rightarrow F_{CF} = 20^K$ (T)



at joint B,



$\Sigma F_x = 0 \xrightarrow{(+)}$

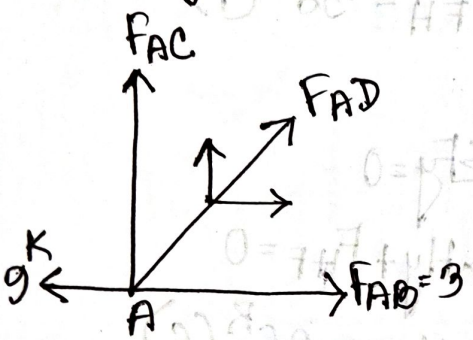
$\Rightarrow 3 - F_{AB} = 0$

$\Rightarrow F_{AB} = 3^K$

$\Sigma F_y = 0$

$\Rightarrow F_{BD} = 0$

at joint A,



$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow -9 + 3F_{AD}\cos(53.13) = 0$

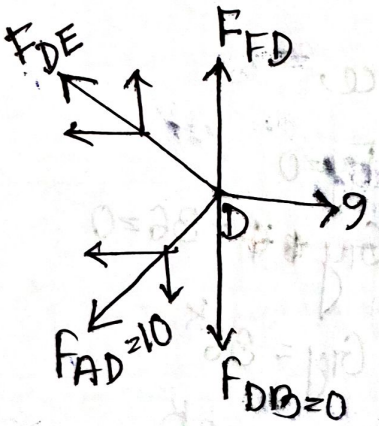
$\Rightarrow F_{AD} = 10^K$ (T)

$\uparrow^{(+)} \Sigma F_y = 0$

$\Rightarrow F_{AC} + F_{AD}\sin 53.13 = 0$

$\Rightarrow F_{AC} = -8^K$ (C)

At joint D



$\Sigma F_x = 0$

$\Rightarrow 9 - F_{AD}\cos\theta - F_{DE}\cos\theta = 0$

$\Rightarrow F_{DE} = 5^K$ (T)

$\Sigma F_y = 0$

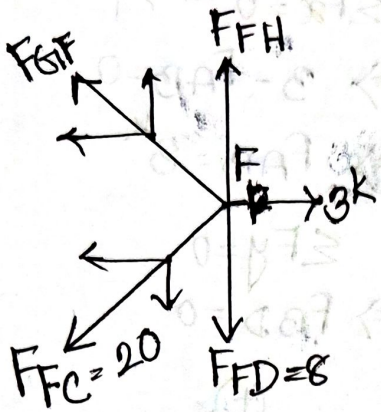
$\Rightarrow F_{FD} + F_{DE}\sin\theta - F_{AD}\sin\theta =$

$\Rightarrow F_{FD} = 4^K$ (T)

(+↑) $\Sigma F_y = 0 \Rightarrow F_{CE} - F_{AC} + F_{CF} \sin 53.13 - F_{CB} \sin 53.13 = 0$

$\Rightarrow F_{CE} = -24^K$ (C)

At joint F,



$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow 3 - F_{FC} \cos(53.13) - F_{GF} \cos(53.13) = 0$

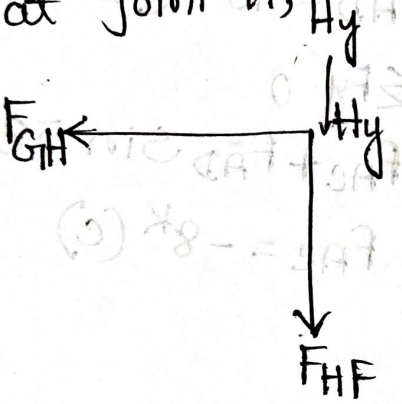
$\Rightarrow F_{FC} = -15^K$ (C)

(+↑) $\Sigma F_y = 0$

$\Rightarrow F_{FH} - 8 - F_{FC} \sin\theta + F_{GF} \sin\theta = 0$

$\Rightarrow F_{FH} = 36^K$ (T)

at joint H,



(+↑) $\Sigma F_y = 0$

$\Rightarrow Hy + F_{HF} = 0$

$\Rightarrow Hy = -36^K$ (C)

$F_{GH} = 0$

at joint G1,

for whole structure,

$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow G_{1x} - 6 - 9 + 3 + 3 = 0$

$\Rightarrow G_{1x} = 9^K$ (T)

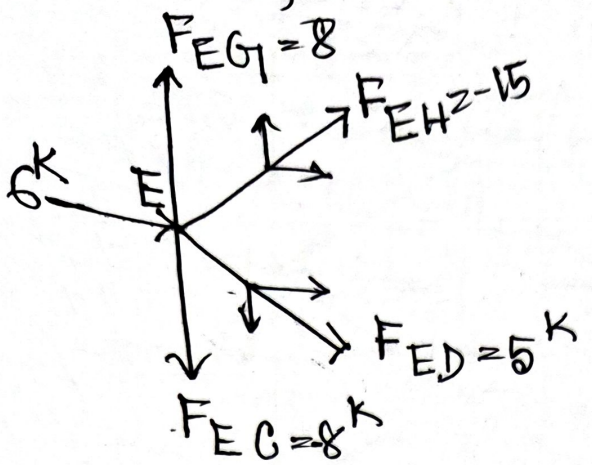
(+↑) $\Sigma F_y = 0$

$\Rightarrow -G_{1y} - 36 = 0$

$\Rightarrow -G_{1y} = 36^K$

$\Rightarrow G_{1y} = -36^K$

At E,



$\Sigma F_x = 0$

$\Rightarrow 6 + F_{ED}\cos\theta + F_{EH}\cos\theta = 0$

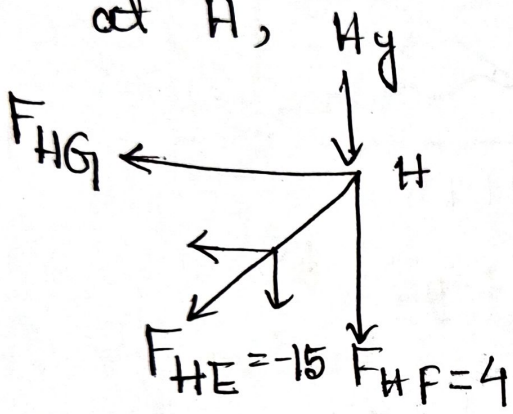
$\Rightarrow F_{EH} = -15$ (C)

$\Sigma F_y = 0$

$\Rightarrow -8 + F_{EG_1} + F_{EH}\sin\theta - F_{ED}\sin\theta = 0$

$\Rightarrow F_{EG_1} = 8^K$ (T)

at H,



(+↑) $\Sigma F_y = 0$

$\Rightarrow -4\theta - H_y - F_{HE}\sin\theta = 0$

$\Rightarrow -H_y = 4 - 15\sin\theta$

$= -8^K$

$\Rightarrow H_y = 8^K$

(+→) $\Sigma F_x = 0 \Rightarrow -F_{HG_1} - F_{HE}\cos\theta = 0$

$\Rightarrow F_{HG_1} = 9^K$

at G_1 (For whole structure),

(+→) $\Sigma F_x = 0 \Rightarrow G_{1x} - 9 + 6 + 9 - 9 + 3 = 0$

$\Rightarrow G_{1x} = -9^K$

(+↑) $\Sigma F_y = 0$

$\Rightarrow -G_{1y} - H_y = 0$

$\Rightarrow G_{1y} = -H_y$

$= -8^K$

③

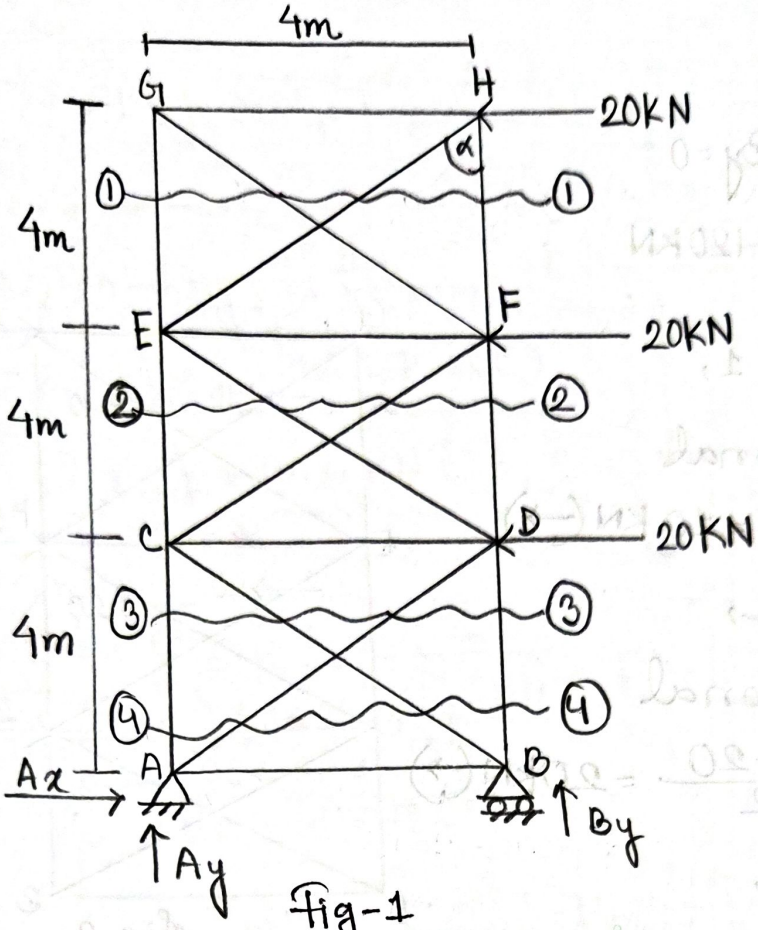


fig-1

By method 2,

$F_{GF} = F_{HE}$; $F_{ED} = F_{FC}$; $F_{BC} = F_{DA}$

$\alpha = \tan^{-1}\frac{4}{4} = 45°$

~~Taking section 1-1:~~

$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow -20 - F_{HE} - 20 - 20 + A_x = 0$

$\Rightarrow A_x = 60\,KN$

$\overset{\curvearrowright(+)}{\Sigma M_A = 0}$

$\Rightarrow -20(4+8+12) - 4B_y = 0$

$\Rightarrow B_y = 120\,KN$

$\oplus\uparrow \Sigma F_y = 0$

$\Rightarrow A_y + B_y = 0$

$\Rightarrow A_y = -120\,KN$

For panel 1,

each diagonal

$= \frac{20}{2} = 10\,KN\,(\leftarrow\rightarrow)$

For panel 2,

each diagonal

$= \frac{20+20}{2} = 20\,KN\,(\leftarrow\rightarrow)$

For panel 3,

each diagonal $= \frac{20+20+20}{2}$

$= 30\,KN\,(\leftarrow\rightarrow)$

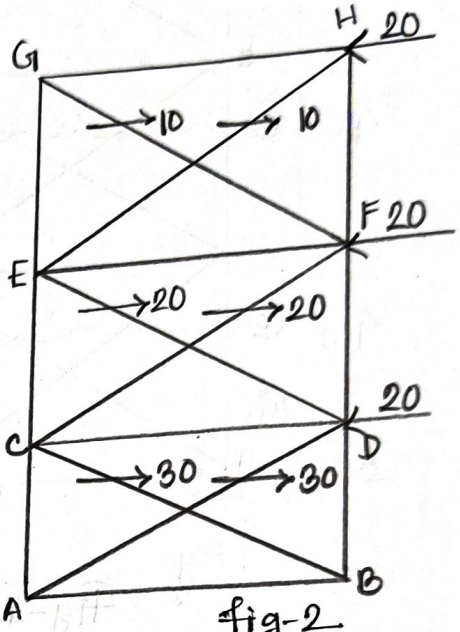


fig-2

Panel-1:

$\xrightarrow{\oplus} \Sigma F_x = 0$ [fig 1, fig 3]

$\Rightarrow F_{GIF}\frac{4}{4\sqrt{2}} + 10 = 0$

$\Rightarrow F_{GIF} = -14.14\,KN\,(C)$

fig 2, fig 3;

$\xrightarrow{\oplus} \Sigma F_x = 0$

$\Rightarrow -F_{HE}\frac{4}{4\sqrt{2}} + 10 = 0$

$\Rightarrow F_{HE} = 14.14\,KN\,(T)$

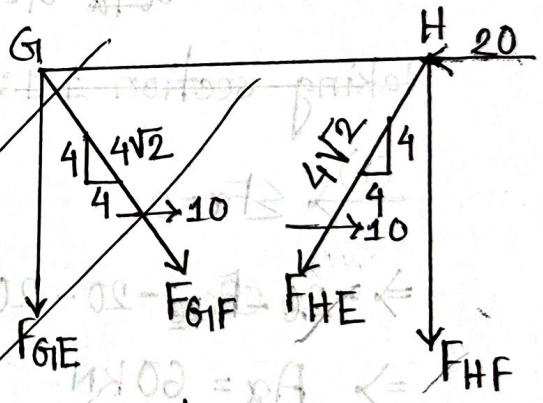


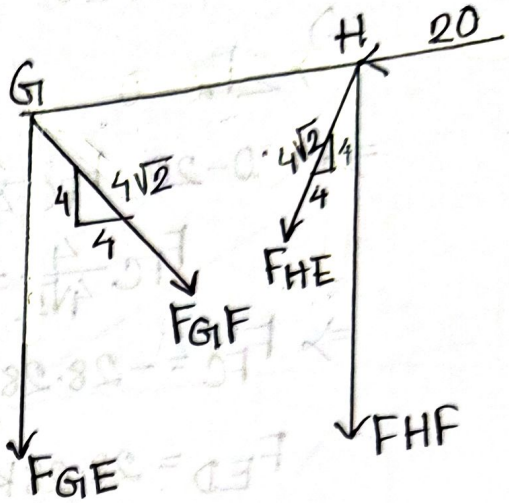
fig-3

$\Sigma F_x = 0$

$\Rightarrow F_{GE}\frac{4}{4\sqrt{2}} - 20 + 10 - F_{HE}\frac{4}{4\sqrt{2}} = 0$

Panel: 1

taking section 1-1,



$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow -20 - F_{HE}\frac{4}{4\sqrt{2}} - F_{HE}\frac{4}{4\sqrt{2}} = 0$

$\Rightarrow F_{HE} = -14.14\,KN\,(C)$

$F_{G1F} = 14.14\,KN\,(T)$

$\overset{+}{\curvearrowright} \Sigma M_E = 0$

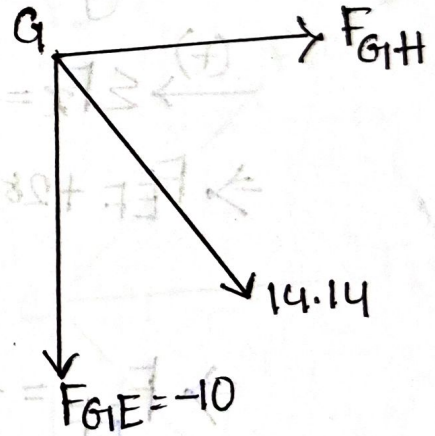
$\Rightarrow (-20 \times 4) + 14.14\frac{4}{4\sqrt{2}} \times 4 + F_{HF} \times 4 = 0$

$\Rightarrow F_{HF} = 10\,KN\,(T)$

$(+)\uparrow \Sigma F_y = 0 \Rightarrow -F_{G1E} - 14.14\frac{4}{4\sqrt{2}} + 14.14\frac{4}{4\sqrt{2}} - 10 = 0$

$\Rightarrow F_{G1E} = -10\,KN\,(C)$

At joint G1,

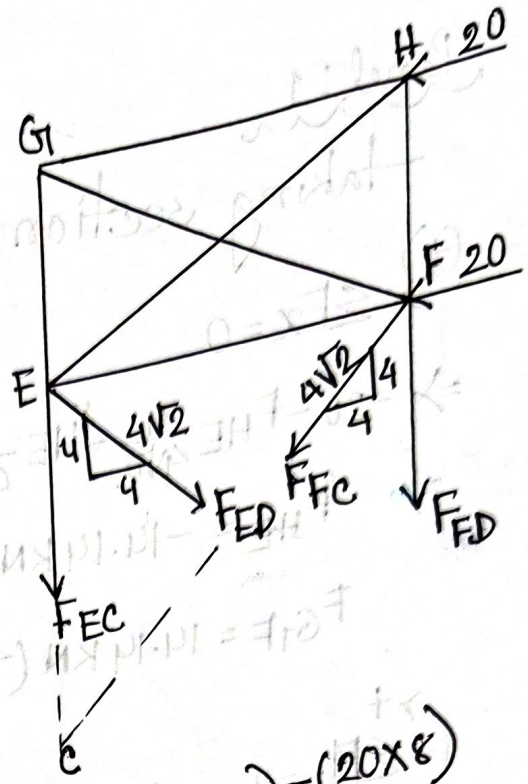


$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow F_{G1H} + 14.14\frac{4}{4\sqrt{2}} = 0$

$\Rightarrow F_{G1H} = -10\,KN\,(C)$

Section 2-2:



$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow +20 - 20 - F_{FC}\frac{4}{4\sqrt{2}} - F_{FC}\frac{4}{4\sqrt{2}} = 0$

$\Rightarrow F_{FC} = -28.28\,KN\,(C)$

$F_{ED} = 28.28\,KN\,(T)$

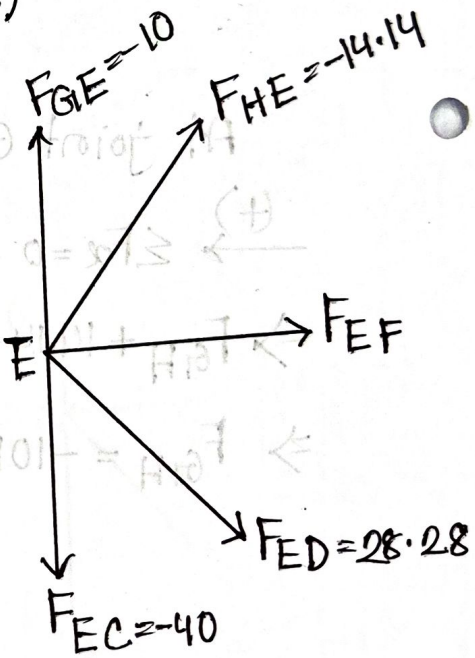
$\overset{(+)}{\circlearrowright} \Sigma M_C = 0 \Rightarrow 28.28\frac{4}{4\sqrt{2}} \times 4 - (20\times 4) - (20\times 8) + 4F_{FD} = 0$

$\Rightarrow F_{FD} = 40\,KN\,(T)$

$\overset{(+)}{\uparrow} \Sigma F_y = 0 \Rightarrow -F_{EC} - 28.28\frac{4}{4\sqrt{2}} + 28.28\frac{4}{4\sqrt{2}} - 40 = 0$

$\Rightarrow F_{EC} = -40\,KN\,(C)$

At joint E,

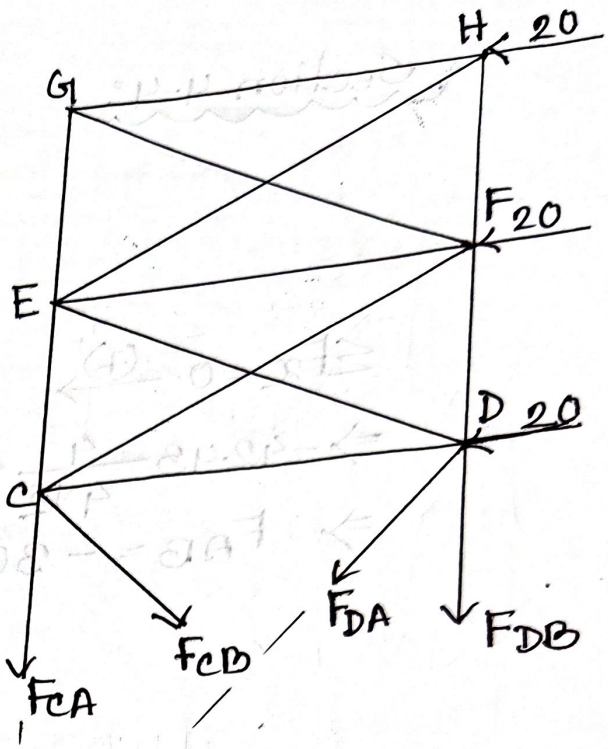


$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow F_{EF} + 28.28\frac{4}{4\sqrt{2}} - 14.14\frac{4}{4\sqrt{2}} = 0$

$\Rightarrow F_{EF} = -10\,KN\,(C)$

Section 3-3:



$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow -20-20-20-F_{DA}\frac{4}{4\sqrt{2}}$

$-F_{DA}\frac{4}{4\sqrt{2}} = 0$

$\Rightarrow F_{DA} = -42.43\ KN\ (C)$

$F_{CB} = 42.43\ KN\ (T)$

$\overset{+}{\circlearrowleft} \Sigma M_A = 0$

$\Rightarrow (-20\times4)-(20\times8)-(20\times12)$

$+4F_{DB}+F_{CB}\frac{4}{4\sqrt{2}}\times4=0$

$\Rightarrow F_{DB} = 90KN\ (T)$

$(+)\uparrow \Sigma F_y = 0 \Rightarrow -F_{CA}-90=0$

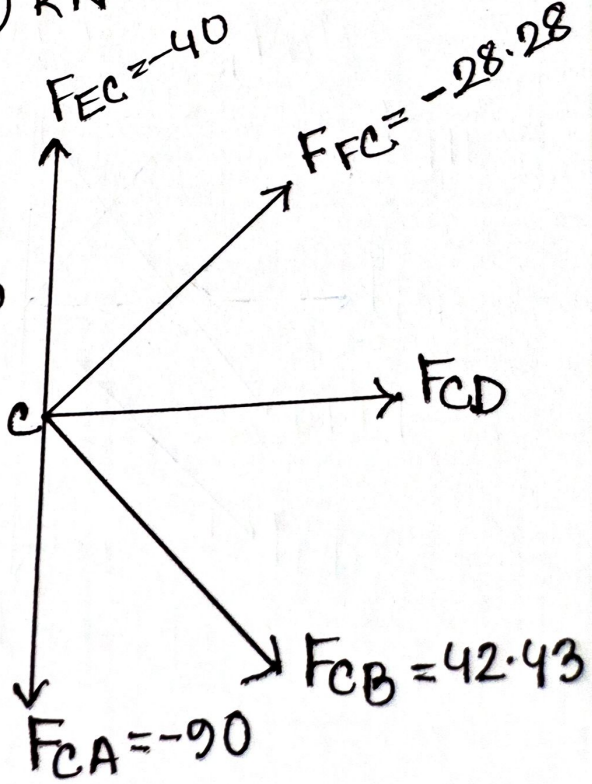
$\Rightarrow F_{CA} = -90\ (C)\ KN$

At joint C,

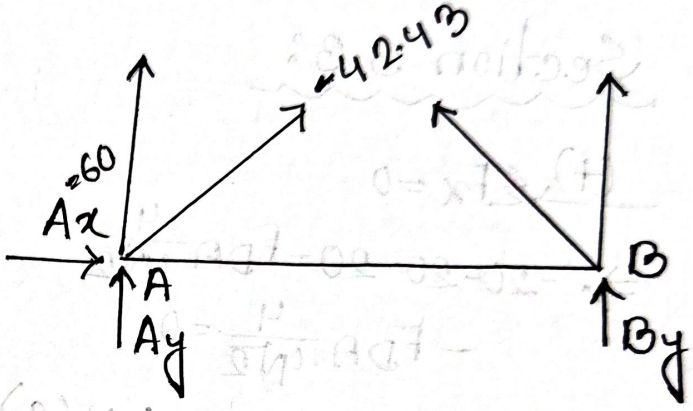
$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow F_{CD}-28.28\frac{4}{4\sqrt{2}}+42.43\frac{4}{4\sqrt{2}}=0$

$\Rightarrow F_{CD} = -10KN\ (C)$



Section 4-4:



$$\Sigma F_x = 0 \xrightarrow{(+)}$$

$$\Rightarrow -42.43 \frac{4}{4\sqrt{2}} + A_x + F_{AB} = 0$$

$$\Rightarrow F_{AB} = -30\,KN\ (C)$$

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

Course Code : 311

Cantilever Method

Name : Oishi

Roll No : 202230061

Level/Term : 1-3 / T-1

Course : ECCE-311

Date of exp :

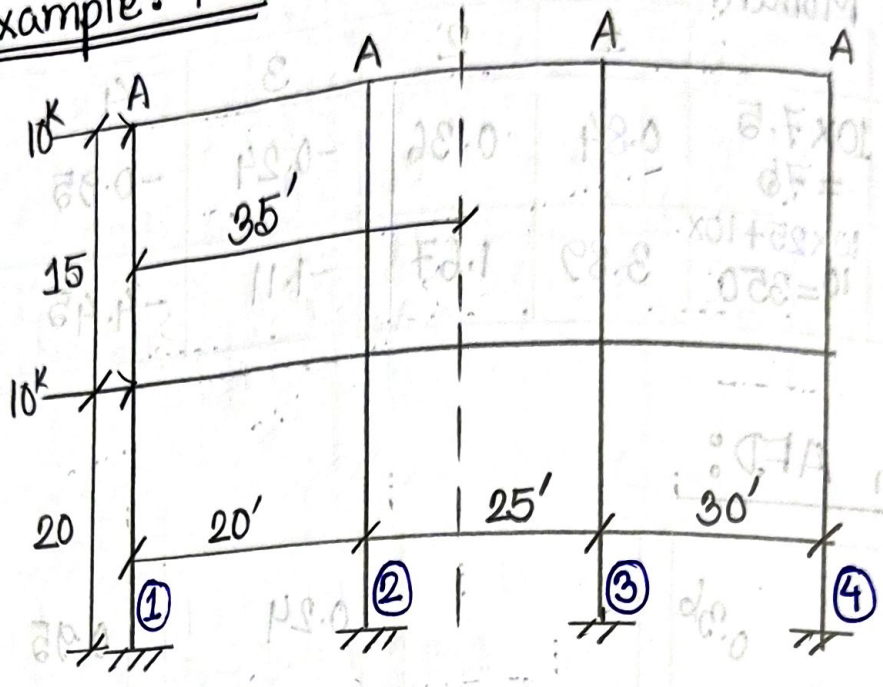
Date of sub :

Group : 01

Signature of Teacher :

Norris & Wilbur:

Example: 7.8



Soln:

$$\bar{x} = \frac{(A\times 0)+(A\times 20)+A(20+25)+A(20+25+30)}{4A}$$

$$= 35'$$

$$I = \leq Ad^2 = A\times 35^2 + A\times 15^2 + A\times 10^2 + A\times 40^2$$

$$= 3150A$$

Axial force at,

$$\text{Column 1} = \frac{M\times 35}{3150A}\times A = 0.0111M$$

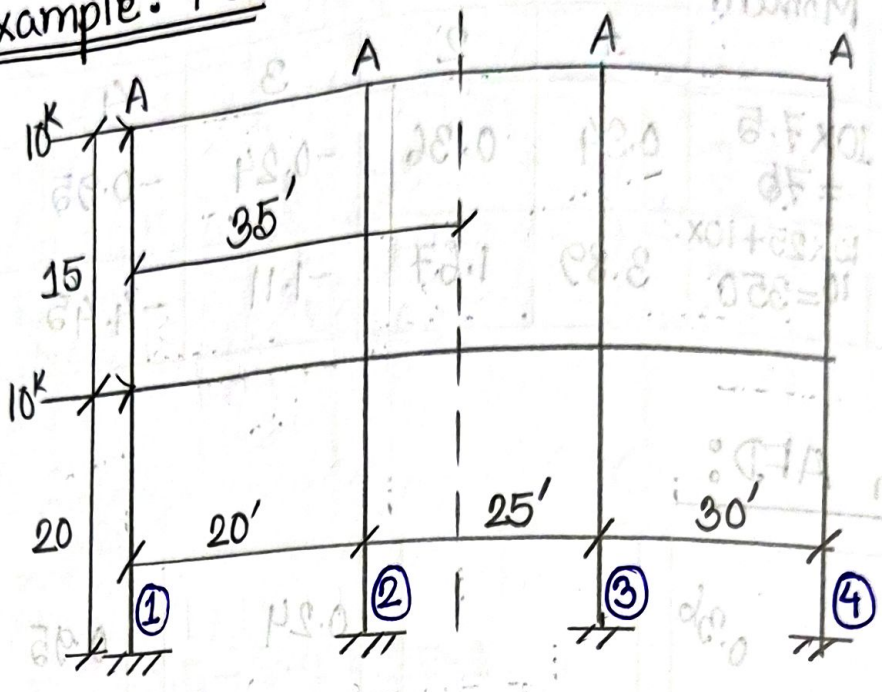
$$\text{Column 2} = \frac{M(35-20)}{3150A}\times A = 0.00476M$$

$$\text{Column 3} = \frac{M(35-45)}{3150A}\times A = -0.00317M$$

$$\text{Column 4} = \frac{M(35-75)}{3150A}\times A = -0.0127M$$

Norris & Wilbur:

Example: 7.8



Soln:

$$\bar{x} = \frac{(A\times 0)+(A\times 20)+A(20+25)+A(20+25+30)}{4A}$$

$$= 35'$$

$$I = \Sigma Ad^2 = A\times 35^2 + A\times 15^2 + A\times 10^2 + A\times 40^2$$

$$= 3150A$$

Axial force at,

$$\text{Column 1} = \frac{M\times 35}{3150A}\times A = 0.0111M$$

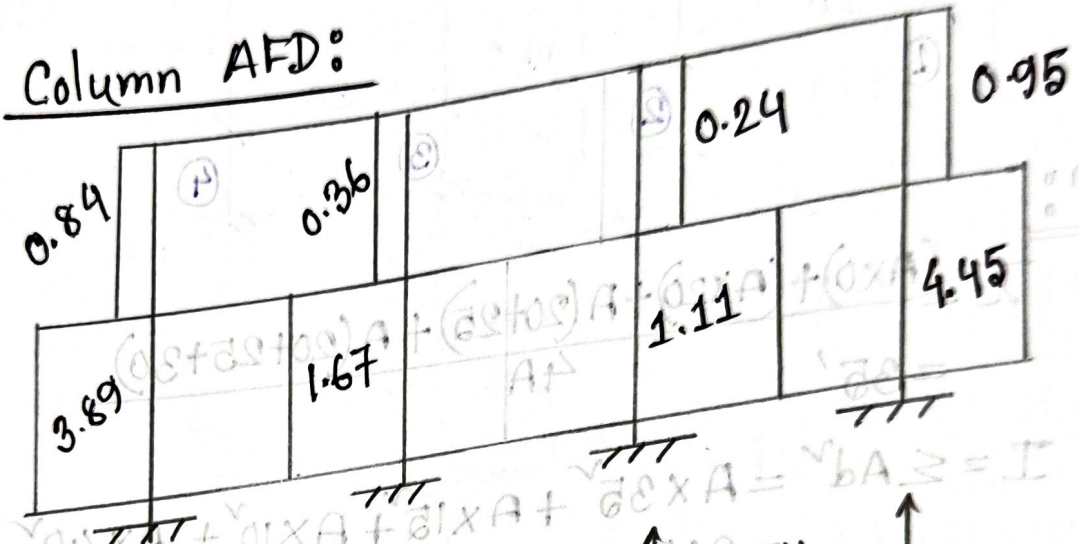
$$\text{Column 2} = \frac{M(35-20)}{3150A}\times A = 0.00476M$$

$$\text{Column 3} = \frac{M(35-45)}{3150A}\times A = -0.00317M$$

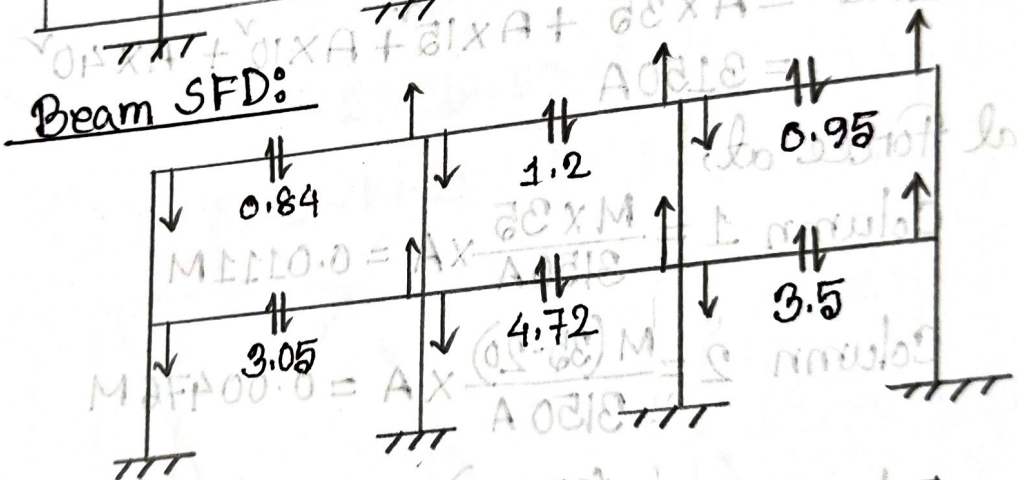
$$\text{Column 4} = \frac{M(35-75)}{3150A}\times A = -0.0127M$$

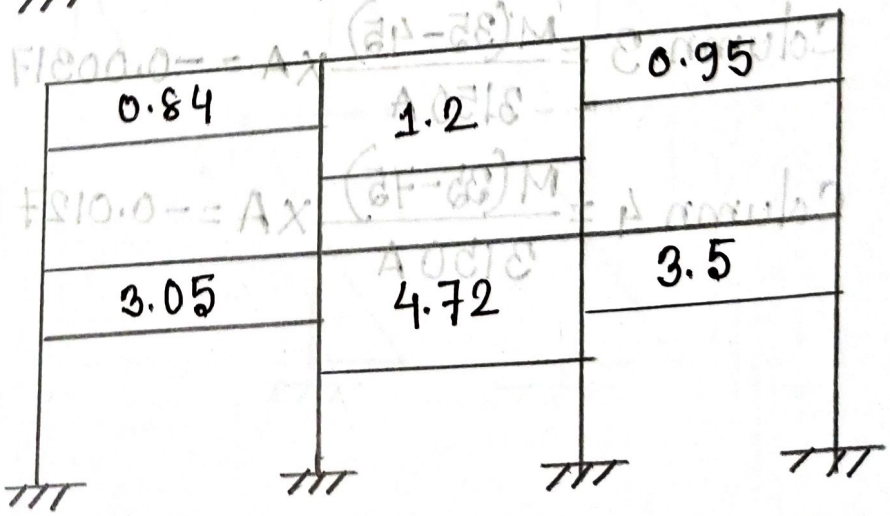
Floor	Moment	AF			
		1	2	3	4
1st	10x7.5 = 75	0.84	0.36	-0.24	-0.95
GF	10x25+10x 10=350	3.89	1.67	-1.11	-4.45

Column AFD:

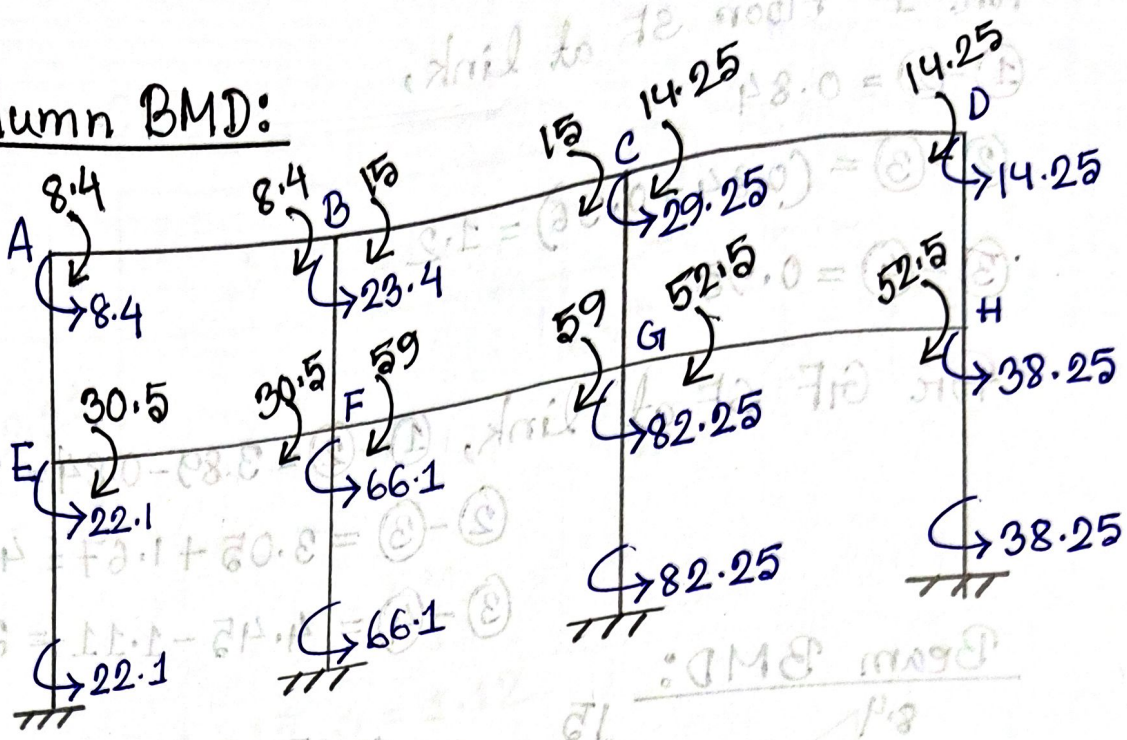


Beam SFD:





Column BMD:



$E = 30.5 - 8.4 = 22.1$

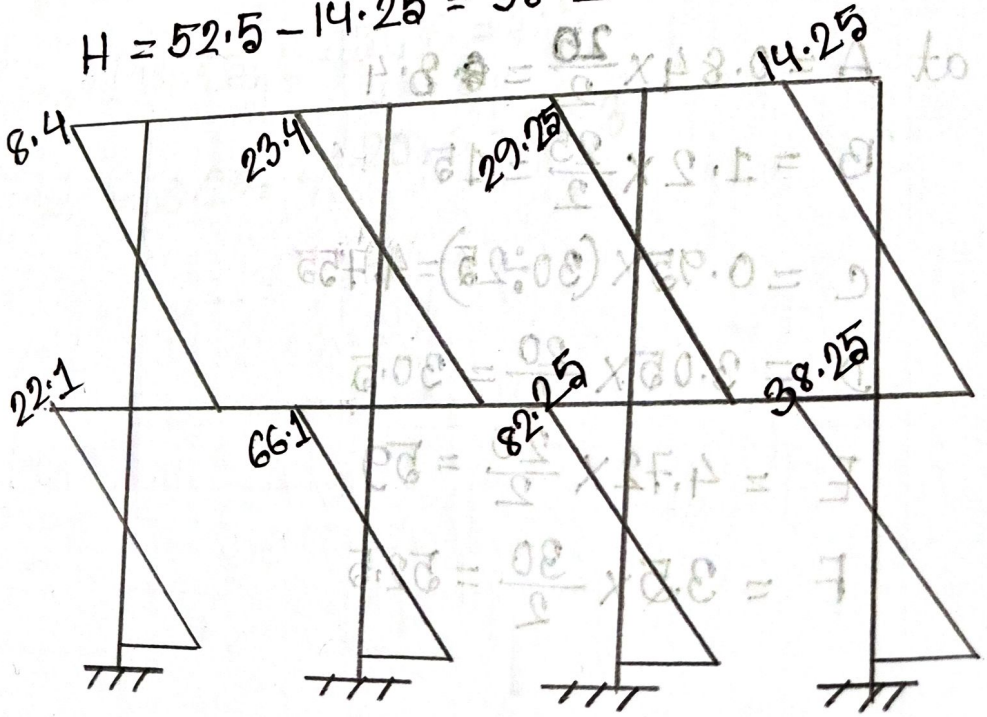
$B = 8.4 + 15 = 23.4$

$F = 59 - 23.4 + 30.5 = 66.1$

$C = 14.25 + 15 = 29.25$

$G = 52.5 - 29.25 + 59 = 82.25$

$H = 52.5 - 14.25 = 38.25$



For 1st Floor SF at link,

①-② = 0.84

②-③ = (0.84+0.36) = 1.2

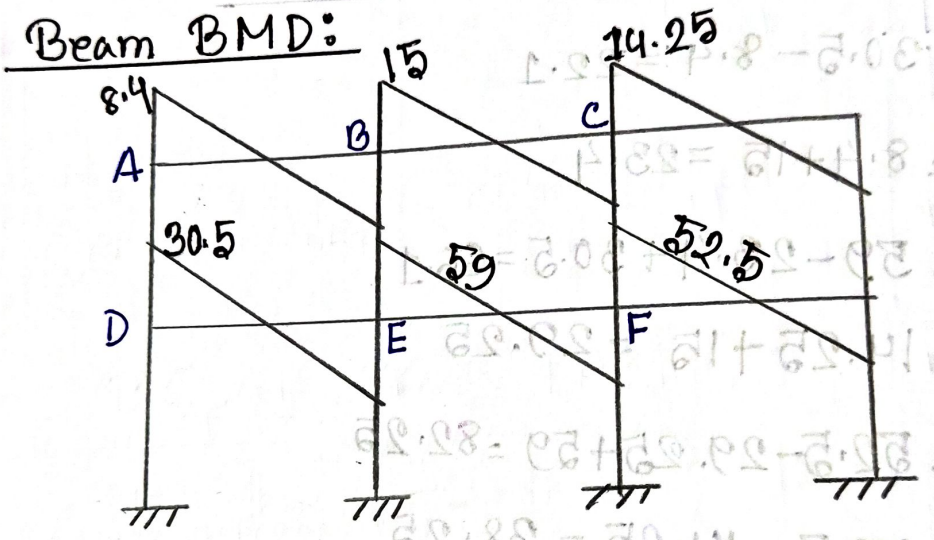
③-④ = 0.95

For GF SF at link, ①-② = 3.89-0.84 = 3.05

②-③ = 3.05+1.67 = 4.72

③-④ = 4.45-1.11 = 3.5

Beam BMD:



at A = $0.84 \times \frac{20}{2}$ = 8.4

B = $1.2 \times \frac{25}{2}$ = 15

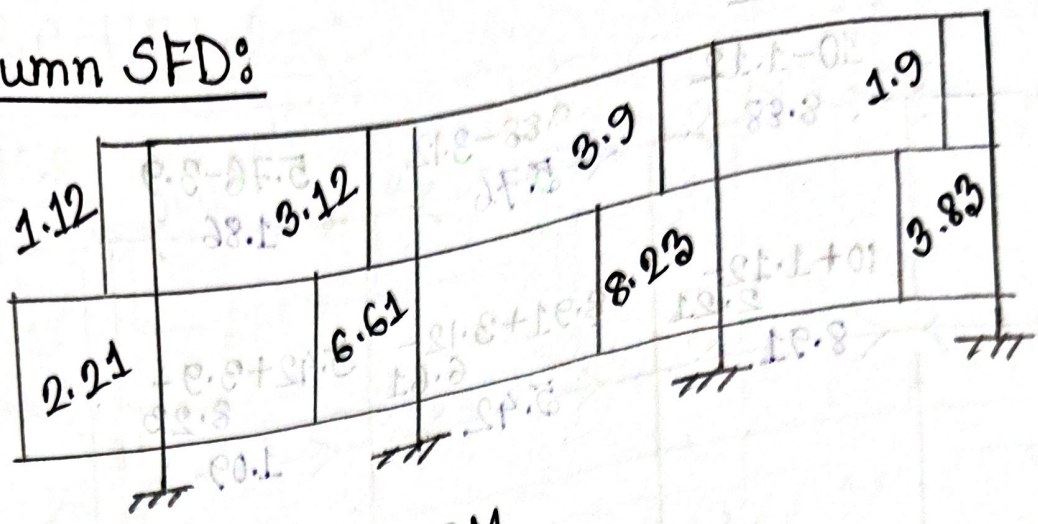
C = $0.95 \times (30 \div 2)$ = 14.25

D = $3.05 \times \frac{20}{2}$ = 30.5

E = $4.72 \times \frac{25}{2}$ = 59

F = $3.5 \times \frac{30}{2}$ = 52.5

Column SFD:



$$S = \frac{2M}{L}$$

$M = 8.4, L = 15, S = 1.12$

$M = 22.1, L = 20, S = 2.21$

$M = 23.4, L = 15, S = 3.12$

$M = 66.1, L = 20, S = 6.61$

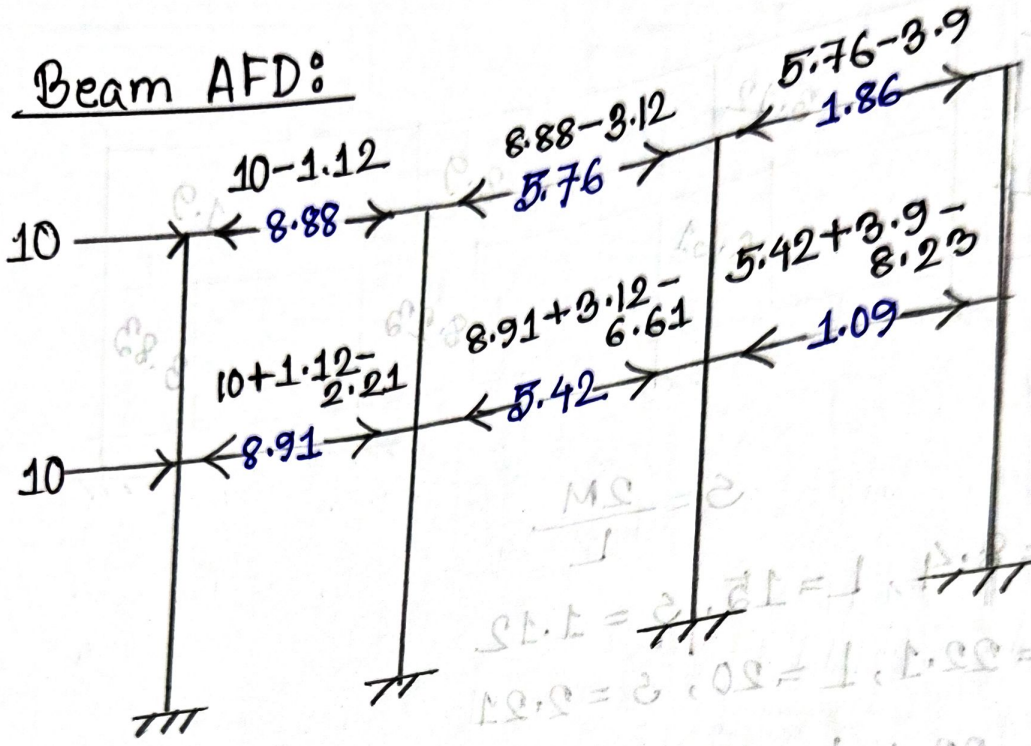
$M = 29.25, L = 15, S = 3.9$

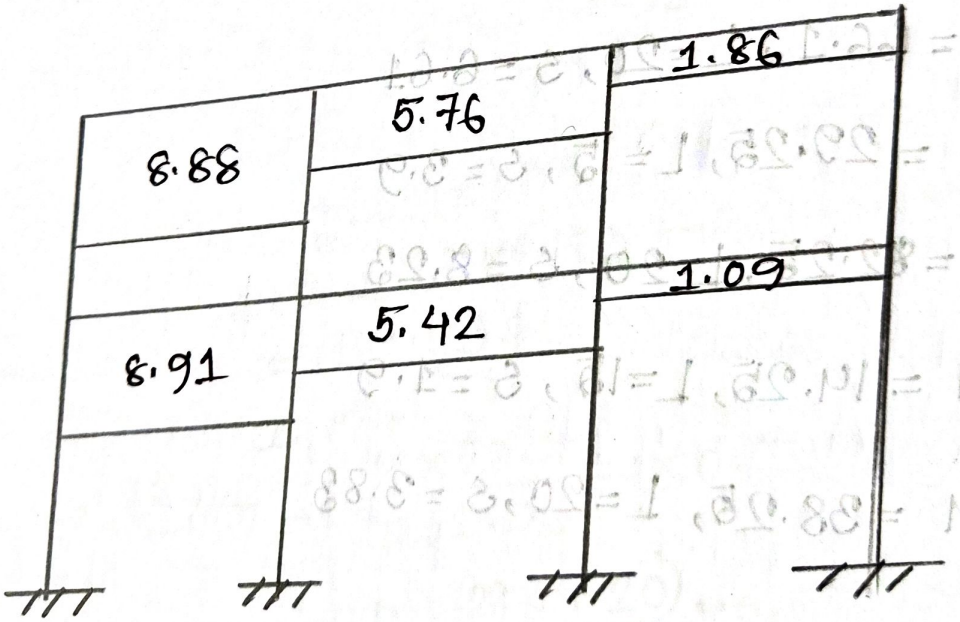
$M = 82.25, L = 20, S = 8.23$

$M = 14.25, L = 15, S = 1.9$

$M = 38.25, L = 20, S = 3.83$

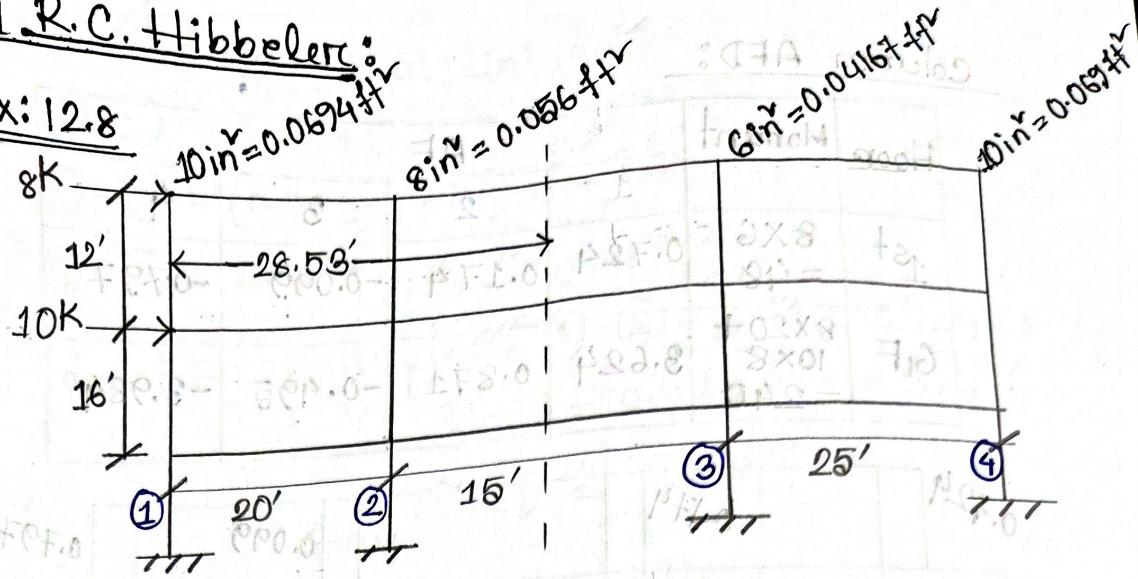
Beam AFD:


10
10
10-1.12
8.88
8.88-3.12
5.76
5.76-3.9
1.86
10+1.12-2.21
8.91
8.91+3.12-6.61
5.42
5.42+3.9-8.23
1.09


8.88
8.91
5.76
5.42
1.86
1.09

R.C. Hibbeler:

Ex: 12.8



Soln:

Centroid from column ①,

$$\bar{x} = \frac{(0.0694\times 0)+(0.056\times 20)+(0.04167\times 35)+(0.0694\times 60)}{0.0694+0.056+0.04167+0.069}$$

$$= 28.53'$$

$$I = \Sigma Ad^2 = 0.0694\times(28.53)^2 + 0.056\times(28.53-20)^2 + 0.04167\times(28.53-35)^2 + 0.069\times(28.53-60)^2$$

$$= 131.03\ ft^4$$

Axial force at,

$$\text{Column 1} = \frac{M\times 28.5}{131.03}\times 0.0694 = 0.0151M$$

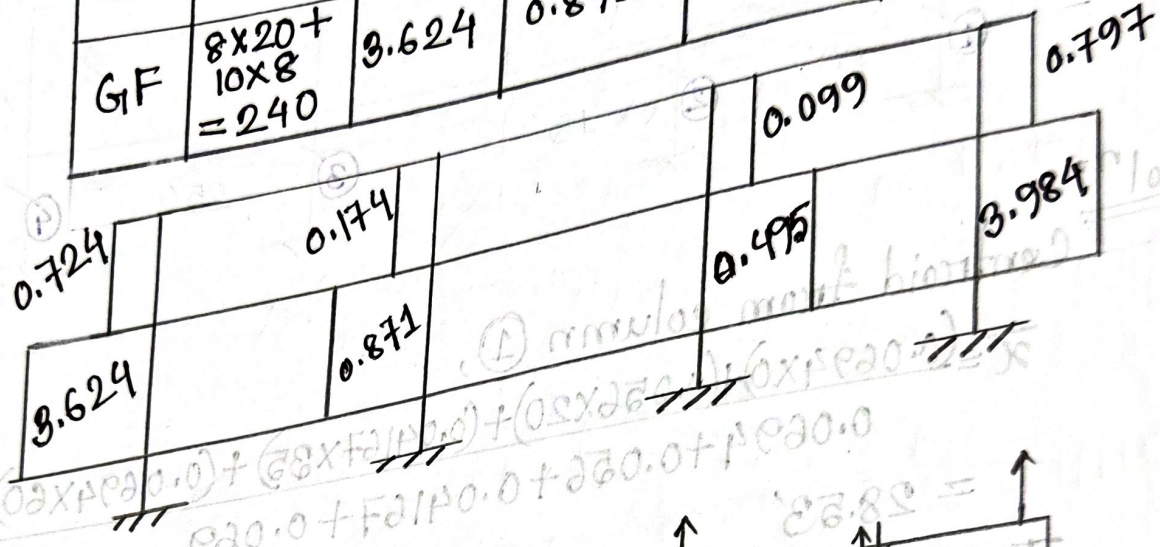
$$\text{Column 2} = \frac{M\times(28.53-20)}{131.03}\times 0.056 = 0.00363M$$

$$\text{Column 3} = \frac{M(28.53-35)}{131.03}\times 0.04167 = -0.002063M$$

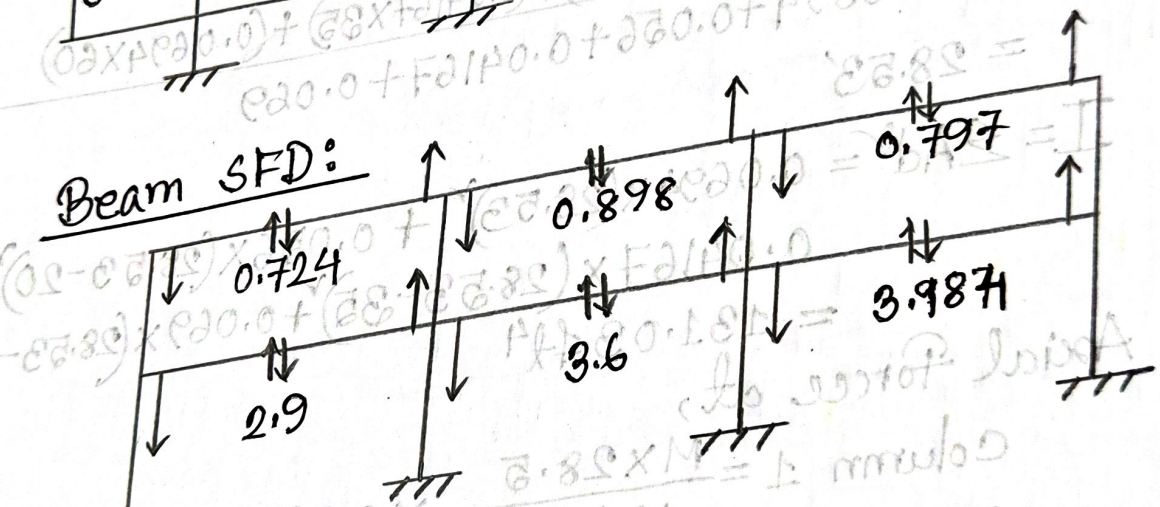
$$\text{Column 4} = \frac{M(28.53-60)}{131.03}\times 0.0694 = -0.0166M$$

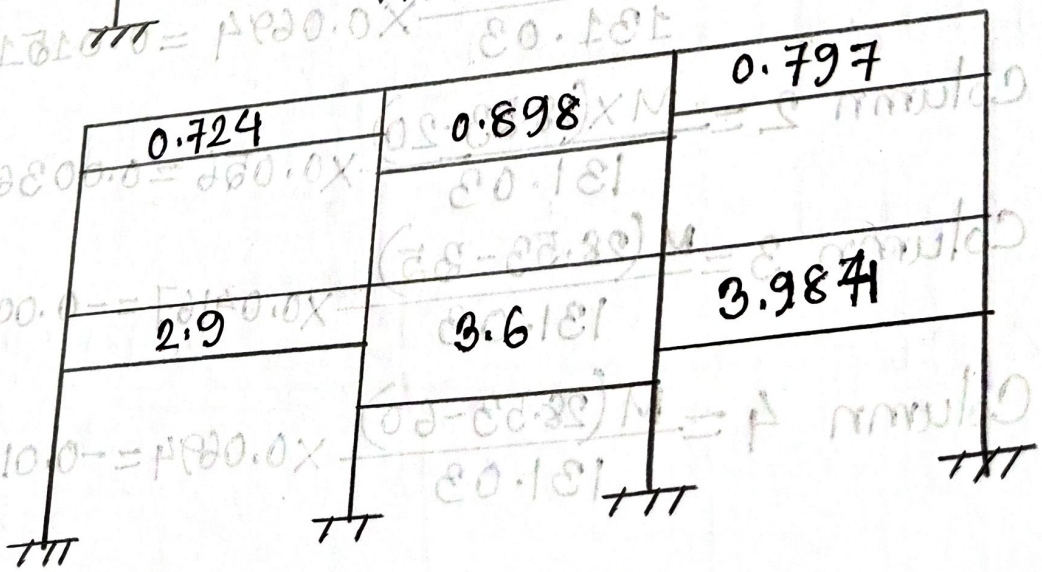
Column AFD:

Floor	Moment	AF 1	2	3	4
1st	8X6 =48	0.724	0.174	-0.099	-0.797
GF	8x20+ 10x8 =240	3.624	0.871	-0.495	-3.984



Beam SFD:





For 1st Floor SF at link,

①-② = 0.724.

②-③ = (0.724+0.174) = 0.898

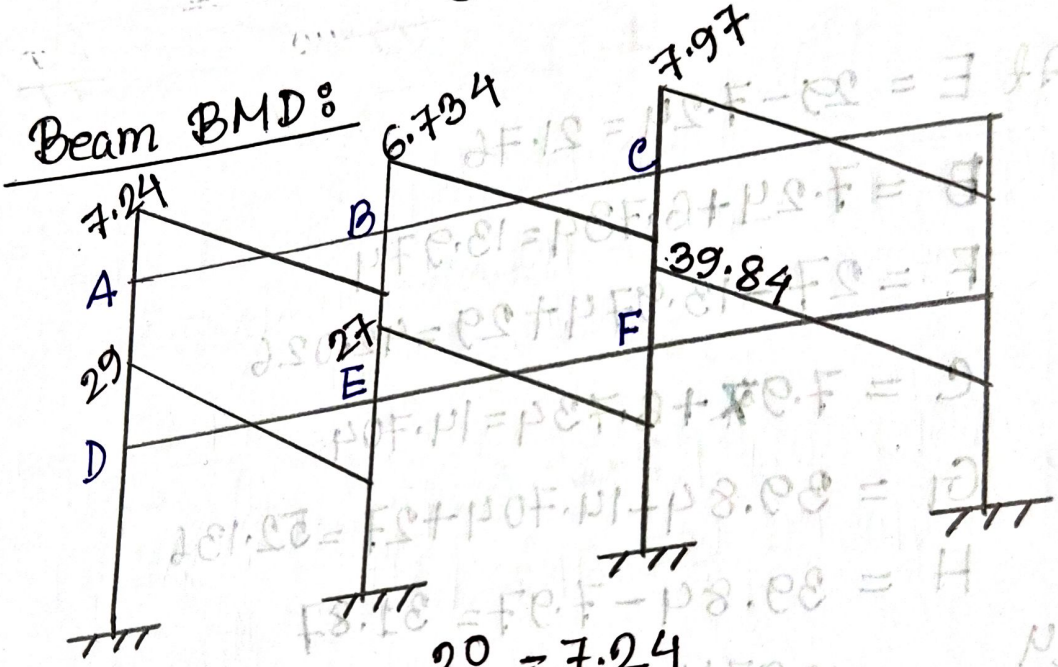
③-④ = 0.797

For GF SF at link, ①-② = 3.624−0.724 = 2.9

②-③ = 2.9+0.871 = 3.6

③-④ = 3.984

Beam BMD:



At A = $0.724 \times \frac{20}{2} = 7.24$

B = $0.898 \times \left(\frac{15}{2}\right) = 6.734$

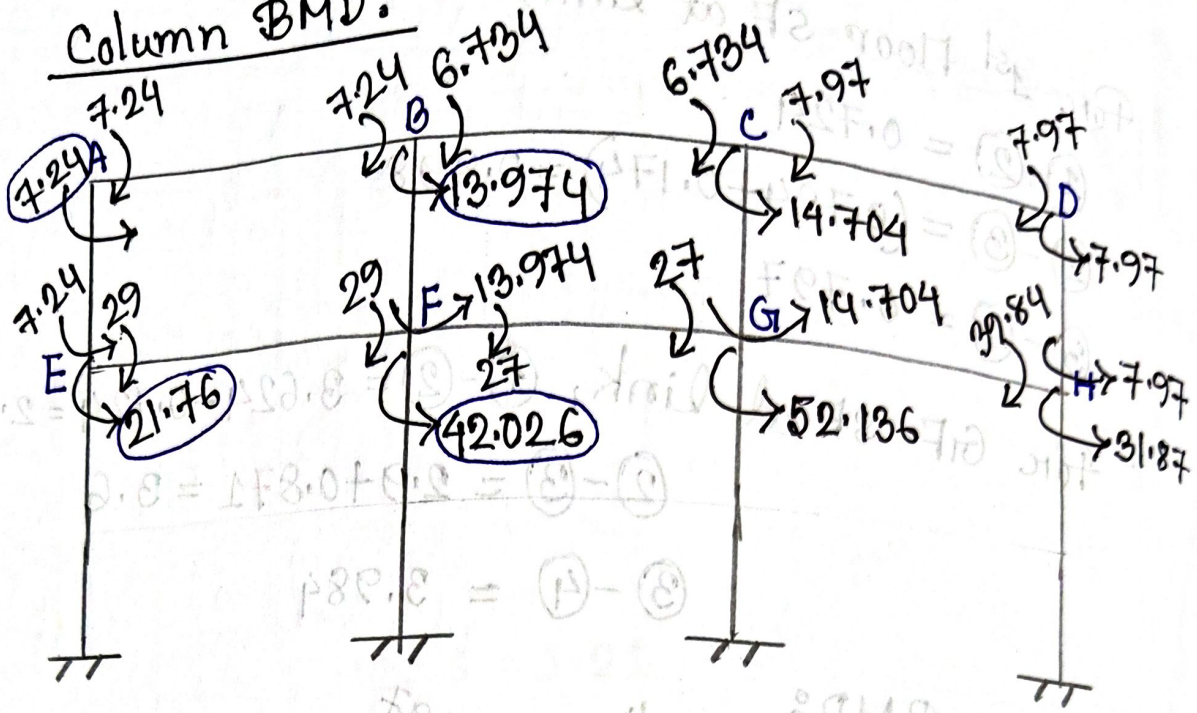
C = $0.797 \times \frac{25}{2} = 7.97$

D = $2.9 \times 10 = 29$

E = $3.6 \times \frac{15}{2} = 27$

F = $3.984 \times 10 = 39.84$

Column BMD:



At E = 29 − 7.24 = 21.76

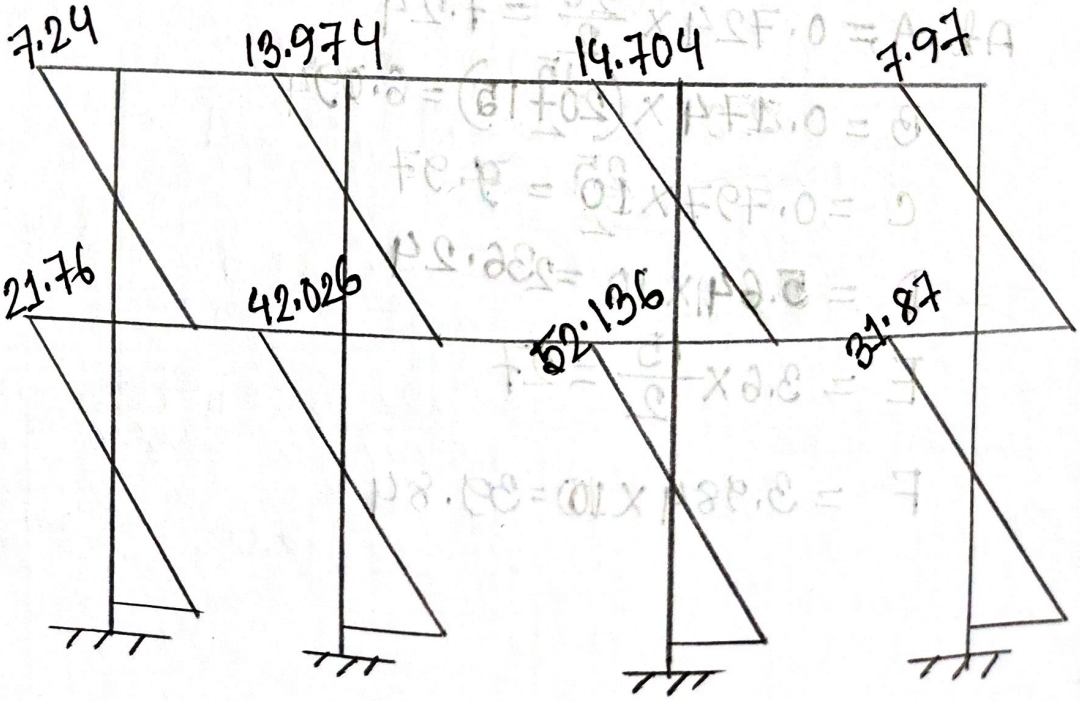
B = 7.24 + 6.734 = 13.974

F = 27 − 13.974 + 29 = 42.026

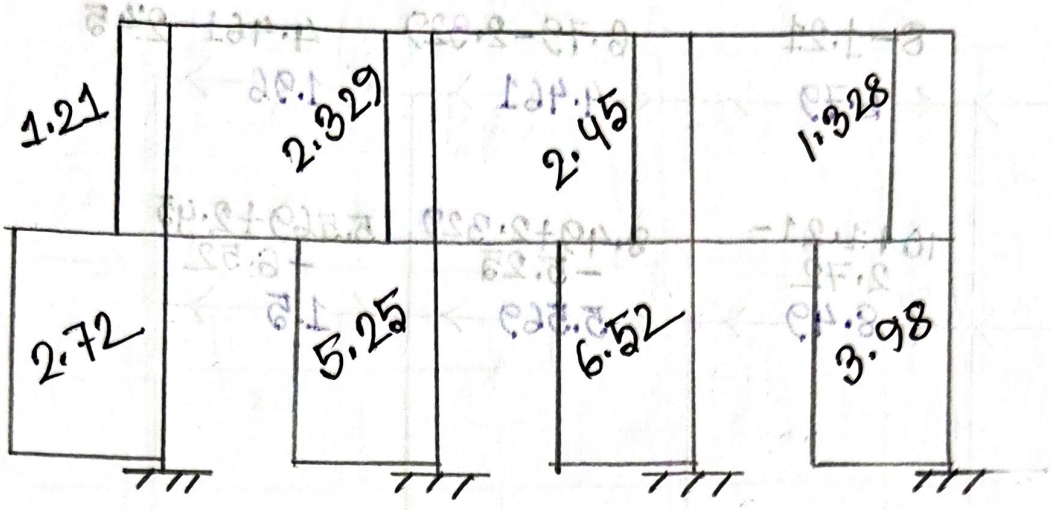
C = 7.97 + 6.734 = 14.704

G = 39.84 − 14.704 + 27 = 52.136

H = 39.84 − 7.97 = 31.87



Column SFD:



$$S = \frac{2M}{L}$$

$M = 7.24, L = 12, S = 1.21$

$M = 21.76, L = 16, S = 2.72$

$M = 13.974, L = 12, S = 2.329$

$M = 42.026, L = 16, S = 5.25$

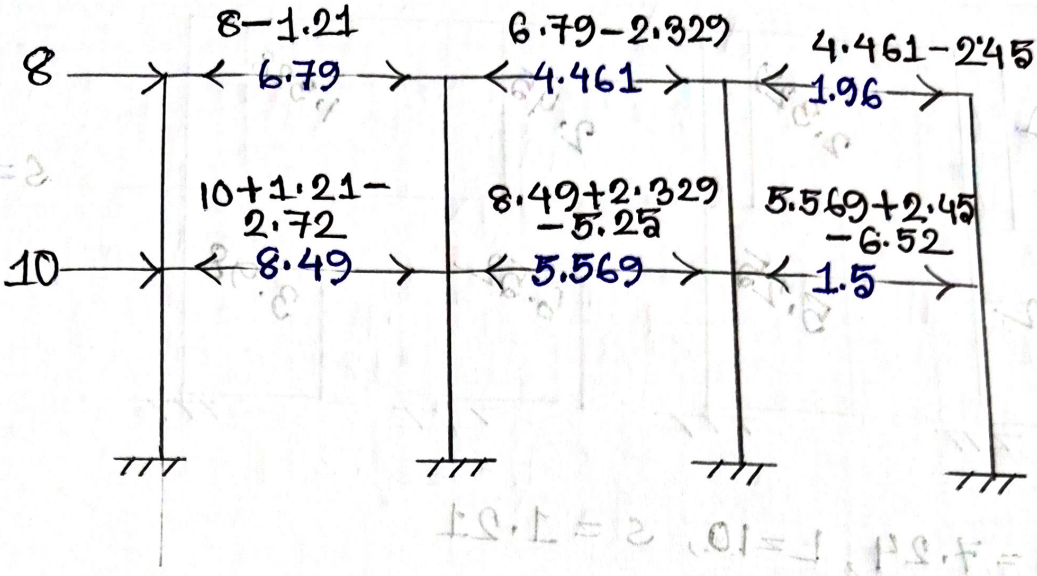
$M = 14.704, L = 12, S = 2.45$

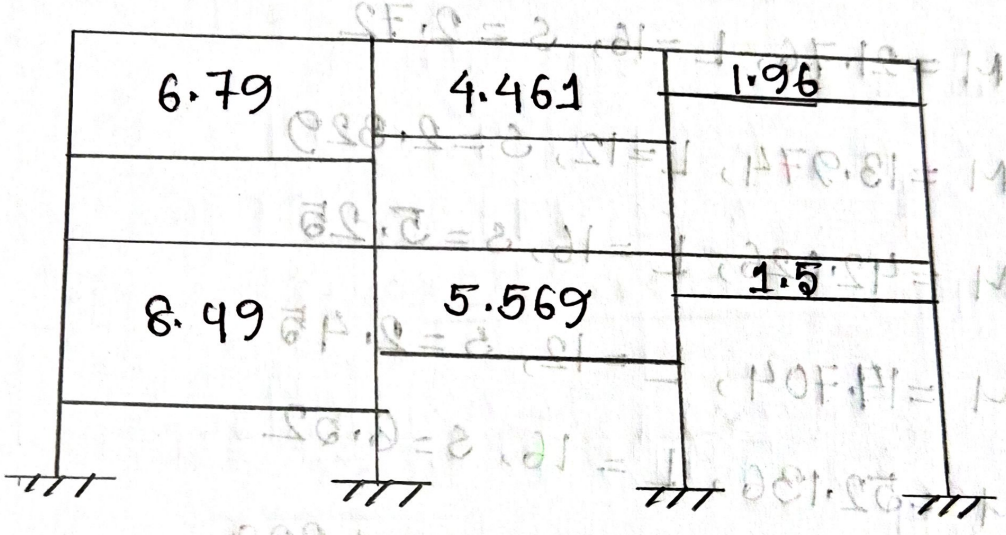
$M = 52.136, L = 16, S = 6.52$

$M = 7.97, L = 12, S = 1.328$

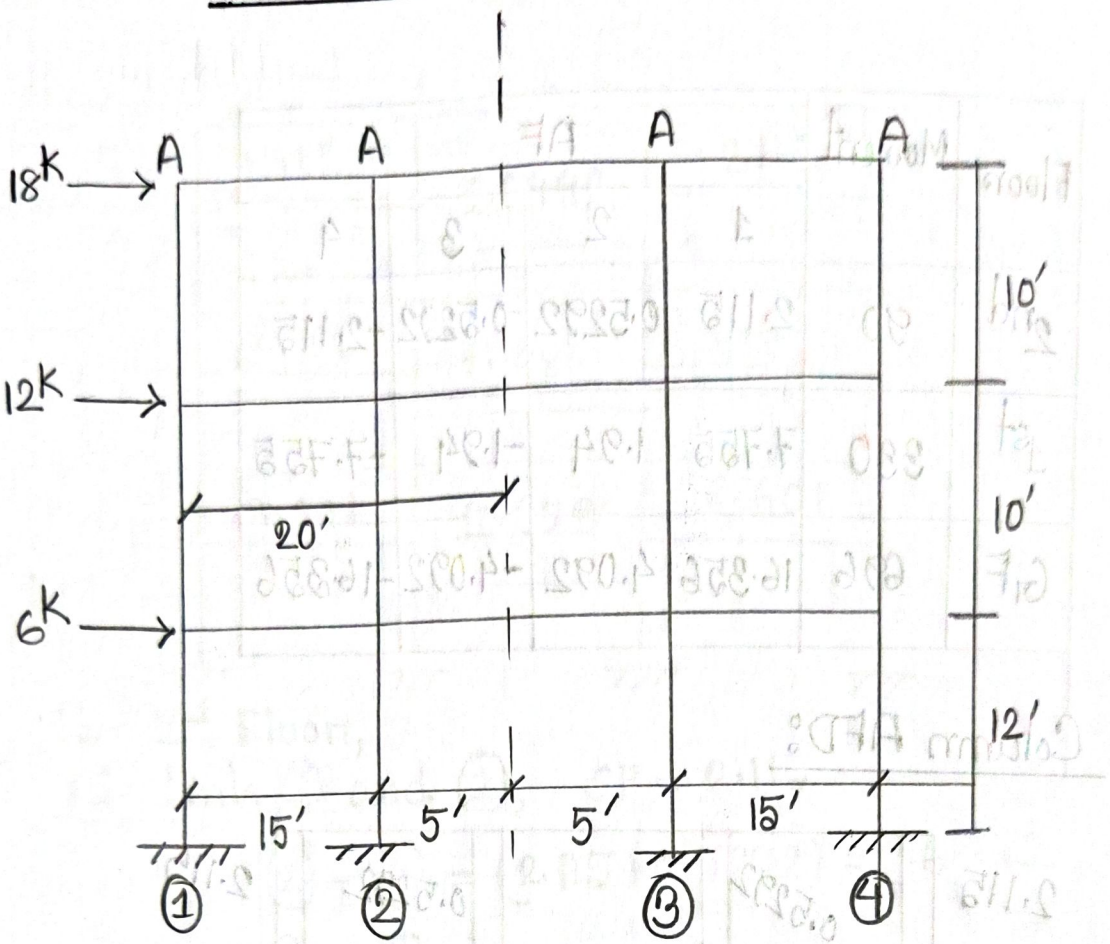
$M = 31.87, L = 16, S = 3.98$

Beam AFD:


8
10
8-1.21
6.79
6.79-2.329
4.461
4.461-2.45
1.96
10+1.21-
2.72
8.49
8.49+2.329
-5.25
5.569
5.569+2.45
-6.52
1.5


6.79
4.461
1.96
8.49
5.569
1.5

Quo-01



Soln:

$$CG_1 = \frac{(A\times 0 + A\times 15 + A\times 25 + A\times 40)}{4A} = 20'$$

$$I = \Sigma Ad^2 = A\times(20)^2 + A\times 5^2 + A\times 5^2 + A\times(20)^2$$

$$= 850A$$

Axial force at,

$$\text{column } 1 = \frac{M\times 20}{850A}\times A = 0.0235\,M$$

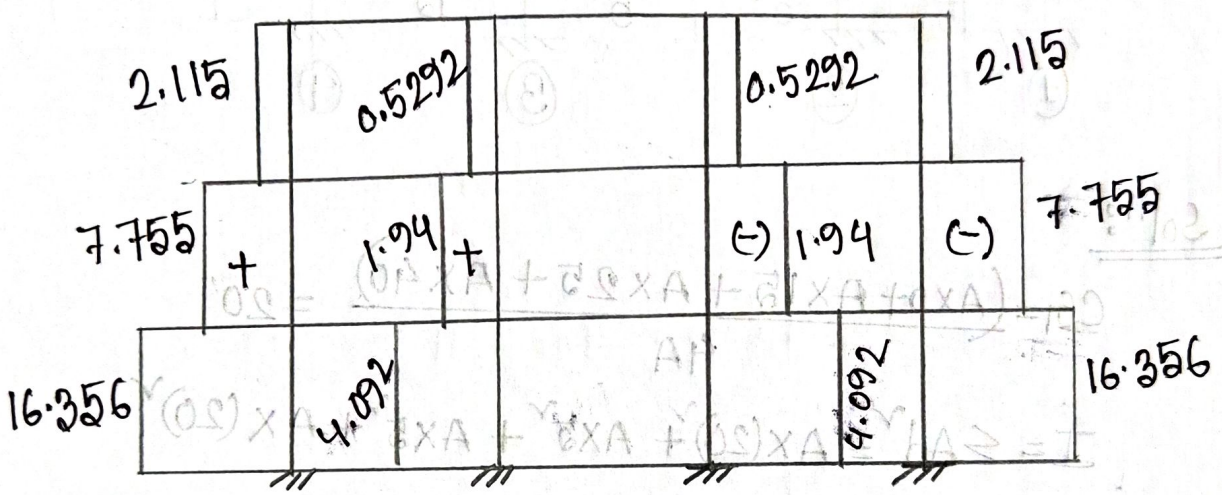
$$\text{column } 2 = \frac{M(20-15)A}{850A} = 0.00588M$$

$$\text{column } 3 = \frac{M(20-25)}{850A}\times A = -0.00588M$$

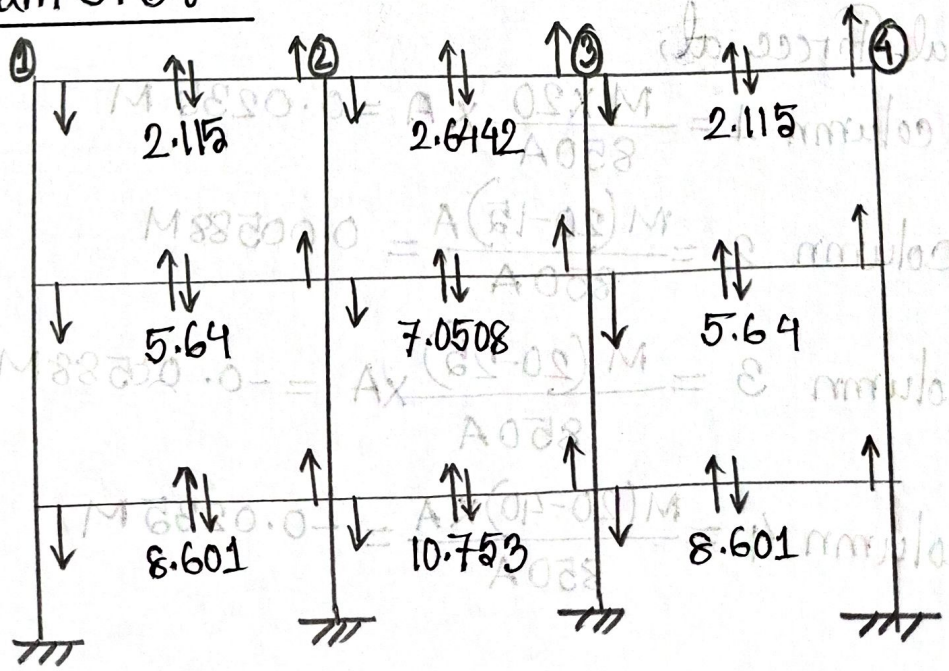
$$\text{column } 4 = \frac{M(20-40)\times A}{850A} = -0.0235\,M$$

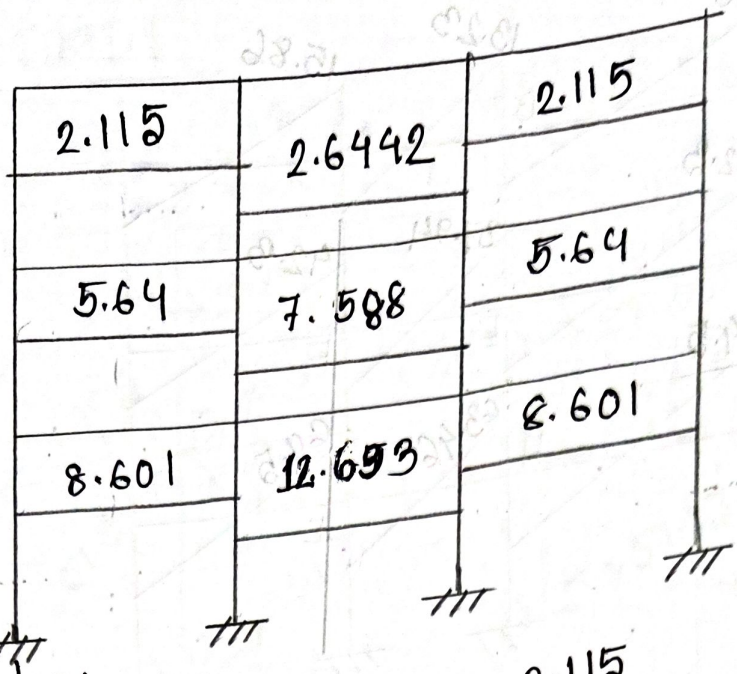
Floor	Moment	AF			
		1	2	3	4
2nd	90	2.115	0.5292	-0.5292	-2.115
1st	330	7.755	1.94	-1.94	-7.755
GF	696	16.356	4.092	-4.092	-16.356

Column AFD:



Beam SFD:





For 2nd Floor,

At link ① and ②, SF = 2.115

② - ③ = (2.115 + 0.5292) = 2.6442

③ - ④ = 2.115

For 1st floor SF at link,

① - ② = (7.755 - 2.115) = 5.64

② - ③ = (5.64 + 1.94) = 7.588

③ - ④ = 5.64

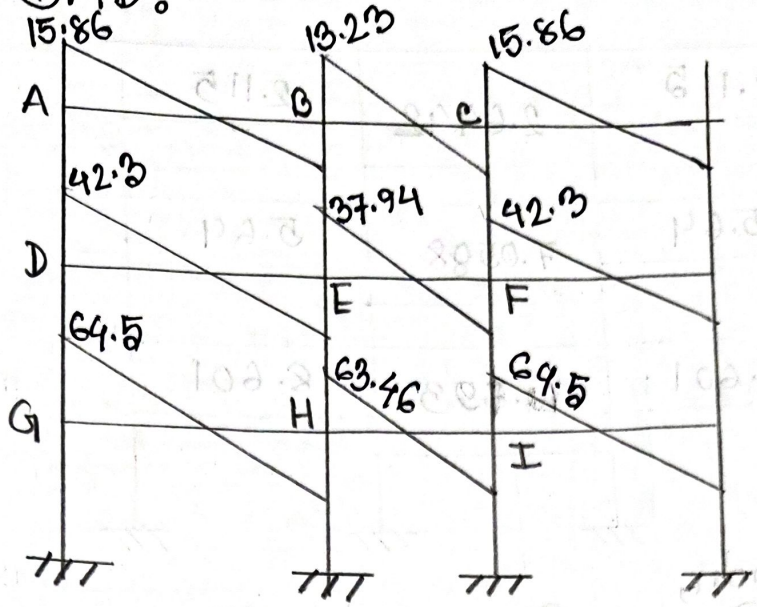
For GF SF at link,

① - ② = 16.356 - 5.64 - 2.115 = 8.601

② - ③ = 8.601 + 4.092 = 12.693

③ - ④ = 8.601

Beam BMD:



At A = $2.115 \times \frac{15}{2} = 15.86$

B = $0.5292 \times (15+10) = 13.23$

C = $2.115 \times \frac{15}{2} = 15.86$

D = $5.64 \times \frac{15}{2} = 42.3$

E = $7.588 \times 5 = 37.94$

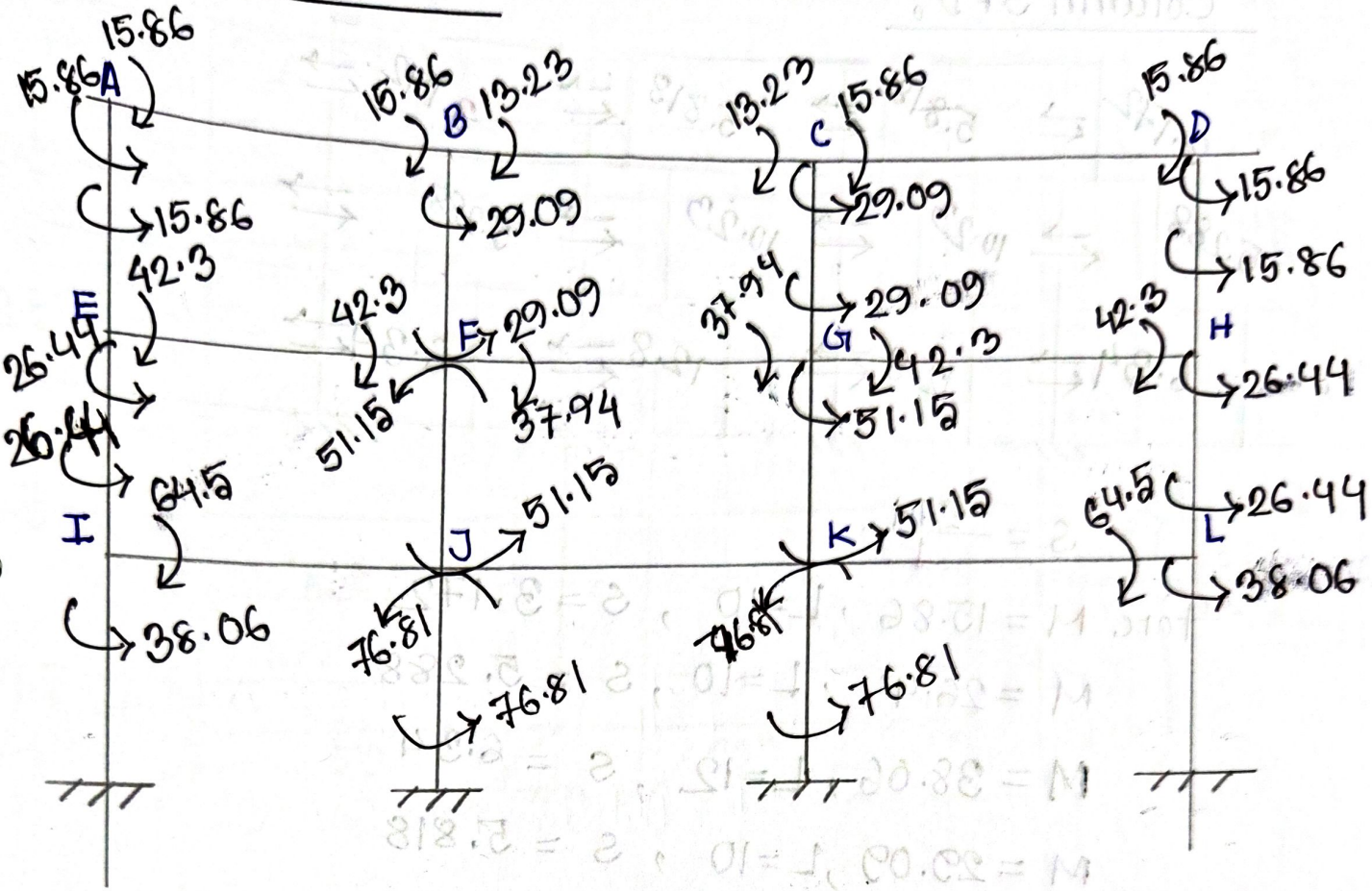
F = 42.3

G = $8.601 \times \frac{15}{2} = 64.5$

H = $12.693 \times 5 = 63.46$

I = 64.5

Column BMD:



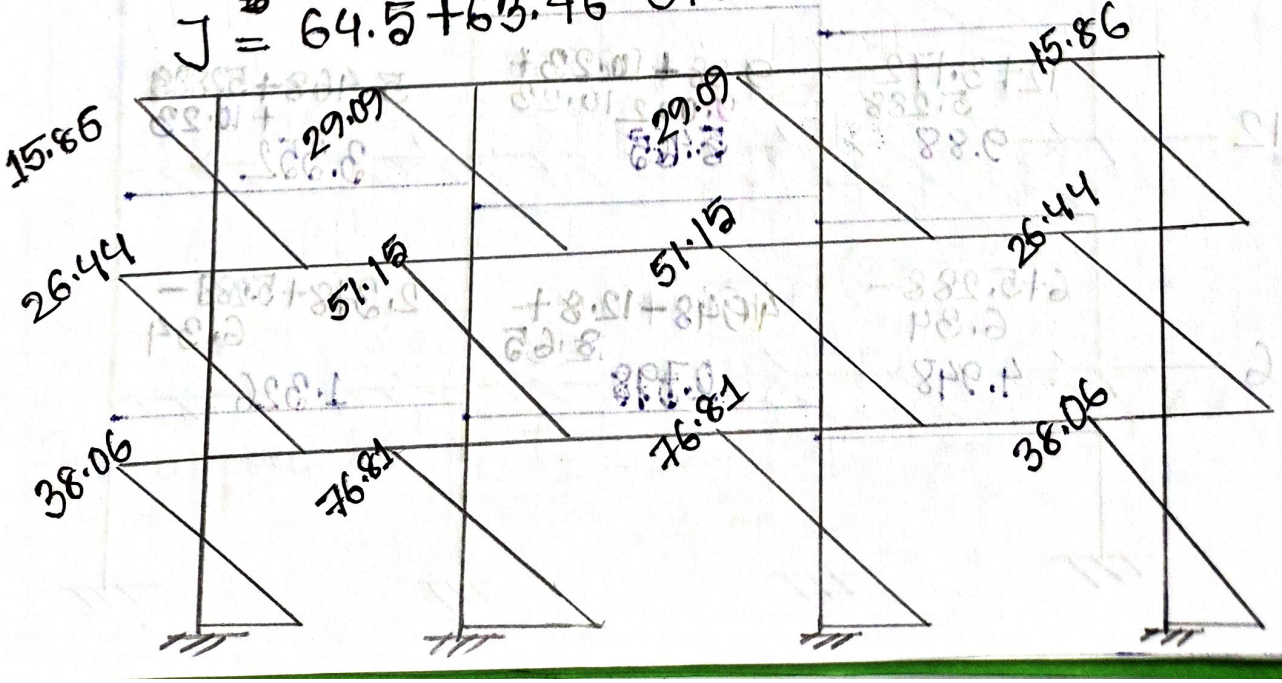
At E = (42.3 − 15.86) = 26.44

I = (64.5 − 26.44) = 38.06

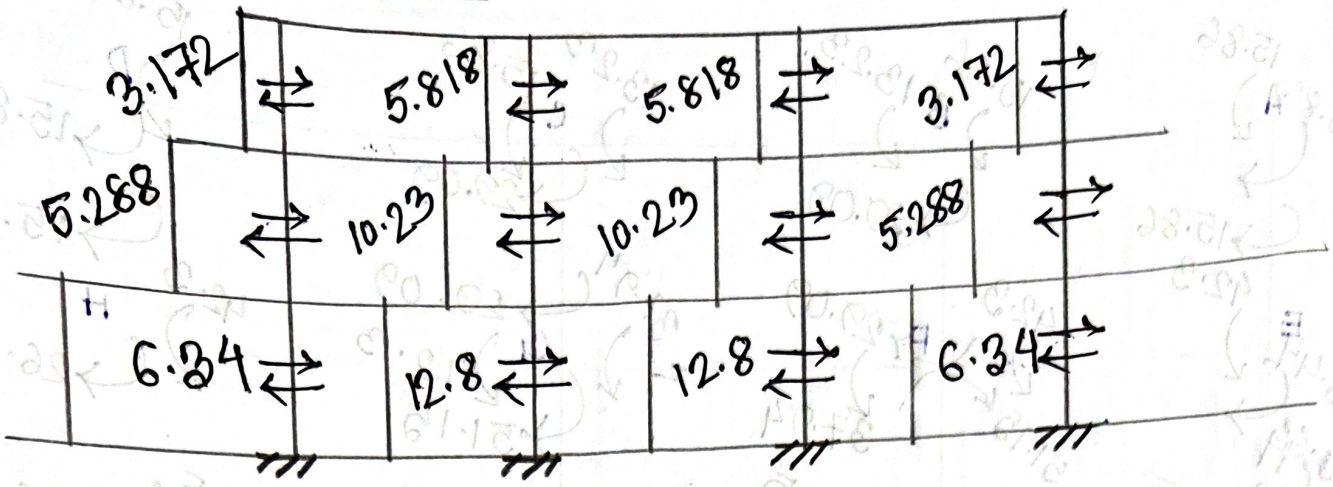
B = (15.86 + 13.23) = 29.09

F = 37.94 − 29.09 + 42.3 = 51.15

J = 64.5 + 63.46 − 51.15 = 76.81



Column SFD:



$$S = \frac{2M}{L}$$

for $M = 15.86$, $L = 10$, $S = 3.172$

$M = 26.44$, $L = 10$, $S = 5.288$

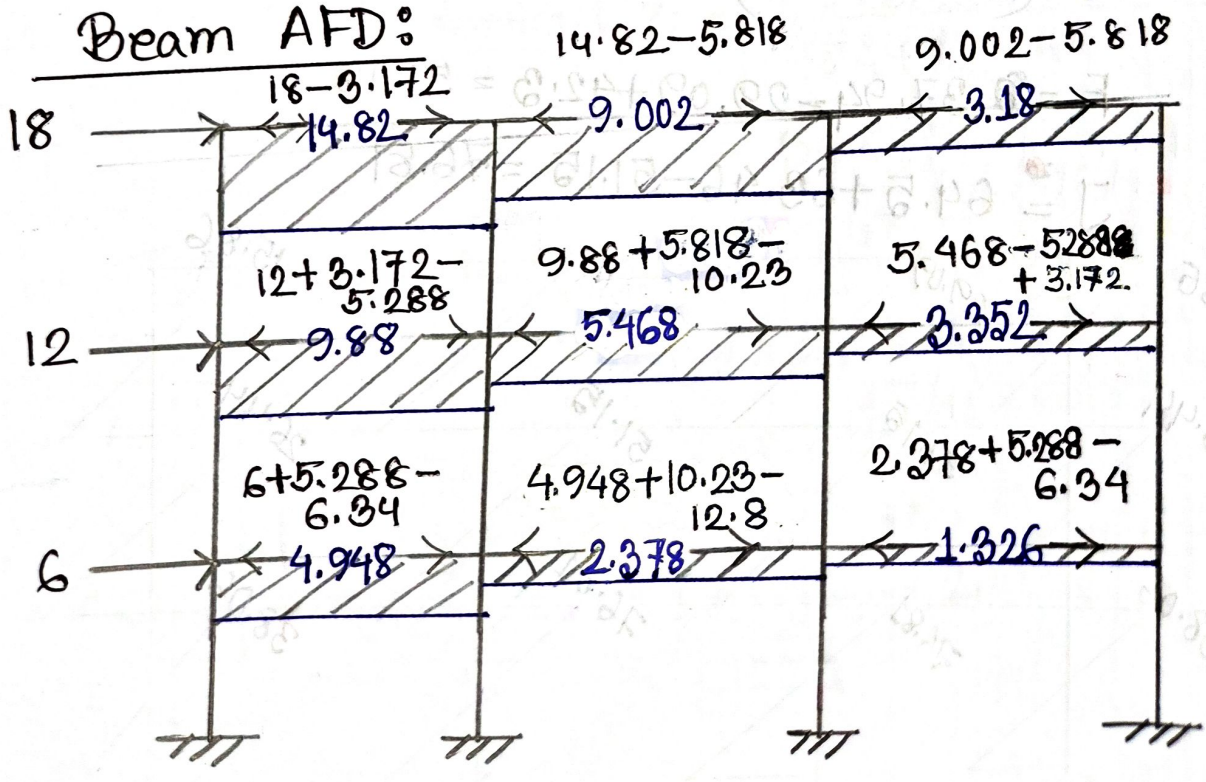
$M = 38.06$, $L = 12$, $S = 6.34$

$M = 29.09$, $L = 10$, $S = 5.818$

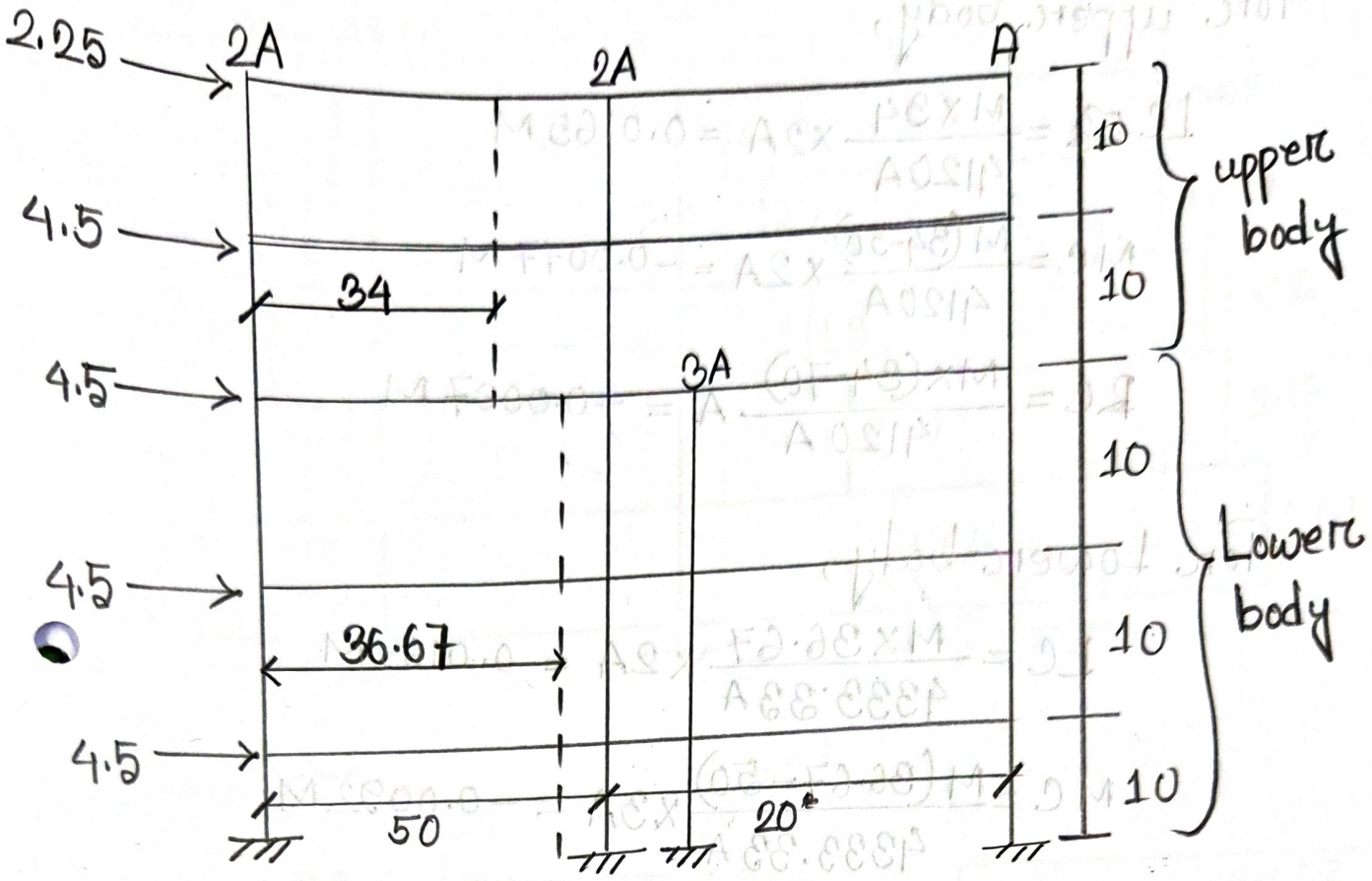
$M = 51.15$, $L = 10$, $S = 10.23$

$M = 76.81$, $L = 12$, $S = 12.8$

Beam AFD:



Quiz-02



Soln:

upper body centroid, $\bar{x}_1 = \frac{2A\times0 + 2A\times50 + A\times70}{2A+2A+A}$

$= 34'$

Lower body centroid, $\bar{x}_2 = \frac{2A\times0 + 3A\times50 + A\times70}{2A+3A+A}$

$= 36.67'$

for lower body, $I_2 = \Sigma Ad^2$

$= 2A\times(36.67)^2 + 3A\times(13.33)^2 + A(33.32)^2$

$= 433.33A$

for upper body, $I_1 = 2A\times(34)^2 + 2A(16)^2 + A\times(36)^2$

$= 4120\,A$

For upper body,

$$LC = \frac{M \times 34}{4120A} \times 2A = 0.0165M$$

$$MC = \frac{M(34-50)}{4120A} \times 2A = -0.0077M$$

$$RC = \frac{M \times (34-70)}{4120A} A = -0.0087M$$

For Lower body,

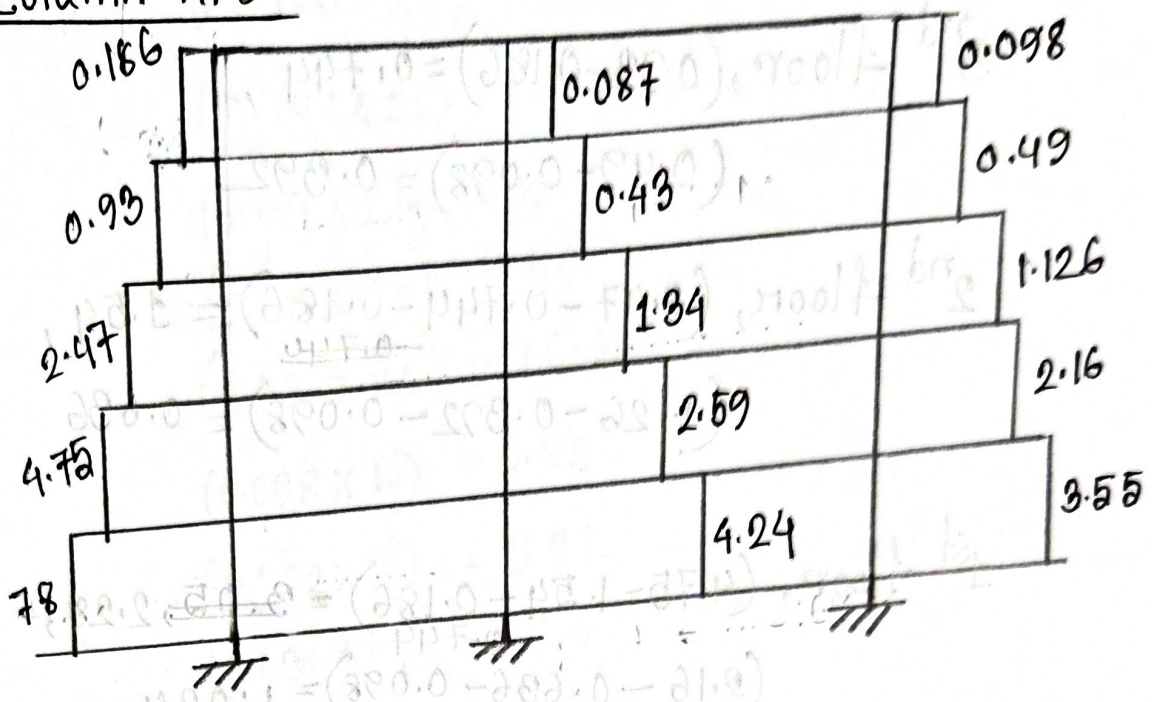
$$LC = \frac{M \times 36.67}{4333.33A} \times 2A = 0.0169M$$

$$MC = \frac{M(36.67-50)}{4333.33A} \times 3A = -0.0092M$$

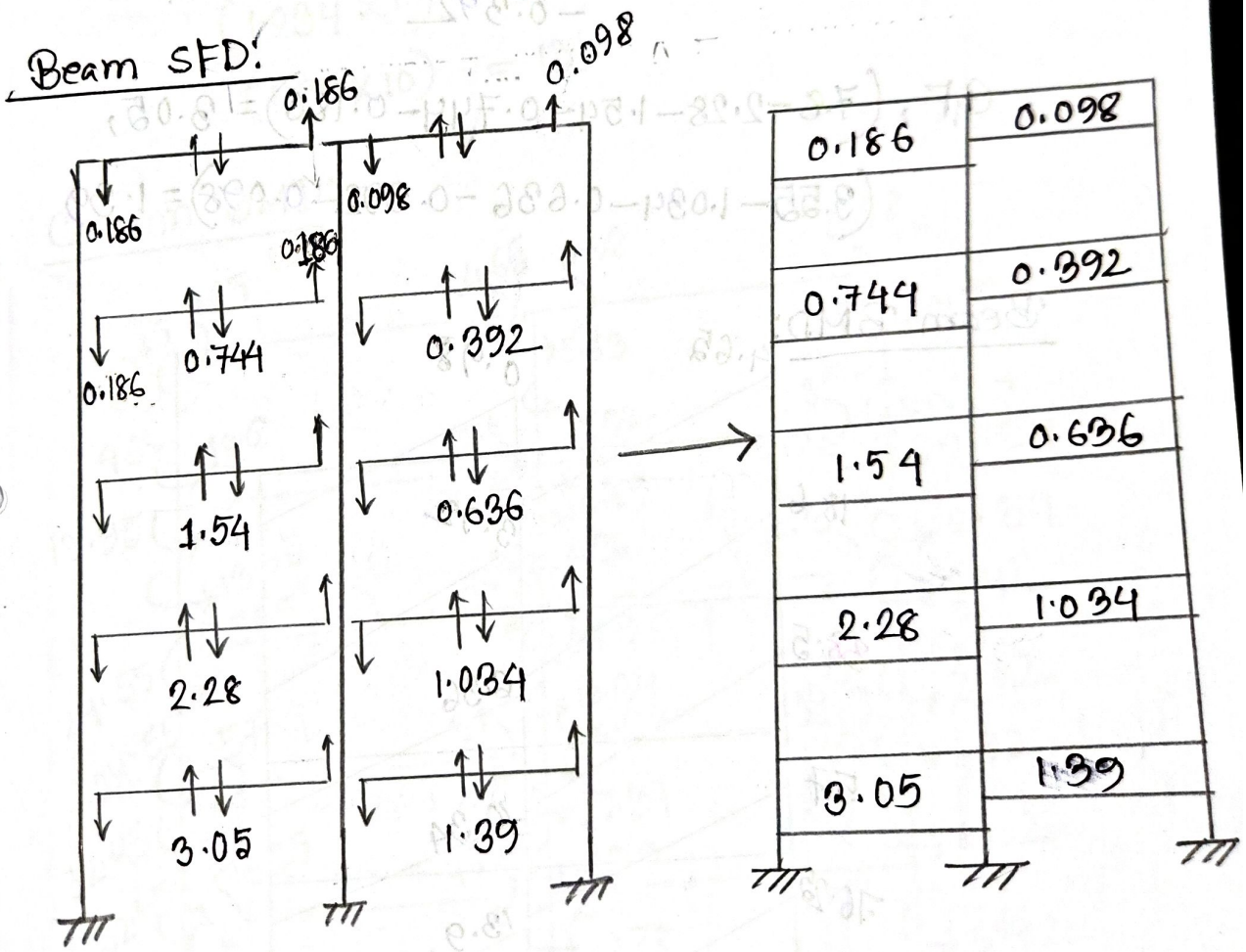
$$RC = \frac{M(36.67-50)A}{4333.33A} = -0.0077M$$

Floor	Moment	AF		
		LC	MC	RC
4th	11.25	0.186	-0.087	-0.0098
3rd	56.25	0.93	-0.43	-0.49
2nd	146.25	2.47	-1.37	-1.126
1st	281.25	4.75	-2.59	-2.16
GF	461.25	7.8	-4.24	-3.55

Column AFD:



Beam SFD:



for 4th floor = 0.186 , 0.098

3rd floor, (0.93 − 0.186) = 0.744 ,

(0.49 − 0.098) = 0.392

2nd floor, (2.47 − 0.744 − 0.186) = 1.54 ,

(1.126 − 0.392 − 0.098) = 0.636

1st floor, (4.75 − 1.54 − 0.186) = 2.28 ,

−0.744

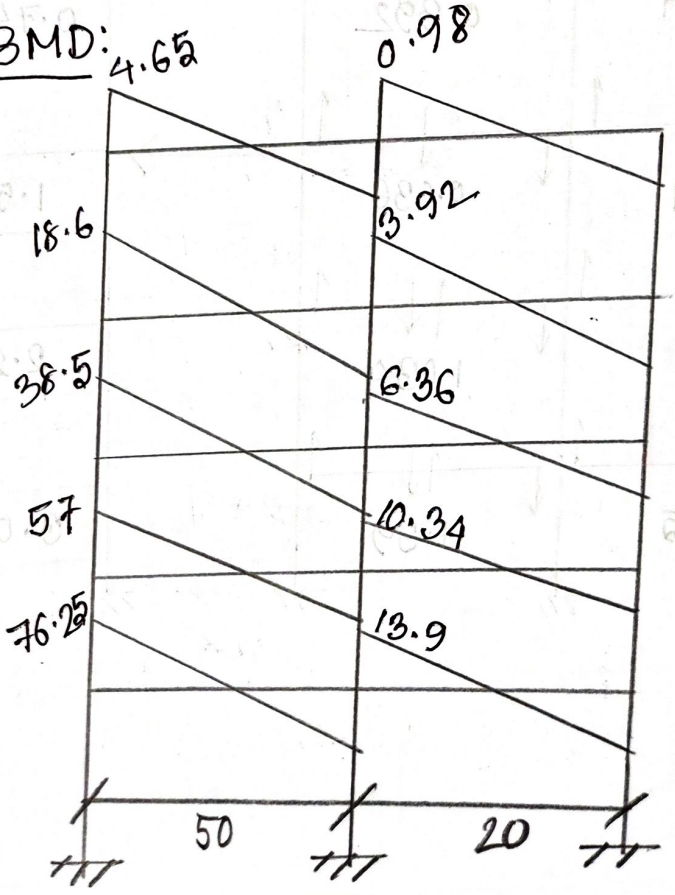
(2.16 − 0.636 − 0.098) = 1.034

−0.392

GF, (7.8 − 2.28 − 1.54 − 0.744 − 0.186) = 3.05 ,

(3.55 − 1.034 − 0.636 − 0.392 − 0.098) = 1.39

Beam BMD:



Moment $(0.186 \times 25) = 4.65$

$(0.744 \times 25) = 18.6$

$(1.54 \times 25) = 38.5$

$(2.28 \times 25) = 57$

$(3.05 \times 25) = 76.25$

$(0.098 \times 10) = 0.98$

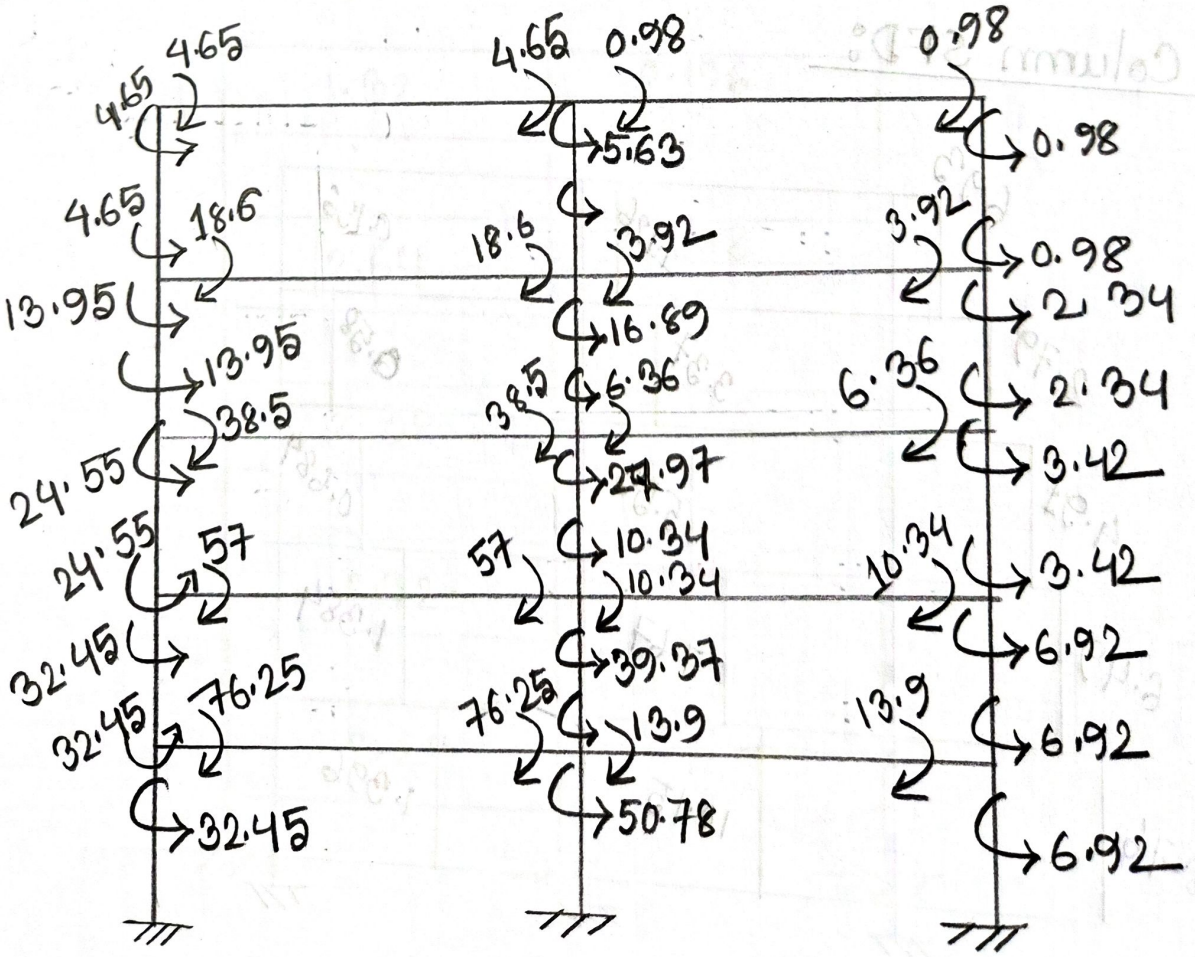
$(0.392 \times 10) = 3.92$

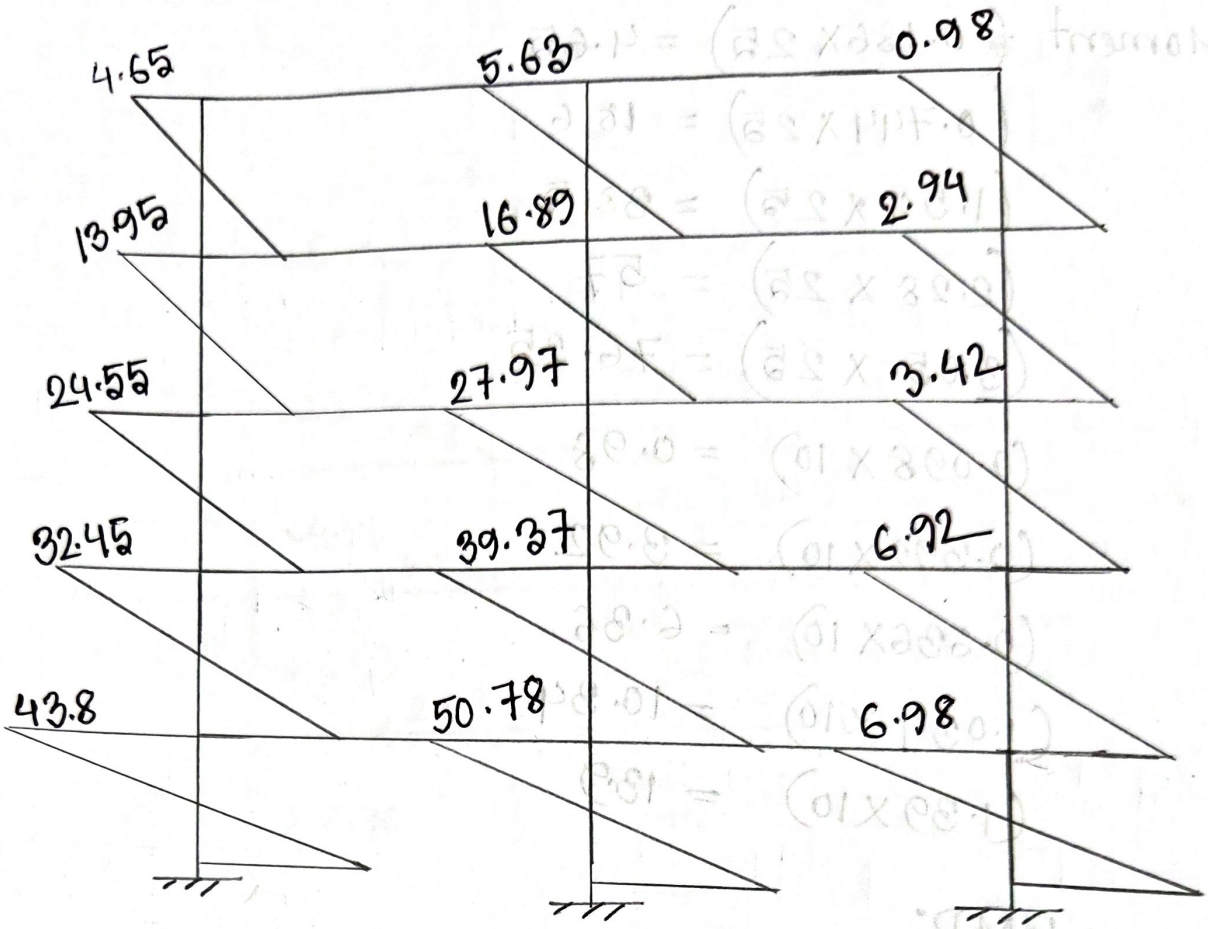
$(0.636 \times 10) = 6.36$

$(1.034 \times 10) = 10.34$

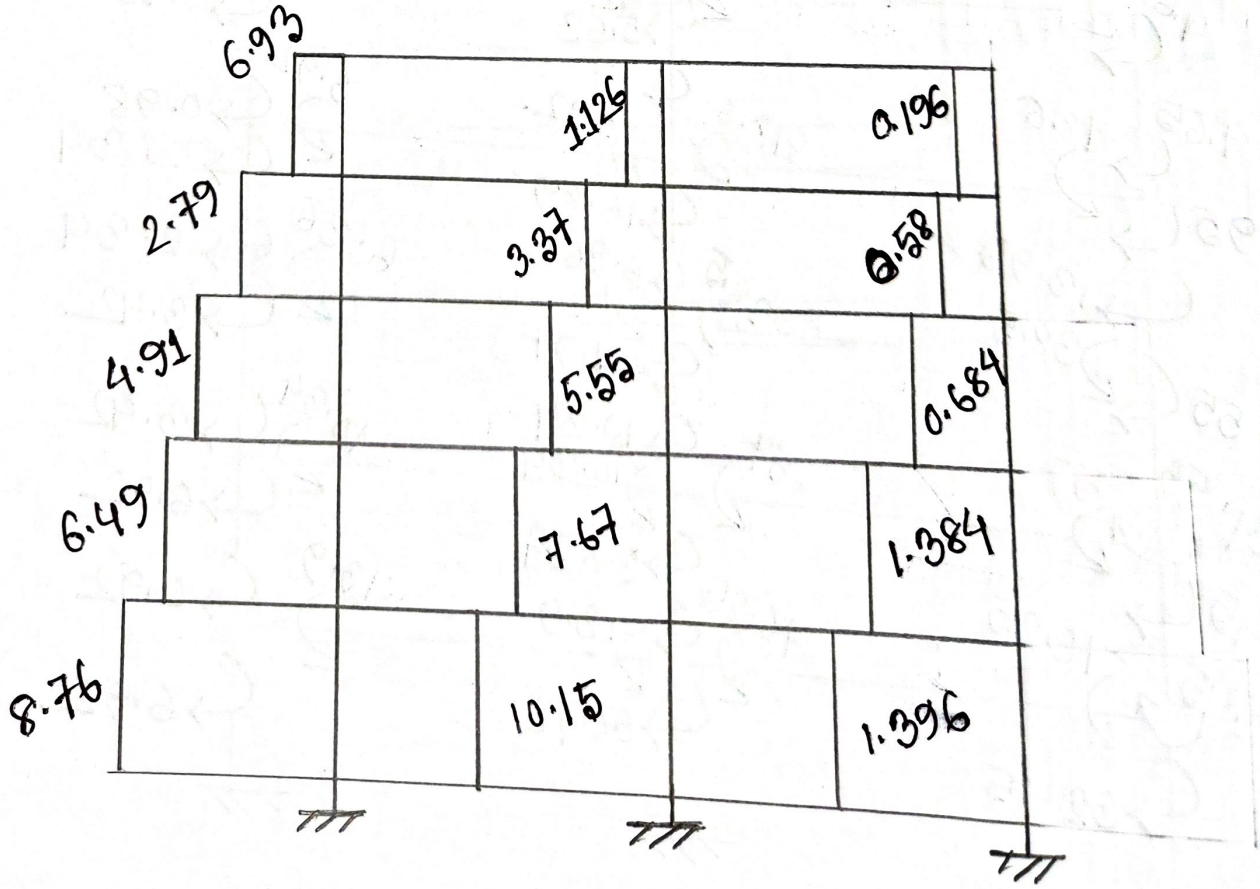
$(1.39 \times 10) = 13.9$

Column BMD:

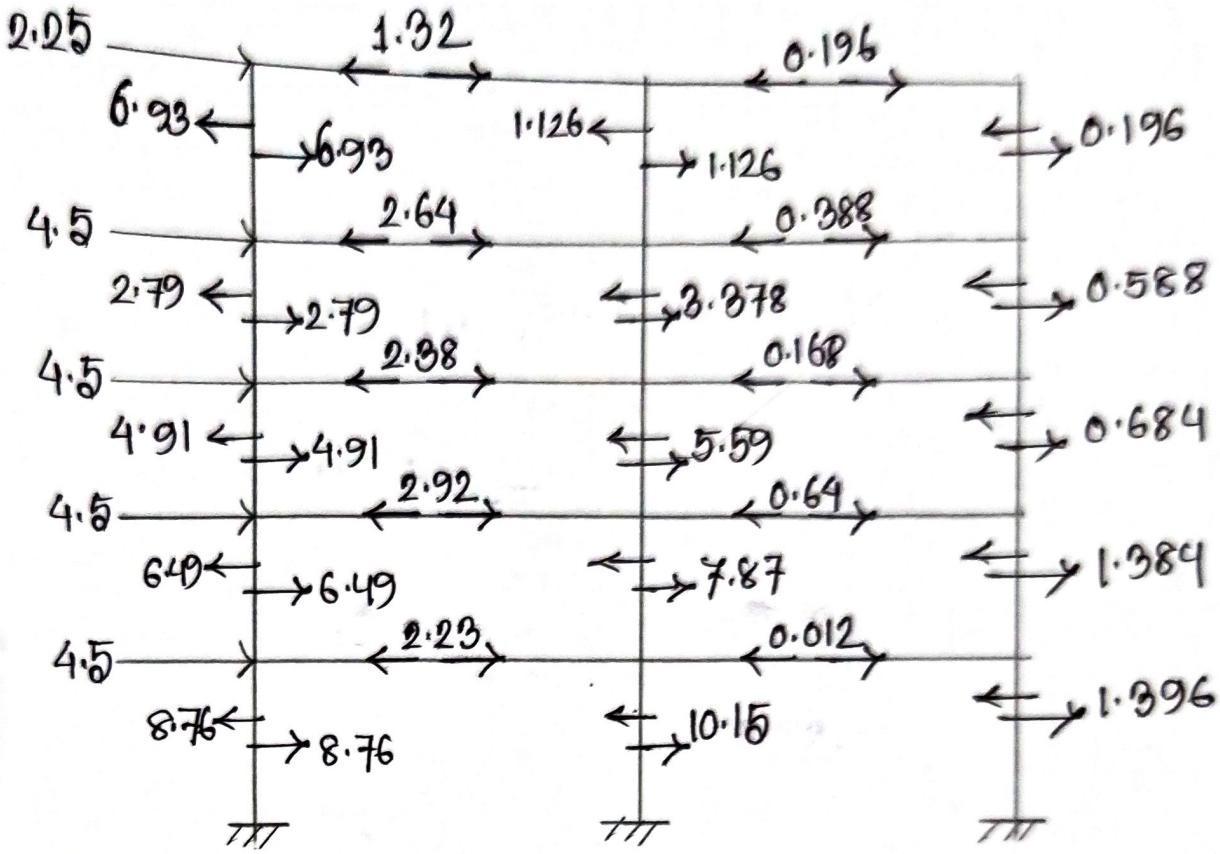


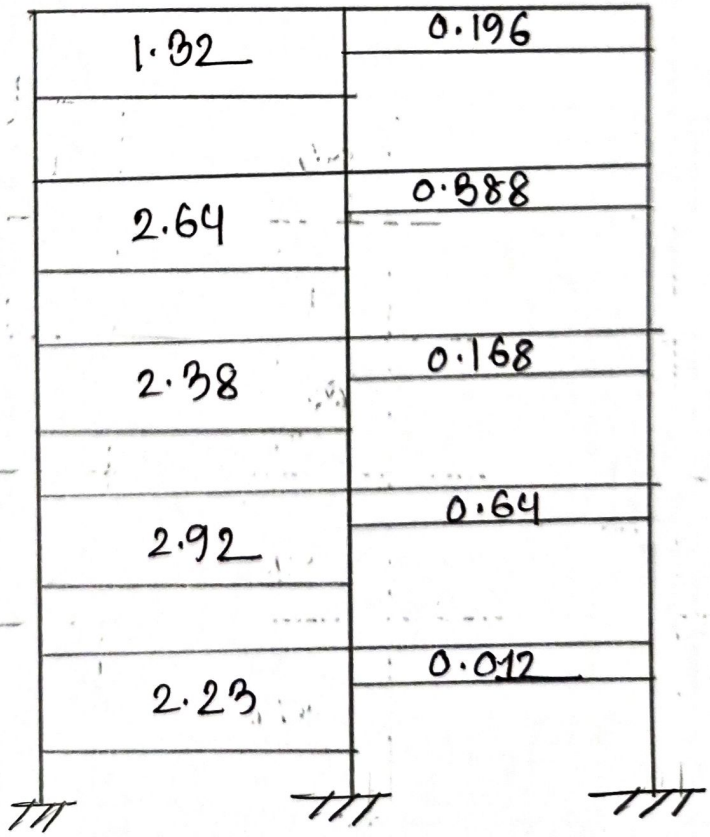

4.65
5.63
0.98
13.95
16.89
2.94
24.55
27.97
3.42
32.45
39.37
6.92
43.8
50.78
6.98

Column SFD:


6.93
1.126
0.196
2.79
3.37
0.58
4.91
5.55
0.684
6.49
7.67
1.384
8.76
10.15
1.396

Beam AFD:


2.25
1.32
0.196
6.93
6.93
1.126
1.126
0.196
4.5
2.64
0.388
2.79
2.79
3.378
0.588
4.5
2.38
0.168
4.91
4.91
5.59
0.684
4.5
2.92
0.64
6.49
6.49
7.87
1.384
4.5
2.23
0.012
8.76
8.76
10.15
1.396


1.32
0.196
2.64
0.388
2.38
0.168
2.92
0.64
2.23
0.012

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

Course Code :

Mill Bent

Name : Oishi

Roll No : 202230061

Level/Term : 1-3/T-1

Course : EWCE-311

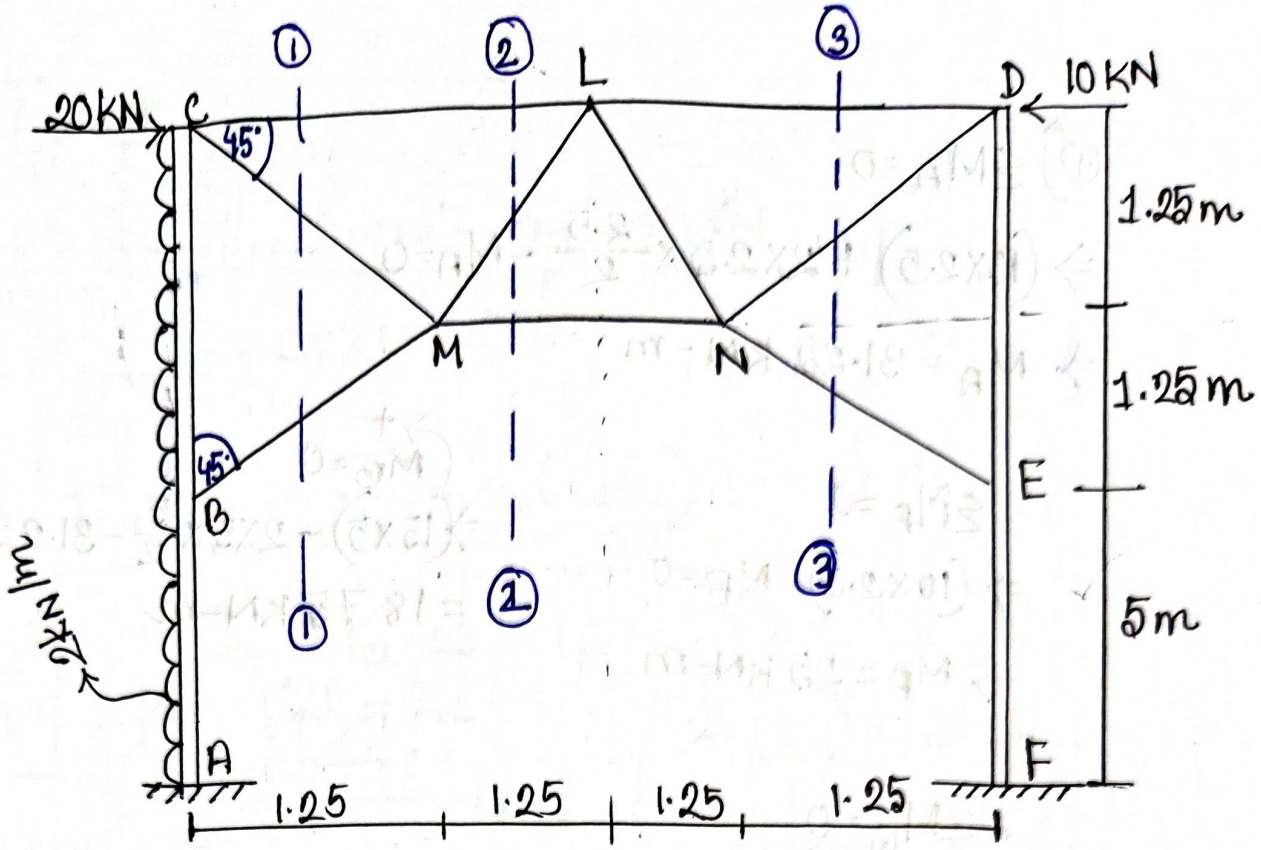
Date of exp :

Date of sub :

Group :

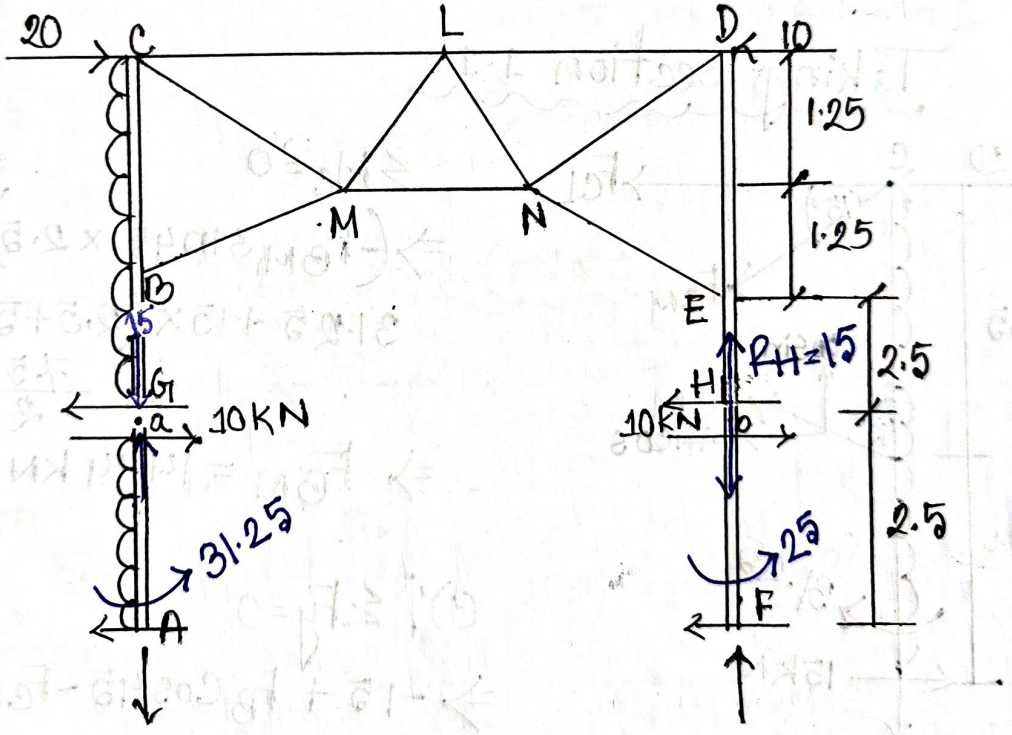
Signature of Teacher :

(1)



Total horizontal force $= 20 - 10 + 2\left(1.25 + 1.25 + \frac{5}{2}\right)$

$= 20\text{KN}$



$\overset{(+)}{\circlearrowleft} \Sigma M_b = 0 \Rightarrow (20 \times 5)$

$\overset{+}{\circlearrowleft} \Sigma M_A = 0$

$\Rightarrow (10 \times 2.5) + 2 \times 2.5 \times \frac{2.5}{2} - M_A = 0$

$\Rightarrow M_A = 31.25 \text{ kN-m}$

$\overset{+}{\circlearrowright} M_B = 0$

$\Rightarrow (15 \times 5) - 2 \times 5 \times \frac{5}{2} - 31.25 = 0$

$= 18.75 \text{ kN-m}$

$\Sigma M_F = 0$

$\Rightarrow (10 \times 2.5) - M_F = 0$

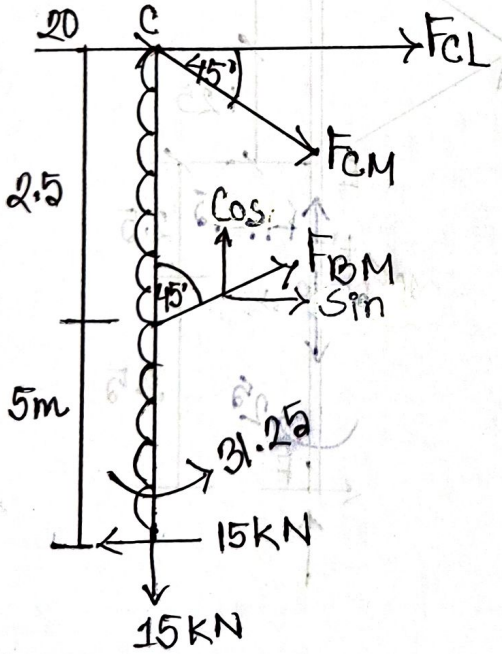
$\Rightarrow M_F = 25 \text{ kN-m}$

$\Sigma M_G = 0$

$\Rightarrow 20 \times \left(1.25 + 1.25 + \frac{5}{2}\right) - (10 \times 5) + 2 \times 5 \times 2.5 - 5R_H = 0$

$\Rightarrow R_H = 15 \text{kN}$

Taking section 1-1



$\Sigma M_C = 0$

$\Rightarrow (-F_{BM} \sin 45 \times 2.5) - 31.25 + 15 \times (2.5 + 5) \times \frac{7.5}{2} = 0$

$\Rightarrow F_{BM} = 14.14 \text{ kN (T)}$

$\overset{+}{\uparrow} \Sigma F_y = 0$

$\Rightarrow -15 + F_B \cos 45 - F_{CM} \sin 45 = 0$

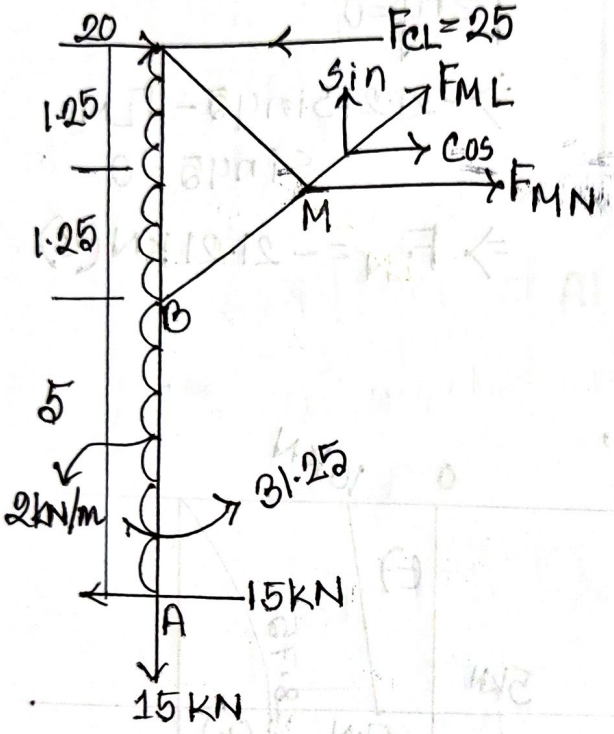
$\Rightarrow F_{CM} = -5\sqrt{2} \text{kN (C)}$

$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow -15 + F_{BM}\sin 45^\circ - F_{CM}\cos 45^\circ + F_{CL} + 2\times 7.5\times 20 = 0$

$\Rightarrow F_{CL} = -25\,kN\ (C)$

Force section 2-2 (left)



$\uparrow^{(+)} \Sigma F_y = 0$

$\Rightarrow F_{ML}\sin 45 - 15 = 0$

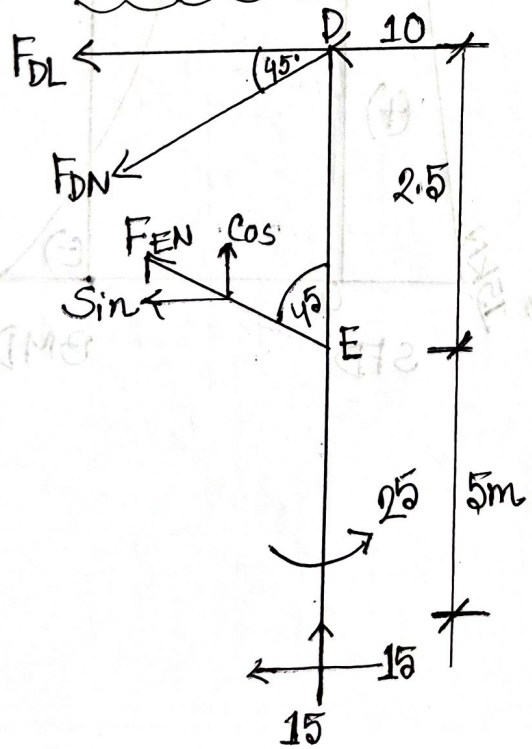
$\Rightarrow F_{ML} = 21.21\,kN\ (T)$

$\Sigma F_x = 0 \xrightarrow{(+)}$

$\Rightarrow 20 - F_{CL} + F_{ML}\cos 45 - 15 + F_{MN} + 2\times 7.5 = 0$

$\Rightarrow F_{MN} = -10\,kN\ (C)$

Force section 3-3 (right)



$+\circlearrowleft \Sigma M_D = 0$

$\Rightarrow F_{EN}\sin 45\times 2.5 - 25 + 10\times 7.5 = 0$

$\Rightarrow F_{EN} = -20\sqrt{2}\,kN(C)$

$(+)\uparrow \Sigma F_y = 0$

$\Rightarrow 15 + F_{EN}\cos 45 - F_{DN}\sin 45 = 0$

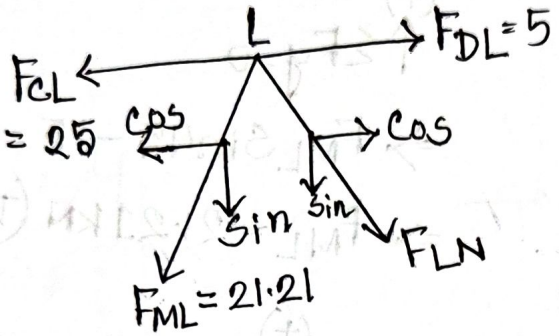
$\Rightarrow F_{DN} = 7.07\,KN\ (T)$

$\xrightarrow{(+)} \Sigma F_x = 0$

$\Rightarrow -10 - F_{DL} + F_{DN}\cos 45 - F_{EN}\sin 45 = 0$

$\Rightarrow F_{DL} = 5\,KN\,(T)$

At joint L,

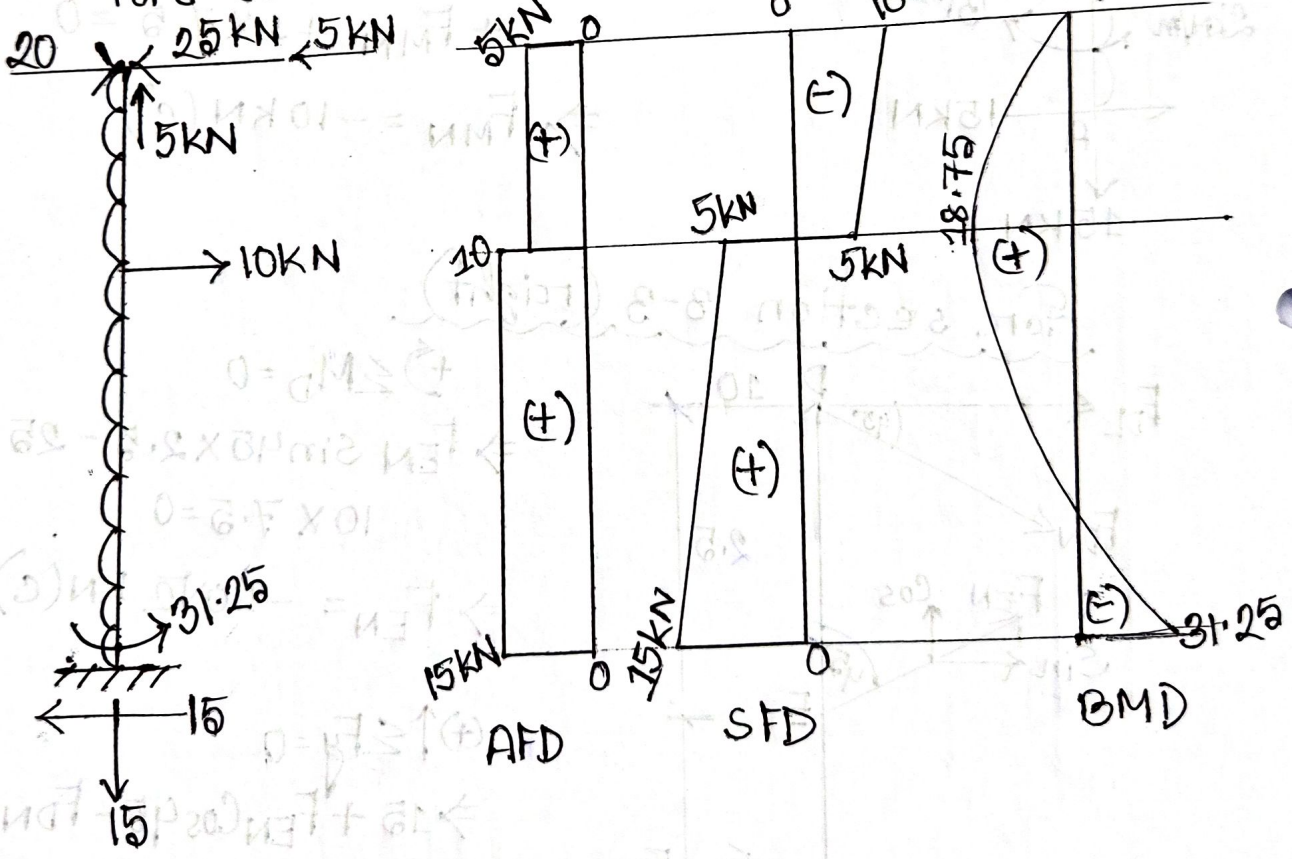


$\uparrow^{(+)} \Sigma F_y = 0$

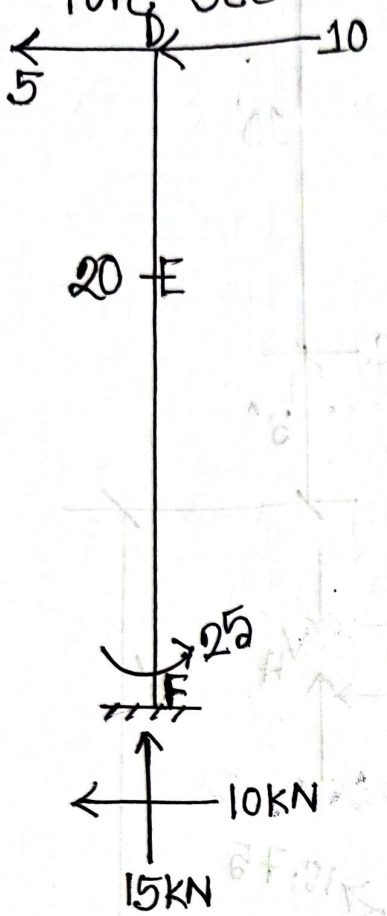
$\Rightarrow -21.21\sin 45 - F_{LN}\sin 45 = 0$

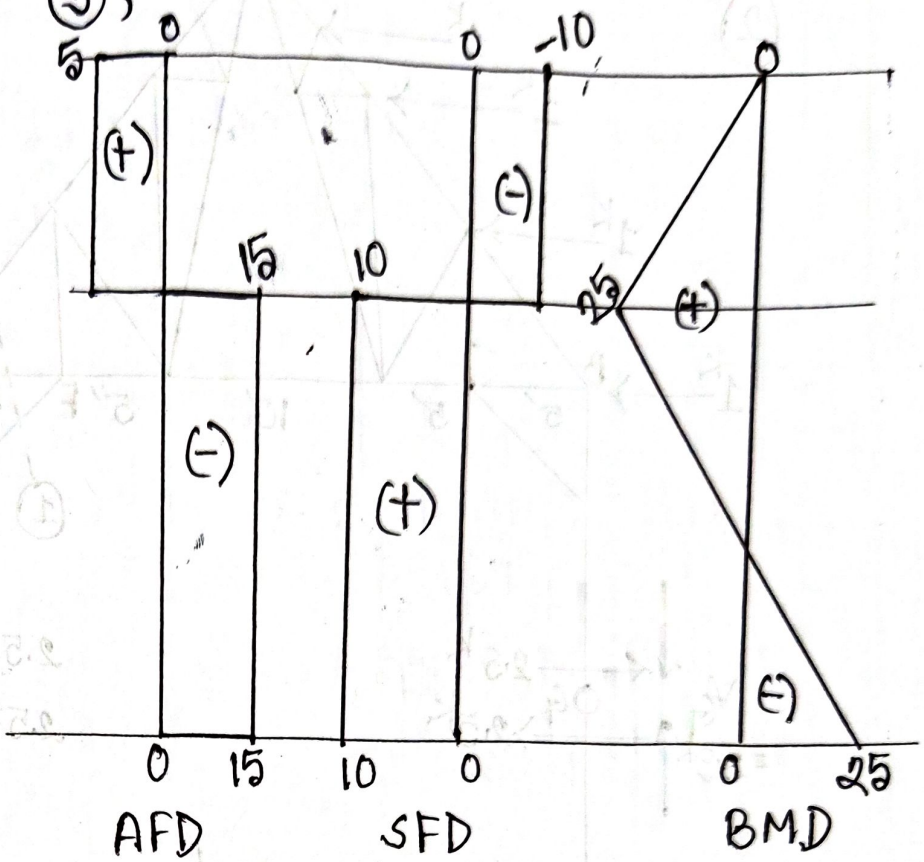
$\Rightarrow F_{LN} = -21.21\,KN\,(C)$

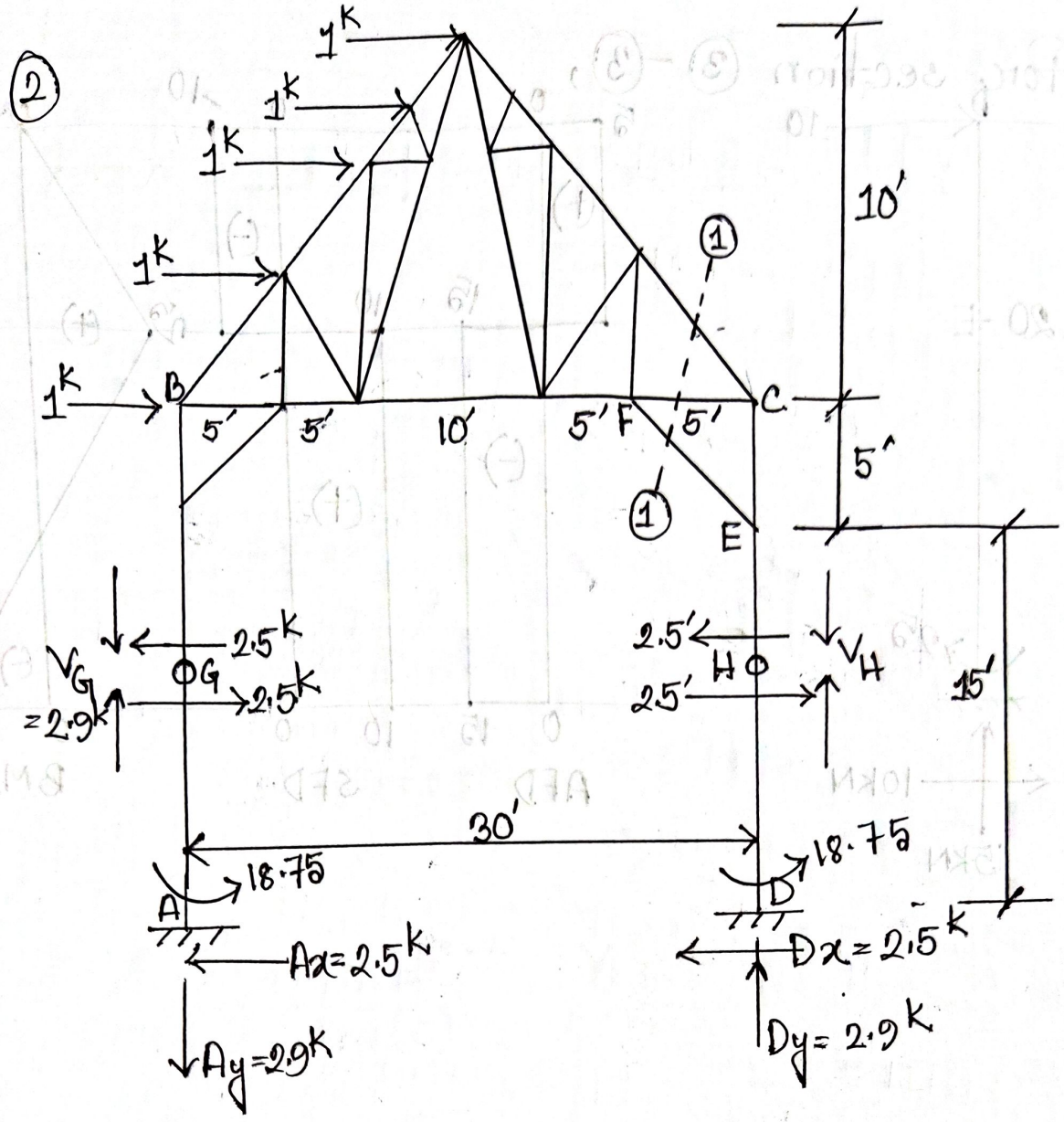
For section (1)-(1),



for section ③-③,







$$\overset{(+)}{\circlearrowright} \Sigma M_H = 0$$

$$\Rightarrow \left(1\times 10+\frac{5}{2}\right)+(1\times 15)+(1\times 17.5)+(1\times 20)+$$

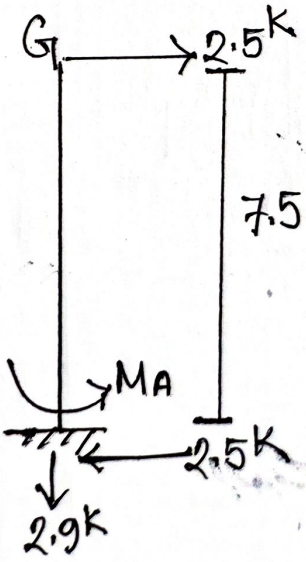
$$(1\times 22.5)-30V_{G_1}=0$$

$$\Rightarrow V_{G_1}=2.9^{K}$$

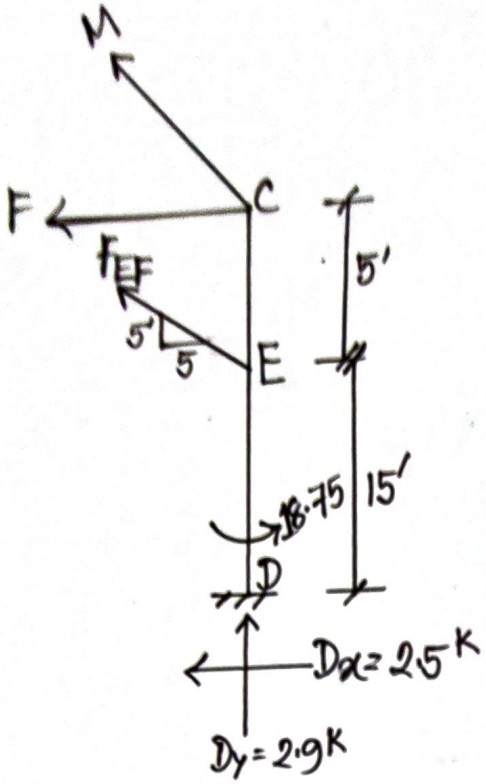
$$\overset{(+)}{\circlearrowright} \Sigma M_A = 0$$

$$\Rightarrow 2.5\times 7.5 - M_A = 0$$

$$\Rightarrow M_A = 18.75\ K\text{-}ft$$



Section ①-①:



$\curvearrowright (+)$

$\Sigma M_c = 0$

$\Rightarrow -18.75 + (2.5 \times 20) + F_{EF} \cos 45 \times 5 = 0$

$\Rightarrow F_{EF} = -8.84^K \ (C)$

$\Sigma F_y = 0 \ \uparrow (+)$

$\Rightarrow D_y + F_{EC} + F_{EF} \sin 45 = 0$

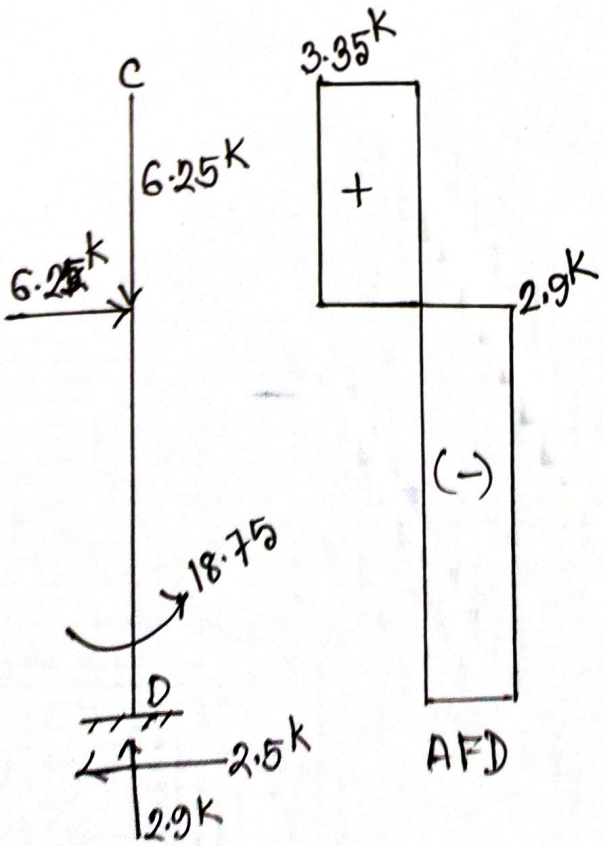
$\Rightarrow 2.9 + F_{EC} - 8.84 \sin 45 = 0$

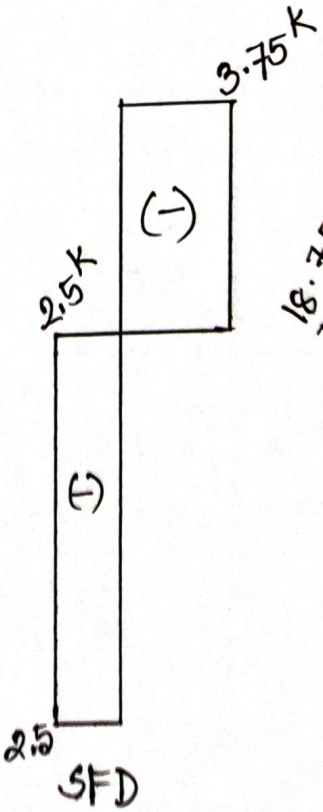
$\Rightarrow F_{EC} = 3.35^K \ (T)$

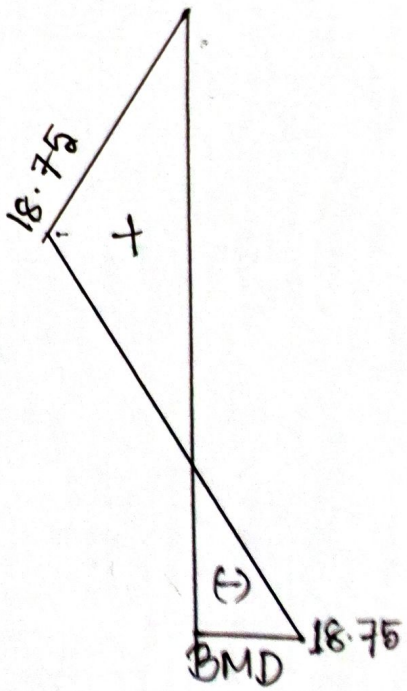
$H_{EF} = -8.84 \cos 45^\circ$

$= -6.25^K \ (C)$

$V_{EF} = -6.25^K \ (C)$







MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

Course Code :

Portal Method

Name :

Roll No :

Level/Term :

Course :

Date of exp :

Date of sub :

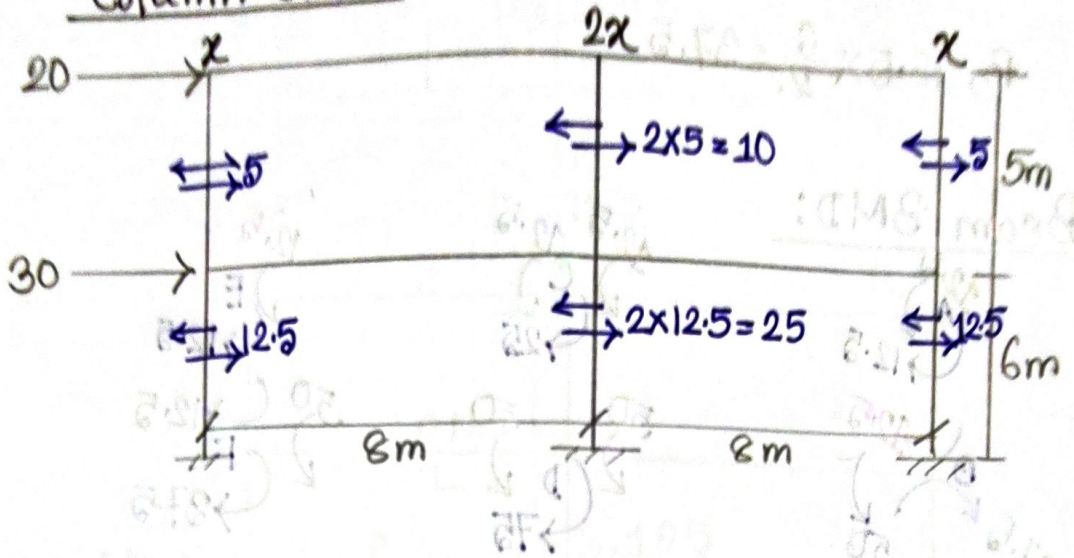
Group :

Signature of Teacher :

Portal Method

(1)

Column SFD:

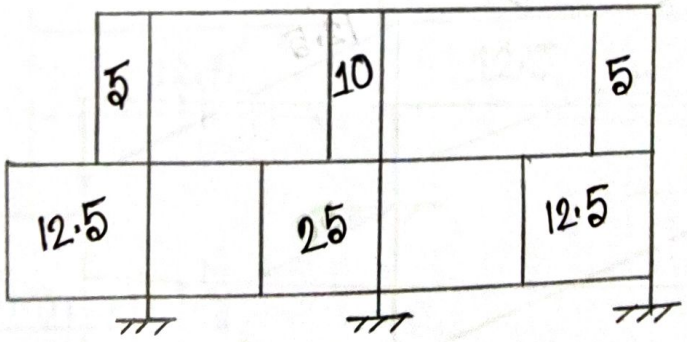


1st Floor $\Rightarrow x + 2x + x = 20$

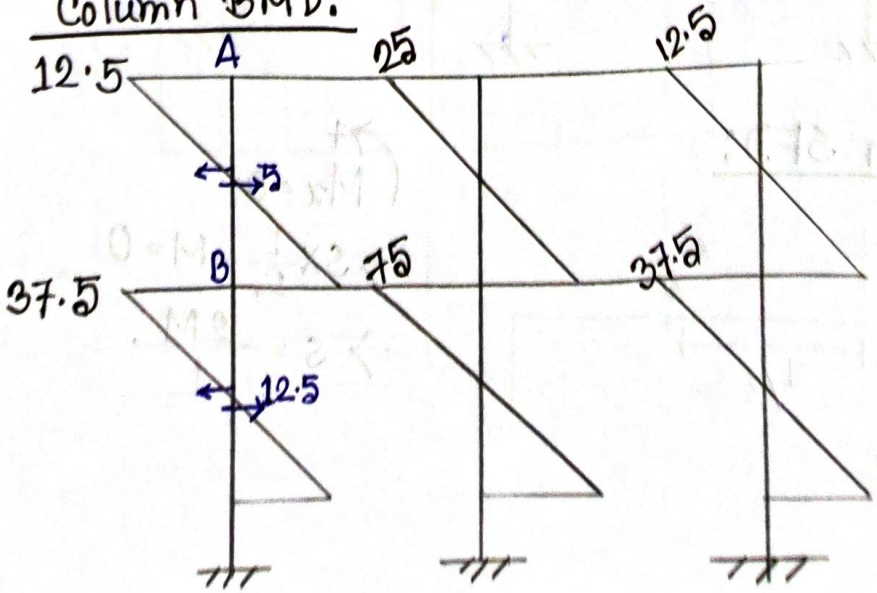
$\Rightarrow x = 5\,kN$

GF $\Rightarrow x + 2x + x = 20 + 30$

$\Rightarrow x = 12.5\,kN$



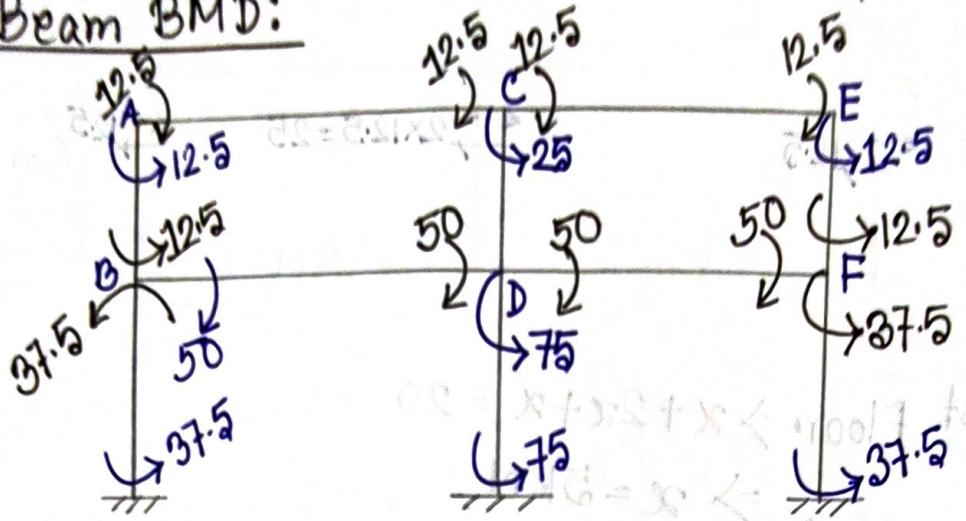
Column BMD:



at A, $5 \times \frac{5}{2} = 12.5$

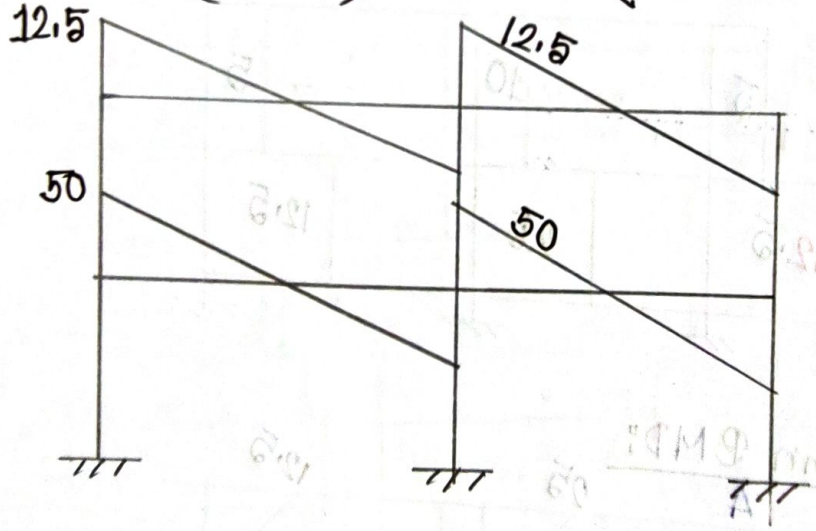
B, $12.5 \times \frac{6}{2} = 37.5$

Beam BMD:

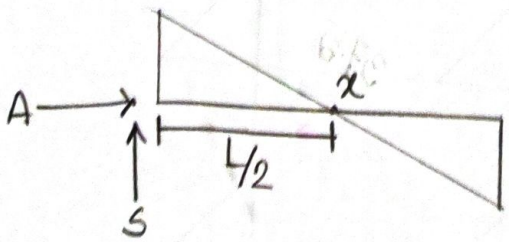


at A = 12.5, B = (37.5 + 12.5) = 50,

C = (12.5 + 12.5) = 25, D = (50 + 50 − 25) = 75



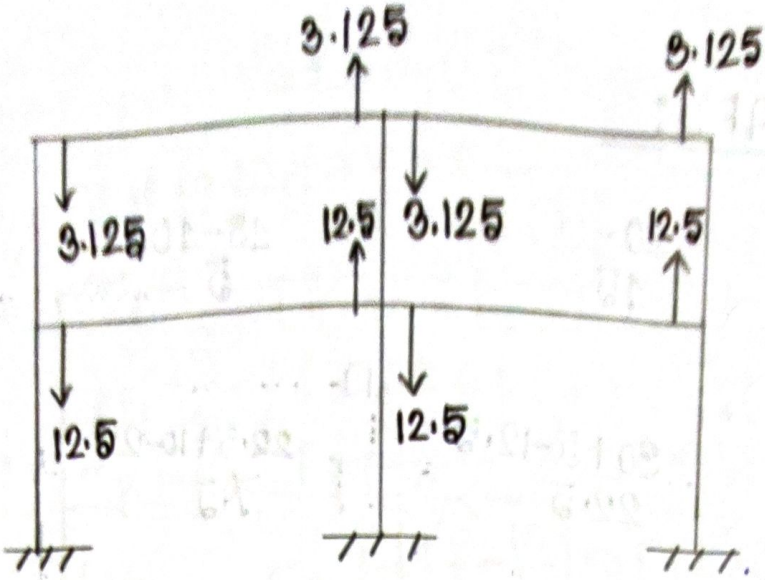
Beam SFD:



$\curvearrowright^{+} M_x = 0$

$\Rightarrow S \times \frac{L}{2} - M = 0$

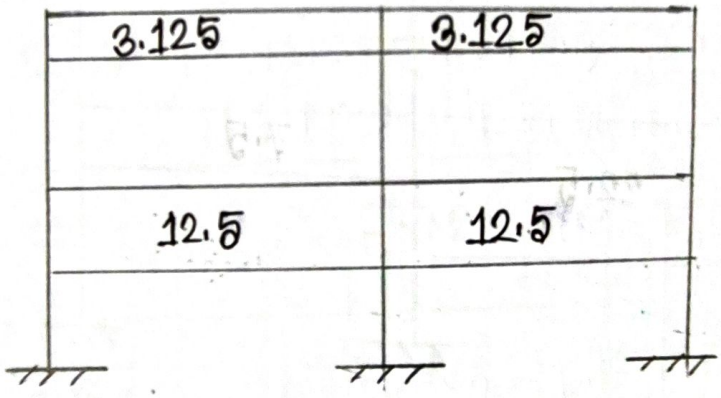
$\Rightarrow S = \frac{2M}{L}$



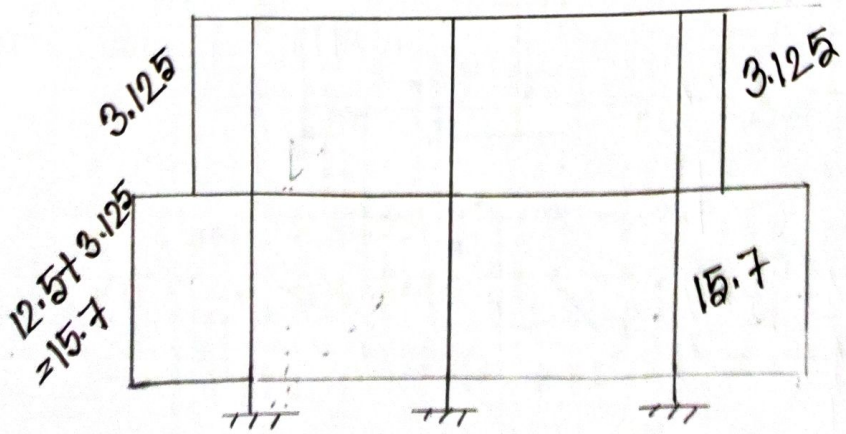
for $S = \frac{2M}{L}$

$M = 12.5$, $L = 8m$, $S = 3.125$

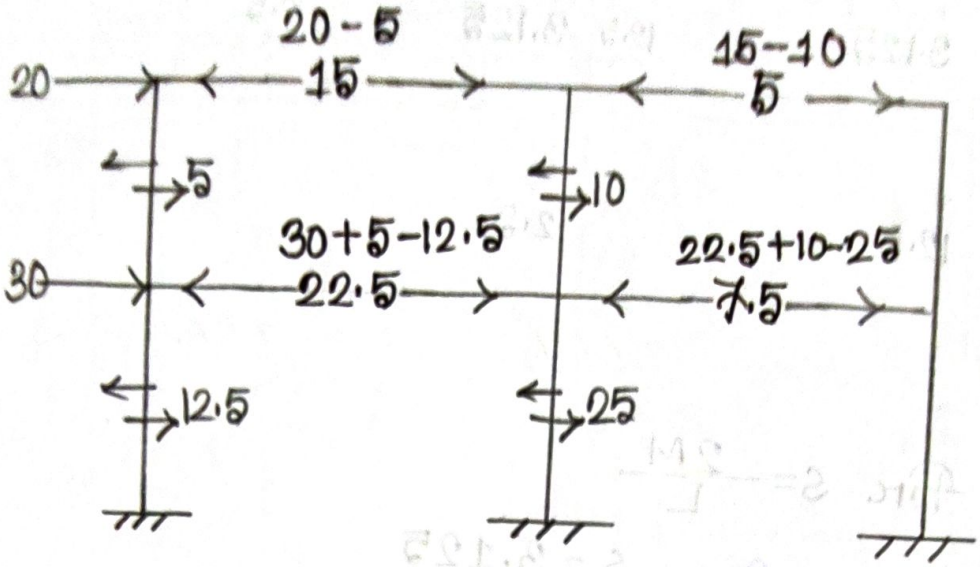
$M = 50$, $L = 8m$, $S = 12.5$

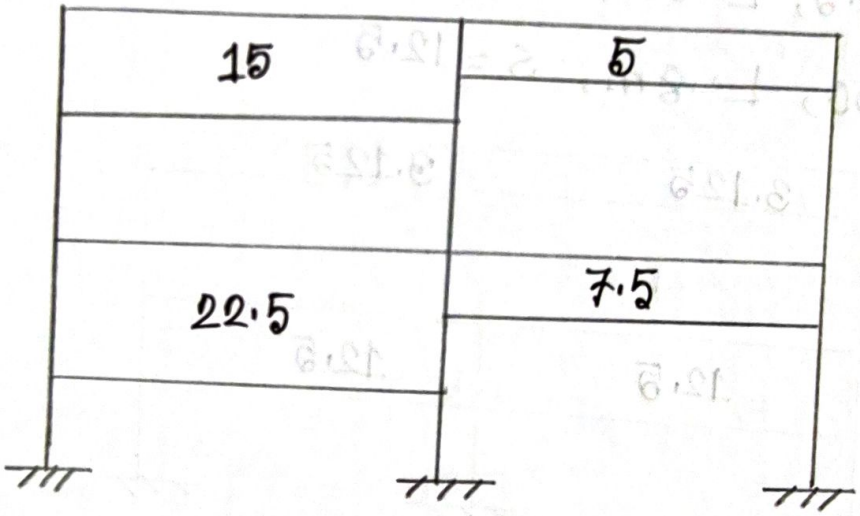


Column AFD:



Beam AFD:





② Wind speed, $V = 120$ mph

$$P = 0.00256 V^2 = 0.00256 (120)^2$$
$$= 37 \text{ Psf}$$

$$w = 37 \times 15 = 555 \text{ lb/ft}$$
$$= 0.555 \text{ k/ft}$$

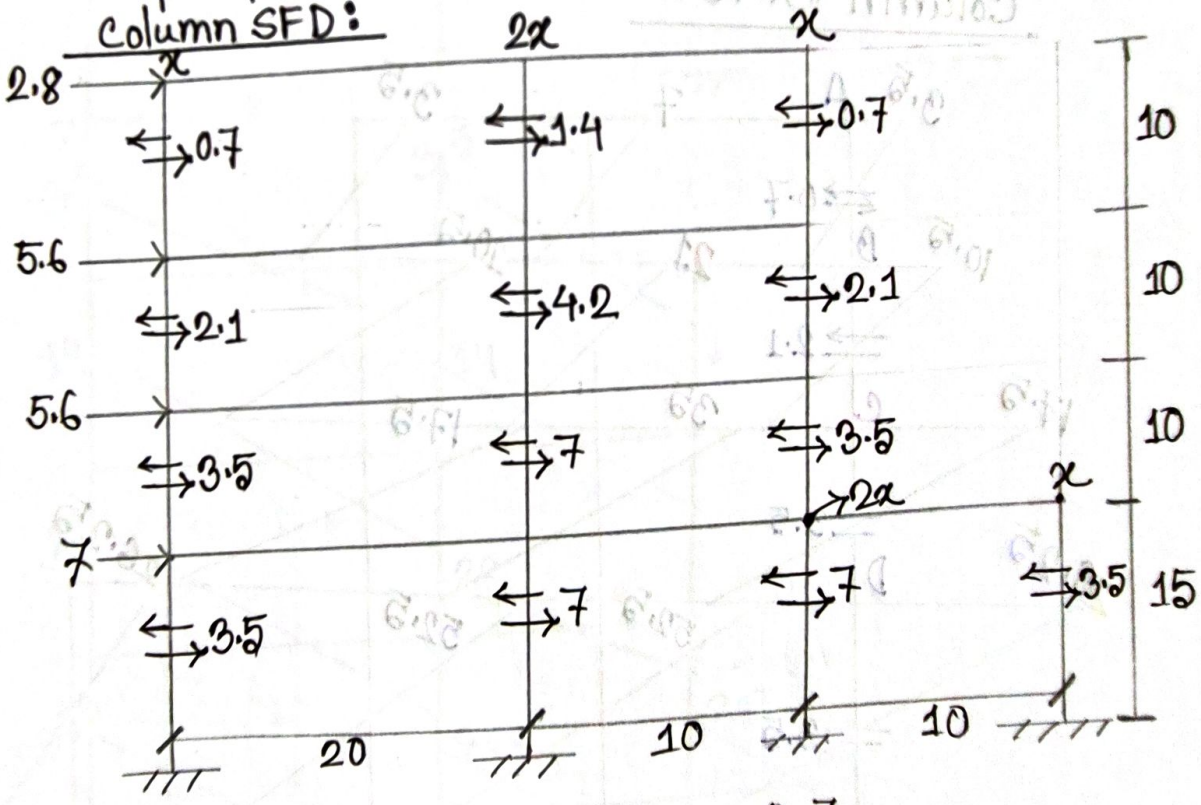
at 1st floor, $F = \left(\frac{15}{2} + \frac{10}{2}\right) \times 0.555 = 7\text{K}$

2nd floor, $F = \left(\frac{10}{2} + \frac{10}{2}\right) \times 0.555 = 5.6\text{K}$

3rd floor, $F = \left(\frac{10}{2} + \frac{10}{2}\right) \times 0.555 = 5.6\text{K}$

4th floor, $F = \frac{10}{2} \times 0.555 = 2.8\text{K}$

Column SFD:



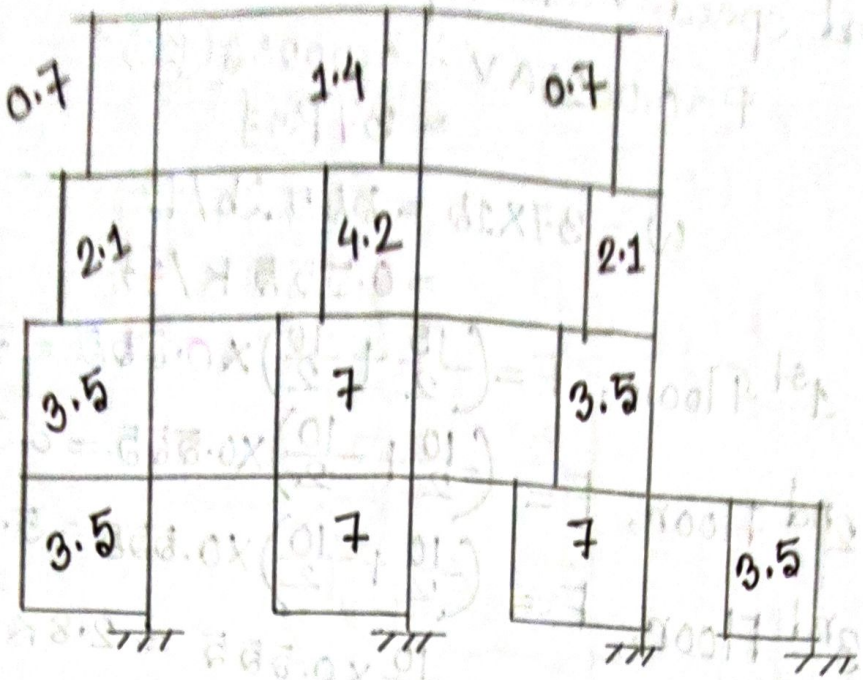
1st floor, $x + 2x + x = 2.8 \Rightarrow x = 0.7$

2nd floor, $x + 2x + x = 5.6 + 2.8 \Rightarrow x = 2.1$

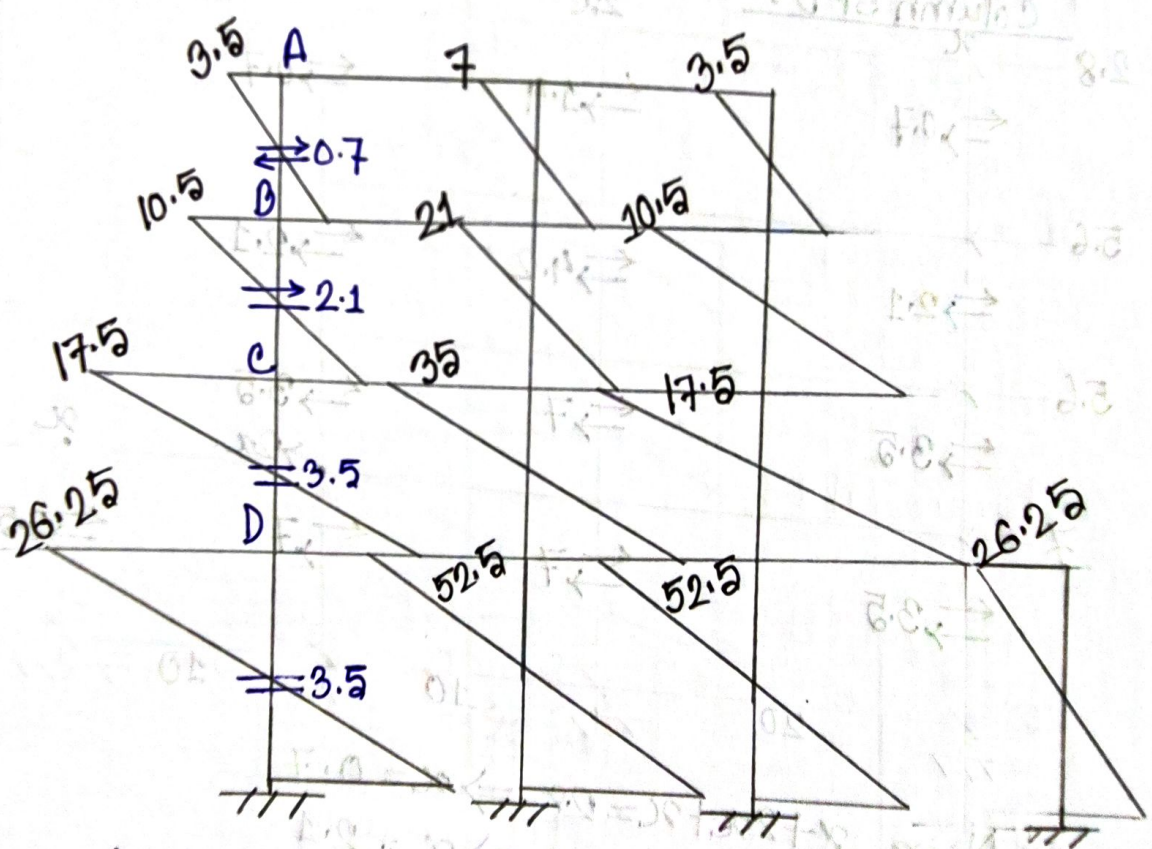
3rd floor, $4x = 5.6 + 2.8 + 5.6 \Rightarrow x = 3.5$

4th floor, $x + 2x + 2x + x = 2.8 + 5.6 + 5.6 + 7$

$\Rightarrow x = 3.5$



Column BMD:



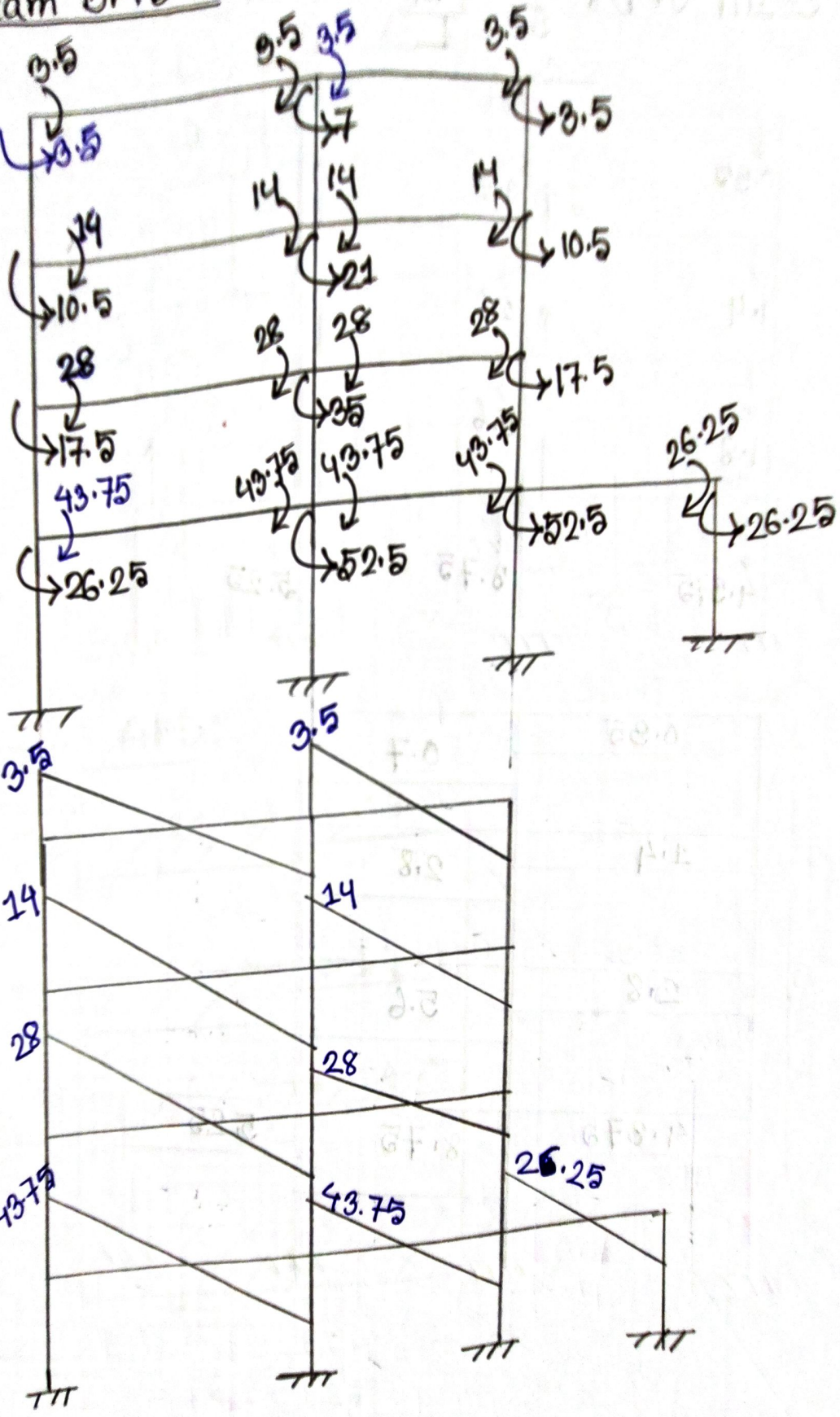
at A = 0.7 × 5 = 3.5

B = 2.1 × 5 = 10.5

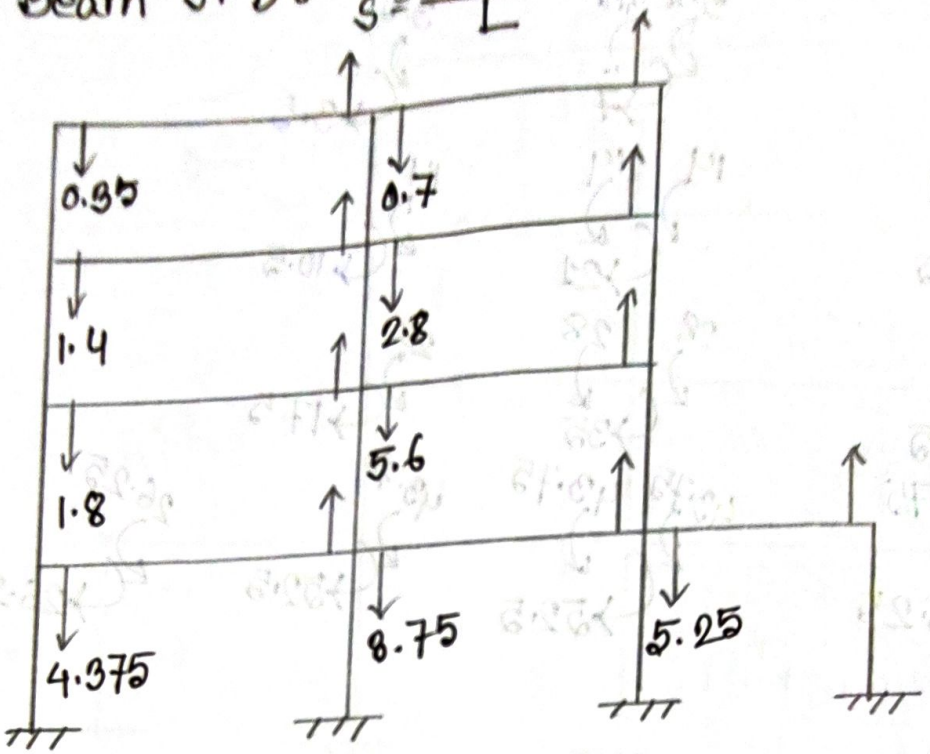
C = 3.5 × 5 = 17.5

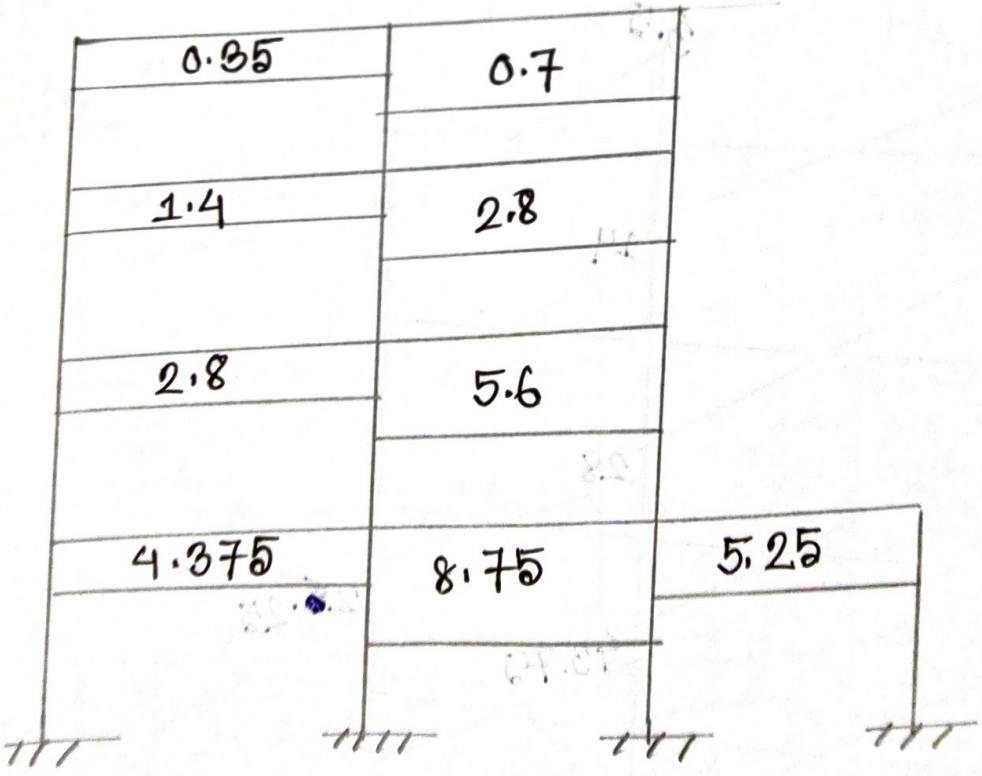
D = $3.5 \times \frac{15}{2}$ = 26.25

Beam BMD:

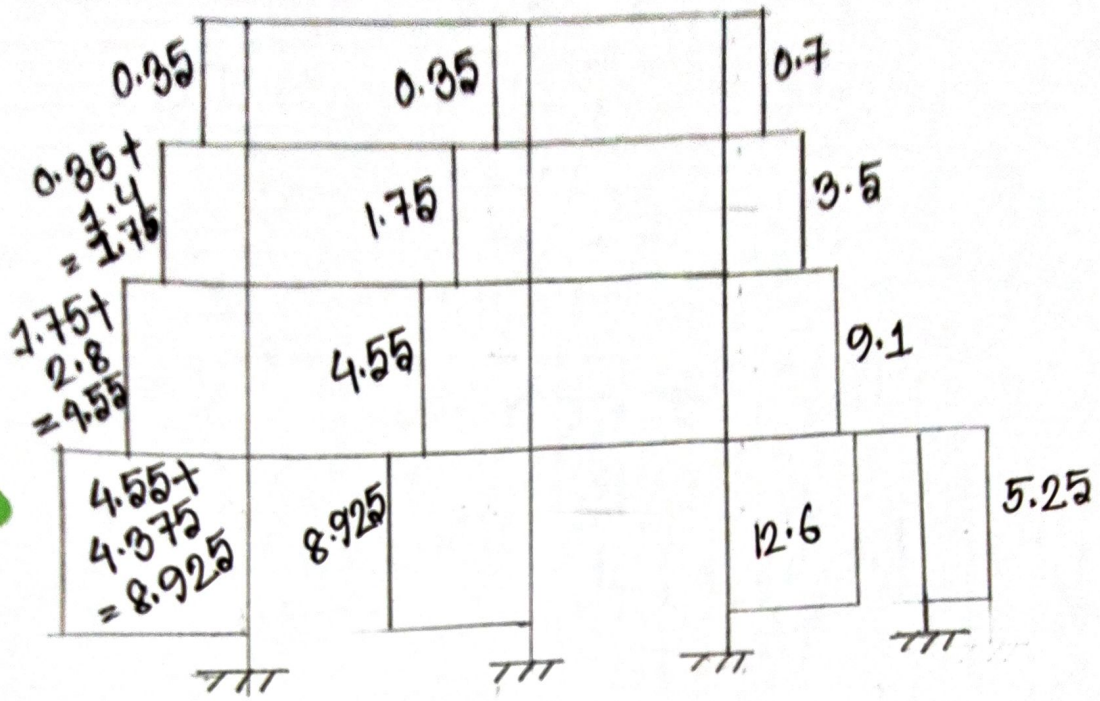

3.5
3.5
3.5
3.5
7
3.5
14
14
14
14
21
10.5
28
28
28
28
35
17.5
43.75
43.75
43.75
26.25
52.5
26.25
3.5
3.5
14
14
28
28
43.75
43.75
26.25

Beam SFD: $S = \frac{2M}{L}$

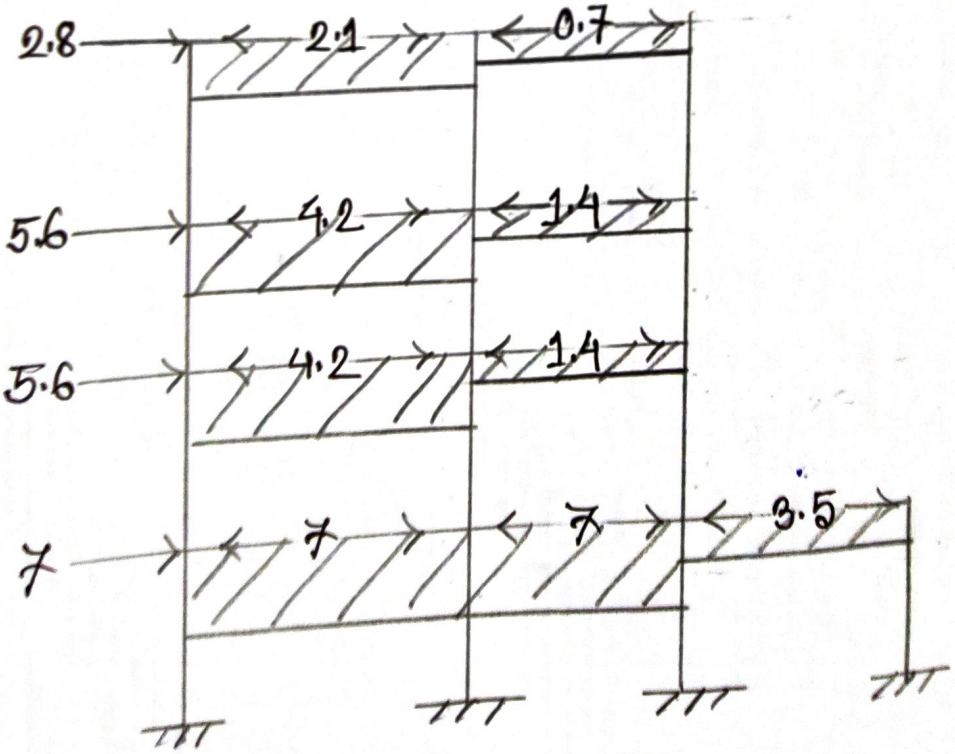




Column AFD:



Beam AFD:

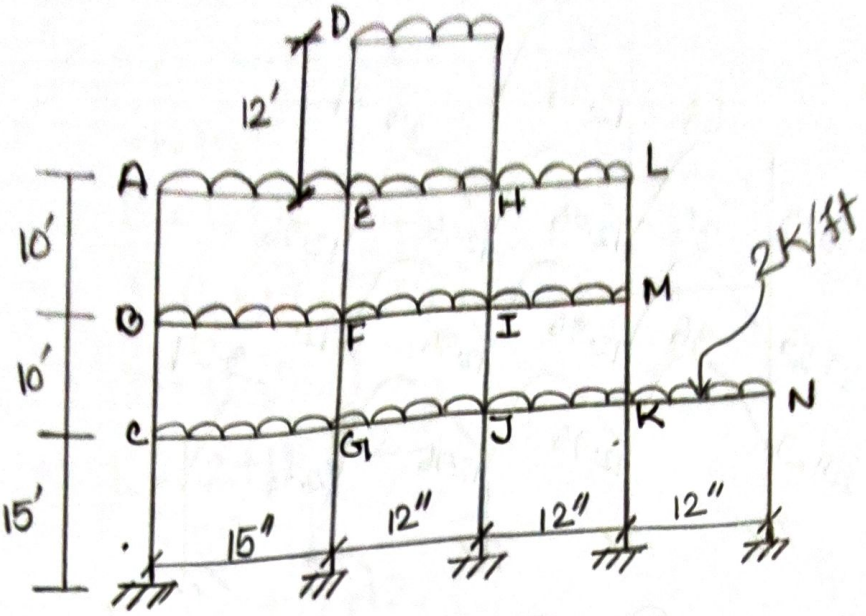


MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

Course Code : 311

Verticle loads on structure

Name	: Tabassum A Habib
Roll No	: 202230061
Level/Term	: L-3/T-1
Course	: CWCE-311
Date of exp	: 16.07.25
Date of sub	: 23.07.25
Group	: 01
Signature of Teacher	:



Solution:

Bending Moment

15' span,

Maximum positive moment $= 0.08\omega L^2$

$= 0.08 \times 2 \times (15)^2$

$= 36$ [roof] [floor]

Negative moment $= 0.045 \times 2 \times (15)^2$

$= 20.25$ [roof, floor]

12' span,

positive moment $= 0.08 \times 2 \times (12)^2$

$= 23.04$

Negative moment $= 0.045 \times 2 \times (12)^2$

$= 12.96$

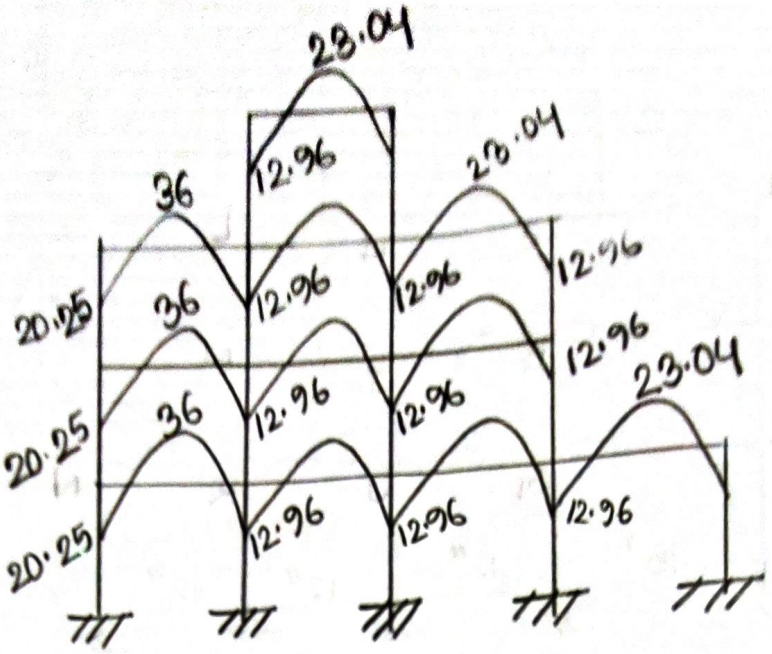


fig: Beam BMD

Beam SFD:

For 15' span,

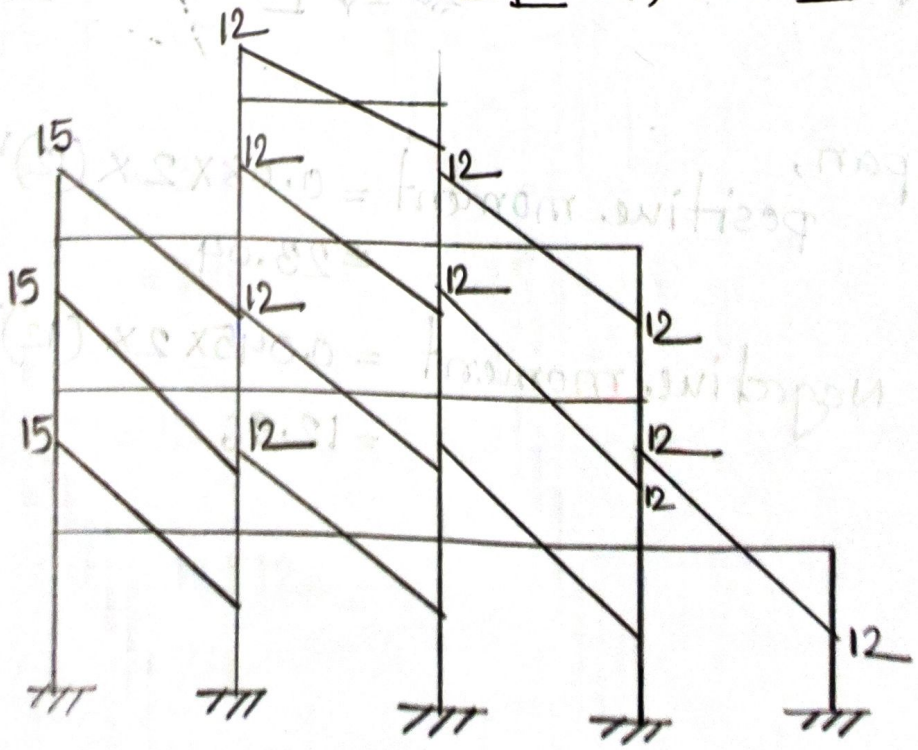
at point A = $0.5\omega L$

$= 0.5 \times 2 \times 15$

$= 15$ [Roof, Floor]

For 12' span $= 0.5 \times 2 \times 12$

$= 12$ [Roof, Floor]



Fore Axial Forces (Beam):

A = 15

B = 15+15 = 30

C = 15+15+15 = 45

D = 12

E = 12+15+12
= 39

F = 39+15+12
= 66

G = 66+12+15
= 93

H = 12+15
= 27

I = 27+12+15
= 54

J = 54+12+15
= 84

L = 12

M = 12+12
= 24

$k = 24 + 12$

$= 36$

$N = 12$

Bending Moment (column):

$$20.25 - 12.96 = 7.29$$

As the span is equal,

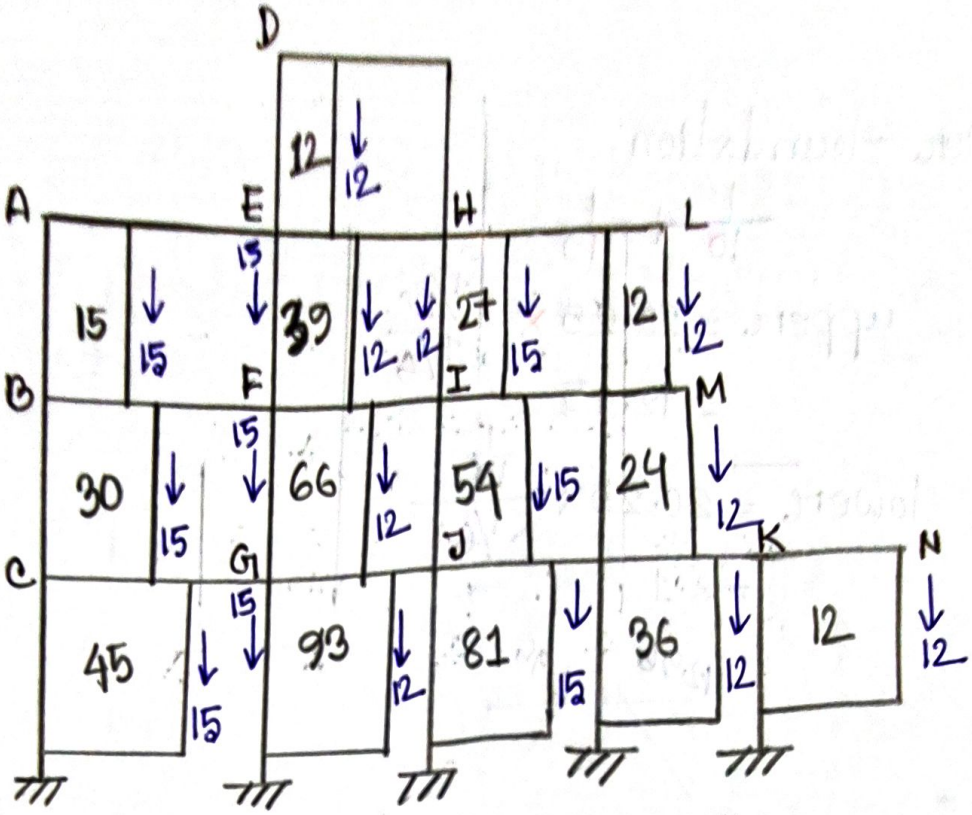
$$\frac{7.29}{2} = 3.6$$

when the span is different,

$$\frac{1}{10} + \frac{1}{15} = \frac{1}{6}$$

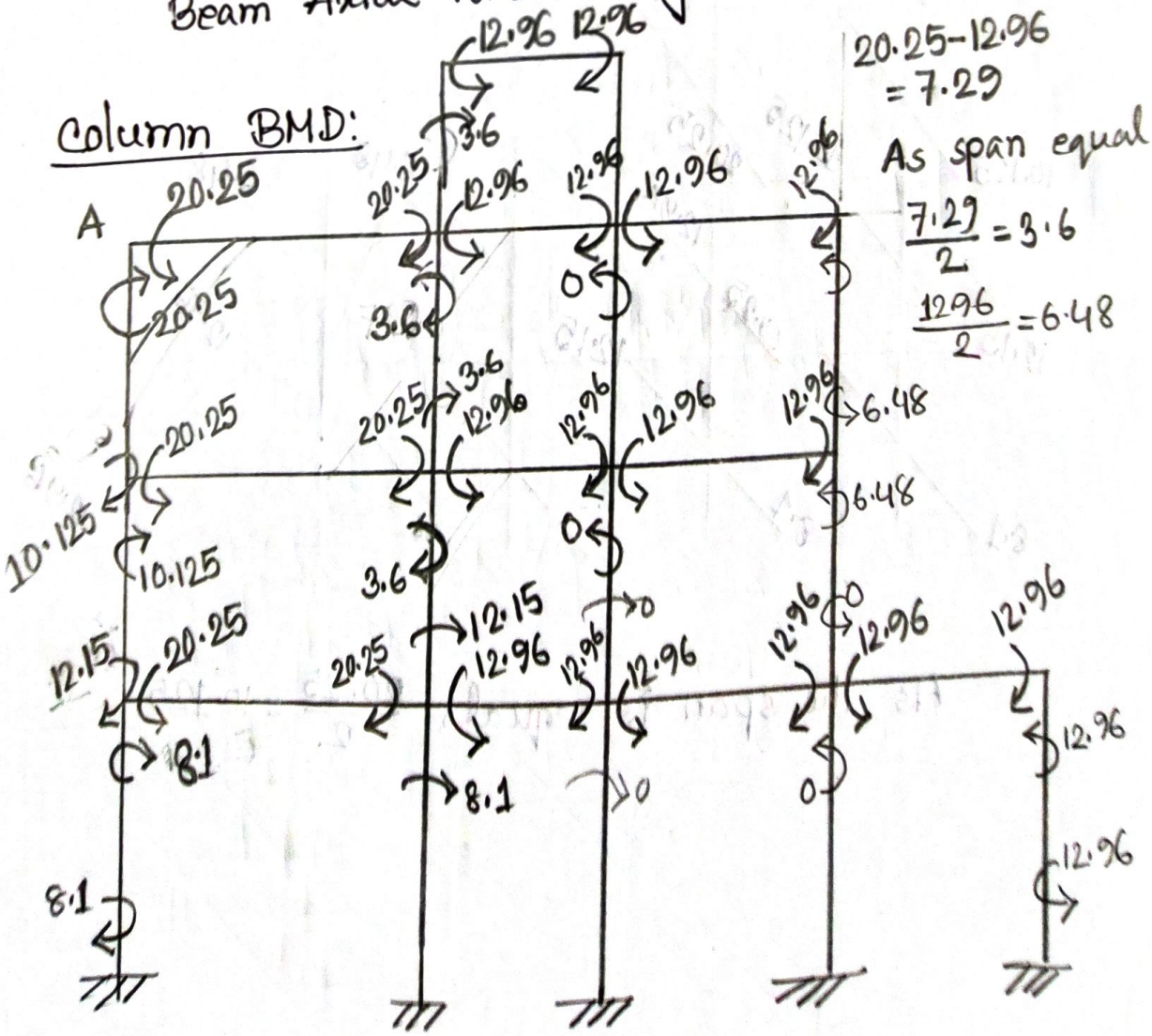
upper, $20.25 \times \frac{1/10}{1/6} = 12.15$

lower, $20.25 \times \frac{1/15}{1/6} = 8.1$



Beam Axial force Diagram

Column BMD:



20.25 − 12.96 = 7.29

As span equal

$\frac{7.29}{2} = 3.6$

$\frac{12.96}{2} = 6.48$

For foundation,

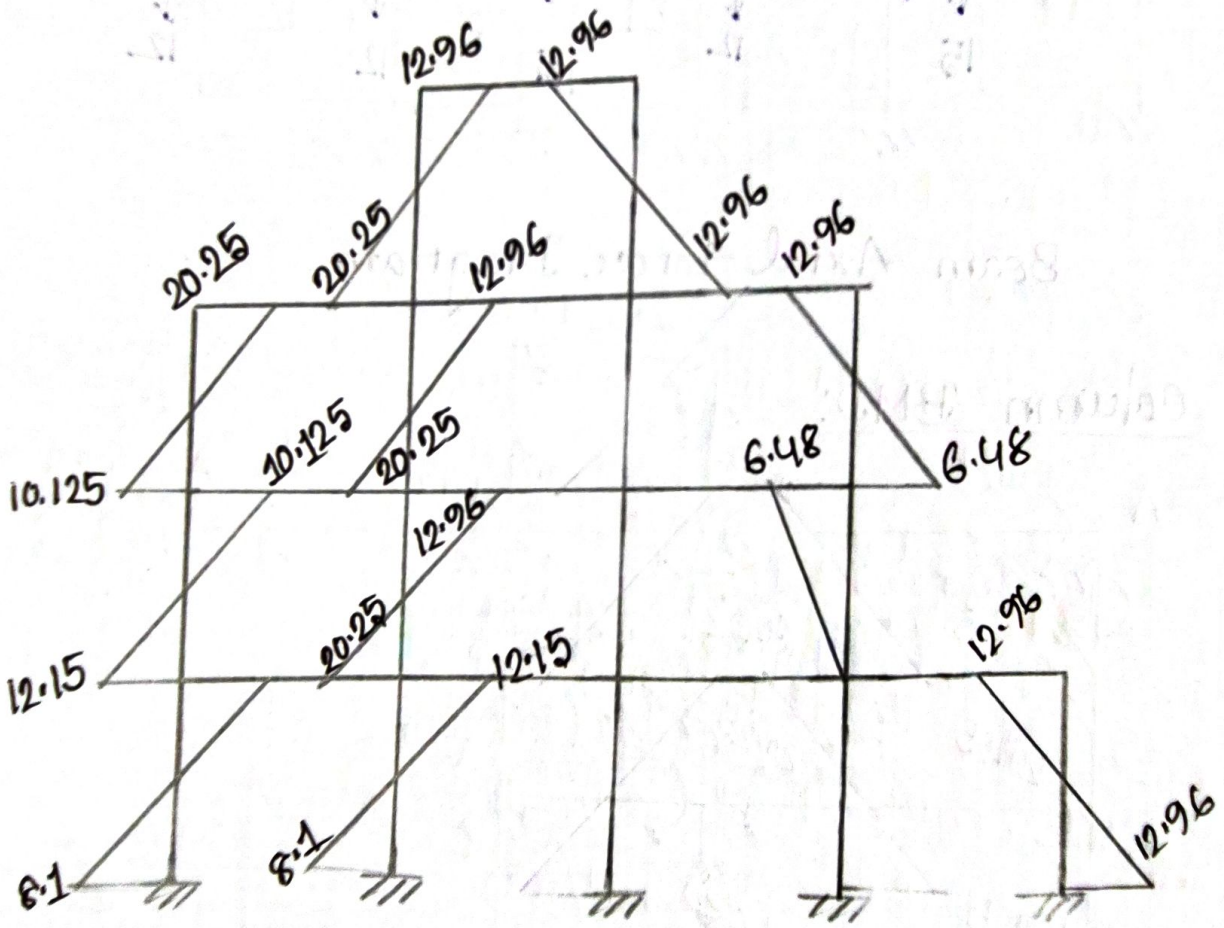
$$\frac{1}{10} + \frac{1}{15} = \frac{1}{6}$$

$$\text{upper} = 20.25 \times \frac{1/10}{1/6}$$

$$= 12.15$$

$$\text{lower} = 20.25 \times \frac{1/15}{1/6}$$

$$= 8.1$$



As the span is equal, $\frac{20.25}{2} = 10.125$

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

Course Code : 311

Determination of Wind load

Name	: Tabassum A Habib Oishi
Roll No	: 202230061
Level/Term	: L-3/ T-1
Course	: EWCE- 311
Date of exp	: 02.07.25
Date of sub	: 09.07.25
Group	: 01
Signature of Teacher	:

Calculate the design load of a rugid, moment resistant building. Rectangular (80x50)m. Hospital building (10 storied). storey height = 3 m. City Dhaka, Exposure = B.

Soln: Exposure = B

$\alpha = 9.5$

$z_g = 274.32$

$k_{zt} = 1$

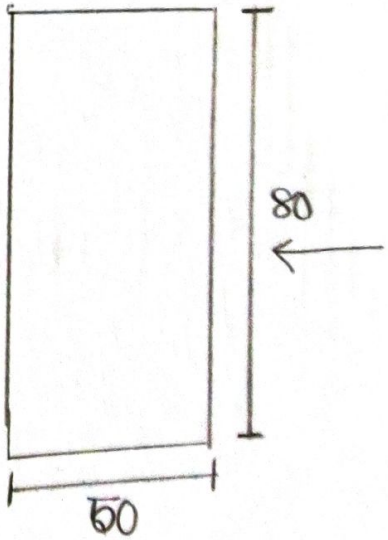
$k_d = 0.85$

$V = 65.7$

$I = 1.15$

height = 10x3 = 30m

type = Haspital



for x-direction,

First floor,

$$k_z = 2.01 \times \left(\frac{4.57}{274.32}\right)^{2/9.5}$$

$$= 0.65$$

$$q_z = 0.000613 K_z K_{zt} K_d V^2 I$$

$$= 0.000613 \times 0.85 \times 1 \times 0.85 \times (65.7)^2 \times 1.15$$

$$= 2.199 \text{ kPa}$$

2nd Floor.

$$K_z = 2.01 \times \left(\frac{6}{274.32}\right)^{2/9.5}$$

$$= 0.9$$

$$q_z = 0.000613 \times 0.9 \times 1 \times 0.85 \times (65.7)^2 \times 1.15$$

$$= 2.33 \text{ kPa}$$

Same type calculation for other floors, values will be different depending on the height.

Time period, $T = C_t (h_n)^m$

$$= 0.0466 (30)^{0.9}$$

$$= 0.99 \text{ sec} < 1$$

the structure is rigid

$\therefore G = 0.85$

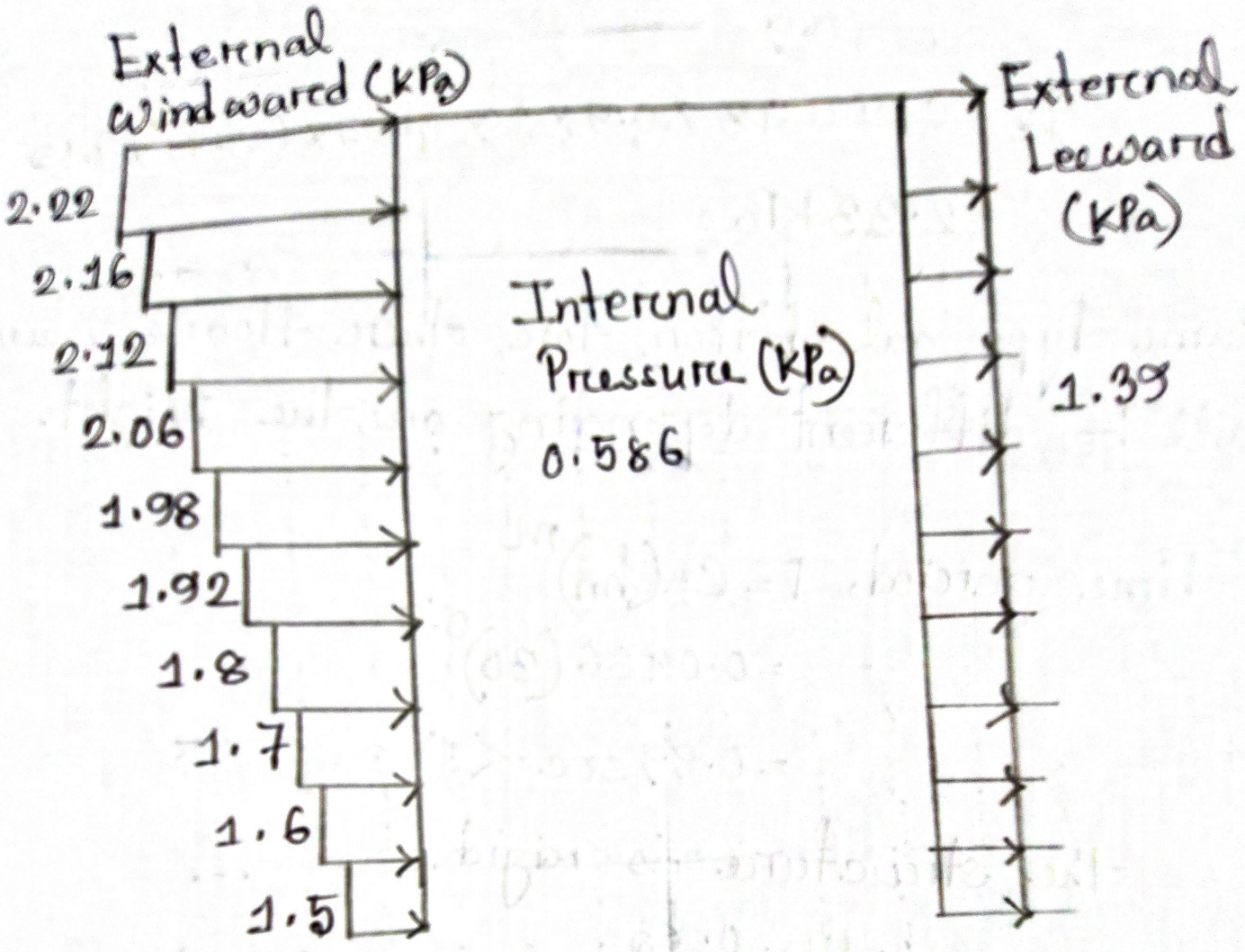
$$\frac{L}{B} = \frac{50}{80}$$

$$= 0.625 < 1$$

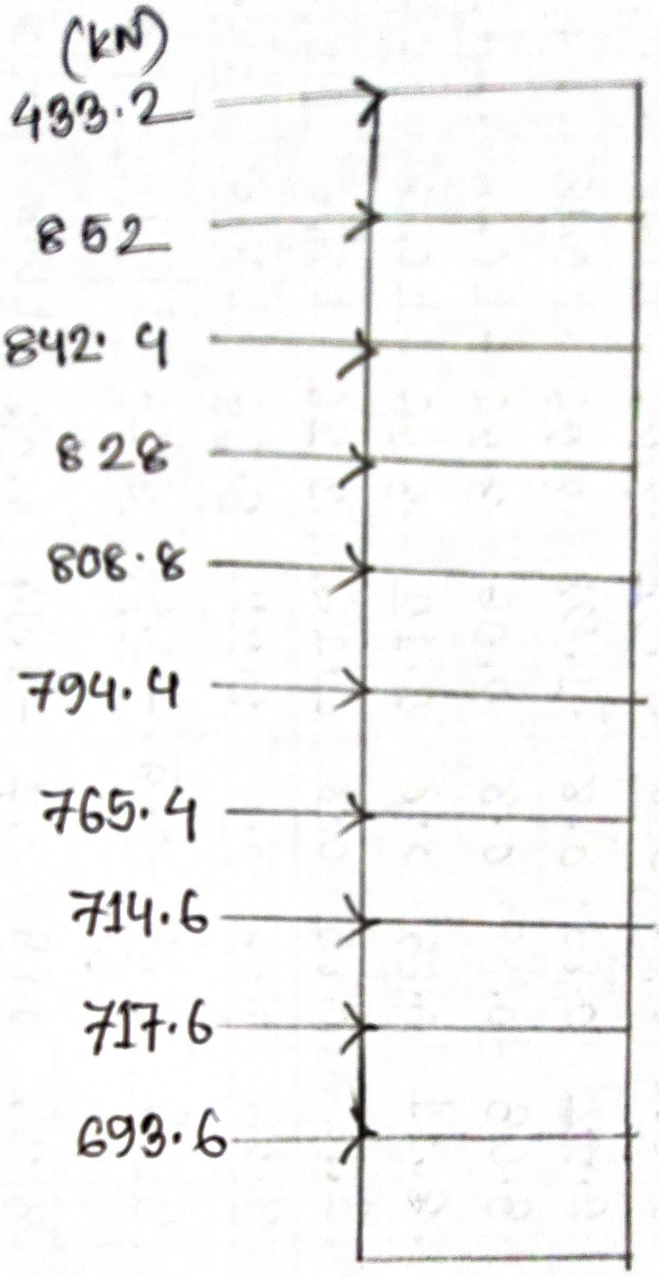
windward, $C_p = 0.8$

Lee ward, $C_p = -0.5$

Side wall, $C_p = -0.7$

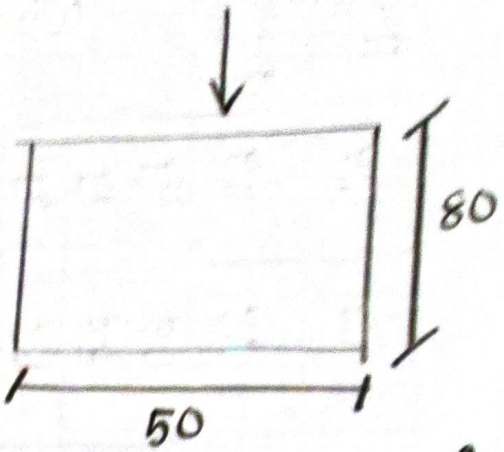

External Windward (kPa)
2.22
2.16
2.12
2.06
1.98
1.92
1.8
1.7
1.6
1.5
Internal Pressure (kPa)
0.586
External Leeward (kPa)
1.39

Location	Floor	Height Above ground	d	zg	Kz	External q_z	G	C_p	$q_z G C_p$	Internal $q_i = q_h$	GC_{pi}	$q_i GC_{pi}$
Wind ward	F_1	3	9.5	274.32	0.85	2.199	0.85	0.8	1.5	3.26	±0.18	±0.586
	F_2	6	9.5	274.32	0.9	2.33	0.85	0.8	1.6	3.26	±0.18	±0.586
	F_3	9	9.5	274.32	0.98	2.53	0.85	0.8	1.7	3.26	±0.18	±0.586
	F_4	12	9.5	274.32	1.04	2.69	0.85	0.8	1.8	3.26	±0.18	±0.586
	F_5	15	9.5	274.32	1.09	2.82	0.85	0.8	1.92	3.26	±0.18	±0.586
	F_6	18	9.5	274.32	1.13	2.92	0.85	0.8	1.98	3.26	±0.18	±0.586
	F_7	21	9.5	274.32	1.17	3.03	0.85	0.8	2.06	3.26	±0.18	±0.586
	F_8	24	9.5	274.32	1.203	3.11	0.85	0.8	2.12	3.26	±0.18	±0.586
	F_9	27	9.5	274.32	1.23	3.18	0.85	0.8	2.16	3.26	±0.18	±0.586
	F_{10}	30	9.5	274.32	1.26	3.26	0.85	0.8	2.22	3.26	±0.18	±0.586
Lee Ward	All	All	9.5	274.32		3.26	0.85	-0.5	-1.39	3.26	±0.18	±0.586
Side wall	All	All	9.5	274.32		3.26	0.85	-0.7	-1.94	3.26	±0.18	±0.586


(kN)
433.2
852
842.4
828
808.8
794.4
765.4
714.6
717.6
693.6

					Windward wall		Leeward wall		
Floor	Height above ground (m)	B (m)	Tributary height (m)	Area	External design wind Pressure (kPa)	Design wind force, P (KN)	External design wind Pressure (kPa)	Design wind force, P (KN)	Total design wind force, P_{net} (KN)
F_1	3	80	3	240	1.5	360	-1.39	-333.6	693.6
F_2	6	80	3	240	1.6	384	-1.39	-333.6	717.6
F_3	9	80	3	240	1.7	408	-1.39	-333.6	741.6
F_4	12	80	3	240	1.8	432	-1.39	-333.6	765.6
F_5	15	80	3	240	1.92	460.8	-1.39	-333.6	794.4
F_6	18	80	3	240	1.98	475.2	-1.39	-333.6	808.8
F_7	21	80	3	240	2.06	494.4	-1.39	-333.6	828
F_8	24	80	3	240	2.12	508.8	-1.39	-333.6	842.4
F_9	27	80	3	240	2.16	518.4	-1.39	-333.6	852
F_{10}	30	80	1.5	120	2.22	~~532.8~~ 266.4	-1.39	-166.8	433.2

For 'y' direction,

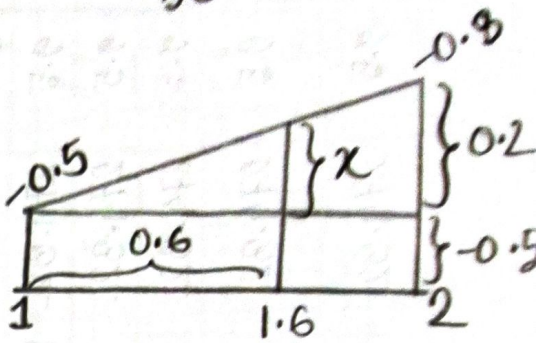


$$\frac{L}{B} = \frac{80}{50}$$

$$= 1.6$$

windward, $C_p = 0.8$

Side wall, $C_p = -0.7$

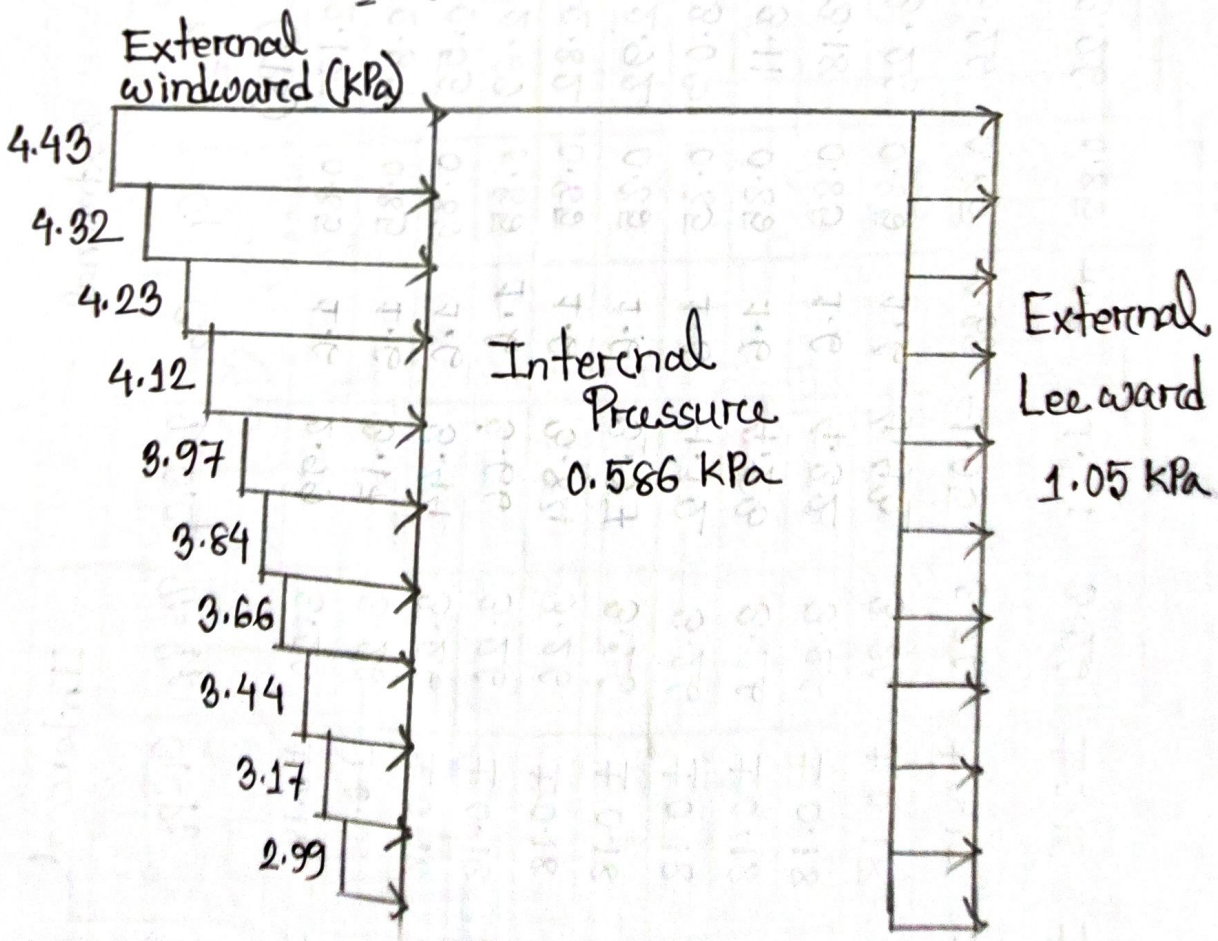


$$\frac{0.2}{x} = \frac{2-1}{0.6}$$

$$\Rightarrow x = 0.12$$

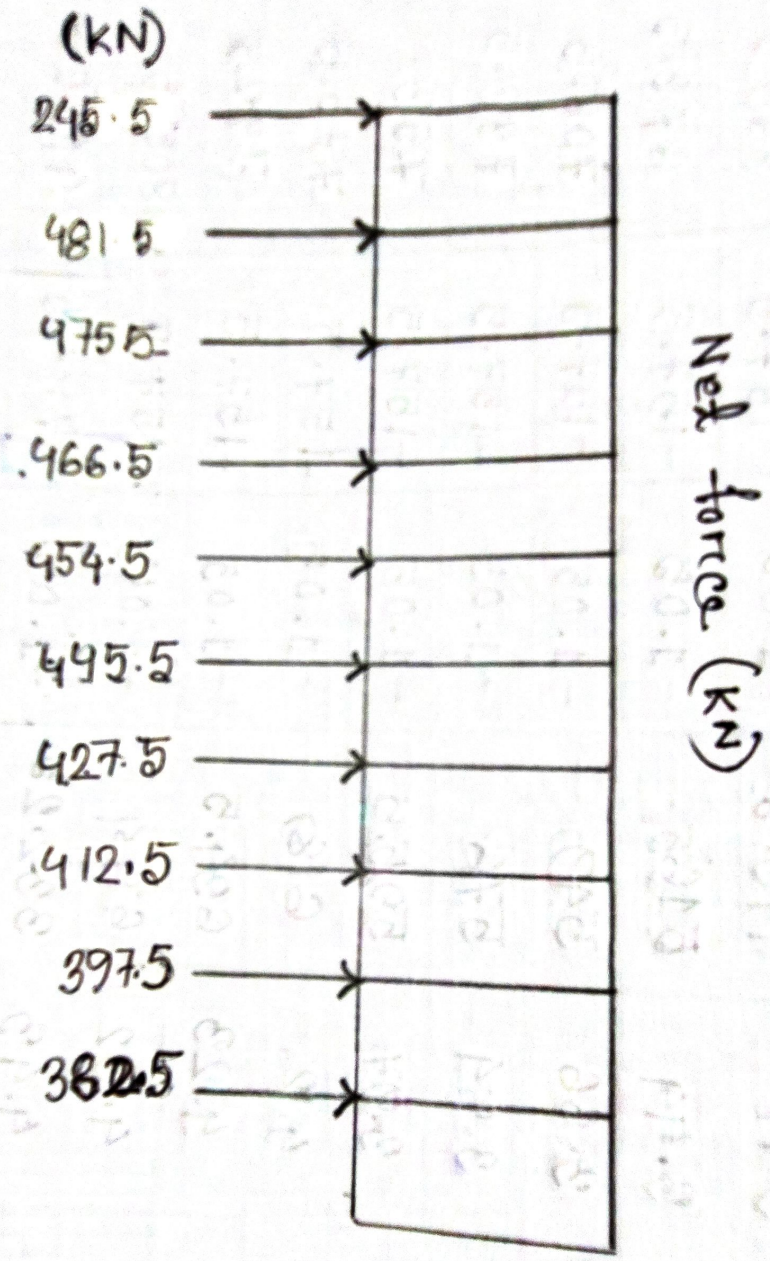
$$\text{leeward} = -0.5 + 0.12$$

$$= -0.38$$

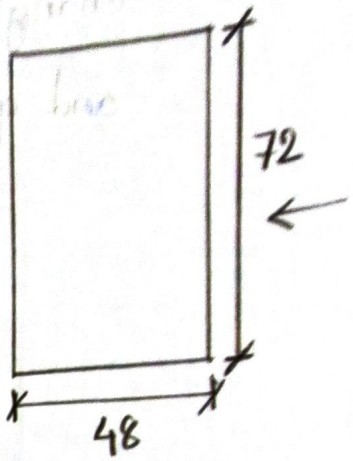


						External				Internal		
Location	Floor	height above ground (m)	d	z_g	k_z	q_z (KPa)	G	Cp	$q_z GCp$	$q_i = q_h$	GCp_i	$q_i GCp_i$
Windward	F_1	3	9.5	274.32	0.85	2.199	0.85	0.8	1.5	3.26	±0.18	±0.586
	F_2	6	9.5	274.32	0.9	2.33	0.85	0.8	1.6	3.26	±0.18	±0.586
	F_3	9	9.5	274.32	0.98	2.53	0.85	0.8	1.7	3.26	±0.18	±0.586
	F_4	12	9.5	274.32	1.04	2.69	0.85	0.8	1.8	3.26	±0.18	±0.586
	F_5	15	9.5	274.32	1.09	2.82	0.85	0.8	1.92	3.26	±0.18	±0.586
	F_6	18	9.5	274.32	1.13	2.92	0.85	0.8	1.92	3.26	±0.18	±0.586
	F_7	21	9.5	274.32	1.17	3.03	0.85	0.8	1.98	3.26	±0.18	±0.586
	F_8	24	9.5	274.32	1.203	3.11	0.85	0.8	2.06	3.26	±0.18	±0.586
	F_9	27	9.5	274.32	1.23	3.18	0.85	0.8	2.16	3.26	±0.18	±0.586
	F_{10}	30	9.5	274.32	1.26	3.26	0.85	0.8	2.22	3.26	±0.18	±0.586
Lee-ward	All	All	9.5	274.32		3.26	0.85	-0.38	-1.05	3.26	±0.18	±0.586
Side Wall	All	All	9.5	274.32		3.26	0.85	-0.7	-1.94	3.26	±0.18	±0.586

					Windward		Leeward		
Floor	Height (m)	B (m)	Tributary height (m)	Area (m^2)	External design wind Pressure	External design wind force (KN)	External design wind Pressure	External design wind force (KN)	Net force (KN)
F_1	3	50	3	150	1.05	225	-105	-157.5	382.5
F_2	6	50	3	150	1.6	240	-1.05	-157.5	397.5
F_3	9	50	3	150	1.7	255	-1.05	-157.5	412.5
F_4	12	50	3	150	1.8	270	-1.05	-157.5	427.5
F_5	15	50	3	150	1.92	288	-1.05	-157.5	445.5
F_6	18	50	3	150	1.98	297	-1.05	-157.5	454.5
F_7	21	50	3	150	2.06	309	-1.05	-157.5	466.5
F_8	24	50	3	150	2.12	318	-1.05	-157.5	475.5
F_9	27	50	3	150	2.16	324	-1.05	-157.5	481.5
F_{10}	30	50	1.5	75	2.22	166.5	-1.05	-78.75	245.25


(kN)
245.5
481.5
475.5
466.5
454.5
445.5
427.5
412.5
397.5
382.5
Net force (kN)

Calculate the design load of the following building.
Rectangular (72×48m). Hospital building (6 storied).
Storey height = 3m. City Dhaka, exposure = A.



Soln: For case-1,

Let, the wind is lee ward

$B = 72m$

Location : Dhaka

Velocity : 65.7 m/s

Exposure : A

Type : IV

I : 1.15

K_{zt} : 1

K_d : 0.85

as $z = 3$, $K_{z=3} = 2.01 \times \left(\frac{4.57}{365.76}\right)^{2/7}$; $\alpha = 7$, $z_g = 365.76m$

$= 0.57$

velocity pressure, $q_z = 0.000613 K_z K_{zt} K_d V^2 I$

$= 0.000613 \times 0.57 \times 1 \times 0.85 \times (65.7)^2 \times 1.15$

$= 1.48$ kPa

2nd floor, $K_z = 2.01 \left(\frac{6}{365.76}\right)^{2/7} = 0.62$

$q_z = 0.000613 \times 0.85 \times 0.62 \times 1 \times (65.7)^2 \times 1.15$

$= 1.63$ kPa

Calculation for the others storeys will be same as 2nd Floor. Because of changing height, K_z will be different and q_z will be changed.

Location	Floor	Height above ground	α	z_g	K_z	External				Internal		
						q_z	G_f	C_p	$q_z G_f C_p$	$q_i = q_h$	$G_f C_{pi}$ (±)	$q_i G_f C_{pi}$
Wind ward wall	F_1	3	7	365.76	0.58	1.51	0.85	0.8	1.03	2.23	±0.18	±0.40
	F_2	6	7	365.76	0.63	1.63	0.85	0.8	1.11	2.23	±0.18	±0.40
	F_3	9	7	365.76	0.7	1.82	0.85	0.8	1.24	2.23	±0.18	±0.40
	F_4	12	7	365.76	0.76	1.97	0.85	0.8	1.34	2.23	±0.18	±0.40
	F_5	15	7	365.76	0.81	2.1	0.85	0.8	1.43	2.23	±0.18	±0.40
	F_6	18	7	365.76	0.86	2.23	0.85	0.8	1.52	2.23	±0.18	±0.40
Lee ward wall	All	All	7	365.76		2.23	0.85	−0.5	−0.95	2.23	±0.18	±0.40
Side wall	All	All	7	365.76		2.23	0.85	−0.7	−1.33	2.23	±0.18	±0.40

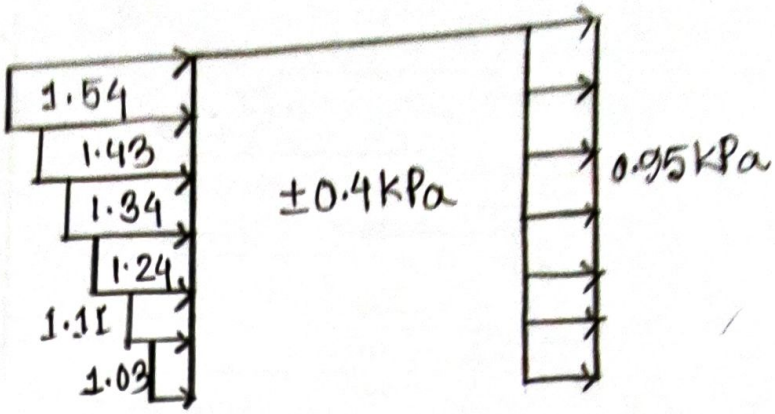
$T = 0.0466 \times 18^{0.9}$

$= 0.628$ sec

$f = \frac{1}{T}$

$= \frac{1}{0.628}$

$= 0.59$



as, $0.59 < 1$

so it is rigid structure

$\therefore G_f = 0.85$

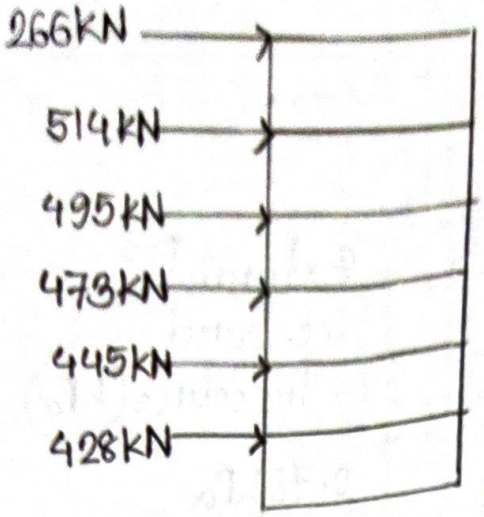
for C_p, $\frac{L}{B} = \frac{48}{72} = 0.625$

wind ward, $C_p = 0.8$

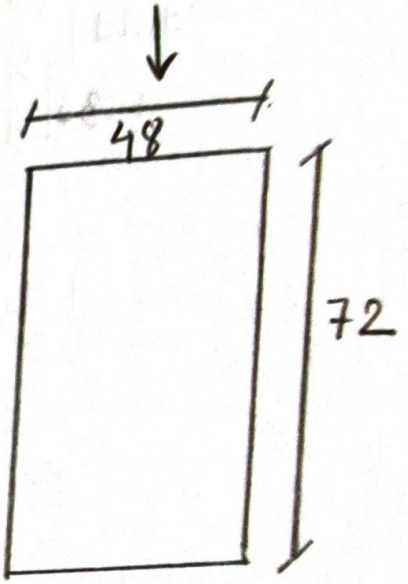
Lee ward, $C_p = -0.5$

Side wall, $C_p = -0.7$

Case-1					Wind ward		Lee Ward		
Floor	Height above ground (m)	B (m)	Tributary height (m)	Area	External Design Wind (KPa)	Design Wind force (KN)	External Design Wind (KPa)	Design Wind force (KN)	Total design wind force (KN)
F_1	3	72	3	216	1.03	222.48	-0.95	-205.2	427.68
F_2	6	72	3	216	1.11	239.76	-0.95	-205.2	444.96
F_3	9	72	3	216	1.24	267.84	-0.95	-205.2	473.04
F_4	12	72	3	216	1.34	289.44	-0.95	-205.2	494.64
F_5	15	72	3	216	1.43	308.88	-0.95	-205.2	514.08
F_6	18	72	1.5	108	1.54	164.16	-0.95	102.6	266.76



For Case: 2



Let,

$B = 48\ m$

For y direction, $\frac{L}{B} = \frac{72}{48}$

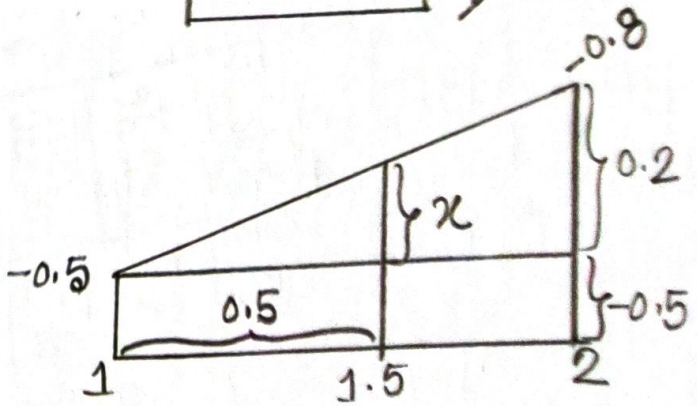
$= 1.5$

~~Leeward wall, Cp =~~

Windward wall,

$C_p = 0.8$

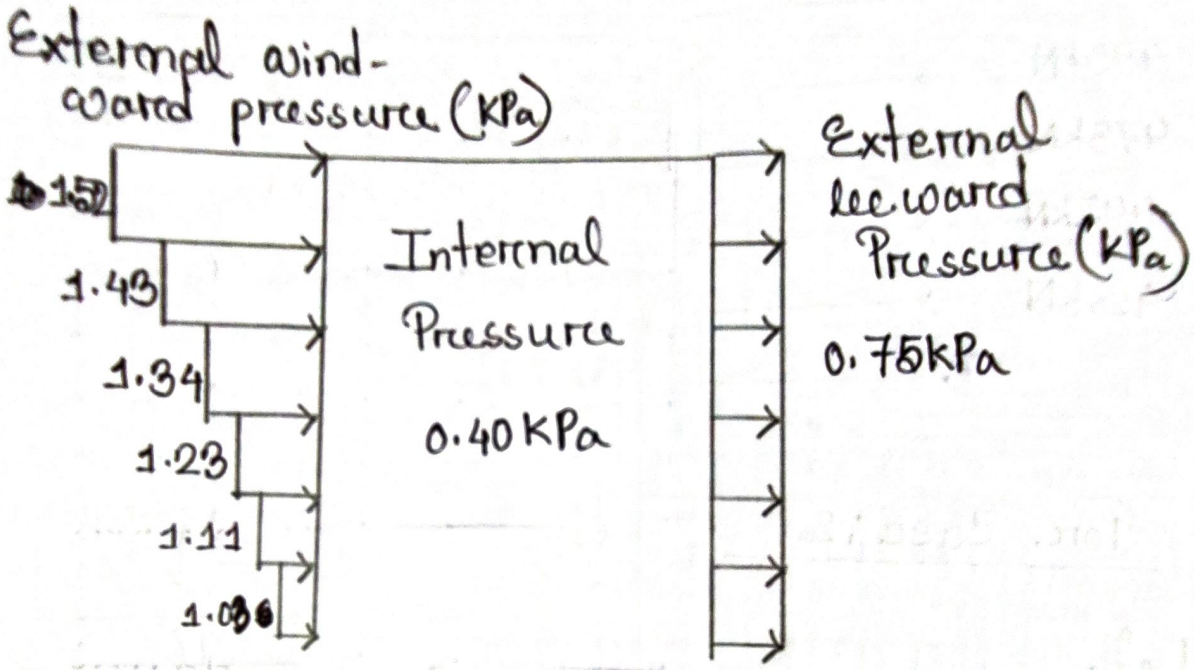
Sideward wall, $C_p = -0.7$



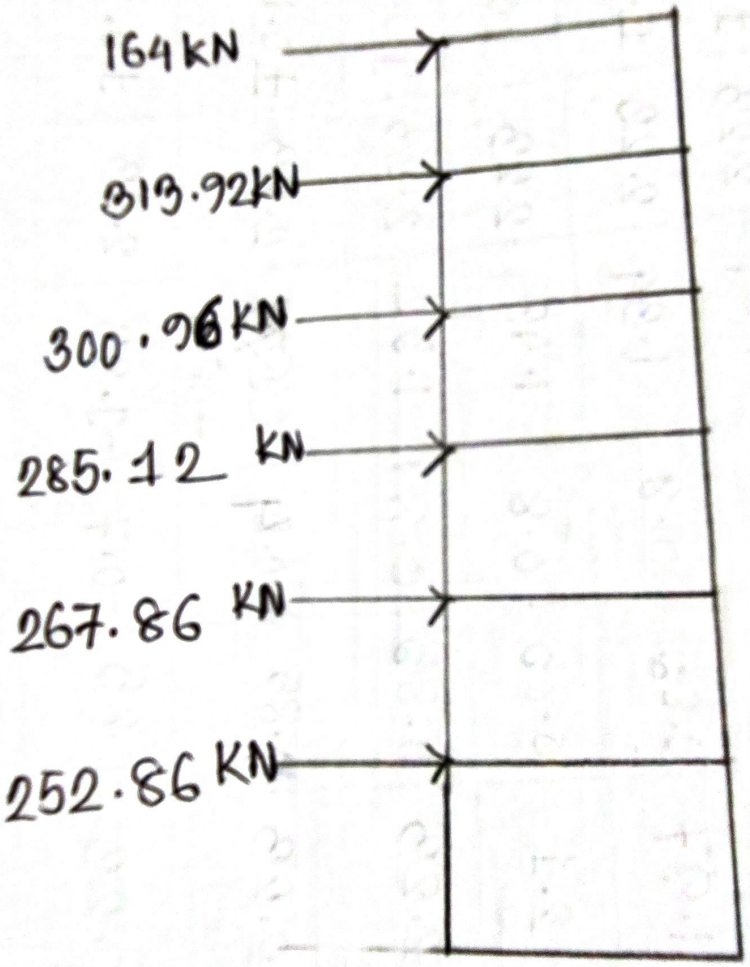
$\frac{0.2}{x} = \frac{2-1}{0.5}$

$\Rightarrow x = 0.1$

Leeward wall, $C_p = -0.5 + 0.1 = -0.4$


External wind-
ward pressure (KPa)
1.52
1.43
1.34
1.23
1.11
1.06
Internal
Pressure
0.40 KPa
External
lee ward
Pressure (KPa)
0.75kPa

						External				Internal		
Location	Floor	Height above ground (m)	α	z_g(m)	K_z	q_z (KPa)	G_f	C_p	$q_z G_f C_p$ (KPa)	$q_i = q_h$	$G_f C_{pi}$ (±)	$q_i G_f C_{pi}$ (KPa)
Windward wall	F_1	3	7	365.76	0.58	1.51	0.85	0.8	1.03	2.23	±0.18	±0.40
	F_2	6	7	365.76	0.63	1.63	0.85	0.8	1.11	2.23	±0.18	±0.40
	F_3	9	7	365.76	0.7	1.82	0.85	0.8	1.24	2.23	±0.18	±0.40
	F_4	12	7	365.76	0.76	1.97	0.85	0.8	1.34	2.23	±0.18	±0.40
	F_5	15	7	365.76	0.81	2.1	0.85	0.8	1.43	2.23	±0.18	±0.40
	F_6	18	7	365.76	0.86	2.23	0.85	0.8	1.52	2.23	±0.18	±0.40
Leeward wall	All	All	7	365.76		2.23	0.85	-0.5	-0.76	2.23	±0.18	±0.40
Side Wall	All	All	7	365.76		2.23	0.85	-0.7	-1.33	2.23	±0.18	±0.40


164 kN
313.92 kN
300.96 KN
285.12 KN
267.86 KN
252.86 KN

					Windward		Leeward		
Floor	Height above ground	B (m)	Tributary height (m)	Area (m^2)	External design wind pressure (KPa)	Design Wind force P (KN)	External design wind pressure (KPa)	Design Wind force	Net force
F_1	3	48	3	144	1.006	144.86	-0.75	-108	252.86
F_2	6	48	3	144	1.11	159.84	-0.75	-108	267.86
F_3	9	48	3	144	1.23	177.12	-0.75	-108	285.12
F_4	12	48	3	144	1.34	192.96	-0.75	-108	300.96
F_5	15	48	3	144	1.43	205.92	-0.75	-108	313.92
F_6	18	48	1.5	72	1.52	108	-0.75	-54	162

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

Course Code : 311

Determination of Base shear and vertical shear distribution of a RC office building

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Level/Term : L-3/T-1

Course : EWCE-311

Date of exp : 25.06.25

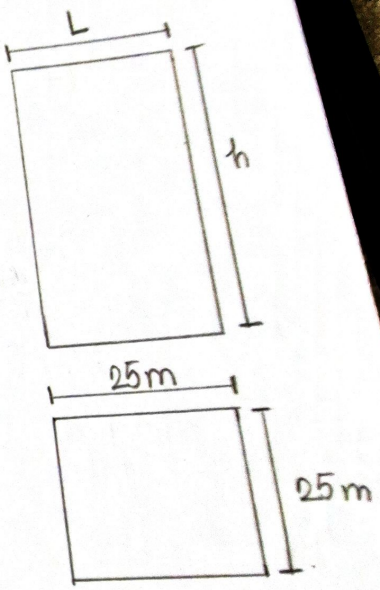
Date of sub : 02.07.25

Group : 01

Signature of Teacher :

Assignment-01

20 storied (each floor 25m x 25m) RC Office building at Dhaka, zone = 2. Soil condition soft to medium stiff clay (SC). Dead load including partition wall/floor = 12KN/m² add 50% of live load (LL) of building where, LL = 4KN/m², Damping 5% and R = 8



Soln:

Let,
per floor height = 3m
zone co-efficient = 2
I (RC office) = II = 1
R = 8
ξ = 8%

here,
$C_t = 0.0466$
$m = 0.9$
$h_n = 20 \times 3$
$= 60\ m$

$$T = C_t (h_n)^m$$
$$= 0.0466 \times (60)^{0.9}$$
$$= 1.85\ sec$$

Site class : SC

$S = 1.15$

$T_B = 0.20s$

$T_C = 0.60s$

$T_D = 2.0s$

as $T_C < T < T_D$, $\eta = \sqrt{\frac{10}{5+5}}$

$= 1$

$$C_s = 2.5 S \eta \left(\frac{T_c}{T}\right)$$

$$= 2.5 \times 1.15 \times 1 \times \left(\frac{0.6}{1.85}\right)$$

$$= 0.93$$

$$S_a = \frac{2}{3} \frac{ZI}{R} C_s$$

$$= \frac{2}{3} \times \frac{0.2 \times 1}{8} \times 0.93$$

$$= 0.0155$$

Check:

$$\frac{2}{3} ZI\beta\theta = \frac{2}{3} \times 0.2 \times 1 \times 0.2$$

$$= 0.02667 > S_a$$

$\therefore S_a = 0.02667\, g_m$

$W_x = (DL + 0.5LL) \times (25 \times 25)$

$= 8750$ KN per floor

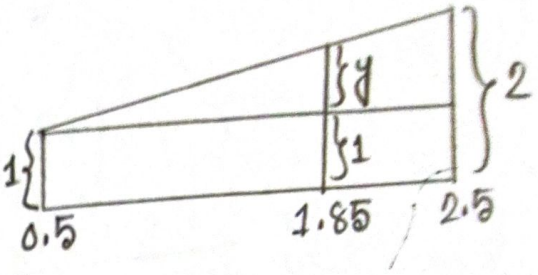
$$W = 8750 \times 20$$
$$= 175000\,KN$$

$$V = S_a W$$
$$= 0.0266 \times 175000$$
$$= 4672.5\,KN$$

for k,

$$\frac{1}{2.5-0.5} = \frac{y}{1.85-0.5}$$

$$\Rightarrow y = 0.68$$



$$K = 1 + 0.68 = 1.68$$

Floor	Height (m)	W_x (KN)	h^K	$W_x \times h^K$	Fx
20	60	8750	971	8496250	586.226
19	57	8750	891	7796250	537.927
18	54	8750	814	7122500	491.439
17	51	8750	739	6466250	446.159
16	48	8750	668	5845000	403.295
15	45	8750	599	5241250	361.637
14	42	8750	533	4663750	321.790
13	39	8750	471	4121250	284.359
12	36	8750	412	3605000	248.738
11	33	8750	356	3115000	214.929
10	30	8750	303	2651250	182.932
9	27	8750	254	2222500	153.348
8	24	8750	208	1820000	125.577
7	21	8750	166	1452500	100.22
6	18	8750	128	1120000	77.278
5	15	8750	94.6	827750	57.113
4	12	8750	65	568750	39.243

3	9	8750	40.1	350875	24.209
2	6	8750	20.3	177625	12.256
1	3	6750	6.83	55387.5	3.8216
Sum		175000	7740	67719137.5	4423.752

$$F_x = V \frac{w_x h_x^k}{\sum w_i h_i^k}$$

$$= 4672.5 \times \frac{w_x h_x^k}{67719137.5}$$