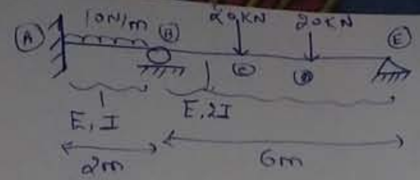
Ans(1)(a)



12:07

Using slope deflection

(1) $M_{F_{AB}} = -3.33$ kNm

$M_{FBA} = +3.33$ kNm

(2) $M_{FBE} = -26.66$ kNm

$M_{FEB} = +26.66$ kNm

$$* M_{AB} = M_{FAB} + \frac{2EI}{2}\left[\theta_B\right]$$

$M_{AB} = -3.33 + EI\theta_B$ — eqn (1)

$M_{BA} = +3.33 + 2EI\theta_B$ — eqn (2)

$M_{BE} = -26.66 + \frac{2}{3}EI\left[2\theta_B + \theta_E\right]$ — eqn (3)

$M_{EB} = 26.66 + \frac{2}{3}EI\left[2\theta_E + \theta_B\right]$ — eqn (4)

and $M_{BA} + M_{BE} = 0$ and $M_{EB} = 0$ ⇒ $-40 = (2\theta_E + \theta_B)EI$ — eqn (5)

$\frac{-40}{EI} - 2\theta_E = \theta_B$

⇓

$23.333 = EI\left[3.33\theta_B + 0.66\theta_E\right]$ — eqn (6)

from eqn (5) and eqn (6)

$$23.333 = 3.333\left[\frac{-40}{EI} - 2\theta_E\right]EI + 0.66\theta_E$$

$$\frac{156.666}{EI} = -6\theta_E$$

so $\boxed{\theta_E = -26.111/EI}$

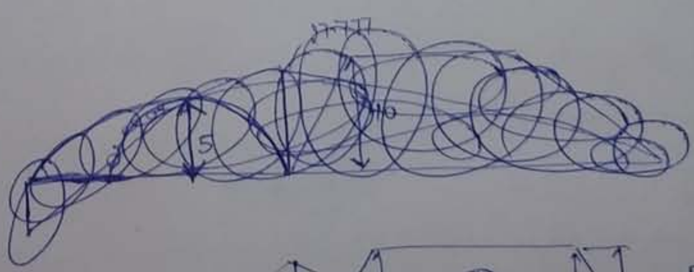
$\boxed{\theta_B = 12.222/EI}$

So $M_{AB} = 8.888$ kNm

$M_{BA} = 27.77$ kNm

$M_{BE} = -27.7777$

$M_{EB} = 0$



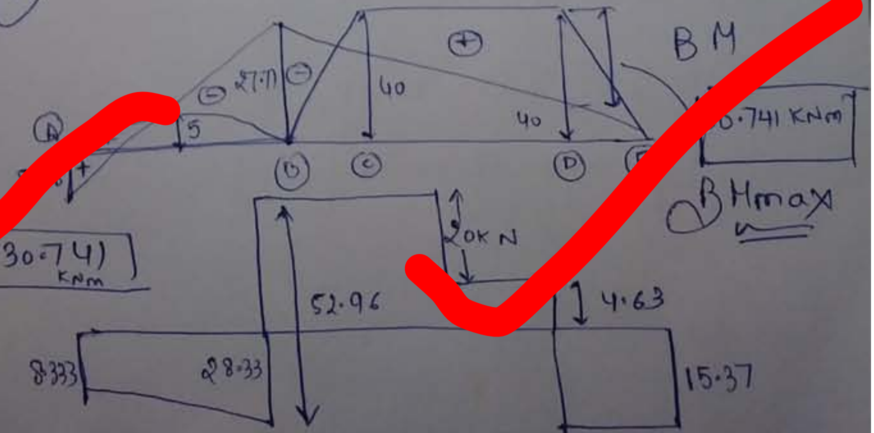
$$R_A = \frac{8.888 + 27.777 - 10\times2\times1}{2}$$

$R_A = 8.33\ (\downarrow)$

$R_E = 15.37$ kN

$R_B = 52.96$ kN

$\boxed{BM_{max} = 30.741 \text{ kNm}}$



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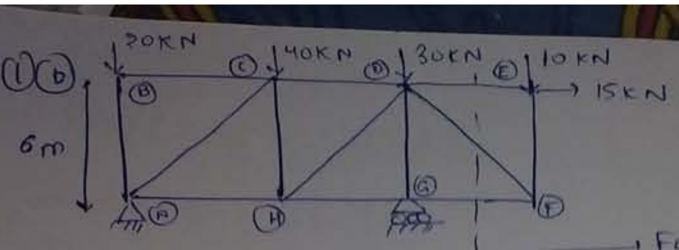
Ans (1)(b)



For force in (5) cutting the sec^n and considering force at (D)

$F_{(5)} \times 6 = 10 \times 4.5$

$\boxed{F_{(5)} = 7.5\ \text{KN (compressive)}}$

for force in (4)

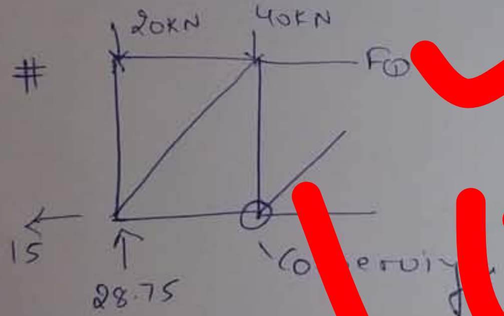
$\Sigma M_A = 0$

$40 \times 6 + 30 \times 12 + 10 \times 16.5 + 15 \times 6 = R_G \times 12$

$R_G = 71.25$

$\boxed{F_{(4)} = 71.25\ (\text{comp})}$

* $\boxed{F_3 = F_5 = 7.5\ \text{KN (Compressive)}}$



so

$F_{(1)} \times 6 = 40 \times 0 + 20 \times 6 - 28.75 \times 6$

80 $\boxed{F_{(1)} = 8.75\ \text{KN compressive}}$

$F_2 \cos 45° = (8.75 + 7.5 + \ldots$

$\boxed{F_2 = 16.\ldots\sqrt{2} + 15\sqrt{2}}$

$\boxed{F_2 = 31.25\sqrt{2}\ldots}$

Ans (1)(c) Mass = 10 kg K = 100 N/m . damping coeff = 5 Ns/m

$\omega_n = \sqrt{\frac{100}{10}} = \sqrt{10}$ and $\left[\text{damping factor} = \frac{C}{C_{cr}} = \frac{5}{20\sqrt{10}} = \frac{1}{4\sqrt{10}}\right]$

$C_{cr} = 2 \times 10 \times \sqrt{10} = 20\sqrt{10}$

(b) $\omega_D = \sqrt{10}\sqrt{1 - \left(\frac{1}{4\sqrt{10}}\right)^2} = 3.152$ rad/sec $\Rightarrow f_D = \frac{3.152}{2\pi} = .501$

(c) logarithmic decrement $\left[\frac{\log x_i}{\log x_{i+1}}\right] = \frac{2\pi \times .079}{\sqrt{1 - .079^2}} = 0.499$

(d) $e^{.499} = 1.647$

Ans ① ⓓ ~ $\bar{P} = \dfrac{112+178+95+139+101}{5} = 125$

$\overline{P^2} = 112^2+178^2+95^2+139^2+101^2/_5 = 16555$

$\sigma = \sqrt{\dfrac{n}{n-1}\left(\overline{P^2} - (\bar{P})^2\right)} = \sqrt{\dfrac{5}{4}\left[16555 - 125^2\right]}$

So $\sigma = 34.095$ cm.

$C_v = \sigma/_P \times 100 = \dfrac{34.095}{125} \times 100 = 27.276\%$.

Opt. No. of raingauge stn $= \left(\dfrac{C_v}{\varepsilon}\right)^2 = \left(\dfrac{27.276}{8}\right)^2 = 11.625 \simeq \underline{\underline{12}}$

So 12 stations required. So 7 more stn are required

Recording type $= \dfrac{10}{100} \times 12 = 1.2$ so 2 no of recording type and 10 no of non-recording type.

Ans ⓔ ①~ Precipitation :- Precipitation is any form of liquid or solid water particle that fall from the atmosphere and reach the surface of the earth. Various type of precipitation are

① Rainfall :- when precipitation takes place in the form of water droplets ranging from 0.5 mm to 6mm. when rainfall > 0.5mm considered as rain Today

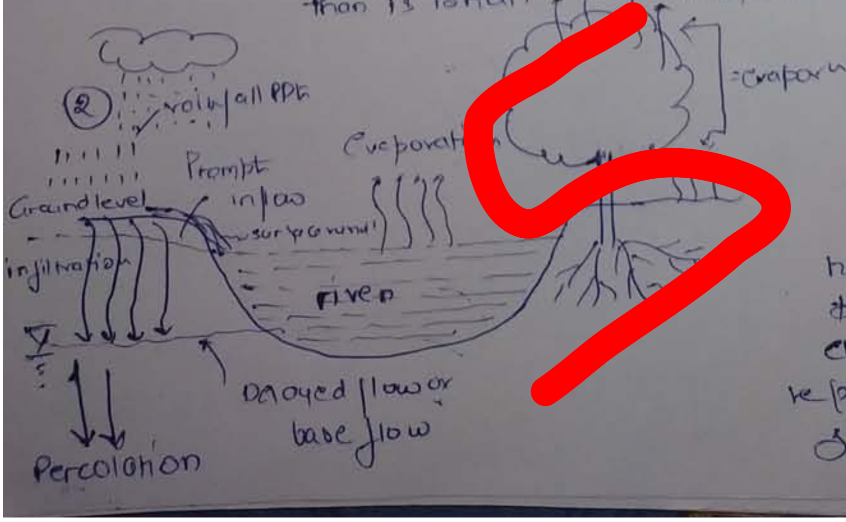
② Snow :- when water drops freeze and fall with snow flakes having density less than $\cdot 1$ gm/cc

③ drizzle ~ Light rainfall with intensity less than 1mm/hr.

④ Glaze ~ when rain comes into contact with freezing ground, ice coating is formed

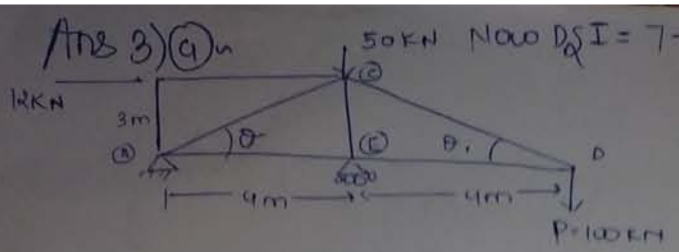
⑤ sleet ~ It is a frozen droplet. If falling rain converts into ice crystal of freezing temperature consider as sleet.

⑥ Hail ~ If ice crystal converts into a lump of size more than 8mm than it is hail



* The cloud when condensed precipitate in form of rain which then converted into infiltration and surface runoff. Now evaporation and traspiration happen from surface of river and plants evaporated water forming clouds againts. This cycle repeat itself continuously as shown in diagram.

Ans 3) (a)



Now DSI = 7+3 − 2×5 = 0 so determinate

* Now Let out find forces in the members.

* $F_{CD} \times \sin\theta_1 = 100KN$ — eq^n ①

and $F_{CD} \times \cos\theta_1 = F_{ED}$ — eq^n ②

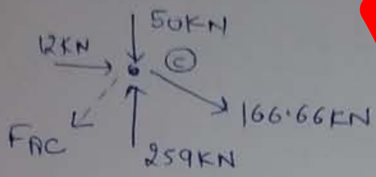
$\boxed{\text{So } F_{CD} = 166.67 \text{ (tensile)} \quad F_{ED} = 133.33 \text{ (compressive)}}$ — eq^n (1*)

and now conserving moment at (A) we get $F_E = \dfrac{100 \times 8 + 50 \times 4 + 12 \times 3}{4}$

So F_E = 259KN

$\boxed{\text{So } F_{CE} = 259\text{KN (compressive)} \quad F_{BC} = 12\text{KN (compressive)} \quad F_{BA} = +50\text{KN (compressive)}}$ — eq^n (2)*

and F_{AC} =



so conserving force in x and y direc^n

$F_{AC} \times 3/5 = 259 - 50 - 166.67 \times 3/5$

$\boxed{F_{AC} = 94.583 \text{ (tension)}} + \boxed{86.8103}$

So $\boxed{F_{AC} = 181.66\text{KN (tension)}}$ — eq^n (3*)

So Now forces in all member are known.

Then K should be func^n as 1KN downward.

So for K=1 downward at D forces in members are.

$F_{BC} = 0$, $F_{BA} = 0$.

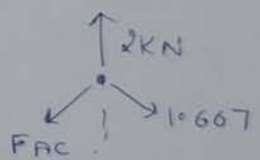
F_{CE} = 2KN (compressive)

F_{CD} = 1.667 (tensile)

F_{ED} = 1.334 (compressive)

F_{AE} = 1.334 (compressive)

F_{AC} =



So $F_{AC} \times 3/5 + 1.667 \times 3/5 = 2$

F_{AC} = 1.6667 (tensile)

Member	Force	K	KPl/AE
AB	−50	0	0
BC	−12	0	0
CD	+166.67	+1.667	4.516×10^{-3}
DE	−133.33	−1.334	2.3124×10^{-3}
EA	−133.33	−1.334	2.3124×10^{-3}
EC	−259	−2	5.053×10^{-3}
AC	+181.66	+1.667	4.924×10^{-3}

So Σ total = 19.1178×10^{-3} (downward)

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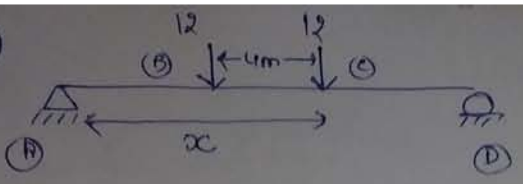
Ans (3) (b) - (1)



$R_A \times 15 = 12(15-x) + 12[19-x]$

$R_A = \dfrac{408 - 24x}{15}$

Now moment

$M = \left(\dfrac{408-24x}{15}\right)x - 12(4)$

So $M = \dfrac{-24x^2 + 408x - 720}{15}$ — eq^n (1)

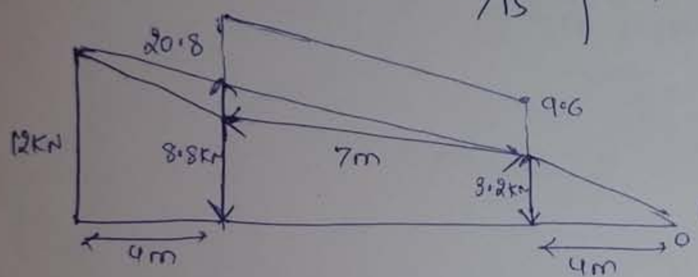
Now $\partial M / \partial x = 0$ So $-48x + 408 = 0$

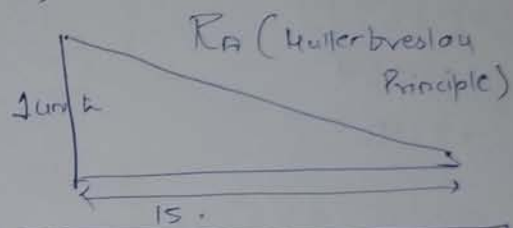
$\boxed{x = 8.5m}$

(b) - Influence line for support rx^n at A.

$R_A \times 15 = 12x + 12(x+4)$

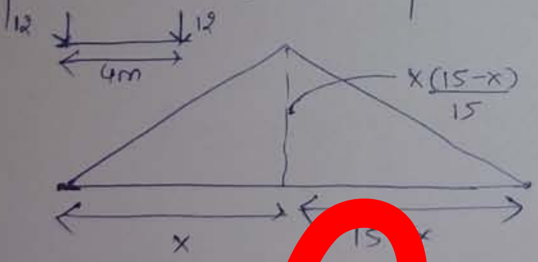
$R_A = 24x + 48/15$ (for x = 4 to x = 11)





$\boxed{\text{Maximum value} = 20.8 KN}$ from figure

(c) - from muller breslau principle



$\dfrac{m}{x} + \dfrac{m}{15-x} = 1$

$\dfrac{m(15-x) + mx}{x(15-x)} = 1$

So $m(15) = x(15-x)$

So $\boxed{m = \dfrac{x(15-x)}{15}}$

* Maximum BM at (C)

$\Rightarrow M = \dfrac{-24x^2 + 408x - 720}{15}$ (from eq^n (1))

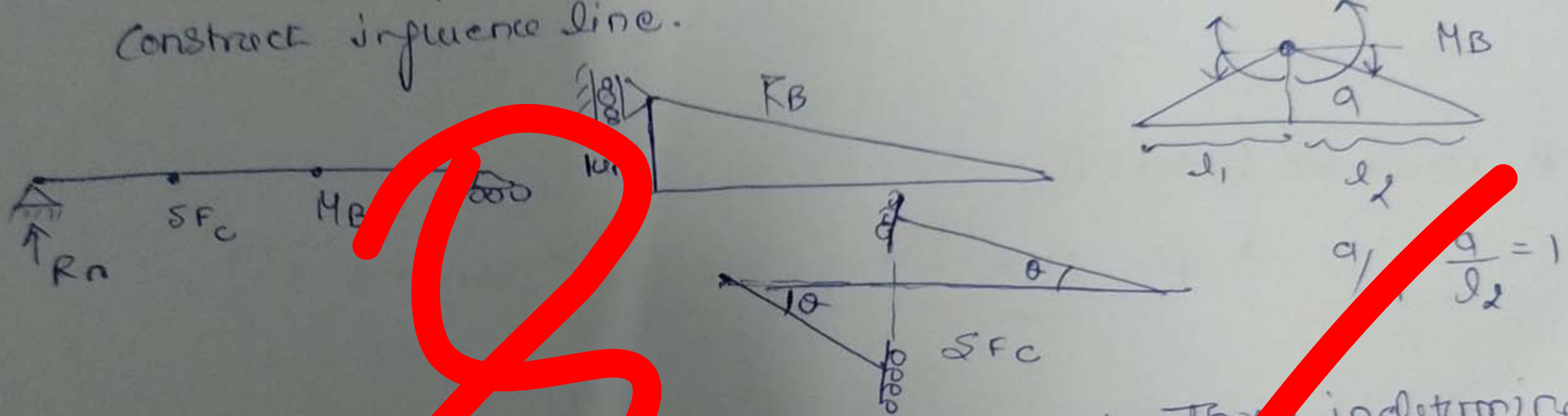
at 8.5m

$M = \dfrac{-24(8.5)^2 + 408(8.5) - 720}{15}$

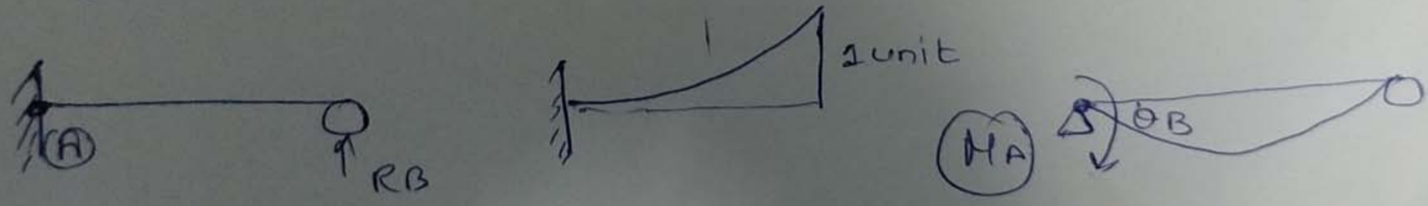
$\boxed{M = 67.6 KNm}$

Ans (3)(b)(ii)

* Muller breslau principle :- If an internal stress component or a reaction component is considered to act through some small distance and there by to deflect or displace a structure, the curve of the deflected or displaced structure will be, to some scale, the influence line for the stress or rx^n component.
* Muller - breslau principle uses betti's law virtual work to construct influence line.



* Mullar-breslau principle is applicable to only The indeterminate structure which are elastic and follow hooke's law. All other indeterminate structure cannot be solved by this principle.



Ans (3) (c)

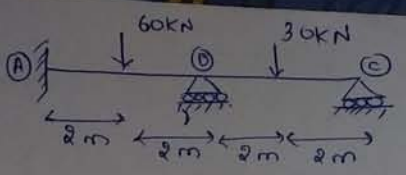
Time hrs	0	2	4	6	8	12	16	30
(m^3/s)	0	2.044	8.1	13.5	11.34	6.75	2.7	0.0

So first unit hydrograph corresponding to 4hrs should be known so 10cm rainfall given and we have to find for 1cm so dividing of 10cm.

* Time	Hydrograph (10cm) (m^3/s)	Unit Hyd. (m^3/s)	(1) For (4hr 5cm) (m^3/s)	(2) For (4hr 7.5cm) (m^3/s)	Σ(1)+Σ(2)
0	0	0	0		0
2	2.044	.2044	.2044×5		1.022
4	8.1	.81	.81×5	0	4.05
6	13.5	1.35	1.35×5	[illegible]44×7.5	8.283
8	11.34	1.134	1.134×5	.81×7.5	11.745
10	9.045	.9045	.9045×5	1.35×7.5	14.6475
12	6.75	.675	.675×[illegible]	1.134×7.5	11.88
14	4.725	.4725	.47[illegible]5	.9045×7.5	9.[illegible]5
16	2.7	0.027	.27×5	.675×7.5	[illegible].4125
18	1.35	0[illegible]	.135×5	.4725×7.5	4.21875
20	0	[illegible]	0	.27×[illegible]5	2.025
				[illegible]5×7.5	1.0125
				0	0

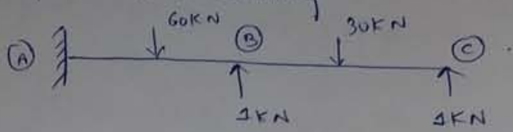
So Maxim[illegible] [illegible] 14.6475 m^3/s at t = 10hrs

Ans (4) (a)

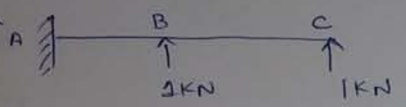


$\Delta_B = 12\,mm$ (downward)
$\Delta_C = 6\,mm$. (downward)

So first creating flexibility matrix assuming



① ⇒



∴ Then flexibility matrix canbe

$$\Delta_{BB} = \frac{(4)^3}{3EI}.$$

$$\Delta_{BC} = \Delta_{CB} = \frac{(4)^3}{3EI} + \frac{(4)^2}{2EI} \times 4$$

and $\Delta_{CC} = \dfrac{(8)^3}{3EI}$

and now $EI = 20 \times 10^{12}\ N\text{-}mm^2 = 20\times10^6\ N\text{-}m^2$

So $\Delta_{BB} = 1.0666 \times 10^{-6}$

$\Delta_{BC} = \Delta_{CB} = 2.6666 \times 10^{-6}$

$\Delta_{CC} = 8.533 \times 10^{-6}$

$$[f] = \begin{bmatrix} 1.0666\times10^{-6} & 2.666\times10^{-6} \\ 2.666\times10^{-6} & 8.533\times10^{-6} \end{bmatrix}$$

and Now we have to find $[f]^{-1}$

$|f| = 1.99 \times 10^{-12}$

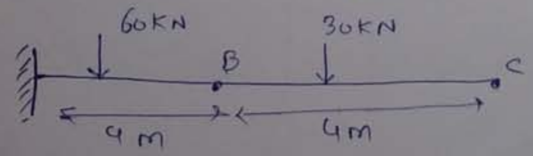
$$\text{So } [f]^{-1} = \frac{1}{1.99\times10^{-12}} \begin{bmatrix} 1.066\times10^{-6} & -2.666\times10^{-6} \\ -2.666\times10^{-6} & 8.533\times10^{-6} \end{bmatrix}$$

Interchange

$$\text{So } [f^{-1}] = 502234.94 \begin{bmatrix} 1.066 & -2.666 \\ -2.666 & 8.533 \end{bmatrix} = 502234.94 \begin{bmatrix} 8.533 & -2.66 \\ -2.666 & 1.066 \end{bmatrix}$$

interchange

\# Now



$$\Delta_B = \frac{60\times10^3 \times (2)^3}{3EI} + \frac{60\times10^3 \times 2^2}{2EI} \times 2 + \frac{30\times10^3 \times (4)^3}{3EI} + \frac{60(4)^2 \times 10^3}{2EI}$$

$$\Delta_C = \frac{60\times10^3}{3EI} \times 2^3 + \frac{60\times10^3 \times 2^2}{2EI} \times 6 + \frac{30\times10^3 \times 6^3}{3EI} + \frac{30\times10^3 \times 6^2 \times 2}{2EI}$$

$\Delta_B = 1520 \times 10^3 / EI = 76\text{mm}$ so total settlement $= 76 - 12 \text{ mm} = 64\text{mm}$

$\Delta_C = 4120 \times 10^3 / EI = 206 \text{ mm}$ " " " " $= 206 - 6\text{m} = 200\text{mm}$

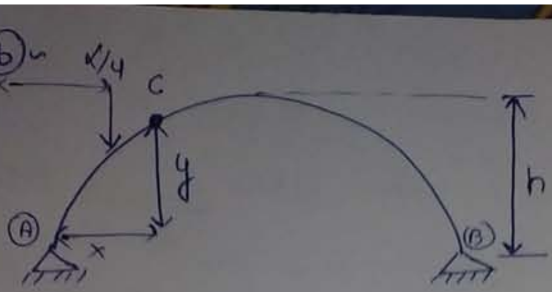
So

$$\begin{bmatrix} F_B \\ F_C \end{bmatrix} = 502[illegible] \begin{bmatrix} 8.533 & -2.66[illegible] \\ -2.666 & 1.066 \end{bmatrix} \begin{bmatrix} +64 \times 10^{-3} \\ +200 \times 10^{-3} \end{bmatrix}$$

$F_B = 6.484 \text{ KN} (\uparrow)$

$F_C = 21.430 \text{ KN} (\uparrow)$

Ans (4)(b)



* Now reaction at (A) is given by $\Sigma M_B = 0$

$R_A \cdot L = P \times 3L/4$

So $\boxed{R_A = 3P/4}$

Now conserving momentum at C

$$\frac{3P}{4}(x) - P\left(x - \frac{L}{4}\right) = H(y)$$

So $H(y) = -\frac{Px}{4} + \frac{PL}{4}$ so $\frac{P}{4}(L - x)$

and $y = \frac{4hx(L-x)}{L^2}$ so $\boxed{H = \frac{PL^2}{16hx}}$

* So maximum moment in arch is given by M_{max} and $\frac{\partial M_{max}}{\partial a} = 0$

So $M_{\text{Right of } L/4} = \frac{P}{4}(a) - \frac{PL^2}{16hx}(y)$

$= \frac{P}{4}(a) - \frac{PL^2}{16hx}\left[\frac{4ha(L-a)}{L^2}\right]$

$M_{\text{Left of } L/4} = \frac{3P}{4}(a) - \frac{PL^2}{16hx}y$

So $M = \frac{3Pa}{4} - \frac{Pah}{4x} + \frac{Pa^2}{4x}$

$M = \frac{P}{4}a\left[1 - \frac{(L-a)}{x}\right] = \frac{Pa}{4} - \frac{PaL}{4x} + \frac{Pa^2}{4x}$

So $\frac{\partial M}{\partial a} = 0$ so $\frac{3P}{4} - \frac{Ph}{4x} + \frac{2Pa}{4x} = 0$

$\left(\frac{L-3x}{2}\right) = a$

$\frac{\partial M}{\partial a} = 0$ so $\frac{P}{4} - \frac{Ph}{} + \frac{2Pa}{4x} = 0$

$\boxed{\frac{(L-\;)}{2} = a}$

* Now Putting ...

$M = \frac{P}{4}a - \frac{PaL}{4x} + \frac{Pa^2}{4x}$

$M = \frac{Pa}{4x}\left[x - L + a\right]$

$M = \frac{P}{4x}\left(\frac{L-x}{2}\right)\left[(\ldots\right]$

$M = -\frac{P}{16x}(L-x)\ldots$

So $\frac{\partial M}{\partial x} = 0$ then $\boxed{x = L}$

* Now Putting in M

$M = \frac{\;a}{4x}\left[3x - L + a\right]$

$M = \frac{Pa}{4x}\left[\frac{3x - L}{2}\right]$

$M = \frac{-P}{\;x}\left[\;\; - 3x\right]$

So $\frac{\partial M}{\partial x} = 0$ then

$\boxed{L/3 = x}$

Ans (4)(c)(i) Area of lake = 5000 hactare

So $Q_{inflow} = 6 m^3/sec = \frac{6 \times 3600 \times 24 \times 30}{5000 \times 10^4}$

$= 311 \cdot 04 mm$

$Q_{outflow} = 336 \cdot 96 mm$

Acc to water budget eqn

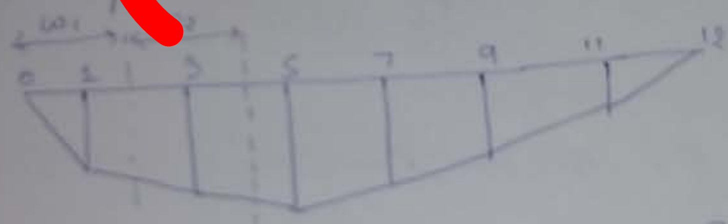
$Q_{inflow} - Q_{outflow} = \pm \Delta Storage$

$\Rightarrow [145 + 311 \cdot 04] - [3[illegible] \cdot 96 + [illegible]1] = \Delta Storage$

5[illegible]8 mm = Δ [illegible]age (↑sed)

So final surface elev^n = 103·2m + ·05808 = 103·25808 [illegible]

Ans (4)(c)(ii)



Given $V = (0 \cdot 51 N_s + \cdot 03) m/sec$

So $w_1 = \frac{[1 + 2/2]^2}{2 \times 1} = 2 m$

$w_2 [2/2 + 2/2] = 2 m$

Distance from left	Depth	Speed (V)	Width avg	Q
0	0	0	0	0
1	1·1	·2289	2	·50358
3	2·0	·3258	2	1·3032
5	2·5	·4108	2	[illegible]·054
7	2·0	·336	2	1·[illegible]44
9	1·7	·2595	2	·8823
11	1	·183	2	·366
12	0	0	0	0

$\Sigma Q = 6 \cdot 45308$ m[illegible]

Ans(5)(a) Bulk modulus is the property of fluid which resist the compression on the fluids body. Bulk modulus is given by

$$\boxed{K = -\frac{\partial P}{\left(\frac{\partial v}{v}\right)}}$$

So unit of bulk modulus = N/m^2

Factors affecting bulk modulus of elasticity
1) Temperature
2) Entrained air content
3) Pressure applied.

8

* Liquid generally have high bulk modulus of elasticity to resist compression. So when force or pressure is applied on fluid i.e. (Liquid) then

$$K(\uparrow) = \frac{-\partial P^{\uparrow} \text{ Pressure change}}{\left(\frac{\partial v}{v}\right)}$$ so for K value very high $\left(\frac{\partial v}{v}\right)_{\lim \to 0}$ so dv is very small hence considered incompressible

Ans(5)(b) $\partial u/\partial x + \partial v/\partial y = 0$ } continuity eq^n

$(u = 3x+y) \cdot (v = 2x-3y)$

$3 - 3 = 0$

so it sati s/y continuity eq^n so flow is possible.

$$\boxed{\partial\phi/\partial x = u \quad \text{and} \quad \partial\phi/\partial y = v}$$ for potential func^n

(1) $d\phi = u\,dx \Rightarrow d\phi = (3x+y)\,dx$

so $\phi = 3x^2/2 + xy + f(y)$ — eq^n(1)

(2) $d\phi = v\,dy \Rightarrow d\phi = (2x-3y)\,dy \Rightarrow$

so $\phi = 2xy - 3y^2/2 + f(x)$

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so velocity potential func^n donot exist for rotational flow

(3) $\omega_z = \frac{1}{2}\left(\partial v/\partial x - \partial u/\partial y\right) = \frac{1}{2}\left[2 - 1\right] = 1/2$ so rotation

* Stream funch on other hand can be written by

$\partial\psi/\partial y = U$ or $\partial\psi/\partial x = -V$

~ $\psi = 3xy + y^2/2 + f(x)$ $\psi = 3xy - x^2 + f(y)$

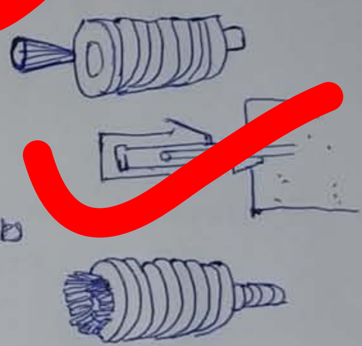
So $\boxed{\psi = y^2/2 + 3xy - x^2}$

Ans (5) (c) ~ (1) Freyssinet system introduced by french engineer freyssinet and it was the 1st method to be introduced.

(2) High strength steel wire of 5mm or 7mm, numbering (8, 12, 16, 24) are grouped into a cable with a helical spring inside. Spring keep proper spacing of wires. Cable is inserted in the duct.

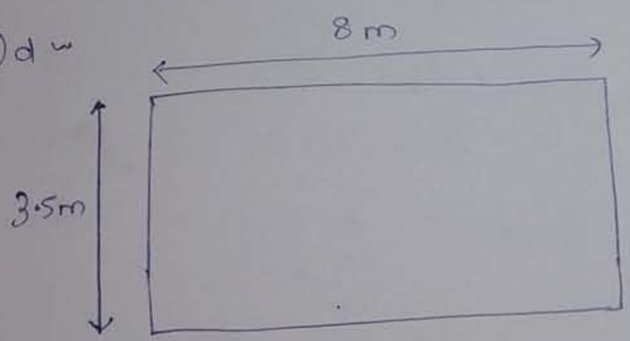
(3) Anchorage device consist of a concrete cylinder with concentric conical hole and conical plug carrying grooves on its surface. Steel wire are carried along these grooves at the ends. Concrete cylinders is heavily reinforced.

(4) Wire are pulled by freyssinet double acting jacks which anchor through suitable grooves all the wires in table at a time



Freyssinet system

Ans (5) d ~



Sow It will be One way slab and Depth can be given by

$D = \frac{3500}{35 \times 0.8} = 125\,mm$

So assuming clear cover of 20mm and 12mm ϕ

So effective width = 125 + 3500 = 3625mm

* Now $D = 125 + 20 + 6 = 151\,mm$

* Now total $LL = 5\,KN/m^2$ and $DL = 25 \times 151 \times 1/1000 = 3.775$

$W_{total} = 1.5(5 + 3.775) = 13.1625$

$M_{uez} = \frac{13.1625 \times 3.5^2}{8} = 20.155\,KN/m$

So $M_{u\,lim} = 0.138 \times 25 \times 1000 \times d^2$

$20.155 \times 10^6 = 0.138 \times 25 \times 1000 \times d^2$

$d = 76.433\,mm$

Take $d = 85\,mm$ then $D = 110\,mm$

Now $A_{st} = \frac{0.5 \times 20}{415} \times 1000 \times 85 \left[1 - \sqrt{1 - \frac{4.6 \times 20.155 \times 10^6}{25 \times 1000 \times 85^2}}\right]$

$A_{st} = 619.279\,mm^2$

Minimum $A_{st} = \frac{0.12}{100} \times 1000 \times 85 = 102\,mm^2$

* Now providing 12mm ϕ

Spacing $= \frac{1000 \times \pi/4 \times 12^2}{619.279} = 182.627$

So Provide 12mm ϕ @ 180mm c-c

Distribution bars in longer direction

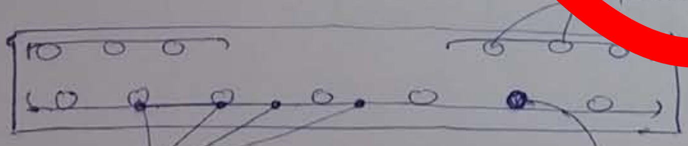
Spacing $= (102)^{-1} \times 100 \times \pi/4 \times 10^2 \simeq 770\,mm$

Minimum = 300 or 3d = 225
main reinf.

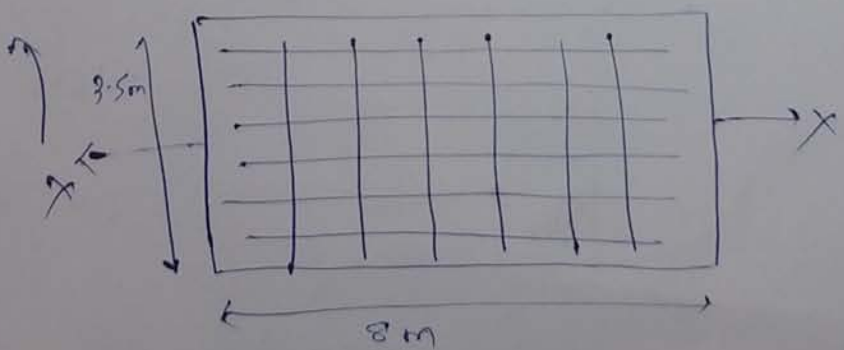
for Distribution = 5d or 450mm ...
revised ⇒ 5d or 300mm

So Proving 10mm ϕ @ 300mm c-c

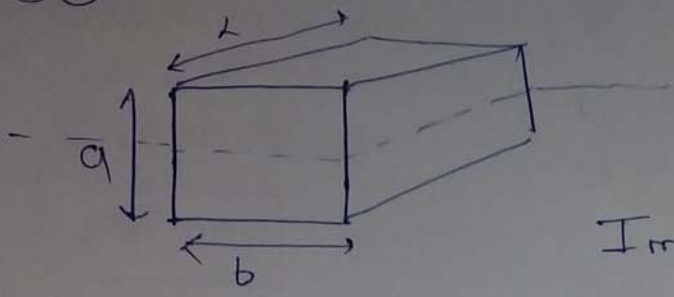
*



Sech x-x



Ans (5) (c)



now $GM = \frac{I}{V} - BG$

$I_{minimum\,(rolling)} = \frac{1}{12} \times l \times b^3$

So $(abl)\,S \cdot g = (b \cdot l)\,x \cdot g$

So $\boxed{x = aS}$

So $BG = a/2 - aS/2$

So $\underline{GM > 0}$ for stable eqn

So $\frac{1/12 \times l b^3}{aS \times b \times l} - \left[a/2 \, [1-S] \right] > 0$

so $\frac{\cancel{l} b^2}{\cancel{l}\, 12 S a} > a/2 \, [1-S]$

So $\frac{b^2}{a^2} > 6S(1-S)$

So $b/a > \sqrt{6S(1-S)}$

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Ans (8)(a) ε = roughness coefficient, t = time

So $\boxed{\varepsilon = Kt + C}$

So at $f = .02$ and $t = 0$ ~ $\frac{1}{\sqrt{.02}} = 2\log\left[\frac{300}{\varepsilon_1}\right] + 1.74$

$\varepsilon_1 = .648$ mm

So $\boxed{C = .648}$.

* at $f = .025$ ~ $t = 10$ Yrs ~ $\frac{1}{\sqrt{.025}} = 2\log\left[\frac{300}{\varepsilon_2}\right] + 1.74$

$\varepsilon_2 = 1.5305$ mm

So $1.5305 = K[10] + .648$

$\boxed{K = .08825}$

~ Now at $t = 25$ Yrs.

$\varepsilon = .08825 \times 25 + .648 = 2.85425$ mm

Now ~

$$1/\sqrt{f} = 2\log_{10}\left[\frac{300}{2.85425}\right] + 1.74$$

$$\boxed{f = .0298}$$

Ans 8(b) ~ total load = 4 kN/m (live/imposed load)

$D\alpha = 25\,kN/m^3 \times .25 \times .4 = 2.5\,kN/m$

So Total load = 4 + 2.5 = 6.5 kN/m

(i) ~ When beam is fully loaded ~ Moment $= W \times l^2/8 = \frac{6.5 \times 7.5^2}{8}$

$= 45.703$ kNm

* Now at Soffit $\frac{\text{force}}{\text{Area}} = 0$

$$\sigma_{soffit} = P/A - \frac{M}{I} \times y_{soff} \qquad (\sigma_{soff} = 0)$$

So $\frac{45.703 \times 10^6}{\frac{1}{12} \times 250 \times 400^3} \times 200 \times 400 \times 250 /$ $\boxed{P = 685.545\ kN}$

(11) $\sigma_{bottom} = 0$. $\sigma_{bottom} = P/A + \frac{P \cdot e \cdot Y}{I} - \frac{M \cdot Y}{I}$

$P\left[\frac{1}{A} + \frac{e \cdot Y}{I}\right] = \frac{M \cdot Y}{I}$

$P = \frac{45.70 \ldots \times 200}{\frac{1}{12} \times [250] \times 400^3} \times \frac{1}{\left[\frac{1}{400 \times 250} + \frac{60 \times 200 \times 12}{250 \times 400^3}\right]}$

$\boxed{P = 860.813 KN}$

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(8)
Ans c- (1) So total no of variables (T, D, N, μ, ρ)

So and fundamental dimension = 3

No of π - terms = 5 - 3 = 2

So $\pi_1 = [D]^{a_1}[N]^{b_1}[\rho]^{c_1} T$

$\pi_2 = [D]^{a_2}[N]^{b_2}[\rho]^{c_2} \mu$

$D = L$
$\rho = ML^{-3}$
$N = T^{-1}$
$T = ML^2T^{-2}$
$\mu = \frac{MLT^{-2} \times T}{L^2} = ML^{-1}T^{-1}$

So $\pi_1 = [L]^{a_1}[T^{-1}]^{b_1}[ML^{-3}]^{c_1} ML^2T^{-2}$

$\pi_1 = [L]^{a_1 - 3c_1 + 2}[T]^{-b_1 - 2}[M]^{c_1 + 1}$

So $a_1 - 3c_1 + 2 = 0$ So $a_1 = -5$ $b_1 = -2$ $c_1 = -1$

$-b_1 - 2 = 0$

$c_1 + 1 = 0$

So $\boxed{\pi_1 = \left[\frac{1}{D^5} \times \frac{1}{N^2} \times \frac{1}{\rho}\right] \times T}$ - eq - (1)

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$\pi_2 = [L]^{a_2}[T^{-1}]^{b_2}[ML^{-3}]^{c_2} \times ML^{-1}T^{-1}$

$\pi_2 = [L]^{a_2 - 3c_2 - 1}[T]^{-b_2 - 1}[M]^{c_2 + 1}$ - eq - (2)

So $a_2 - 3c_2 - 1 = 0$ $a_2 = -2$

$-b_2 - 1 = 0$ $b_2 = -1$

$c_2 + 1 = 0$ $c_2 = -1$

$\left[\pi_2 = \left[\frac{1}{D^2 N \rho}\right] \times \mu\right]$

So from eq^n (1) and (2)

$$\pi = \left[\frac{T}{D^5 N^2 \rho \phi}\right], \left[\frac{\mu}{D^2 N \rho}\right] f$$

So $$T = D^5 N^2 \rho \phi \left[\frac{\mu}{D^2 N \rho}\right]$$

Ans c (ii)- $T_{critical} = 2 \times L / C = \frac{2 \times 3500}{1483.23} = 4.719$ sec.

$$C = \sqrt{K/\rho} = \sqrt{\frac{2.2 \times 10^9}{10^3}} = \sqrt{2.2} \times 10^3 = 1483.23 \text{ m/s}.$$

an[illegible] is closed in 4 s then rapid closure

$p = \rho[illegible]C = 10^3 \times 0.8 \times 1483.2[illegible] kPa.

Ans c (ii) = 1[illegible]3.23 × 4 = [illegible]gk = 5932.92

~~1000 - 5932.92 = 1067.08 m~~