Page # 1

Name Taimur Bacha
ID 16456
Dep Civil engg
Sec B

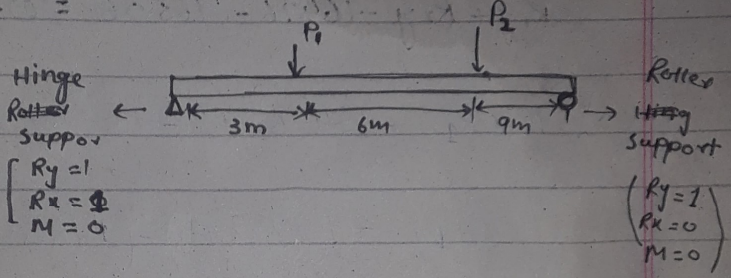
Page: 2

1
Q
/ Ans

Find the support

$P_1 = 20 + 1D$; $P_2 = 50 + 1D$

=

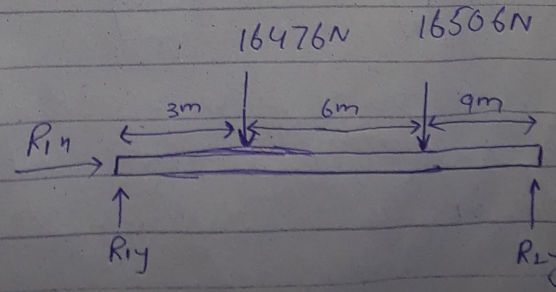


Solution

$P_1 = 20 + (16456) = 16476N$

$P_2 = 50 + (16456) = 16506N$

So, Diagram as:



So,

$R_1x = 0$ ... $\Sigma fx = 0$

we know that

$R_1y + R_2y - 16476 - 16506 = 0 \rightarrow$ eq2

$18 \times R_1y - 16476 \times 15 - 16506 \times 9 = 0$

$18 \times R_1y - (247140) - (148554) = 0$

$18 \times R_1y - (395694) = 0$

$18 \times R_1y = 395694$

$R_1y = \frac{395694}{18}$

$R_1y = 21983$

Put the value of R_2y in eq no (2) for find R_1y

So,

$R_2y + R_1y - 16476 - 16506 = 0$

$R_2y + (21983) - 16476 - 16506 = 0$

$R_2y + 21983 - (395694)$ (32982)

$R_2y = 395694 - 21983$ (32982)

~~$R_2y = 373711$ N~~

$R_2y = 10999$ N

Ans

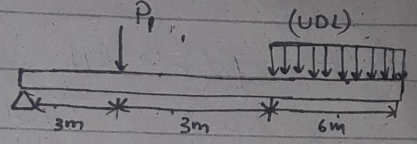
→ Support #1 = $R_1x = 0$ 10999 N

→ Support #2 = $R_1y = 373711$ N

→ Support # 3 = $R_2y = 21983$ N

Q2

Shear force.



$P_1 = 100 + 1D$, P_2

$UDL = 150 + 1D$

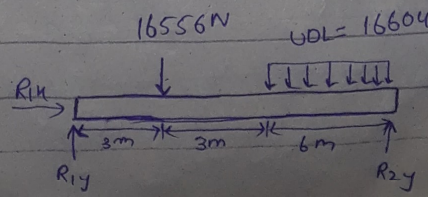
Solution :-

$P_1 = 100 + 16456 = 16556N$

$UDL = 150 + 16456\ KN/m = 16604\ \frac{KN}{m}$

Steps for find Shear force :

① Find support reaction :



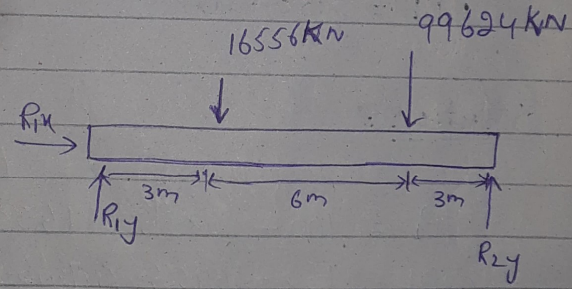
$P_2 =$ UDL x x

$P_2 = 16604\ KN/m \times 6m$

$P_2 = 99624\ KN$

react at middle where the UDL react

So Diagram as :



So

$R_{1x} = 0$ $\quad \Sigma f_x = 0$

$R_{1y} + R_{2y} - 16556 - 99626 = 0$ — eq1

and

$$R_{2y} \times 12 - P_2 \times 9 - P_1 \times 3 = 0$$

$$R_{2y} \times 12 - (99624 \times 9) - (16556 \times 3) = 0$$

$$R_{2y} \times 12 - (896616) - (49668) = 0$$

$$R_{2y} \times 12 - 946284 = 0$$

$$R_{2y} = 946284 / 12$$

$$\boxed{R_{2y} = 78857}$$

Put the value of R_{2y} in eq (1)

$$R_{2y} + R_{1y} - 16556 - 99626 = 0$$

(eq1)

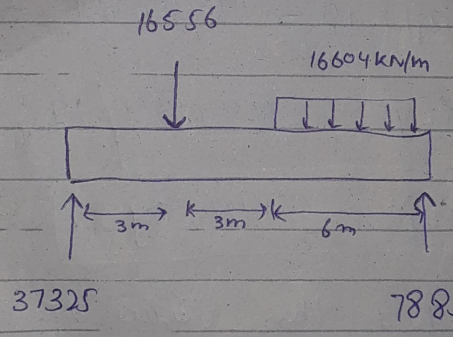
$$R_{2y} + R_{1y} - 116182 = 0$$

$$78857 + R_{1y} - 116182 = 0$$

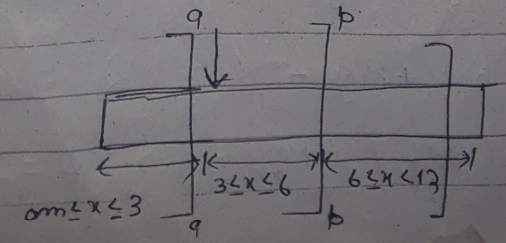
$$R_{1y} = 116182 - 78857$$

$$R_{1y} = \frac{87325}{3}\ kN$$

$$\boxed{R_{1y} = 37325\ N}$$



step # 2: shear force at different section.



page # 8

Section aa

$\Sigma fy = 0$

$-vaa + 37325 = 0$

$vaa = 37325$ eq ①

① aī $x = 0m$ eq ① $vaa = 37325$

② aī $x = 3m$ $vaa = 37325$

Section bb

$3 \le x \le 6$

$-vbb - P_3 + 37325 = 0$

$vbb = 37325 - 16556$

$vbb = 20769$ eq ②

vbb

① aī $x = 3 = 20769$

aī $x = 6 = vbb = 20769$

aī

Section cc:

$6m \le x \le 12$ UDL = ?

$P_2 = 16604 \times x - 6$

$P = 16604x - 99624$

$\Sigma fy = 0$

$-Vcc - P_2 + 37325$

$vcc = -(16604(x-6)) + 37325$

$vcc = -16604x + 99627 + 37325$

$vcc = -16604x + 136952$

① ~~$= 16604$~~

① aī $x = 6$ $vec = -16604x + 136952$

$vcc = 16604(6) + 136952$

$vcc = -99624 + 136952$

(10)

$V_{cc} = -37328$

ai $x = 12$ $V_{cc} = ?$

$V_{cc} = -16604x + 136952$

$V_{cc} = -16604(12) + 136952$

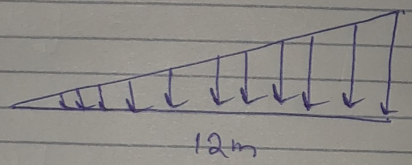
$V_{cc} = -199248 + 136952$

$V_{cc} = -62296$

①	ai $x=0$	$V_{aa} = 37325$
②	ai $x=3$	$V_{aa} = 37325$
③	ai $x=3$	$V_{bb} = 20769\ N$
④	ai $x=6$	$V_{bb} = 20769\ N$
⑤	ai $x=6$	$V_{cc} = -37328\ N$
⑥	ai $x=12$	$V_{cc} = -62296$

Q3 Draw shear force and bending moment

shear force



UVL = 1D/1000

UVL = 16456/1000 KN/m

UVL = 16.4 KN/m

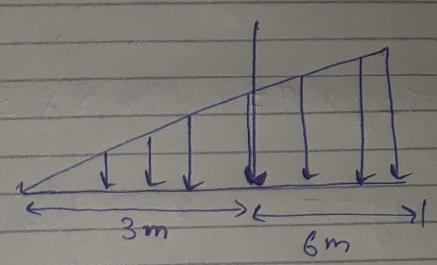
P = I x L

P = 16.4 KN/m x 12m

P = 196.8 KN

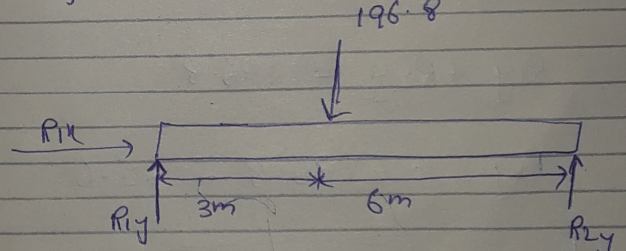
This P act on one

3rd Distance from maximum.



Step # 1

find support reaction.



So,

$R_{1x} = 0$, $\Sigma f_x = 0$

$\Rightarrow R_{1y} + R_{2y} = 196.8 \longrightarrow (1)$

$R_{2y} \times 9 = 196.8 \times 3$

$R_{2y} = 590.4/9$

$\boxed{R_{2y} = 65.6 \text{ kN}}$

Put in eq (1)

$R_{1y} + R_{2y} = 196.8$

$R_{1y} = 196.8 - 65.6$

$\boxed{R_{1y} = 131.2 \text{ kN}}$

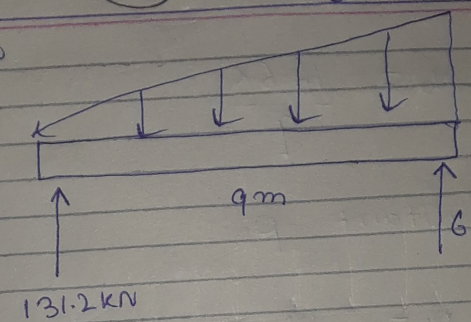
$R_{1x} = 0 \text{ kN}$

$R_{1y} = 131.2 \text{ kN}$

$R_{2y} = 65.6 \text{ kN}$.

UVL = 16.4

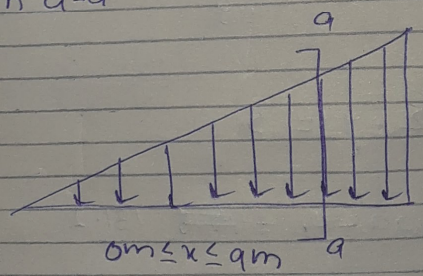
So



Step #2

Shear force at different section.

Section a-a



we know that

$$\frac{16.6\ kN/m}{9m} = \frac{w_o kN/m}{x-m}$$

$$w_o = \frac{16.6x}{9}$$

Resultant P_1

$$P_1 = w_o \, x/2$$

$$P = \frac{16.6x}{9} \cdot x/2$$

$$P = \frac{16.6x^2}{18}$$

So,

$$\Sigma f_y = 0$$

$$-v_{aa} - P_1 + \cancel{16.6}\ 131.2$$

$$-v_{aa} - \left[\frac{16.6x^2}{18}\right] + \cancel{16.6}\ 131.2$$

$$v_{aa} = \cancel{16.6} = \cancel{16.6x}$$

$$V_{AB} = -\frac{16.6x^2}{18} + 131.2 \longrightarrow (2)$$

Step # 3

(1) at $x = 0m$ $\quad V_{AB} = 131.2kN.$

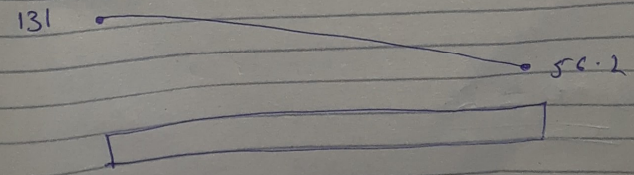
(2) at $x = 9m$ $\quad V_{AB} = 56.5$

$$-\frac{16.6(81)}{18} + 131.2$$

$$-74.7 + 131.2$$

$$56.5$$

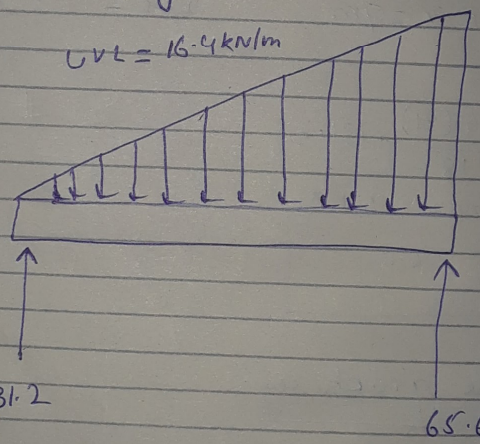
The graph as



(2) bending moment.

Step 1

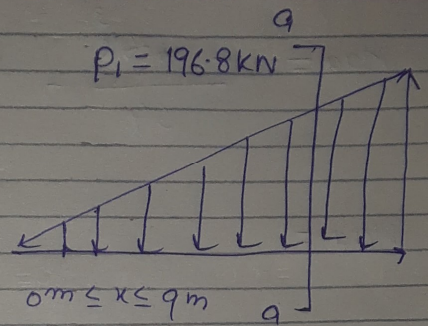
find support reaction was already Calculated.



Step # 2

Shear force at different section.

18



$P_1 = \frac{16.6x^2}{18}$ which was already calculated.

We known that the UVL will act at x/3 of length from the maximum side.

So,

$\Sigma M = 0$

$M_{aa} + x/3\ P_1 - 131.2$

$M_{aa} = -x/3\ P_1 + 131.2$

$m_{aa} = -\frac{x}{3}\left(\frac{16.6x^2}{18}\right) + 131.2$

(19)

$M_{aa} = -\frac{16.6x^3}{54} + 131.2$

$M_{aa} =$

ai section a.a.

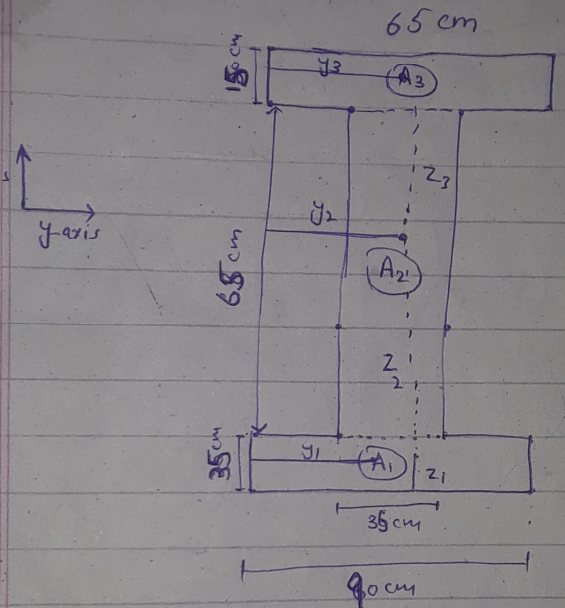
Step # 03

(1) at $x = 0m$, $M_{aa} = 0$ KN-m

(2) ai $x = 9m$ Put? value left Time short

Q4

⑨ Find Centroid.



* establish the Co-ordinate

* divide the area into different Simple area show in fig.

→ Area = LXW

$A_1 = \frac{15}{100} m \times \frac{90}{100} m = .15 \times .9 = 1.05 m^2$

$A_2 = \frac{65}{100} m \times \frac{35}{100} m = .65 \times .35 = 1 m^2$

$A_3 = \frac{65}{100} m \times \frac{15}{100} m = .65 \times .15 = .8 m^2$

* Then find the Center point of each each area from origin.

$y_1 = \frac{90}{100} m / 2 = \frac{.9}{2} = 0.45 m$

$y_2 = \frac{35}{100} m / 2 = \frac{0.70}{2} = 0.35 m$

$y_3 = \frac{65}{100} m / 2 = \frac{0.65}{2} = .325 m$

$Z_1 = \frac{35}{100} m / 2 = \frac{.35}{2} = 0.175 m$

$Z_2 = .35 + \frac{80}{100} m / 2 = .35 + .4 = 0.75 m$

$Z_3 = .35 + .8 + \frac{15}{100} / 2 m = 1.15 m$

$$y_c = \frac{A_1 y_1 + A_2 y_2 + A_3 y_3}{A_1 + A_2 + A_3}$$

$$y_c = \frac{1.05(.45) + 1(.45) + .8(.45)}{1.05 + 1 + .8}$$

$$y_c = \frac{.4725 + .45 + .36}{2.85}$$

$$y_c = 1.2825 / 2.85$$

$$y_c = .45 \text{ m}$$

$$z_c = \frac{A_1 z_1 + A_2 z_1 + A_3 z_3}{A_1 + A_2 + A_3}$$

$$z_c = \frac{1.05(.175) + 1(.75) + .8(1.15)}{1.05 + 1 + .8}$$

(.183, .75, .92)

$$z_c = \frac{.183 + .75 + .92}{2.85}$$

$$z_c = \frac{1.853}{2.85}$$

$$z_c = .6501 \text{ m}$$

(b)

(1)

moment of Inertia.

$I_y = bh^3/12$

$I_z = b^3h/12$

so we find This as:

$b = \frac{35}{100}/2 = .175 \text{ m}$ ~~find above.~~

$h = \frac{65}{100}/2 = .325$ ~~find above.~~

24 (a)

put the value.

$I_y = bh^3/12$

$I_y = .325 - (.385)^3/2$

$I_y = (.35)(.034)/12$

$I_y = .015/12$

$\boxed{I_y = .00125}$

$I_2 = b^3h/12$

$I_2 = (.45)^3(.65)/12$

$I_2 = (.091)(.65)/12$

$\boxed{I_2 = .00493}$

24 (b)

(2) Ridius Gyration

$r_y = \sqrt{\frac{I_y}{A}}, \sqrt{\frac{I_2}{A}}$

r_2

$A = \frac{65}{100} m \times \frac{35}{100} m$

$A = .65 \times .35$

$\boxed{A = .2275 m^2}$ ⟶

$I_y = .0012$ ⟶

$I_2 = .00493$ ⟶

put in eq

$\boxed{r_y = \sqrt{\frac{.0012}{.2275}}}$

$\boxed{r_2 = \frac{.00493}{.2275}}$

* Work *

work can be define as, work is the product of force and displcement.

→ $w = f \cdot d$

→ Its unit is joul

→ 1joul : a work is to be 1 joul if we exert one Newton force on a body and it displace by one meter.

Example # 1

If we displace the block of 2m by 4N force, The work will be

$w = f \cdot s \Rightarrow 2(4) = 8j$

* passitive work :

a work will be +ive if the body displace Toward force.

Such as force exert on ~~any~~ object and it displace Toward force

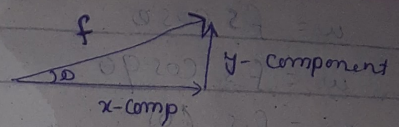
* Negative work force :

a work will be negative, if The body displace against the force such as - کرکٹ کے ذریعے گیند سے پانی نکالنا

* work done by force an angle:

We know that only the x-component of a force converted to work.

So, The x-component of a work calculated as.



$$f_x = f\cos x$$

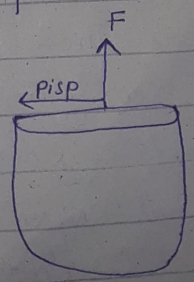
$$w = fs$$

$$w = f\cos\theta\, s$$

This is the equation of work when force exert at some angle.

∴ Example :

if we displace ~~Some~~ a fallen pot of water, Then, the angle b/w force and displacement is 90° so



$$w = f\cdot s\cos\theta$$
$$w = f\cdot s\cos 90$$
$$w = f\cdot s\ (0)$$
$$w = 0$$

x ——————— x

* Energy :-

→ Energy is define as the ability of a body to do work.

when we say that a Certain body has energy, we mean that it has the ability of external force on another body and of doing work on it

→ there are many type of energy

① - kinetic energy
② - gravitational P.E
③ - elastic energy

* P.E and K.E are interconvertable.

→ when we through an object to opper side, then its height increase, as a result the K.E Change to P.E. at Peak point, the K.E is zero and the P.E is maximum

Science State that, energy Can't be Created nor destroyed, but it transpered from one form to another like the above Statement.

* **Power:**

the rate at which work is done or the rate at which energy is transpered.

Example: He displace the object by Some force For Several time.

Mathematically, It Can be written as.

→ $P = w/t$

or

→ $P = f \cdot s/t$

→ $P = f \cdot \frac{s}{t}$

= $P = fv$

→ Power is ~~measured~~ measured in watt but Time take in second.

→ Power effeciency is the ratio of useful work done by the system, to that of the total work done

$$\text{Effeciency} = \frac{W(\text{useful})}{W(\text{Total})}$$

→ effeciency of power of any body must be less that 1 or 100%