Date:

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Section:- A

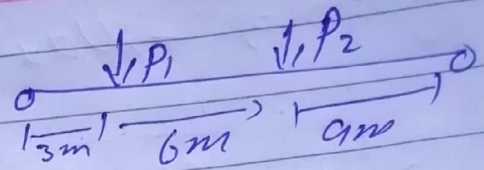
Department:- Bs (Civil Eng).

Subject:- Engineering Mechan

Submitted to:- M. Majid Naeem.

Date:

Q 1:-

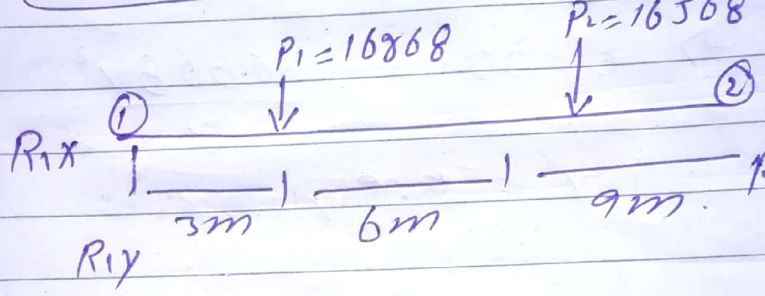


$P_1 = 500 + 16068$

$P_1 = 16568$

$P_2 = 500 + 16068$

$P_2 = 16568$



$R_{1x} = 0$ Sumation of $f(x) = 0$.

$R_{1y} + R_{2y} = 16568 - 16568$

$R_{1y} + R_{2y} = 16568 + 16568$

$R_{1y} + R_{2y} = 33136$ — (1)

$R_{1y} = \left[\frac{(16268 \times 9) + (16568 \times 15)}{18}\right]$

$R_{1y} = \frac{146412 + 248520}{18}$.

$R_1y = 21940.66 \ldots$ (2)

Put Eq(2) in Eq(1).

$R_1y + R_2y = 38836.$

$21940.66 + R_2y = 38836.$

$R_2y = 38836 - 21940.66.$

$R_2y = 10895.34$

$R_1H = 0N$

$R_2y = 10895.34\ N$

$R_1y = 21940.66$

ANSWER:

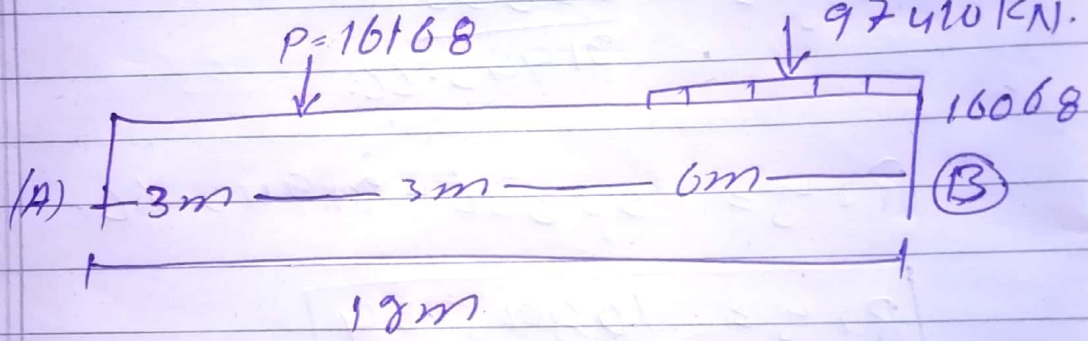
Date:

Q2:- Shear Force Diagram:-

Student ID = 16068.

P = 100 + 16068 = 16168 KN.

UDL = 150 + 16068 = 16218 KN/m.

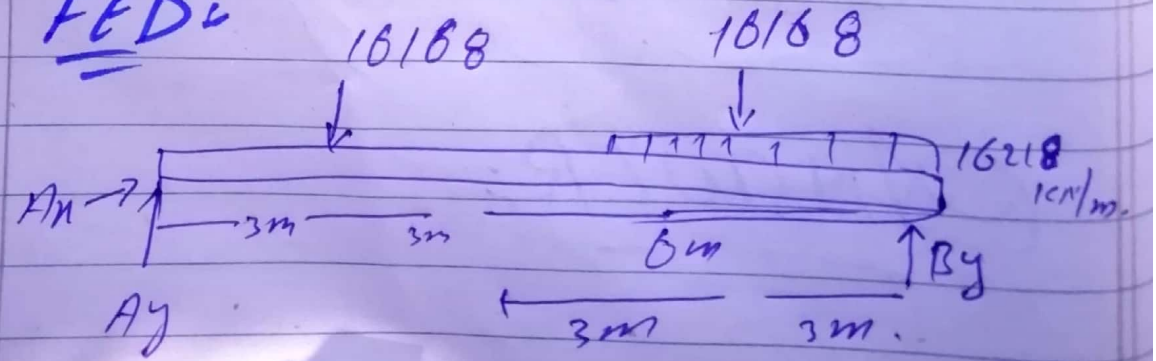


UDL = Point Load:-

16218 × 6

= 97308 KN.

FED:-



Support Moment:-

$\Sigma F_H = 0 \Rightarrow A_H = 0$.

$\Sigma F_y = 0 = A_y + B_y = 16168 + 97308$

$= 113476$. ~~~ (1).

~~$\Sigma M_A = 0 = (B_y \times 12) - (16168 \times 3) -$~~

$\Sigma M_A = 0 \Rightarrow (B_y \times 12) - (16168 \times 3) -$

$(97308 \times 9) = 0$.

$B_y \times 12 = 48504 + 875772$.

$B_y = \frac{924276}{12}$.

$\boxed{B_y = 77023 \text{ KN}}$

Eq (1):-

$$Ay + By = 113476$$

$$Ay + 77083 = 113476.$$

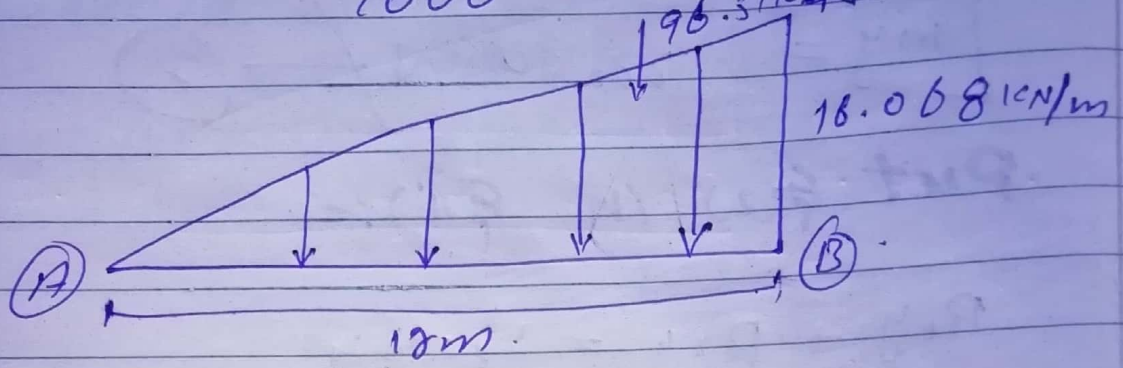
$$Ay = 113476 - 77083.$$

$$\boxed{Ay = 105774}$$

Q3 SFD and BMD.

Student ID = 16068.

$$UVL = \frac{16068}{1000} = 16.068 \text{ KN/m}.$$

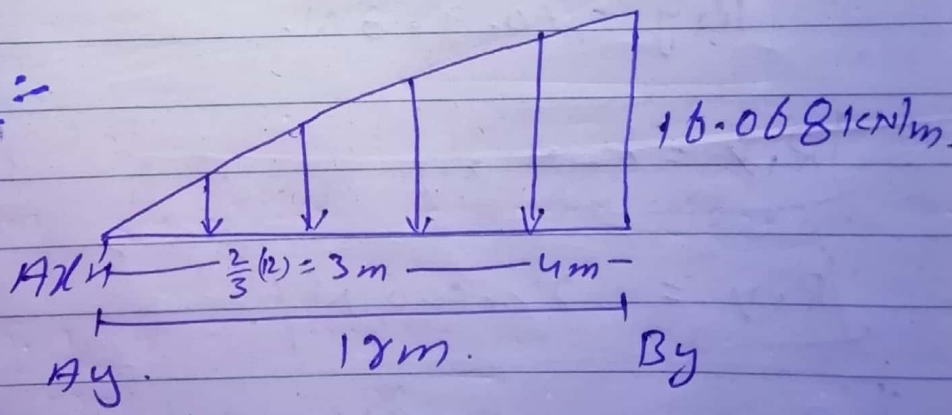


UVL Point Load :-

$$16.068 \times 12 \times 1/2$$

$$= 96.51 \text{ KN}.$$

FBD :-



Support Reactions :-

$$\Sigma F_x = 0 \Rightarrow Ax = 0.$$

$$\Sigma F_y = 0 \Rightarrow Ay + By = 96.51 \text{ KN} \quad (i)$$

Date:

(* $\Sigma M_A = 0 \Rightarrow (By \times 12) - (96.51 \times 8) = 0$.

$\Rightarrow By \times 12 = 772.08$

$By = \frac{772.08}{12}$

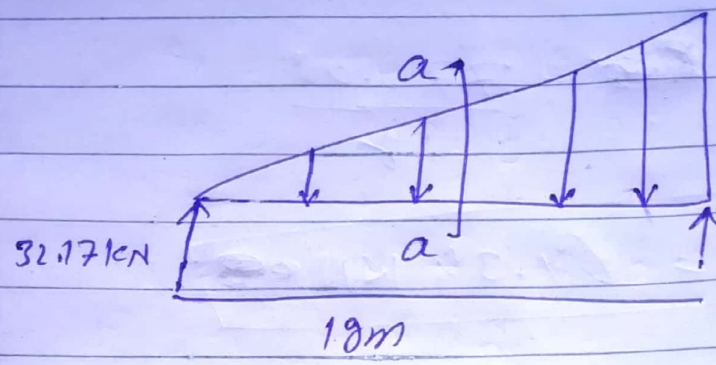
$\boxed{By = 64.34 \text{ KN}}$

Equation (i) $\Rightarrow$

$Ay + 64.34 = 96.51$

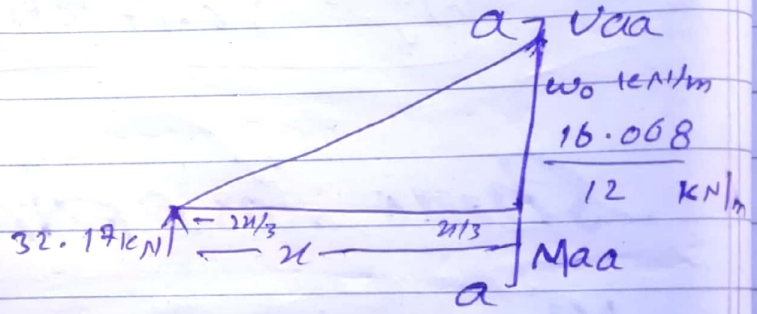
$\boxed{Ay = 32.17 \text{ KN}}$

Shear Force and Bending Moment at different Section:-



Section:-a :- $0 \leq x \leq 19$.

$$\frac{16.068x^2}{24} = P_1$$



From Law of similar Δs:-

$$\frac{16.068}{19} = \frac{wo\ 1cN/m}{x}$$

$$\Rightarrow wo = \left(\frac{16.068}{19}\right) 1cN/m.$$

$$P_1 = \left(\frac{16.068x}{19}\right)\left(\frac{x}{2}\right)$$

$$\boxed{P_1 = \frac{16.068x^2}{24}}$$

$\Sigma F_y = 0 \Rightarrow -V_{aa} - \frac{16.068x^2}{24} + 37.17 = 0$

$\Rightarrow \boxed{V_{aa} = 37.17 - \frac{16.068x^2}{24}} \quad -(a).$

(1) At $x = 0 \Rightarrow y_{aa} = 37.17 kN.$

(2) At $x = 17 \Rightarrow y_{aa} = -64.34 kN$

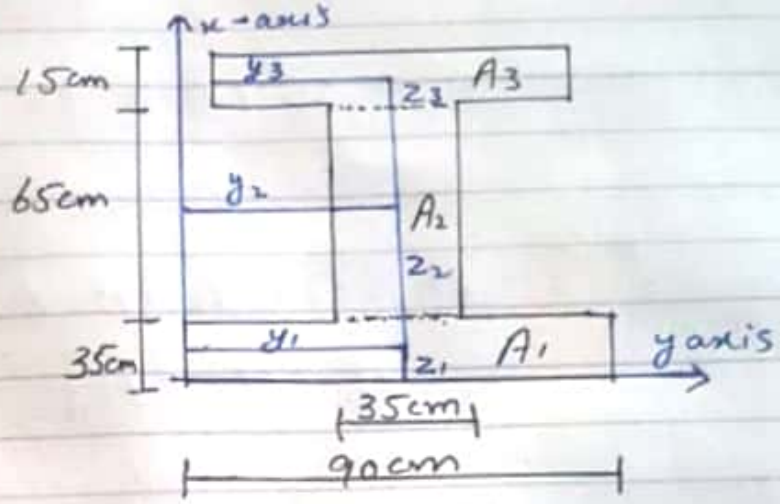
So (a) $\Rightarrow 0 = 37.17 - \frac{16.068x^2}{17}$

$\sqrt{x^2} = \sqrt{24.025}$

$\boxed{x = 4.901 m}$

(3) At $x = 4.901 \Rightarrow V_{aa} = 0 kN$

(4) a) Find the centroid of the given shape, show all your calculation.



Sol. * Establish the coordinate system
* Divide the composite area into different simple areas.

$A_1 = 0.35 \times 0.9 = \boxed{0.315\ m^2}$

$A_2 = 0.65 \times 0.35 = \boxed{0.2275\ m^2}$

$A_3 = 0.65 \times 0.15 = \boxed{0.0975\ m^2}$

Finding center ~~area~~ point of each o from the origin

$Y_1 = 0.9/2 = \boxed{0.45\ m}$

$Y_2 = 0.9/2 = \boxed{0.45\ m}$

$Y_3 = 0.9/2 = \boxed{0.45\ m}$

$Z_1 = 0.35/2 = \boxed{0.175\,m}$

$Z_2 = 0.35 + (0.65/2) = \boxed{0.675\,m}$

$Z_3 = 0.35 + 0.65 + 0.15/2 = \boxed{0.075\,m}$

$$Y_c = \frac{A_1Y_1 + A_2Y_2 + A_3Y_3}{A_1 + A_2 + A_3}$$

$$= \frac{(0.315 \times 0.45) + (0.2275 \times 0.45m) + (0.0975 \times 0.45)}{0.315 + 0.2275 + 0.0975}$$

$$= \frac{0.1417 + 0.10237 + 0.04387}{0.43525}$$

$$= \frac{0.28794}{0.43525}$$

$Y_c = \boxed{0.6615\,m}$

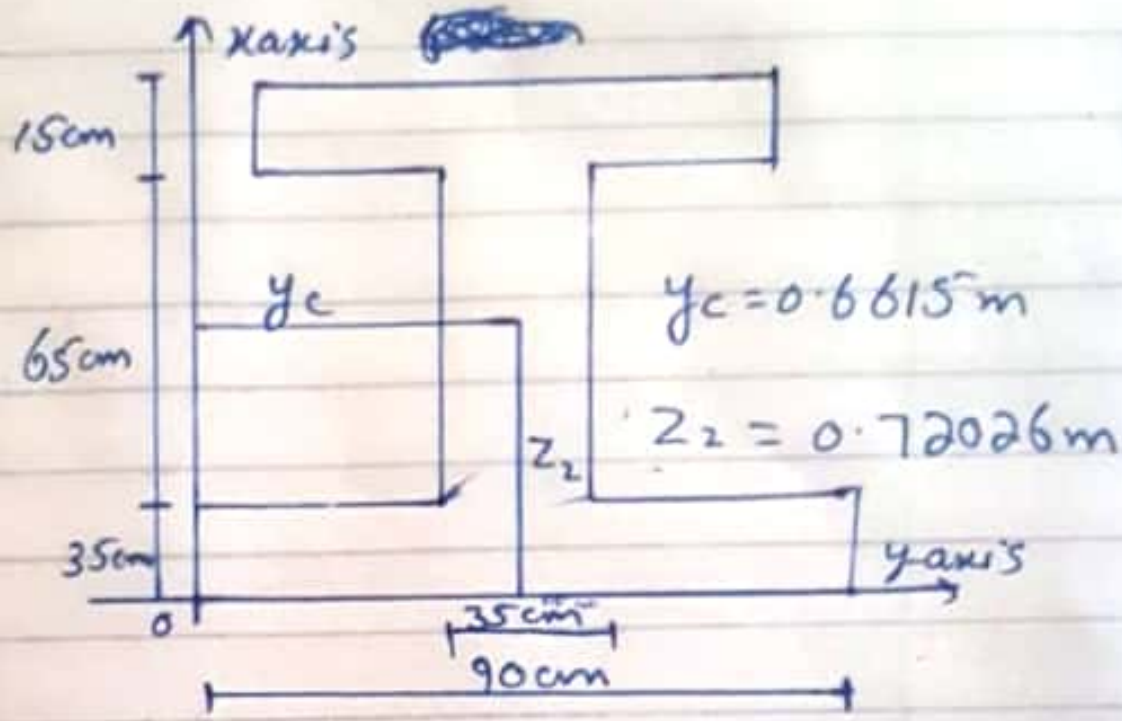
$$Z_c = \frac{A_1Z_1 + A_2Z_2 + A_3Z_3}{A_1 + A_2 + A_3}$$

$$Z_c = \frac{(0.315 \times 0.175) + (0.2275 \times 0.675) + (0.0975 \times 1.075}{0.43525}$$

$$= \frac{0.05512 + 0.153562 + 0.104812}{0.43525}$$

$$= \frac{0.3134945}{0.43525}$$

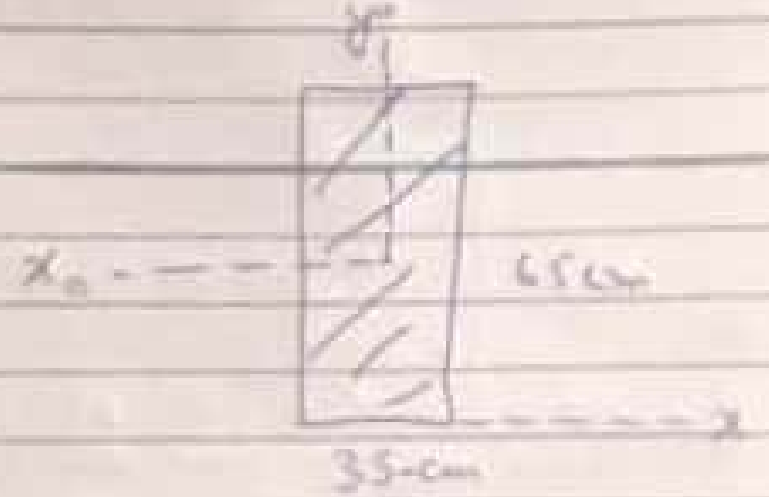
$z_c = \boxed{0.72026\ m}$



(a)

Ans:-

Moment of inertia for (65cm x 35cm)



$$I = \frac{bh^3}{12} = \frac{(35)(65)^3}{12}$$

$$\therefore I = 800,989.58 \text{ cm}^4$$

Radius of gyration:-

$$r_x = \frac{h}{\sqrt{12}} = \frac{65}{\sqrt{12}} = 18.76 \text{ cm}$$

$$r_y = \frac{b}{\sqrt{12}} = \frac{35}{\sqrt{12}} = 10.1 \text{ cm}$$

$$r_z = \frac{h}{\sqrt{3}} = \frac{65}{\sqrt{3}} = 37.5 \text{ cm}$$

Section modulus :-

$$S = \frac{bh^2}{6}$$

$$S = \frac{35 \times 65^2}{6}$$

$$S = 24645.83\ cm^3$$

Q.5 Explain work, energy & power in details along with practical example from daily life?

Ans:. **Work:**

The application of a force through certain distance is know as work. It meaused in jouls (J).

Work = Force × Distance travelled in direction of force

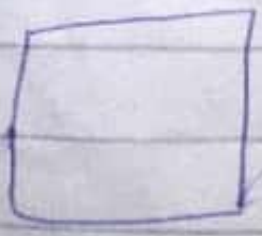
$W = F \cdot d$.

Explanation:

A work is done that when a body is in rest and some external force are applied on them and the body is accelarates are moved from their rest position and they cover some distance in the direction of applied then we will is said work is done.

Examples:

A box is pulled along by a piece of string which is at 30° to the horizontal. Calculate the work done in pulling the toy if the tension in the string is 12 N, and it is pulled along 7 m.



$W = Fs \cos\theta$

$= 12 \times 7 \times \cos 30^\circ$

$= 84 \times \cos 30^\circ$

$W = 72.746$

Energy:-

The measure of the ability of an object or system to perform work. Its unit is joule. Denote by (J).

Energy = Fed.

and $1J = 1N.m$.

Explanation:

Energy is that which is the ability to do work. Which we can use for our daily life for our basic facilities.

Examples:

① Fire energy.
② hydrelic energy.
③ electrical energy.
④ Heat energy etc.

Power:-

Power is the rate at which work is done, or rate at which energy is transfered.

Power = work done / time taken

$P = W/t$

Example:

1) Strength need to run five miles

2) The authority a local government has to collect taxes.

3) Power machine in which we move load from one place to another.