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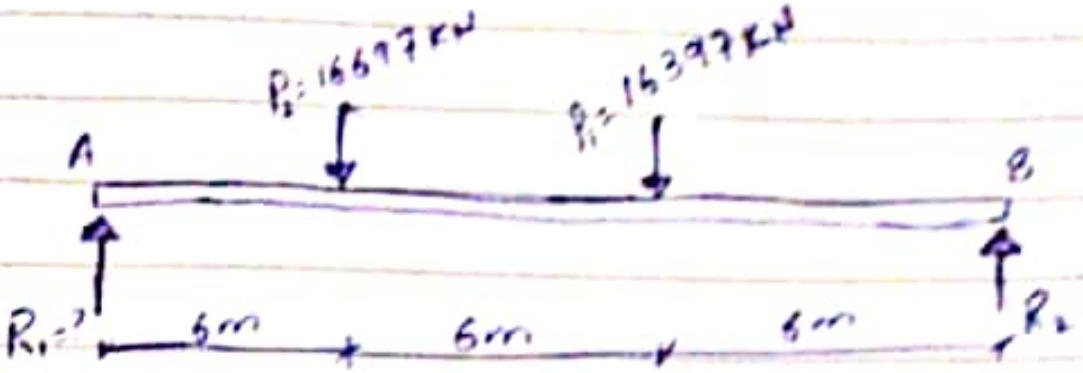
Section : B
Dept : BE Civil Engineering
ID : 16197
Paper : Final Term Engineering Mechanics

Date: _____

Q No 1: Given data: Student Id: 16197

$P_1 = 200 + 16197 = 16397$ KN

$P_2 = 500 + 16197 = 16697$ KN



To Find R_2 :-

By Taking Moment at A

$\Rightarrow \Sigma M_A = 0$ $+\circlearrowright$

$-(R_2 \times 18) + (16697 \times 6) + (16397 \times 12) = 0$

$(R_2 \times 18) = 100182 + 196764$

$$\boxed{R_2 = 16497 \text{ KN}}$$

To Find R_1 :-

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

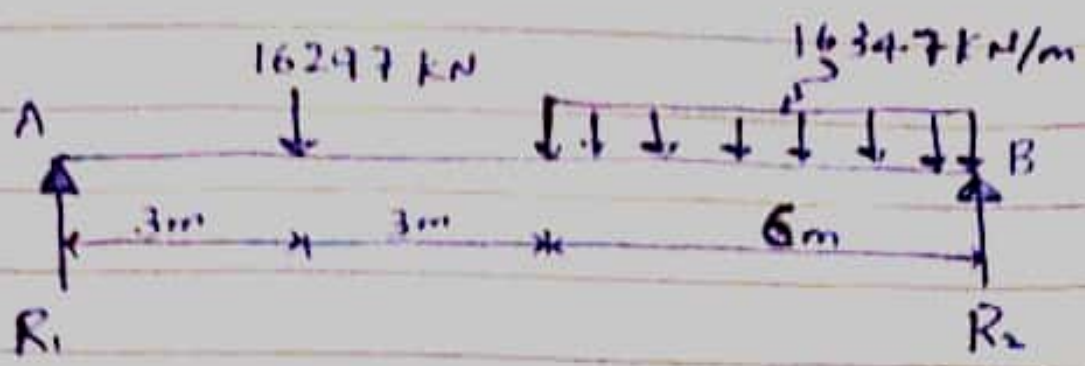
$R_1 - 16697 - 16397 + 16497$

$$\boxed{R_1 = 16597 \text{ KN}}$$

Q.no 2: Given data:

P = 100 + 16197 = 16297 KN

UDL = 150 + 16197 = 1634.7 KN/m



To find R_2:

By Taking Moment at RA

$\Sigma M_A = 0$ ↻

$\Rightarrow (16297 \times 3) + (16397 \times 6)(9) - R_2(12) = 0$

$R_2(12) = 48891 + 882738$

$R_2 \times 12 = 931629$

$$\boxed{R_2 = 77635.75 \text{ KN}}$$

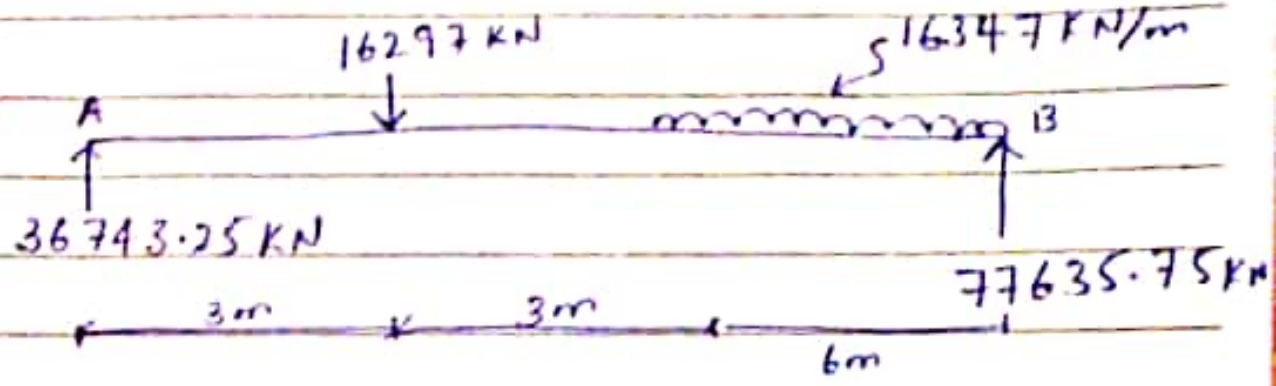
To Find R_1:-

$\Sigma F_y = 0 \quad \uparrow +\downarrow -$

$\Rightarrow \quad R_1 - 16297 - 95082 + 77635.75 = 0$

$$\boxed{R_1 = 36743.25 \text{ KN}}$$

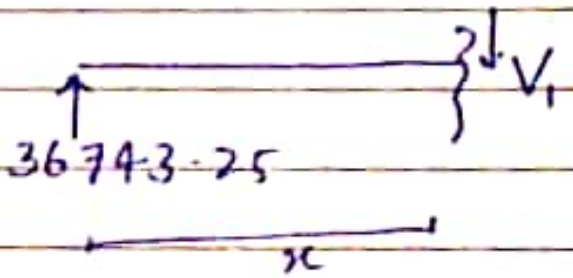
Calculation for Sheas force Diagrame:-



Section 1-1:-

$0 \leq x \leq 3$

$\Sigma F_y = 0$

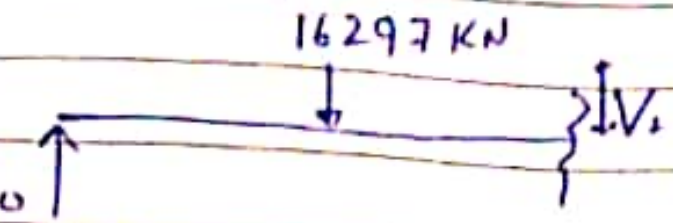


$36743.25 - V_1 = 0$

$$\boxed{V_1 = 36743.5 \text{ KN}}$$

Section 2-2:-

interval : $3 \leq x \leq 6$



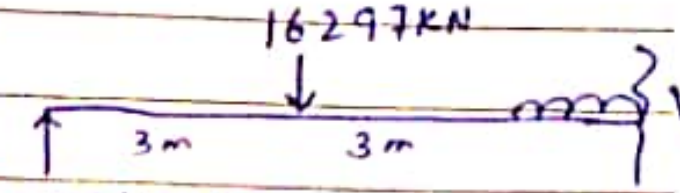
$\Sigma F_y = 0$

$3674.3.25 - 16297 - V_2 = 0$

$$\boxed{V_2 = 20446.25 \text{ KN}}$$

Section 3-3:-

$6 \leq x \leq 12$



$\Sigma F_y = 0$

$36743.25 - 16297 - 16347(x-6) = 0$

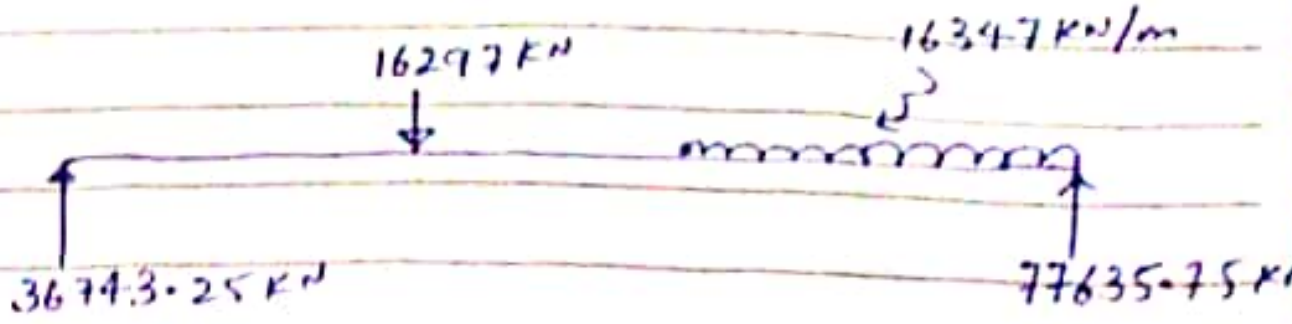
By Puting $x = 6$ in the above equation

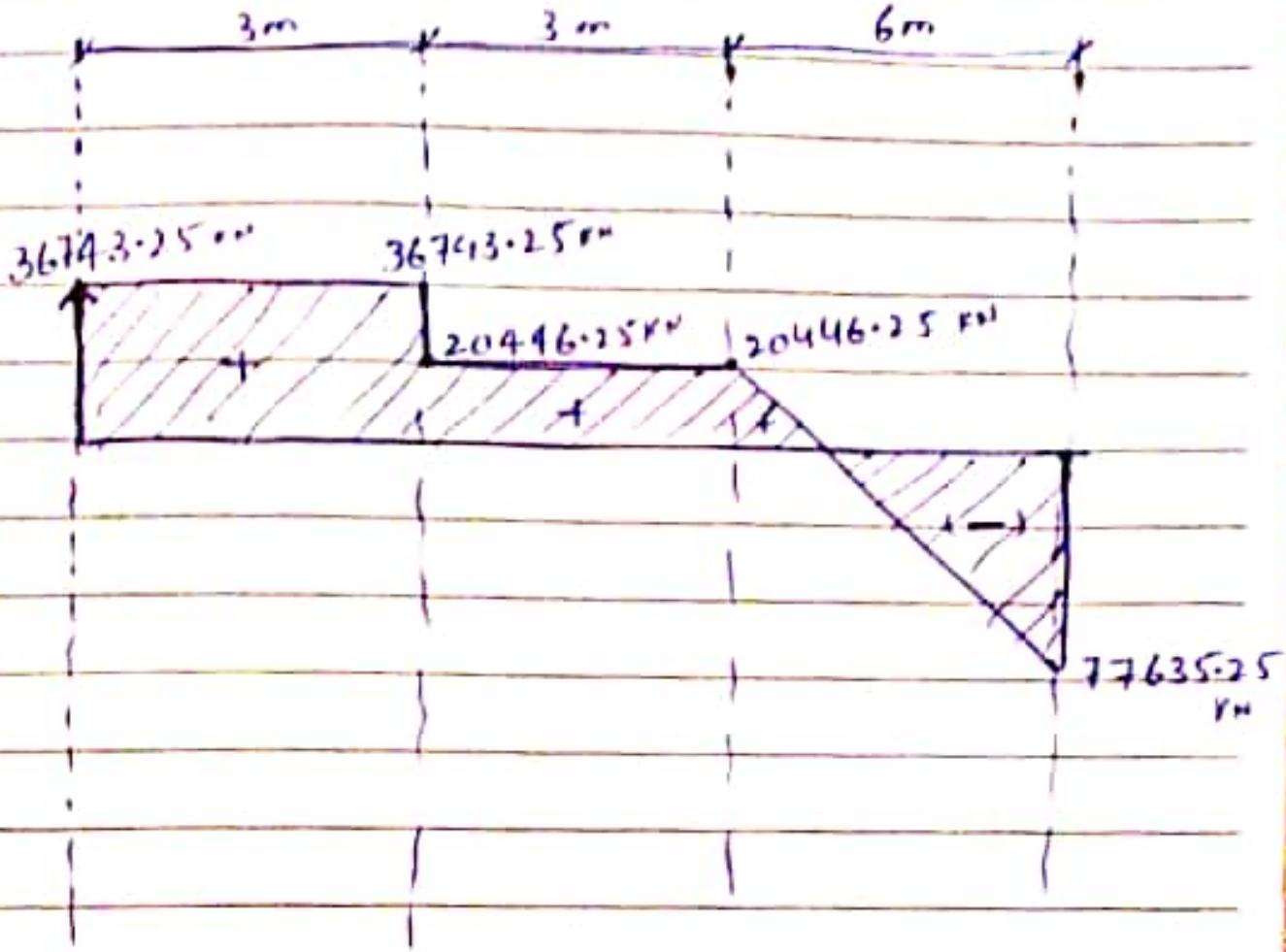
$V_3 = 20446.25$ KN

By Puting $x = 12$ in the above equation

$V_3 = -77635.75$ KN

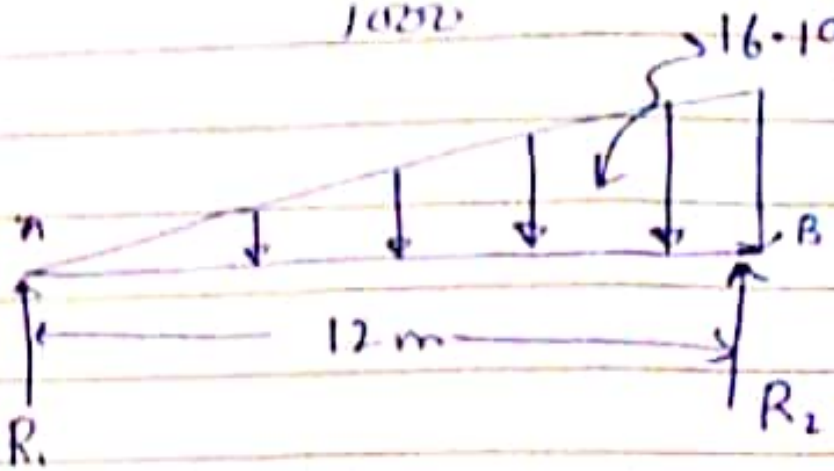
Shear Force Diagrames:





Q.No 3: Given data:

$$UVL = \frac{16197}{1000} = 16.197 \text{ KN/m}$$



To Find R_2:-

$$\Sigma M_A = 0$$

$$\left(\left(\frac{16.197 \times 12}{2}\right) \times 8\right) - (R_2 \times 12) = 0$$

$$\boxed{R_2 = 64.788 \text{ KN}}$$

$$\Sigma F_y = 0$$

$$R_1 - 97.182 + 64.788$$

$$\boxed{R_1 = 32.394 \text{ KN}}$$

Shear force equation:- $0 \le x \le 12$

$$V_x = \frac{WL}{2}\left(\frac{1}{3} - \frac{x^2}{L^2}\right)$$

For $x = 0$ $+\uparrow -\downarrow$

$$V_{x=} = -\frac{16.197(12)}{2}\left(\frac{1}{3} - \frac{0^2}{12^2}\right)$$

$$V_x = 32.394 \text{ kN}$$

Maximum shear force at right support:-

$$V_{max} = \frac{WL}{3} = \frac{16.197 \times 12}{3}$$

$$V_{max} = 64.788$$

Bending Moment equation :- $0 \le x \le 12$

$$M_x = \frac{wlx}{6}\left(1 - \frac{x^2}{L^2}\right)$$

For $x = 0$:-

$$M_0 = \frac{12 \times 16.197 \times (0)}{6}\left(1 - \frac{0^2}{12^2}\right)$$

$$\boxed{M_0 = 0 \text{ KN-m}}$$

Minimum Shear Force at $x = \frac{L}{\sqrt{3}}$

$$x = \frac{L}{\sqrt{3}} = \frac{12}{\sqrt{3}} = 6.928 \text{ m}$$

Maximum Bending moment at zero shear

Location = $M_{max} = \frac{WL^2}{9\sqrt{3}}$

$$M_{max} = \frac{16.197 \times 12^2}{9\sqrt{3}}$$

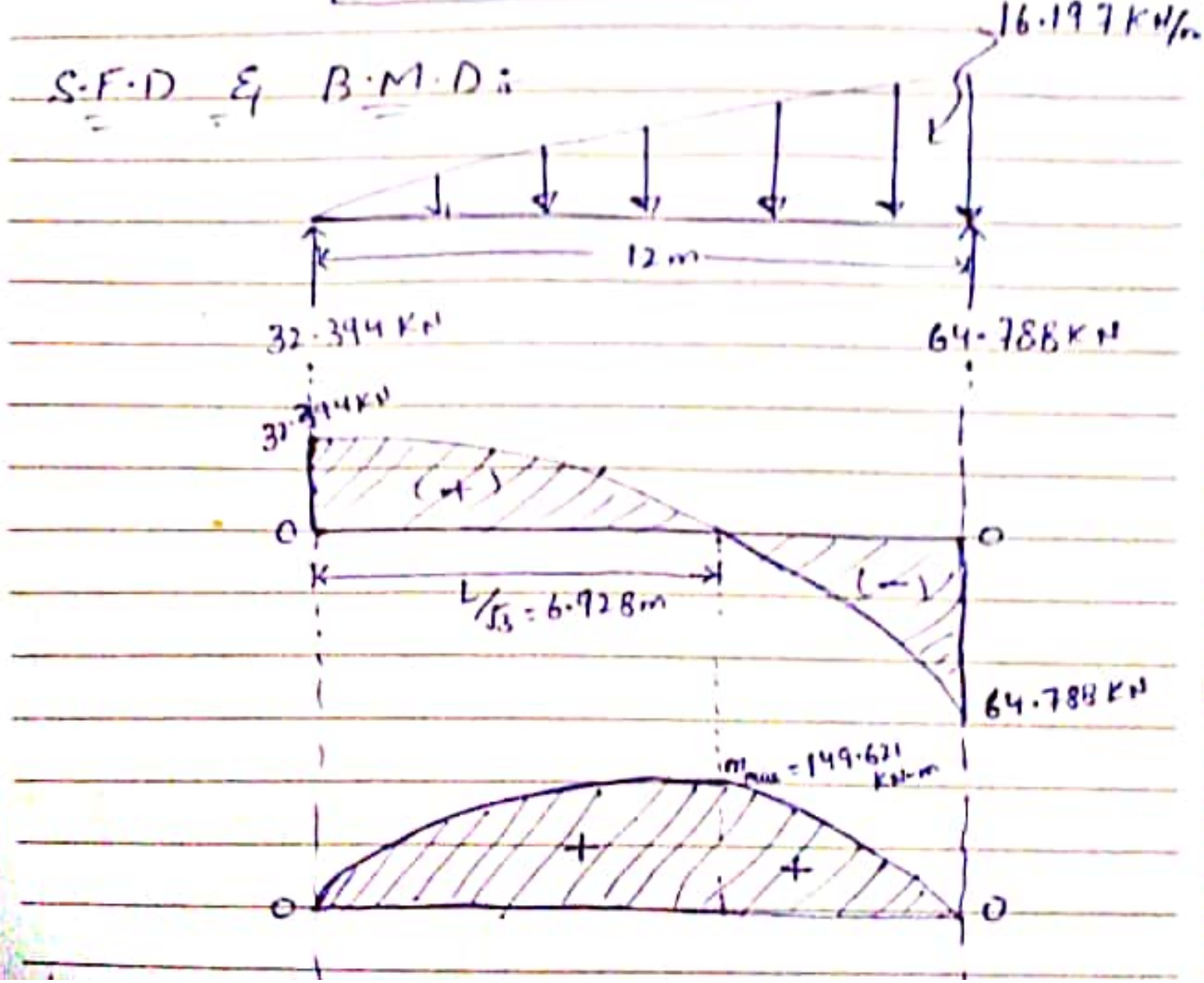
M_{max} = 149.621 KN-m

Bending moment at x = 12 :

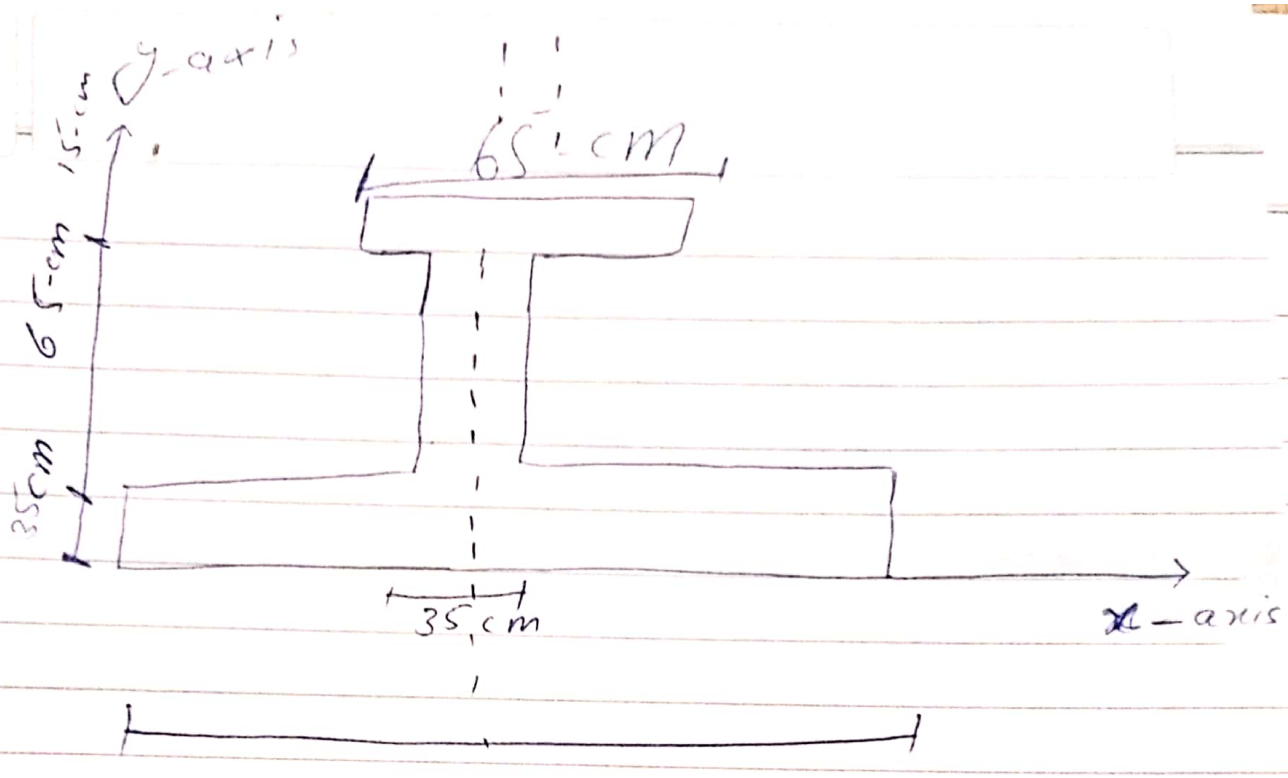
$$M_{12} = \frac{16.197 \times 12 \times 12}{6}\left(1 - \frac{12^2}{12^2}\right)$$

$$\boxed{M_{12} = 0 \text{ KN-m}}$$

S.F.D & B.M.D :



Q No 4



90cm

To Find the Centeriod.

Solv

A_1	$3150cm^2$	X_1	45	Y_1	17.5
A_2	$2275cm^2$	X_2	45	Y_2	67.5
A_3	$975cm^2$	X_3	45	Y_3	107.5

$$\Sigma A = 6400cm^2$$

$$x_c = \frac{A_1x_1 + A_2x_2 + A_3x_3}{A_1 + A_2 + A_3}$$

$$= \frac{3150(45) + 2275(45) + 975(45)}{6400}$$

$$\boxed{x_c = 45\,cm}$$

$$Y_c = \frac{A_1 Y_1 + A_2 Y_2 + A_3 Y_3}{A_1 + A_2 + A_3}$$

$$= \frac{(3150)(17.5) + 2275(67.5)(45) + 975(45}{6400}$$

$$\boxed{Y_c = 48.984375\,cm}$$

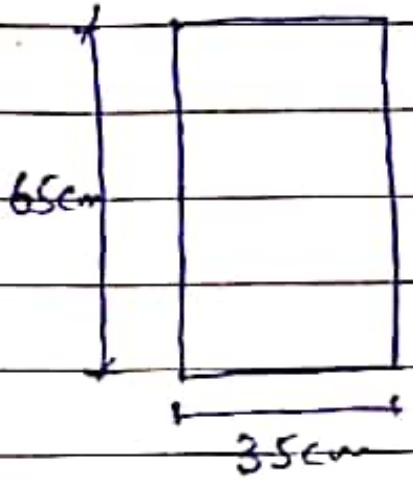
(2) NO 4(b) :

Solv:-

Moment of Inertia:

For Rectangular Section:

$A = 65 \times 35 = 2275\ cm^2$



$$I_y = \frac{bh^3}{12} = \frac{35 \times 65^3}{12}$$

$$I_y = 800989.58\ cm^4$$

$$I_x = \frac{b^3 h}{12} = \frac{35^3 \times 65}{12}$$

$$I_x = 232239.59\ cm^4$$

Date: _____

Radius of Gyration:-

$$r_y = \sqrt{\frac{800989.58}{2275}}$$

$$\boxed{r_y = 18.76 \text{ cm}}$$

$$r_x = \sqrt{\frac{232239.59}{2275}}$$

$$\boxed{r_x = 10.10 \text{ cm}}$$

Section Moduli:-

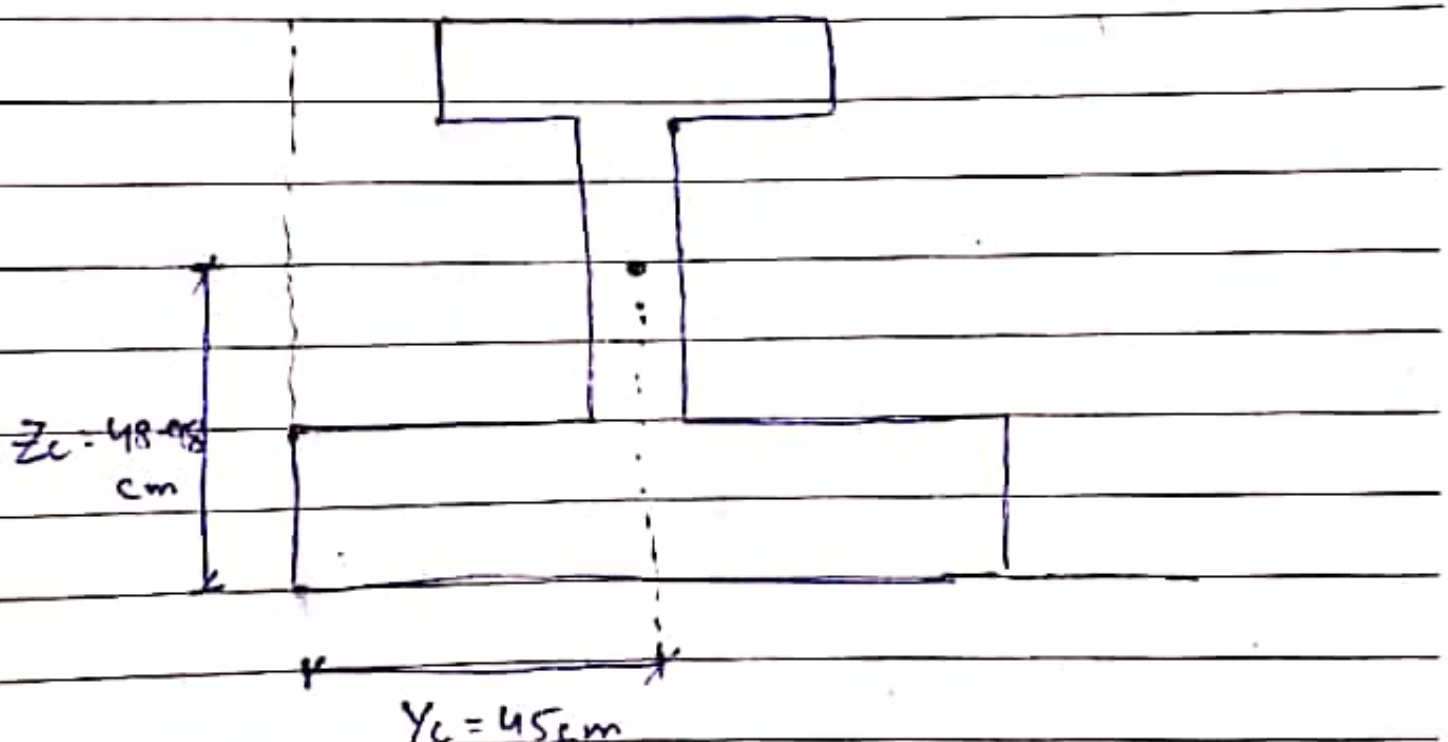
$z_1 = 107.5$ cm

$z_2 = 67.5$ cm

$z_3 = 17.5$ cm

$$z_c = \frac{975(107.5) + 2275(67.5) + 3150(17.5)}{6400}$$

$$z_c = \frac{313500}{6400} = 48.98 \text{ cm}$$



Q#10:5

Work Def:

The product of force & displacment is called work"

- Explation :- A force is said to be position work when the applied force has a component in the direction of the displacment of the point of application & a force does negtive work if the force component opposite to the direction of displacement at the point of application of the force.
- Example:- When a ball is hald above the ground & then dropped, the work done by the gravitional force on the ball as it falls is equal to the height of the ball (force) multiply by the distance to the ground (displacement) When the force (F) is constant & the angle between the force & displacement (s) = Q

Then the work done is given by

$$W = Fs\cos Q$$

=> The SI unit of work is Joul (J)

2 Energy :-

Def:- The ability of a body to do work.

OR

"The capacity for doing work"

- Explanation:- It may exist in potential Thermal, Electrical, chemical nuclear or in other various forms i.e Energy in the process of transfer from one body to other
- Example :- Light energy, heat energy, mechanical energy, gravitational energy chemical energy.

-> We divide our energy use among four concentric sectors, residential, commerical, transportation & industrial heating & cooling our home lighting offices, building, driving & manufacturing the products that we really use in our daily lives are function that require Energy.

-> The SI unit of energy is Joul (J)

3) Power Def:- The rate of doing work

- Explanation:- It is the work done in unit time

-> Some time the power of motor which & other machine are given in term of horsepower (hp)

Which is approximately equal to 745.7 Watts

. Example.

=> Power is the Strength needed to run five miles

=> Power is the authority a local government has to collect taxes.

=> The SI unit of power is watt (W) which is (J/s).