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SECTION: A
SUBMITTED TO: Sir Majid
2nd Semester
Civil Engineering.

QUESTION:- 05 Explain work, energy and Power .. .. ?

ANSWER:

→ WORK:- Measure of energy transfer that occures when an object is moved over a distance by an external force at least Part of which is applied in the direction of displacement.

The standard unit of work is the joule (J), equivalent to a newton-meter (N.m).

→ **FORMULA FOR WORK:**

Work = Force x Distance x Cosine

$W = F \times d \times \cos\theta$

→ **DERIVATION OF WORK FORMULA:**

W = work done.

F = the force which we express in Newton.

d = distance that object covers.

Cosθ = refers to the angle amidst the force and movement distance

→ **EXAMPLE:-**

The force you applied and the distance you apply must be in the same direction.

* Pushing a car horizontally from rest.
* Shooting a bullet.
* Walking up stairs.

→ ENERGY :-

Physicists, who are scientists who study force, motion and energy, say that energy is the ability to do work, and work is moving something against a force, like gravity.

These are alot of different kinds of energy in the universe and that energy can do different things.

→ TYPES OF ENERGY :-

- → Mechanical Energy
- → Thermal Energy
- → Nuclear Energy
- → Chemical Energy
- → Electromagnetic Energy
- → Sonic Energy
- → Gravitational Energy
- → kinetic Energy
- → Potential Energy
- → Ionization Energy

EXAMPLE :-

Sunlight allows plants to grow and produce food. More, directly however, solar power is a growing part of the renewable energy scene.

→ UNIT :-

Energy = Power x Time

The unit of energy is joule,

⇒ POWER :- We can define Power as "the rate of doing work, it is the work done in unit time.

S.I unit :-

The S.I unit of Power is "watt (W)" which is joules per second (J/s). Sometimes the powers of motor vehicles and other machines are given in terms of Horsepower (hp), which is approximately equal to 745.7 W.

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

$$\text{Power} = \frac{\text{Force} \cdot \text{Displacement}}{\text{Time}}$$

$$\text{Power} = \text{Force} \times \text{Velocity}.$$

⇒ EXAMPLE:-

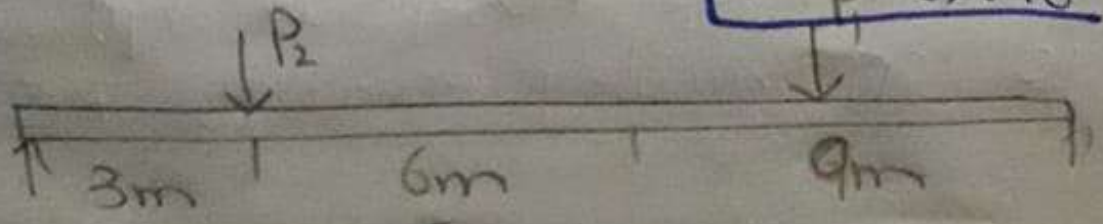
→ The Tax office Vs anyone.
→ Casting directors Vs actors.
→ Primary School Teacher Vs students

QUESTION:- 01.

Find the support reactions, show.. .. ?

P_2 (500 + Stud id)
P_2 (500 + 16098)
$P_2 = 16598$

P_1 (200 + Stud id)
P_1 (200 + 16098)
$P_1 = 16,298$



Pg:06

$R_1 + R_2 = 32896$

$-R_2 \times 18 - 16,298 \times 9 - 16598 \times 3 = 0$

$-18R_2 - 146682 - 49794 = 0$

$-18R_2 + 196476 = 0$

$$\frac{196476}{18} = \frac{18R_2}{18}$$

$$\boxed{R_2 = 10915.3}$$

$R_1 + 10915.3 = 32896$

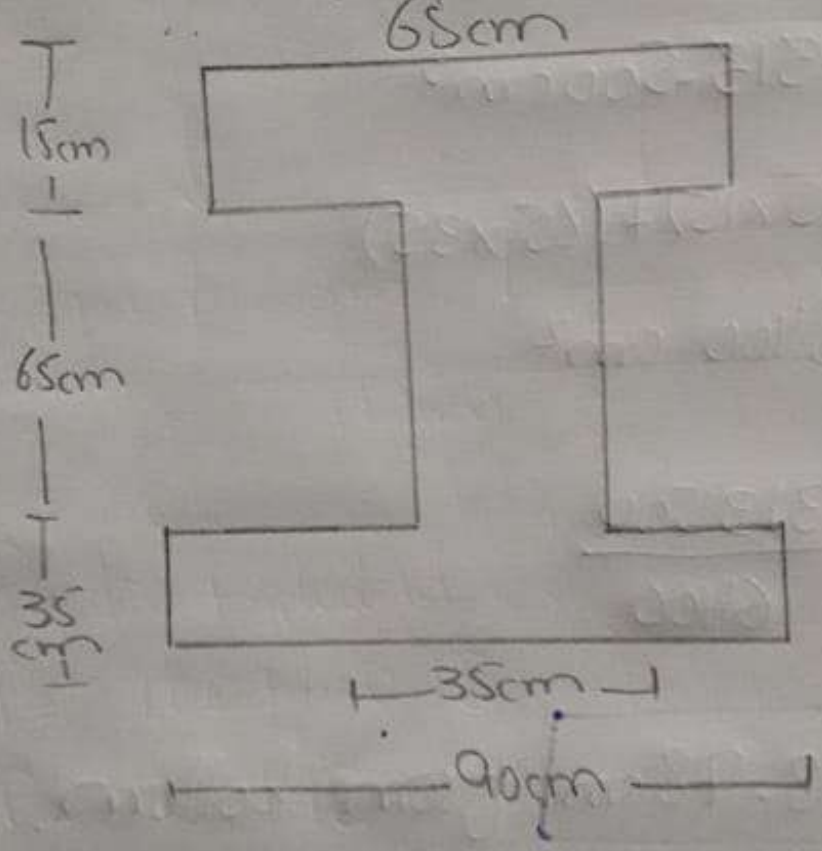
$R_1 = 32896 - 10915.3$

$$\boxed{R_1 = -21980.7}$$

Question:- 04

Find the centroid of the given shape.. .. .. ..?

Solution:-



$(15 \times 65)(35+65+7.5)+(65 \times 35)(35+32.5)$
$+(35 \times 90)(17.5) = A_T(\bar{x})$

$A_T(\bar{x}) = 104812.5 + 153562.5 +$
55125

Pg#08

$A_T(\bar{x}) = 313{,}500 cm^3$

$A_T = (65 \times 15) + (65 \times 35)$

$A_T = 6{,}400\ cm^2$

$\bar{x} = \frac{313500}{6400}$

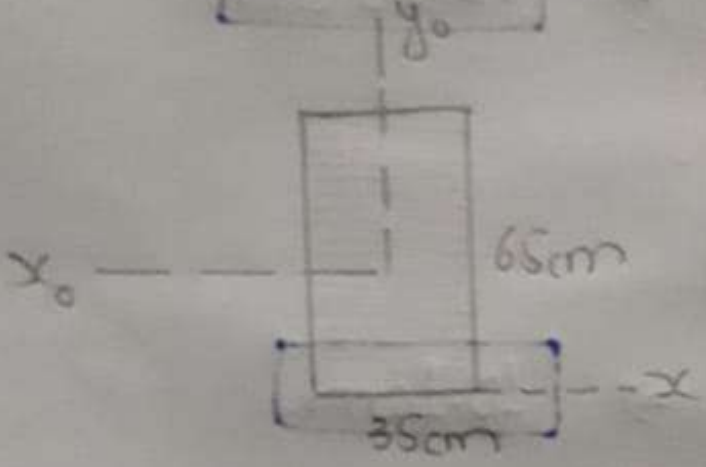
$\bar{x} = 48.98 cm$ from bottom.

Pg #09:

QUESTION:-04:: Part (b)

⇒ SOLUTION:-

Moment of intesia for (65cm×35cm)



$$I = \frac{bh^3}{12}$$

(Putting Values):-

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

$$I = 800,989.58\ cm^4$$

Now;

→ Radius Of Gyration:-

$$x_o = \frac{h}{\sqrt{12}}$$

$$\Rightarrow \frac{65}{\sqrt{12}} \Rightarrow \boxed{18.76\,cm}$$

$$\gamma_y = \frac{b}{\sqrt{12}}$$

$$= \frac{35}{\sqrt{12}} \Rightarrow \boxed{10.1\,cm}$$

$$\gamma_x = \frac{h}{\sqrt{3}}$$

$$= \frac{65}{\sqrt{3}} \Rightarrow \boxed{37.5\,cm}$$

⇒ Section Modulus:-

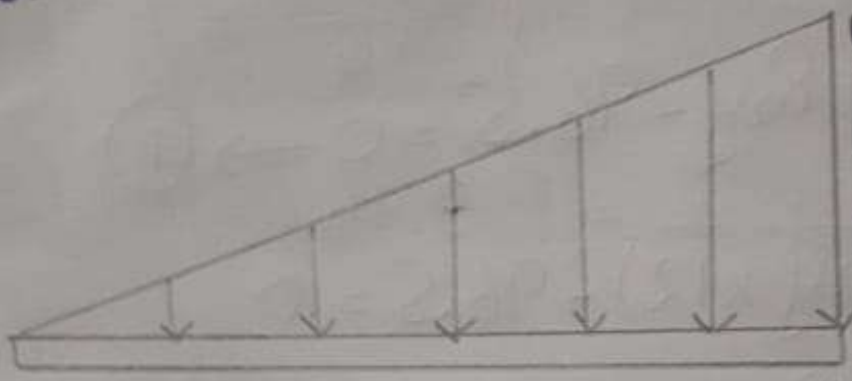
$$S = \frac{bh^2}{6}$$

$$S = \frac{3.5 \times 65^2}{6} \Rightarrow \boxed{S = 2464.5.83\,cm^3}$$

QUESTION:- 03

Draw neat ... ... ?

=> Solution:-



UVL =>

Resultant for UVL :-

$$P = \frac{(16.098 \times 12)}{2}$$

$$P = \frac{193.176}{2}$$

$$P = 96.5 \text{ KN/m}$$

Pg#12

distance from low side $\left(\frac{2}{3} \times 12\right) = 8m$

distance from high side $\left(\frac{1}{3} \times 12\right) = 4m$

$R_{1x} = 0$

$R_{1y} + R_{2y} - 96.5 = 0 \rightarrow (1)$

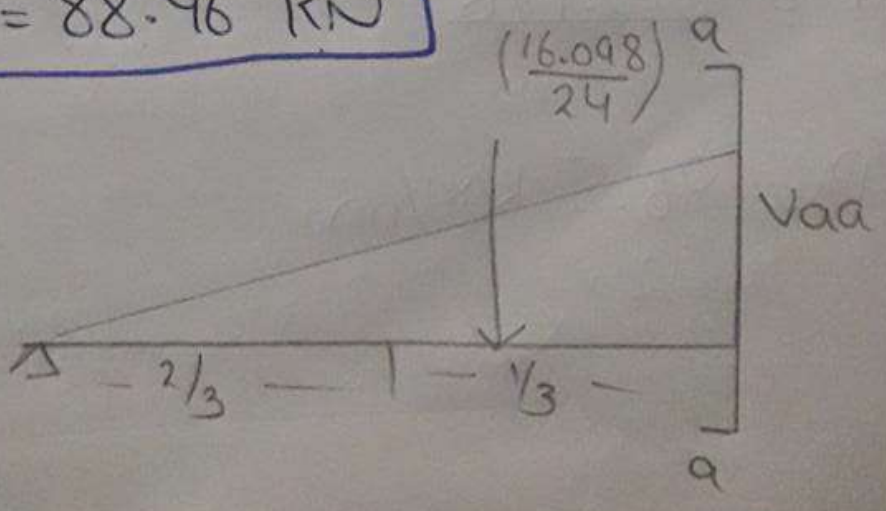
$(R_{2y} \times 12) - 96.5 = 0$

$\frac{12 R_{2y}}{12} = \frac{96.5}{12}$

$\boxed{R_{2y} = 8.04\ kN}$ Put in eq(i)

$R_{1y} + 8.04 - 96.5 = 0$

$\boxed{R_{1y} = 88.46\ kN}$



from law of Similar triangles;

$$\frac{16.098}{12} = \frac{w_o \text{ kN/m}}{x}$$

$$w_o = \left[\frac{16.098}{12}\right] \text{kN/m}$$

Resultant $P = [w_o \times x]/2$

$$P = \frac{16.098}{24}$$

Now;

$$-V_{aa} - \left(\frac{16.098}{24} x^2\right) + 88.46 = 0$$

$$V_{aa} = 88.46 - \left(\frac{16.098}{24} x^2\right) \rightarrow (1)$$

at $x = 0$,

$$\boxed{V_{aa} = 88.46 \text{ kN}}$$

at

$x = 12$,

$$V_{aa} = 88.46 - \left(\frac{16.098 (12)^2}{24}\right)$$

Pg#14

$V_{aa} = -8.04$ KN

To find at which point shear = 0

eq(1) = 0

$$0 = 88.46 - \left(\frac{16.098}{24} x^2\right)$$

$$\frac{16.098}{24} x^2 = 88.46$$

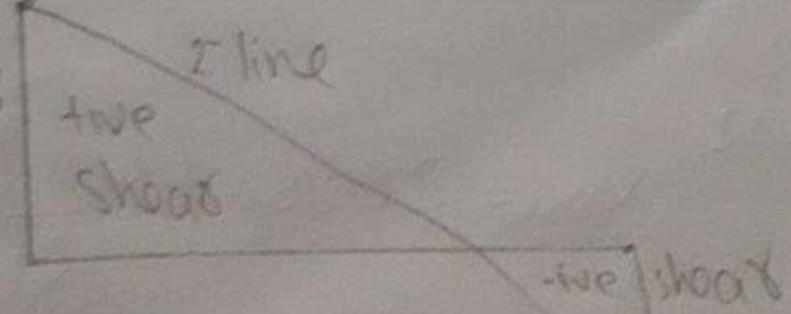
$$x^2 = \frac{2123.04}{16.098}$$

$$\sqrt{x^2} = \sqrt{131.8}$$

$x = 11.48$ at this point

$V_{aa} = 0$

→ Shear Force diagram:-

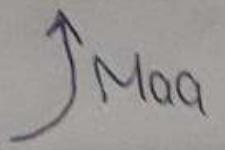


Pg #15

Now;

for bending moments

$R_{1x} = 0$, $R_{1y} = 88.46$, $R_{2y} = 8.04$



$$Maa + P(x/3) - 88.46x = 0$$

$$Maa = -\left(\frac{x}{3}\right)P + 88.46x$$

$$Maa = -\frac{16.098}{72} + 88.46x$$

at

$x = 0$ $\quad Maa = 0$ KN/m

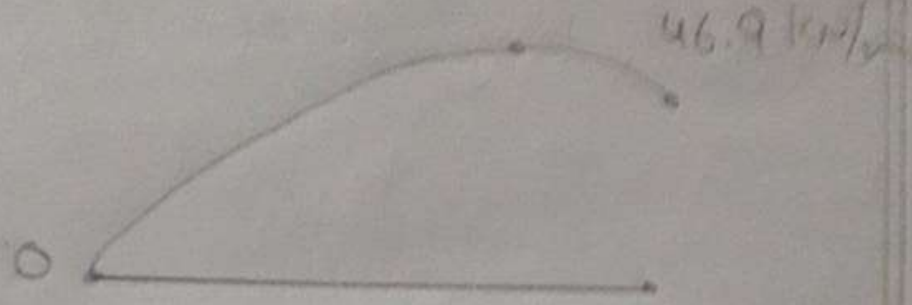
at $x = 12$,

$$Maa = -\frac{16.098(12)^3}{72} + 88.46(12)$$

$$Maa = \frac{2318.11 + 1,061.52}{72}$$

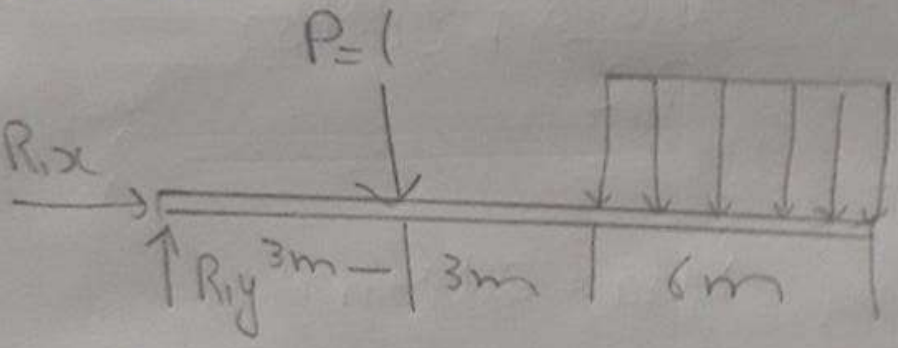
$$Maa = \frac{3,379.63}{72} \Rightarrow 46.9 \text{ KN/m}$$

→ BENDING DIAGRAM:-



QUESTION:- 02

SOLUTION:-



UDL Resultant $P = (100 + 16098 \times 6)$

$= (16198 \times 6)$

$= (97,188)$ acts at centre

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

$R_{1y} + R_{2y} - 16198 - 97,188 = 0 \rightarrow (1)$

$(R_{2y} \times 12) - (16198 \times 3) - (97,188 \times 9)$

$12R_{2y} - 48,594 - 874,692$

$12R_{2y} - 826,098 = 0$

$\frac{12R_{2y}}{12} = \frac{826,098}{12}$

$\boxed{R_{2y} = 68,841.5}$ Put in eq (1)

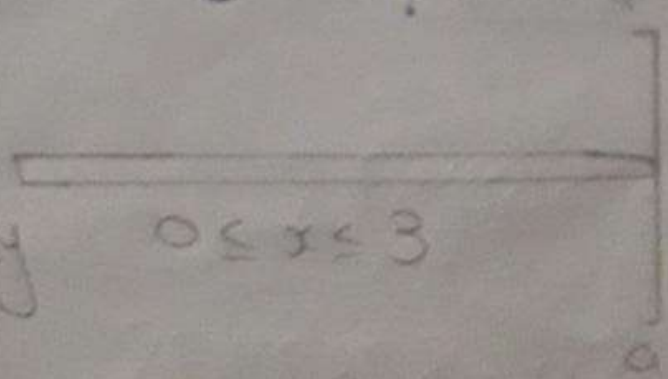
$R_{1y} + 68,841.5 - 16198 - 97188 = 0$

$R_{1y} + 52,643.5 - 97188 = 0$

$R_{1y} - 44,544.5 = 0$

$\boxed{R_{1y} = 44,544.5}$

Now finding Shear values;



Pg H.18

$-V_{aa} + 36486.75 = 0$

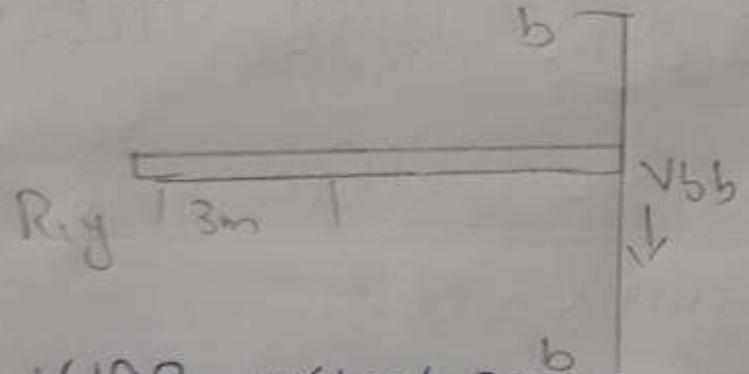
$V_{aa} = 36486.75 \rightarrow (1)$

at

$x = 0$ $\boxed{V_{aa} = 36486.75}$

at $x = 3$,

$\boxed{V_{aa} = 36486.75}$



$-V_{bb} - 16198 + 36486.75 = 0$

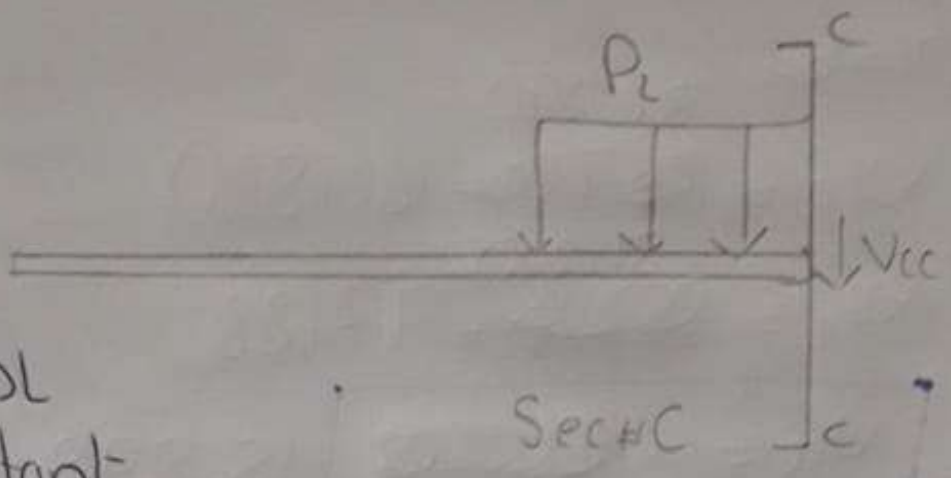
$-V_{bb} + 52684.75 = 0$

$\boxed{V_{bb} = 52684.75}$

at $x = 3$, $\underline{V_{bb} = 52684.75}$

at $x = 6$ $\underline{V_{bb} = 52684.75}$

Now;



UDL

Resultant

$P_2 = (16.248(x-6))$

$-V_{cc} - 16248x + 97488 - 16198 = 0$

~~$-V_{cc} - 129,634$~~

$-V_{cc} + 80940 - 16198x = 0$

$-V_{cc} + 64742$

$V_{cc} = 64742$

$V_{cc} =$

$V_{cc} = 81,290 - 16198x$

81,290

Pg H20

at; $x = 6$,

$$V_{cc} = 81{,}290 - 16198(6)$$

$$V_{cc} = 81{,}290 - 97188$$

$$\boxed{V_{cc} = -15{,}898}$$

at $x = 12$;

$$V_{cc} = 81{,}290 - 16198(12)$$

$$V_{cc} = 81{,}290 - 194376$$

$$\boxed{V_{cc} = -113{,}086}$$

Now to find shear point o eq(3) = 0

$$16198 - 16248x$$

$$\frac{16248x}{16248} = \frac{16198}{16248}$$

$$\boxed{x = 0.99} \text{ at } V_{cc} = 0$$

Shear force diag,