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ID = 16319

section = "B"

Dep = civil

Examination = final

Subject = "Mechanics"

Q1:

Given data

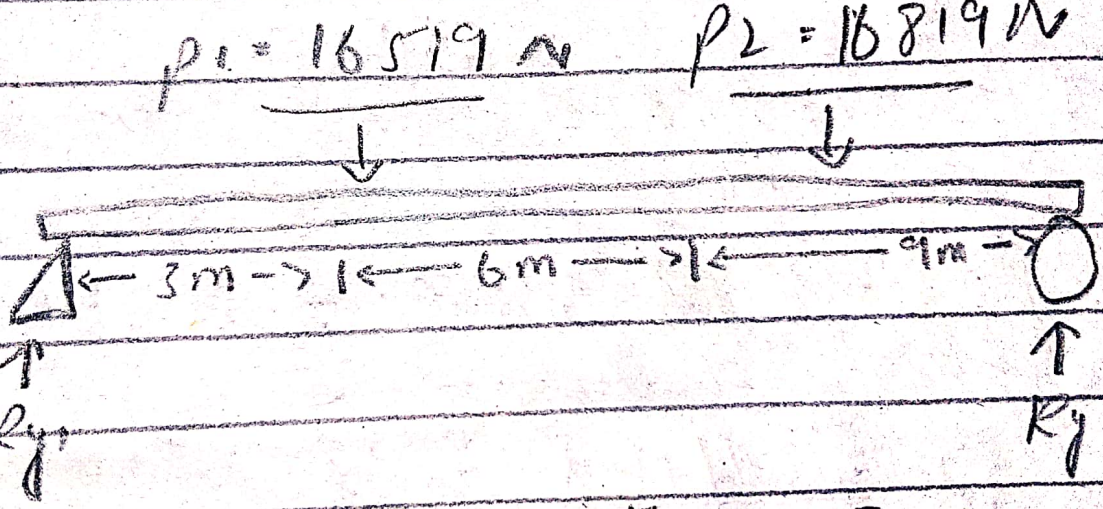
$P_1 = 200 + 16319$

$= 16519\ N$

$P_2 = 500 + 16319$

$= 18819\ N$

Sol:-



R_y Θ $F_y = 0$

$$R_{y1} + R_{y2} - 16519 - 18819 = 0$$

$$\boxed{R_{y1} + R_{y2} = 33,338\ N} \quad - (A)$$

now

$$R_{y1} = \frac{[(16819 \times 9) + (16819 \times 15)]}{18}$$

(2)

$$Ry_1 = \frac{(151.371 + 247.785)}{18}$$

$$\boxed{Ry_1 = 22175.3\,N} \rightarrow (2)$$

Now

put eq (2) in eq (A) we have

$$22175.3N + Ry_2 = 33,338\,N$$

$$Ry_2 = 33,338\,N - 22175.3\,N$$

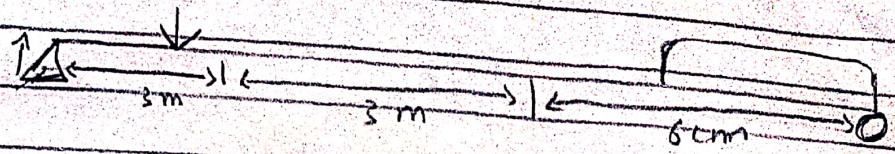
$$\boxed{Ry_2 = 11162.7\,N}$$

SO

$\uparrow$ $Ry_1 = 22175.3N$

$\uparrow$ $Ry_2 = 1162.7N$

Q No 02 :-

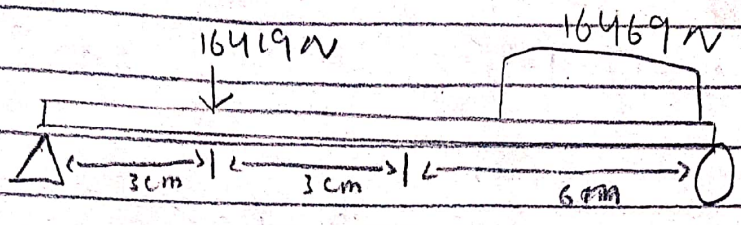


Sol:-

Given data

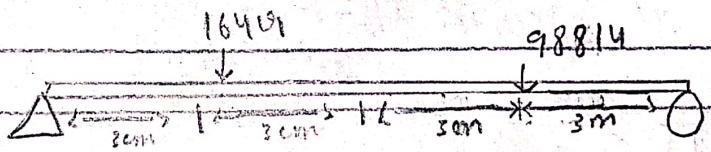
$P_1 = 100 + 16319 = 16419$

$P_2 = 150 + 16319 = 16469$



UDL Resultant = 16469 x 6

= 98,814 will be at centre of UDL



where $R_M \Rightarrow 0$

$R_{y1} + R_{y2} - 16419 - 98814 = 0$

$\boxed{R_{y1} + R_{y2} = 115,233\ N}$ -> eq (ii)

$R_{y1} = \frac{[(98814 \times 3) + (16419)]}{12}$

$= \frac{(296,442 + 147,771)}{12}$

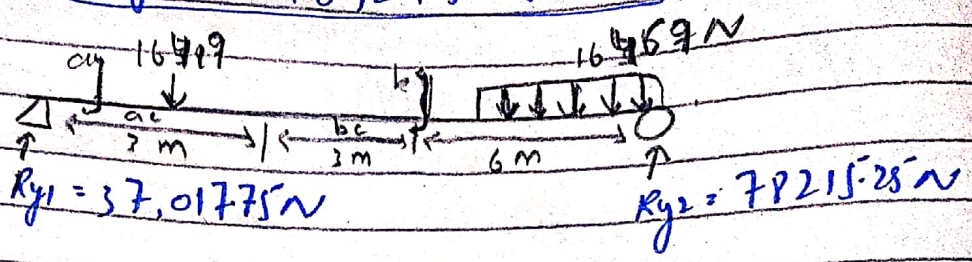
$= \frac{444,213}{12} \Rightarrow \boxed{R_{y1} = 37,017.75\ N}$ -> (i)

=> Putting eq(1) in eq (A)

$37,017.75N + R_{y2} = 115233N$

$R_{y2} = 115233N - 37017.75N$

$$\boxed{R_{y2} = 78,215.25\ N}$$

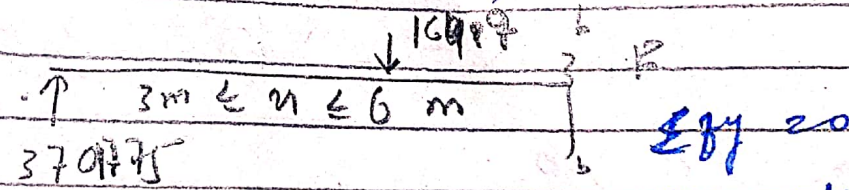


Of section (a-a)

Now at $x = 0m$ => $+37,017.75N$

Where at $x = 3m$ => $37017.75N$

Now at section (b-b)



$\Sigma F_y = 0$

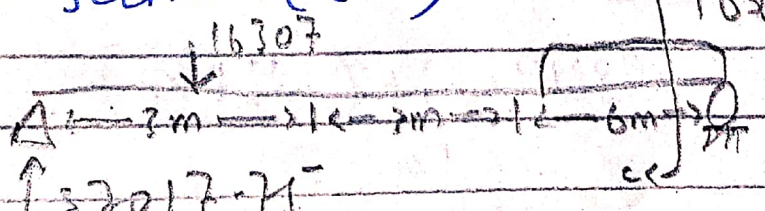
$\Rightarrow F_b = 16919 + 37,017.75N$

$= 20598.15$

at $x = 3m = 20598.15$

at $x = 6m = 20598.15$

Now at section (c-c)



$6m = 20598.15$

Where at 12m.

$-F_{CC} \Rightarrow -P_2 - P_1 + 37017.75$

$\Rightarrow -16419 - 98814 + 37017.75$

Sorry sir ←

$= -115233 + 37017.75$

$\Rightarrow \boxed{= -78215.25\ N}$

Now at

0m = 37017.75 N

3m = 37017.75 N

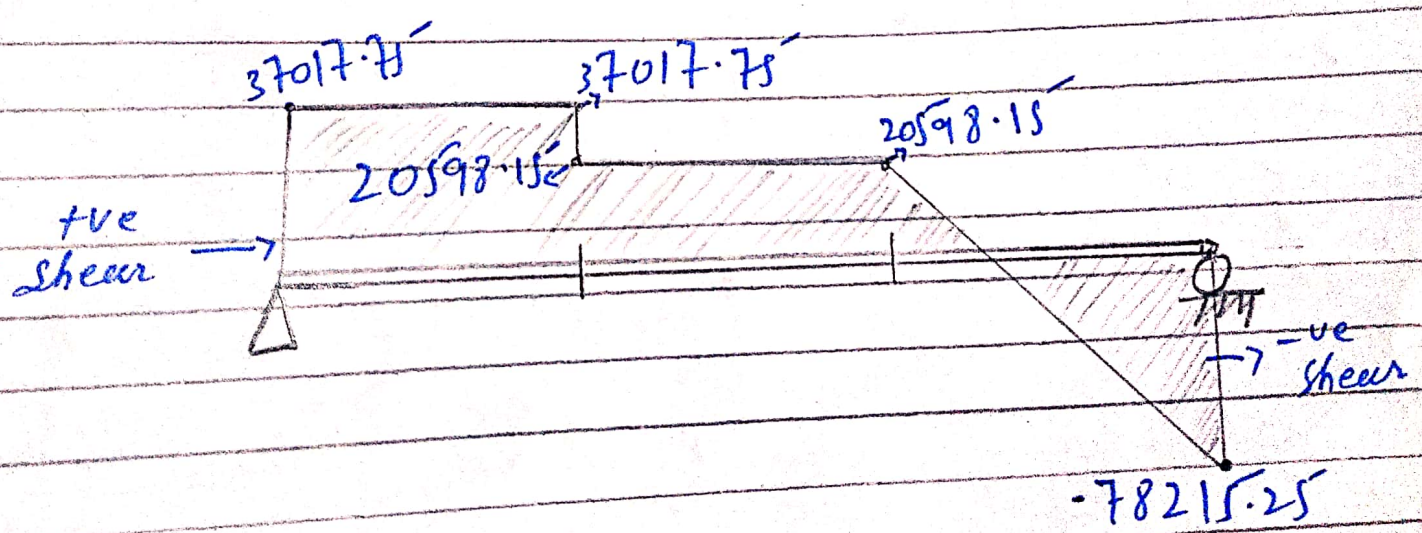
3m = 20598.15 N

6m = 20598.15 N

6m = 2059.15 N

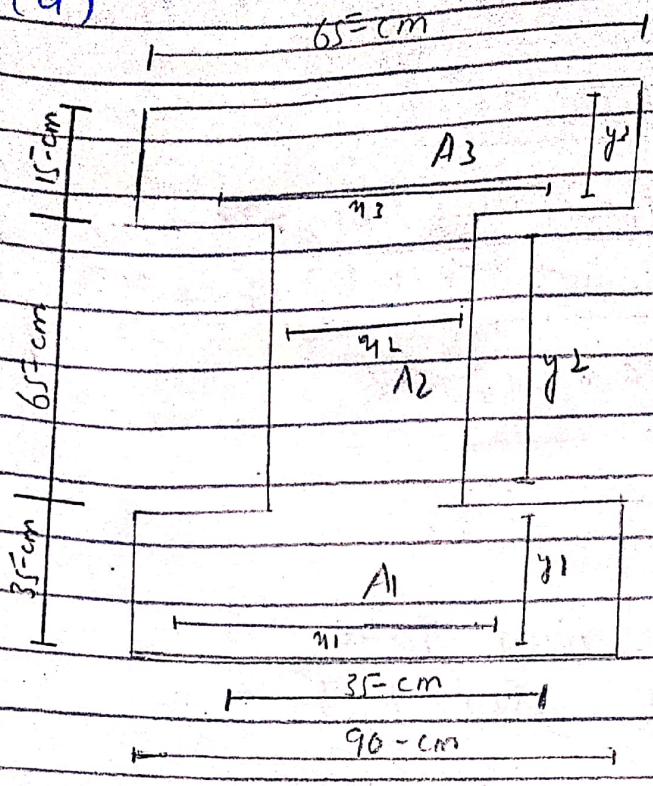
12m = -78215.25 N

Diagram :-



Q4:-

Sol:- part (a)



A_1	$3150\ cm^2$	$x_1 = 45cm$	$y_1 = 17.5$
A_2	$2275\ cm^2$	$x_2 = 45cm$	$y_2 = 50$
A_3	$975\ cm^2$	$x_3 = 45cm$	$y_3 = 107.5$
ΣA	$6400\ cm^2$		

$$x_c = \frac{A_1 x_1 + A_2 x_2 + A_3 x_3}{A_1 + A_2 + A_3}$$

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

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

$$\boxed{x_c = 45}$$

$$y_c = \frac{(3150)(17.5) + (2275)(50) + (975)(10.75)}{3150 + 2275 + 975}$$

$$\boxed{y_c = 42.76}$$

Part (b):-

Given data

area = 65cm × 35cm

Required

moment of intertia = ?

Radius of Gyration = ?

Section of moduli = ?

for

moment of inertia =

$$I_x = \frac{1}{3}bh^3$$

$$= \frac{1}{3}(65)(35)^3$$

$$= \frac{1}{3}(65)(35)^3$$

$$= 928958\ mm^4$$

$$\Rightarrow I_y = \frac{1}{3}b^3h$$

$$= \frac{1}{3}(65)^3(35)$$

$$= 3203958\ mm^4$$

=> $\bar{I}_x = \frac{1}{12} bh^3$

$\bar{I}_x = \frac{1}{12} (65)(35)^3$

$= 6635.41 \text{ mm}^4$

$\bar{I}_y = \frac{1}{12} b^3 h$

$= \frac{1}{12} (65)^3 (35)$

$= 800989 \text{ mm}^4$

=> $\bar{J}_c = \frac{1}{12} bh (b^2 + h^2)$

$= \frac{1}{12} (65)(35)((65)^2 + (35)^2)$

$= 1033229.16 \text{ mm}^4$.

(b) Radius of gyration

$r = \left(\frac{I}{A}\right)^{1/2}$

$A = bxd$

$A = 65 \times 35$

$= 2275$

$r = \left(\frac{1033229.16}{2275}\right)^{1/2}$

$r = 21.31 \text{ mm}$

(c) section module

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

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

$S = 13270.83 \text{ mm}^2$

Q5

Ans:- **Work:**

When a force acts upon an object to cause a displacement of the object. it is said that work was done upon the object. There are three key ingredients to work i.e force, displacement and cause. In order for a force to qualify as having done work on an object, there must be a displacement and the force must cause the displacement.
Work is a scalar quantity.

Work equation:-

Mathematically work can be expressed by the following equation

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

where "F" is the force, "d" is displacement and "θ" is the angle b/w the force and displacement vector. The S.I unit of work is Joule.

Examples:-

There are several good examples of work that can be observed in daily life:-

(1) a weightlifter lifting a barbell above his head.

(2) an olympian launching the shot-put.

(3) a man pulling a grocery cart down the aisle of a grocery store.

Energy:- The capacity for doing work is called energy.

It may exist in potential, kinetic, thermal, electrical chemical, nuclear or other various forms.

All forms of energy are associated with motion. e.g:- any given body has kinetic energy if it is in motion. A tensioned device such as a bow or spring though at rest has the potential for creating motion. It contains potential energy because of its configuration.

The S.I unit of energy is Joule, which is the energy transferred to an object by the work of moving a distance of 1 meter against a force of 1 newton. energy is a vector quantity.

Examples:-

with out energy not work is possible Hence any work performed in our daily life is due to energy some of which are given below.

(1) Over seventy percent of petroleum use goes into the transport sector which is a good example of chemical energy in our daily life.

(2) The fans and bulbs or any other electrical equipment in our homes works due to electrical energy.

(3) Moving an object from one place to another is the example of kinetic energy. Stored energy in a spring is potential energy.

Power:-

Power is the amount of energy transfered or converted per-unit time. Power is the rate at which work is done. It is the work time ratio. Mathematically it is computed using the following equation

$$\text{power} = \text{work}/\text{time}$$

or

$$P = w/t$$

The standard metric unit of power is the "watt." As is implied by the equation for power. a unit of power is equalent to a unit of work divided by a unit of time thus a watt is equivalent to Joule/second.

power is a scaler quantity.

Examples:

As we have said that power is rate of doing work so every work in our daily life with its rate of doing is call example of power such as.

an electric motar having a power of 2 horsepower.

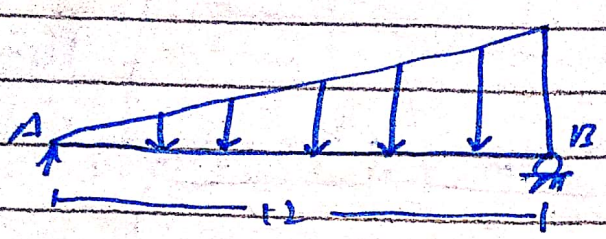
Another example can be a horse runing is doing work and the time taken by horse to do this work is said to be its power. etc.

Q3:-

Sol:-

$$UVL = \frac{16319}{1000}$$

$$= 16.319$$

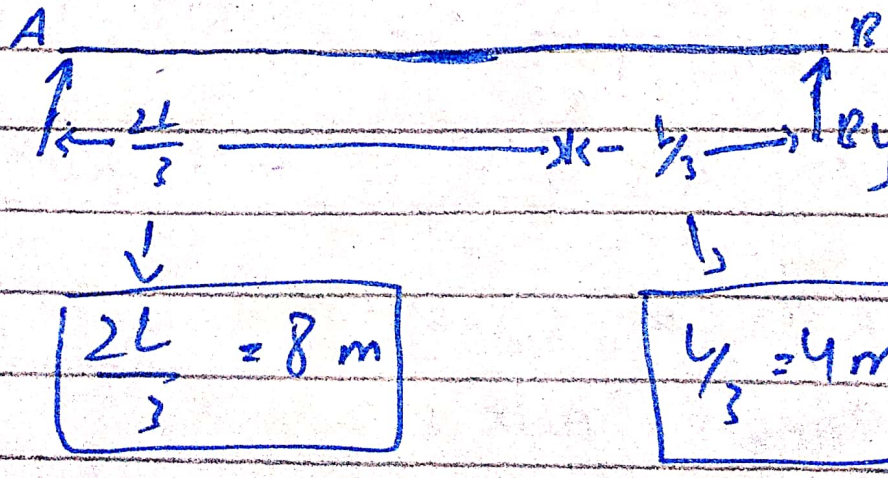


magnitude of point load = Area of UVL

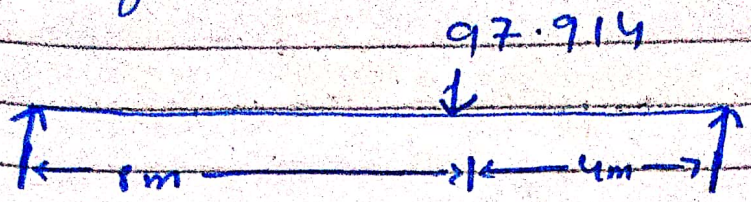
$$= \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 12 \times 16.319$$

$$= 97.914$$



Now find reactions



$\Sigma M_B = 0$

$A_y \times 12 - 97.914 \times 4 = 0$

$A_y \times 12 = 391.656$

$A_y = \frac{391.656}{12}$

$A_y = 32.638$

$\Sigma F_y = 0$

$A_y - 97.914 + B_y = 0$

$32.638 - 97.914 + B_y = 0$

$-65.278 + B_y = 0$

$B_y = +65.278$

$$\boxed{B_y = -65.78}$$

(3)