Date: __/__/__

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ID = 16139

Section = 'A'

Dept = BE(C)

Paper = Engineering Mechanics

Submitted To = Majid Naeem Sir

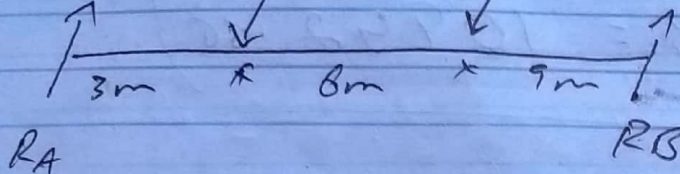
Date: __/__/__

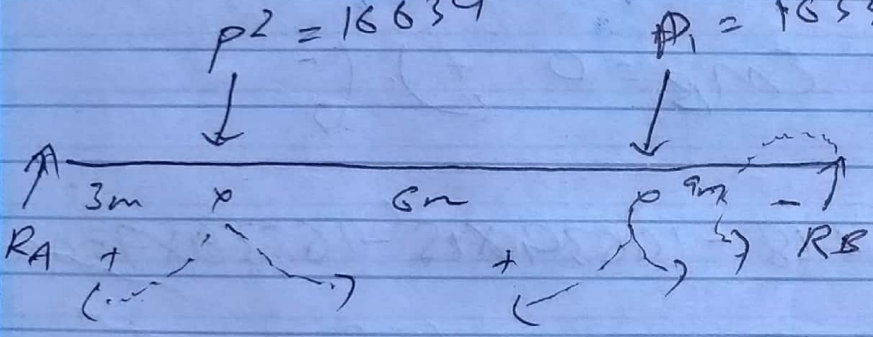
Q2: find the support reaction, show all your calculation

$P_2 = 200 + 5.1D$, $P_2 = 500 + 5.1D$

$P_2 = 500 + 16139 = 16639$

$P_1 = 200 + 16139 = 16339$





Reaction:

$R_A = ?$

$R_B = ?$

$\sum M_A = 0$

$R_A = ?$

$16639 \times 3 + 16339 \times 9 - R_B \times 18 = 0$

$$49917 + 14705\frac{1}{1} - R_B \times 18 = 0$$

$$196908 - R_B \times 18 = 0$$

$$\frac{18R_B}{18} = \frac{196908}{18}$$

$$\boxed{R_B = 10942.66}$$

$R_A = ?$

$$\Sigma M_B = 0 \quad (+)\ (-$$

$$R_A \times 18 - 16639 \times 15\frac{1}{1} - 16639 \times 9 = 0$$

$$18R_A - 249585\frac{1}{1} - 147051 = 0$$

$$18R_A = -102534 = 0$$

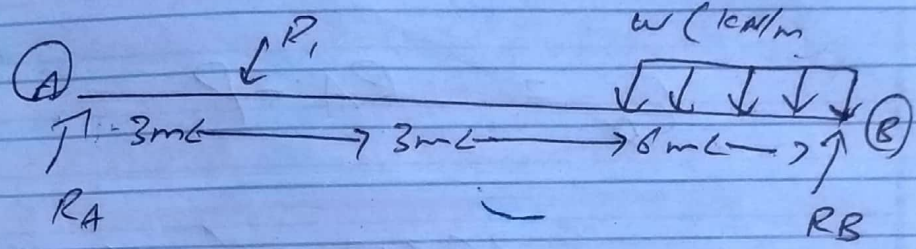
$$\frac{18R_A}{18} = \frac{102534}{18}$$

$$\boxed{R_A = 5696.33_{\downarrow}}$$

Q2.

$P = 16239\ kN$

$W = 16289\ kN/m$



$\Sigma M_A = 0$

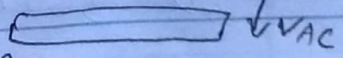
$$R_B = \frac{16239 \times 3 + 16289 \times 6 \times 9}{12}$$

$$R_B = 77,360.25\ kN$$

$$R_A = 36,612.75\ kN$$

Shear force:

In the section AC:



$V_{AC} = R_A$

$$V_{AC} = 36612.75\ kN$$

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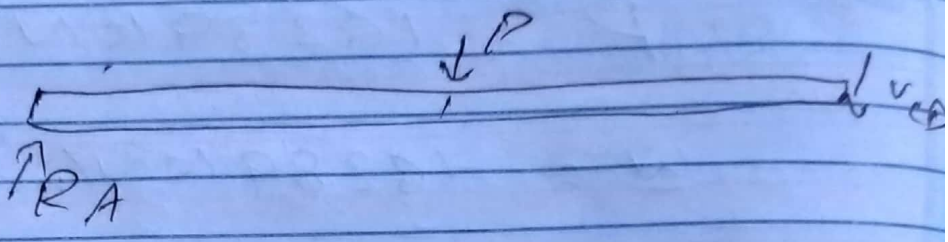
(4)

In the section CD

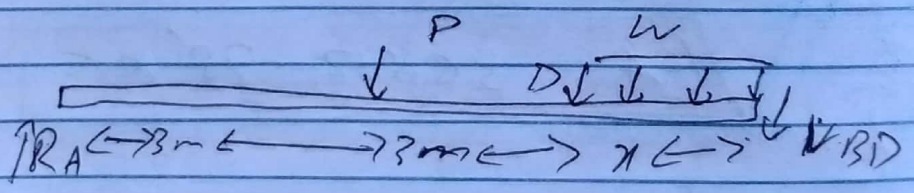


$$V_{CD} = RA - P$$

$$V_{CD} = 36612.75 - 16239$$

$$\boxed{V_{CD} = 20,373.75 \text{ lcN}}$$

In Section DB



$$V_{BD} = RA - P - Wx$$

$$V_{BD} = 36612.75 - 16239 - 16289x$$

$$V_{BD} = +16289x + 20373.75$$

at $x = 0$

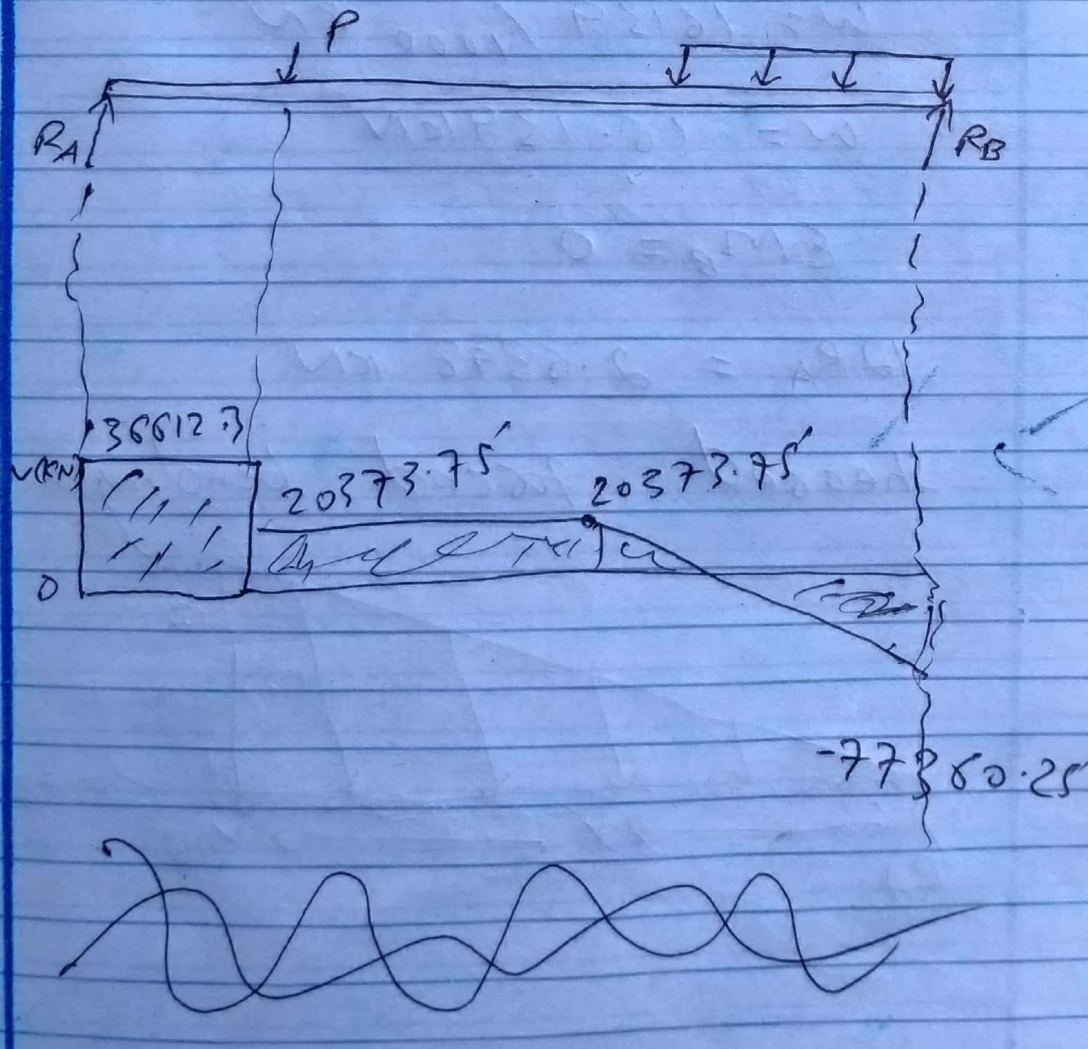
$V_0 = 20373.75 kN$

at $x = 6m$

$V_B = -16289(6) + 20373.75$

$V_B = -77,360.25$

Shear force diagram



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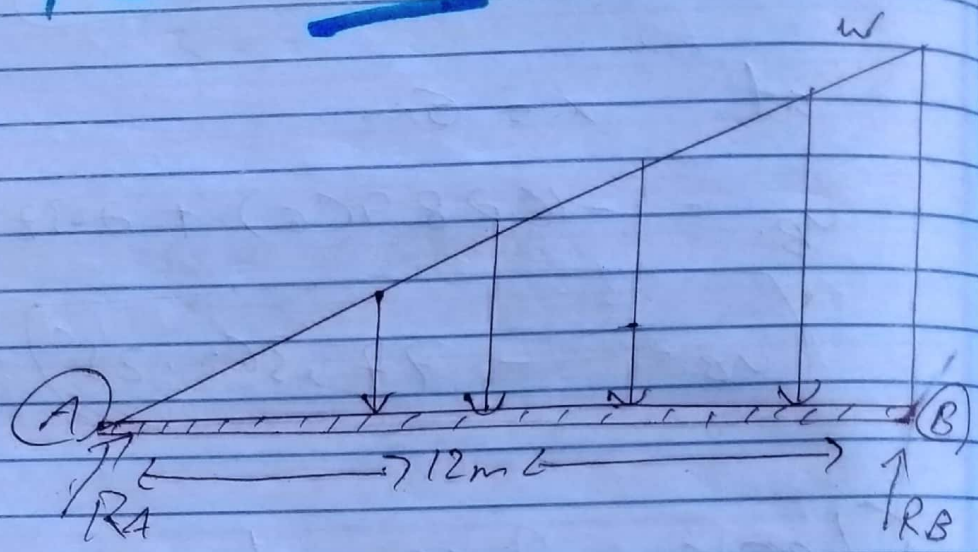
(6)

Q3 Q3



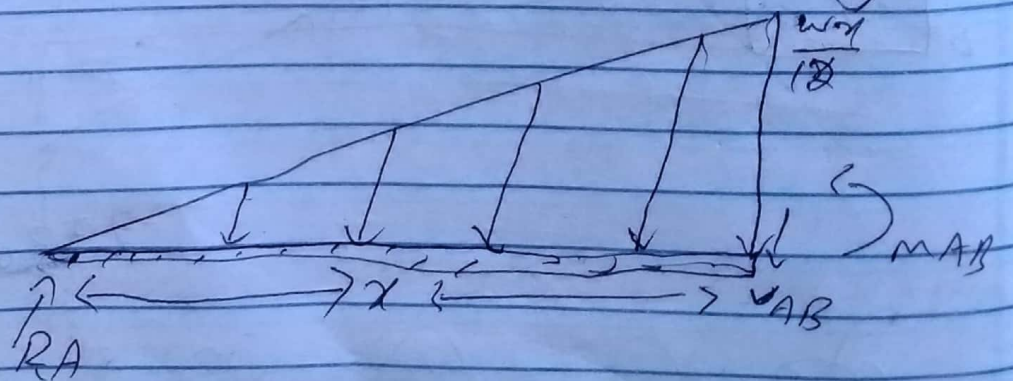
$W = 16189 / 1000$ KN

$W = 16.189$ KN

$\Sigma M_B = 0$

$12 R_A = 2.6898$ KN

Sheared forced bending mes



$$\Sigma f_y = 0$$

$$V_{AB} = R_A - \frac{wx}{12}(x)\left(\frac{1}{2}\right)$$

$$= 2.699 - \frac{16.139x^2}{24}$$

$$V_{AB} = 2.699 - 0.67x^2$$

at $x = 0$

$$V_A = 2.699 - 0.67(0)^2$$

$$\boxed{V_A = 2.699\ KN}$$

at $x = 12$

$$V_B = 2.699 - 0.67(12)^2$$

$$\boxed{V_B = -93.78\ KN}$$

Bending Moment

$$M_{AB} = (R_A)(x) - \frac{wx}{12}(x)\left(\frac{1}{2}\right)\left(\frac{x}{2}\right)$$

$$= (2.6898)(x) - \frac{16.139x^3}{72}$$

$$M_{AB} = 2.6898x - 0.224x^3$$

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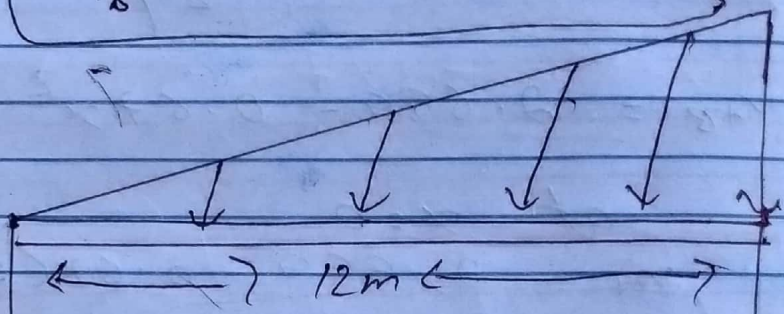
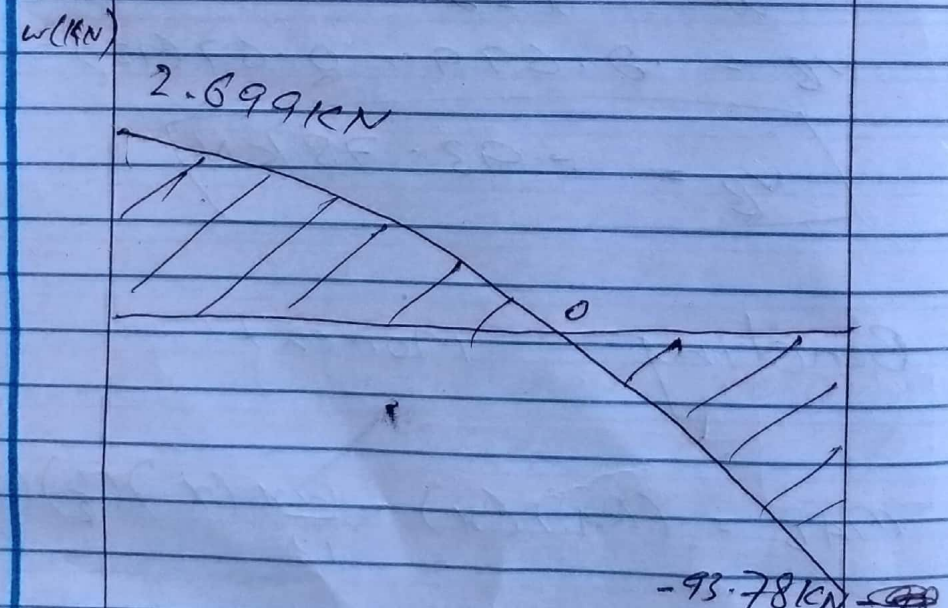
at $x = 0$

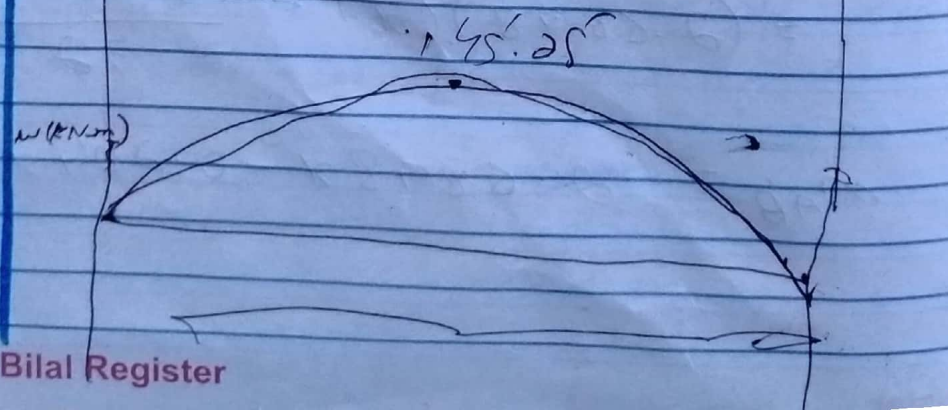
$M_{AB} = 0$

at $x = 12$

$M_B = 32.266 \text{ kN-m}$







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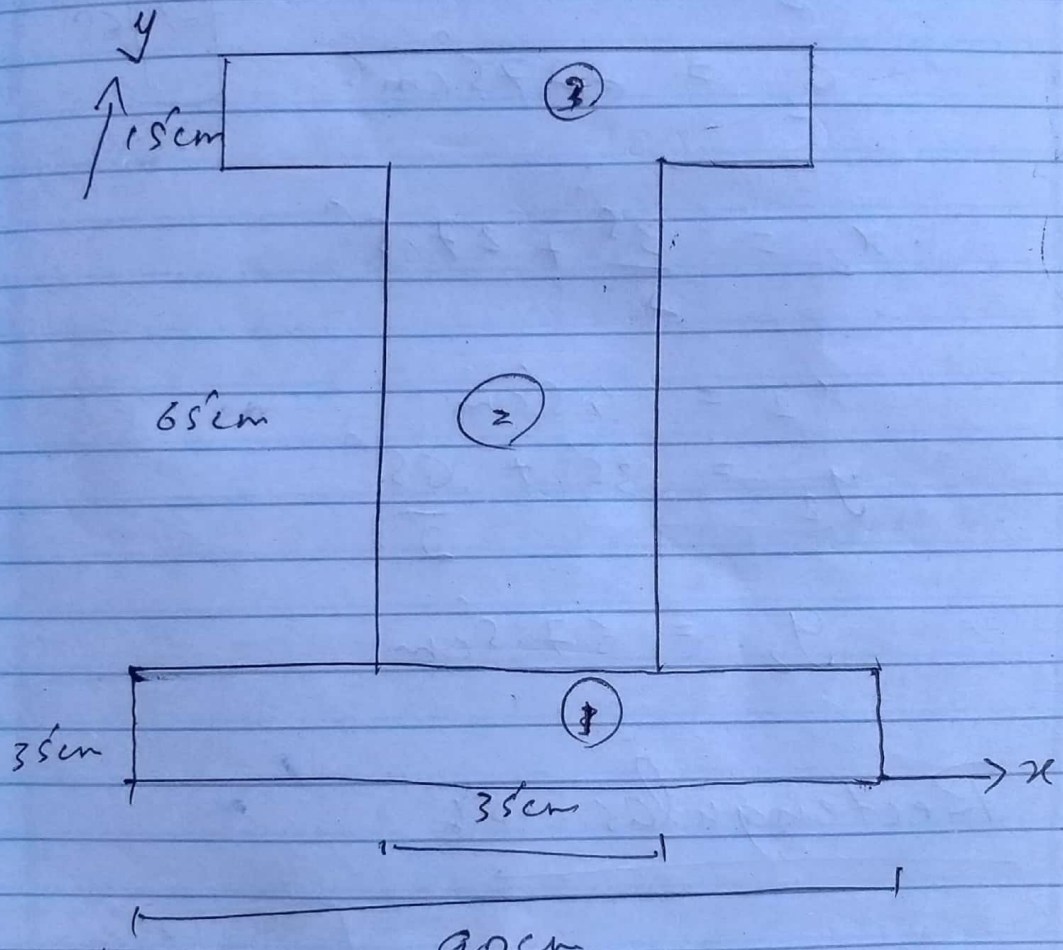
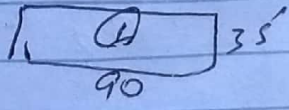
Q4 :- (a)

find the centroid of the shape, show all your calculations.



Solution:

Rectangular 1 :-



$$a_1 = 90 \times 35$$

$$a_2 = 3150 \text{ cm}^2$$

$$x_1 = \frac{90}{2} = 45 \text{ cm}$$

$$y_1 = \frac{35'}{2} = 17.5'cm$$

Rectengular (2) :-

$$a_2 = 65' \times 35'$$

$$a_2 = 2275' cm^2$$

$$x_2 = \frac{35'}{2} + 27.5'$$

$$x_2 = 45' cm$$

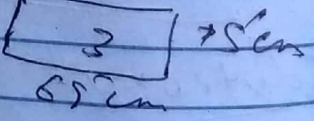
$$y_2 = 35' + \frac{65'}{2}$$

$$y_2 = 67.5' cm$$

Rectengular 3 :-

$$a_3 = 15' \times 65'$$

$$a_3 = 975' cm^2$$



$$x_3 = \frac{65'}{2} + 12.5'$$

$$x_3 = 45' cm$$

$$y_3 = 35' + 65' + \frac{15'}{2}$$

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$y_3 = 107.5'$ cm

Total area $= A = a_1 + a_2 + a_3$

$= 3150 + 2275 + 975$

$A = 6400\ cm^2$ ✓

$$\bar{x} = \frac{a_1 x_1 + a_2 x_2 + a_3 x_3}{A}$$

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

$\bar{x} = 45'$ cm

$$\bar{y} = \frac{a_1 y_1 + a_2 y_2 + a_3 y_3}{A}$$

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

$\bar{y} = 48.98$ cm.

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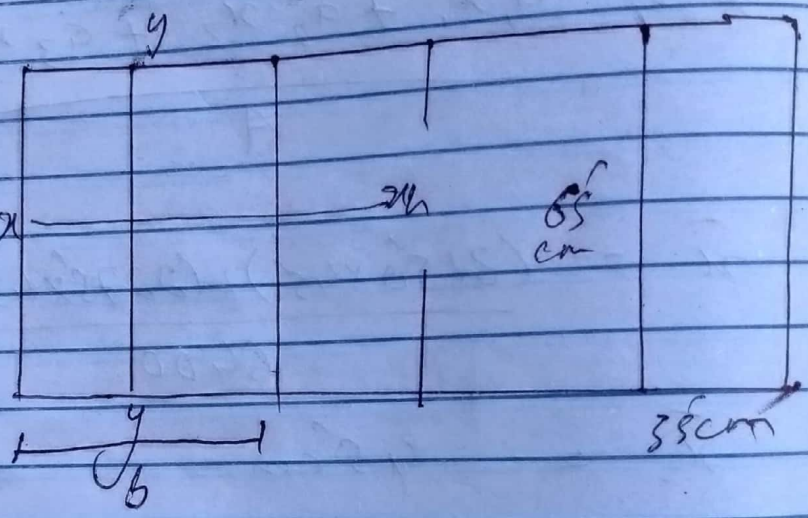
(4) (B) Past (B)

Find mid area (65cm x 35cm) only find the moment of inertia, Radius of Gyration and section moduli.



Area = b x d, h

A = 35 x 65

A = 2275 cm²

$$I_{x_0} = \frac{bd^3}{12}$$

$$I_{x_0} = \frac{35(65)^3}{12}$$

$$I_{x_0} = 800985.58 \text{ cm}^4$$

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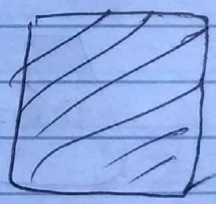
$$I_{y_0} = \frac{bd^3}{12}$$

$$I_{y_0} = \frac{6.5'(35')^3}{12}$$

$$I_{y_0} = 232239.58 cm^4$$

Radius of Gyration:-

formula of Radius of Gration



$$\gamma = \sqrt{\frac{I}{A}}$$

$\therefore h = d$

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

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

$$I = 800989.58 cm^4$$

$$Area = A = b \times h$$

$$A = 35' \times 65'$$

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$A = 35' \times 65'$

$A = 2275' cm^2$

Formula

$$\gamma = \sqrt{\frac{I}{A}}$$

$$\gamma = \sqrt{\frac{800989.58'}{2275'}}$$

$$\gamma = 18.763$$

Section modulus

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

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

$$S = 24645.83 cm^3$$

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Q1) Explain work, Energy and Power in details along with practical examples from daily life.

Ans:-

Work:-

In the physics, work is defined as a force causing the movement - or displacement - of an object. In the case of a constant force, work is a scalar product of the force acting on an object and the displacement caused by that force. Though both force and displacement are vector quantities, work has no direction due to the nature of a scalar product (or dot product) in vector methamatics. This definition is consistent with the proper definition because a constant force integrates to merely the product of the force and the distance.

Examples in Real life.

These are many examples in everyday life of work. few are given below.

① A horse is pulling a plow through the field; a father pushing a grocery cart down the aisle of a grocery store; ② a student lifting a backpack full of the books upon her shoulder ③ A weightlifter lifting a barbell above his head; and an olympian launching the shot-put.

In the general, for the work to occure, a force has to be exerted on an object causing it to move. So, a frustrated person pushing against a wall, only to exhaust himself, is not doing work because the wall does not move. But, a book falling off a table and

liting the ground would be considered work, at least in terms of physics, because a force acts on the book causing it to be displaced in downward direction.

Formula:-

$$\Rightarrow W = f \times d.$$

Energy:-

Energy is a word which tends to be used a lot in everyday life. Though it is often used quite loosely, it does have a very specific physical meaning.

Energy is a measurment of the ability of something to do work. It is not a material substance. Energy can be stored and

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and measured in many forms.

Although we often hear people talking about the energy consumption the energy is never really destroyed. it is just transferred from one form to another, doing work in the ~~prog~~ process. some forms of energy are less useful to us than others. eg low level heat energy. it is better to talk about the consumption or extraction of energy resources, for example, oil or wind than the consumption of energy itself.

Examples:-

⇒ ① A speeding bullet has a measurable amount of energy associated with it; this is known as kinetic energy. The bullet gain ~~that~~ this energy because work has done on it by a charge of

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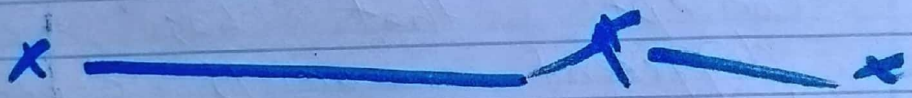
gunpowder which lost some chemical potential energy in the process.

② A hot cup of coffee has a measurable amount of thermal energy which is aquired via work done by a microwave oven, which is in turn took electrical energy from the electrical grid.



Power:-

The word power is something we hear a lot. In the everyday life it has a wide range of meanings. In physics however, it has a very specific meaning. it is measure of the rate at which work is done (or similarly, at which energy is transferred).

⇒ The ability to accurately measure power was one of the key abilities which allowed early engineers.

To develope the steam engines which drove the industrial revolution. it continous to be essential for understanding how to best make use of the energy resources which drive the modern world.

Also

=> The power is a physical concept that has several different meanings, depending on the context and the information that is give: we can define power is the rate of doing work. it is the amount of energy consumed per unit time.

Formula:-

$$P = \frac{W}{t}$$

P = power

W = work done

t = Time taken.

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Examples:-

1. The authority of government to collect taxes from the people.
2. Car engines gives power and it can convert energy to mechanical energy.
3. Turbine is - also the power example it gives power and convert energy to electrical energy.