ENGINEERING MECHANICS

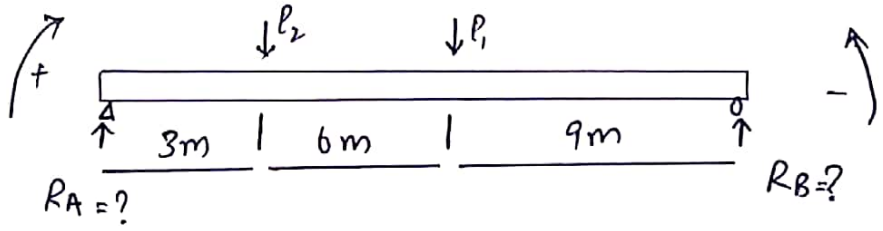
FINAL ASSIGNMENTS

Problem #1
Solution.

GIVEN DATA:-

$P_1 = 200 + 10\,\# \Rightarrow P_1 = 200 + 16582 = 16782 \times 9m$

$P_2 = 500 + 10\,\# \Rightarrow P_2 = 500 + 16582 = 17082 \times 3m$



CALCULATIONS:-

As we know,

Sum of clockwise Rxns = Sum of anticlockwise Rxns

$R_A + P_1 = R_B + P_2 \longrightarrow (A)$

$R_A + P_1 - R_B - P_2 = 0$

$R_A + (16782 \times 9) - 0 - (17082 \times 3) = 0$ (Put $R_B = 0$, For finding R_A).

$R_A + 151038 - 151246 = 0$

$R_A + 99792 = 0$

$\rightarrow$

$R_A + 99792 = 0$

$R_A = -99792$

$\Rightarrow$ $\boxed{R_A = 99792}$ units

Equation (1), $\Rightarrow$ $R_A + P_1 = R_B + P_2$

$\Rightarrow$ $R_A + P_1 = R_B + P_2$

Put $R_A = 0$ for finding R_B, we have,

$P_1 = R_B + P_2$

(or) $R_B = P_1 - P_2$

Putting values,

$R_B = 151038 - 51246$

$\boxed{R_B = 99792}$ units

RESULTS:-

$R_A = 99792$
$R_B = 99792$ } Balanced

Problem #2
Solution

GIVEN VALUES:-

$P_4 = 100 + 10\ \#$ $\Rightarrow$ $P = 16582 + 100 = 16682$ (× 3m)

$UDL = 150 + 10\ \#$ $\Rightarrow$ $UDL = 150 + 16582 = 16732$

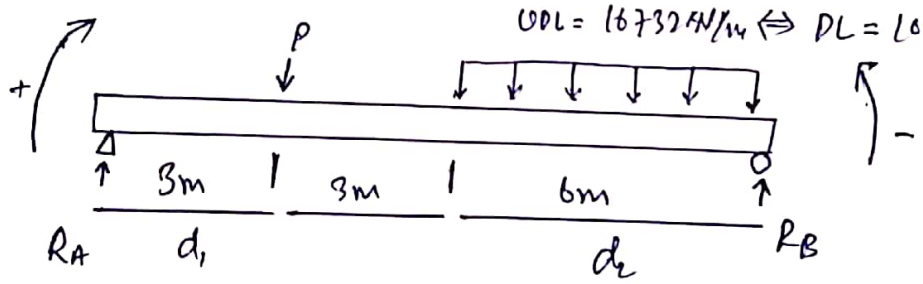
We have to convert UDL into PL.

So,

Point load = UDL × 6m

PL = 150 + 16582 × 6m

PL = 100392 KN/m. (× 6m)



CALCULATIONS:-

As we know that,

Sum of clockwise Rxns = Sum of Anticlockwise Rxns.

$R_A + (P \times d_2) = R_B + (P \times d_1)$ ⟶ (1)

$R_A + 60,2352 = R_B + 50,045$

P.T.O

→

$R_A + 602352 = 50045 + 0$ (Put $R_B = 0$, for R_A)

$R_A = 50045 - 602352$

$R_A = -552307$

or $\boxed{R_A = 552307}$

Eqn ① ⇒ $R_A + (P L x d_2) = R_B + (P x d_1)$

$R_A + 602352 = R_B + 50045$

Putting $R_A = 0$, for finding R_B, we get,

$602352 = R_B + 50045$.

or $R_B = 602352 - 50045$

$\boxed{R_B = 552307.}$

RESULTS :-

$R_A = 552307$
$R_B = 552307$ } Balance

✻ ——————— ✻

Question #5

Answer

WORK :-

Work is said to be doneed, "when there is some force applied on an object and that object change its origional position and cover some distance."

FORMULA :-

Work = Force x distance

$W = F \times d.$

UNIT :-

The SI unit of work is joule.

EXAMPLE :-

1. When we apply force on a body trolly it moves in the direction of force applied, that is what actully work is, there should be maximum work doned in that case.

p.t.o

ENERGY:

The ability of an object/Body to do some work is known as energy.

UNIT:

The SI unit of energy is Joule

EXAMPLES:

Energy have its different forms, and each form of energy have their own many examples but some common of them are given below;

1. Human being do their daily works with the help of energy.
2. Different machinary works due to mechanical energy, and chemical energy.
3. Fans and AC even all electric devices runs and works due to electrical energy.
4. All the moving objects and bodies contain kinetic energy due to which they can move from one place to another.

P.T.O

POWER:-

"Work doned per unit time by an object is known as power of that object."

Work done in less time consuming by the body, than that body is said to be more powerful than the other consuming more time for the same amount of work done.

FORMULA:-

$$\text{Power} = \frac{\text{Work}}{\text{Time}} \Rightarrow P = \frac{W}{t} = J/s$$

UNIT:-

The SI unit of power is watt.

EXAMPLE:-

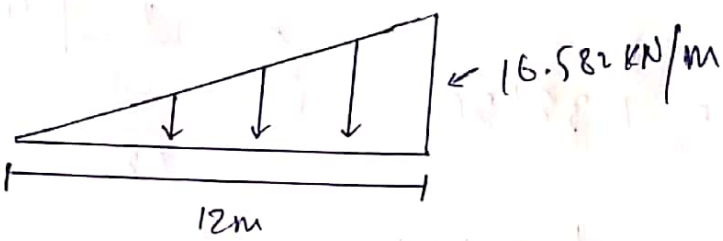
1. Power of the body.
2. Powe of machinary.
3. Power of Horse.
4. Power of electronics devices etc.

Problem #3

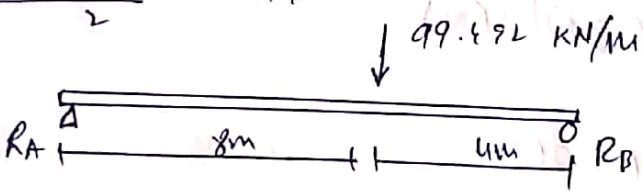
Solution

GIVEN DATA:-

$$UVL = \frac{16582}{1000} = 16.582 \text{ KN/m}$$



$$W_1 = \frac{16.582 \times 12}{2} = 99.492$$



CALCULATIONS:-

$$R_A + (99.492 \times 12) = R_B + 0$$

$R_A = -1193.90$ units ($R_B = 0$, for R_A).

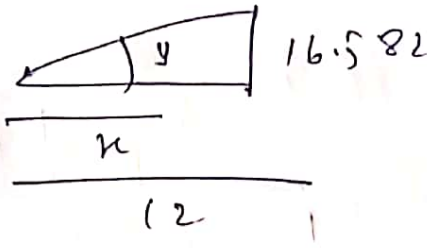
or $R_A = 1193.90$ units

$R_B = 1193.90$ units ($R_A = 0$, for R_B).

By angle of simplicity:

$$\frac{x}{y} = \frac{12}{16.582}$$

$$\frac{16.582\,x}{12} = y$$



$$Y = 1.381x$$

$$w_o = \frac{1}{2}(y)(x)$$

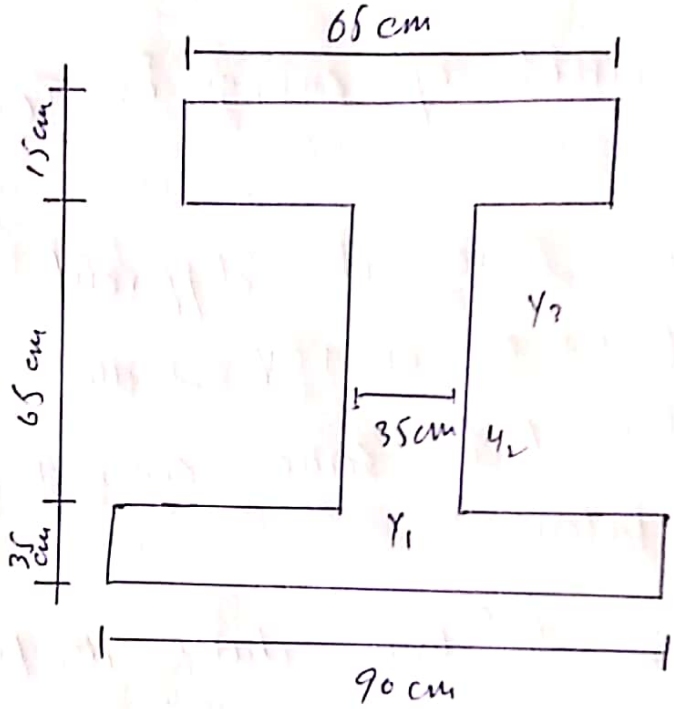
$$= \frac{1}{2}(1.381x)(x)$$

$$w_o = 0.69x^2$$

Problem #4

Solution (a)

GIVEN DATA :-



CALCULATION :-

$$a_1 = 65 \times 15 = 975 \text{ cm}^2$$

$$a_2 = 16 \times 35 = 2275 \text{ cm}^2$$

$$a_3 = 90 \times 15 = 1350 \text{ cm}^2$$

$$y_1 = 15/2 = 7.5 \text{ cm}$$

$$y_2 = 15 + 65/2 = 47.5 \text{ cm}$$

$$y_3 = 80 + 15/2 = 87.5 \text{ cm}$$

$$\bar{y} = \frac{\Sigma ay}{\Sigma a}$$

p.t.o

$$\bar{y}_{\text{Centroid}} = \frac{a_1 y_1 + a_2 y_2 + a_3 y_3}{a_1 + a_2 + a_3}$$

$$\Rightarrow \quad \bar{y}_{\text{Centroid}} = \frac{975 \times 7.5 + 2275 \times 47.5 + 1350 \times 87.5}{(975 + 2275 + 1350)\ cm^2}$$

$$\bar{y}_{\text{Centroid}} = \frac{7312.5\ cm^3 + 108062.5\ cm^3 + 118125\ cm^3}{4602\ cm^2}$$

$$\bar{y}_{\text{Centroid}} = \frac{233500\ cm^3}{4600\ cm^2}$$

$$\bar{y}_{\text{Centroid}} = 50.76\ cm$$

Solution (b)

Mid area $= 65\ cm \times 35\ cm = 2275\ cm^2$.