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Semester 2nd

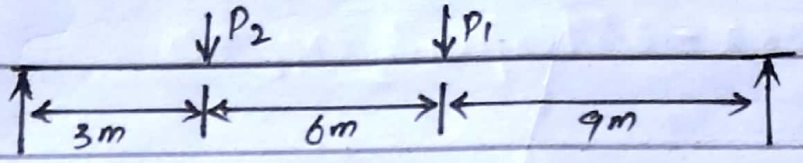
Term Final

Subject Engineering Mechanics

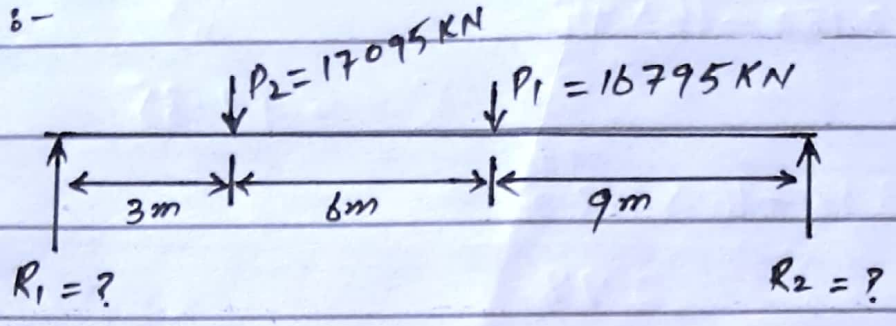
id # 16595

(P=1)

Question # 01



Solution :-



My id # 16595

then $P_1 = 200 + 16595 = 16795$ KN

$P_2 = 500 + 16595 = 17095$ KN

$\{ R_1 = 0 = R_2 \times 18 - 16595 \times 9 - 17095 \times 3$

$= R_2 \times 18 - 151195 - 51285$

$R_2 \times 18 = 66440$

$R_2 = 11246.66$

$\{ R_2 = 0 = R_1 \times 18 - 17095 \times 15 - 16795 \times 9$

$R_1 \times 18 - 256425 - 151155$

$R_1 \times 18 = 407580$

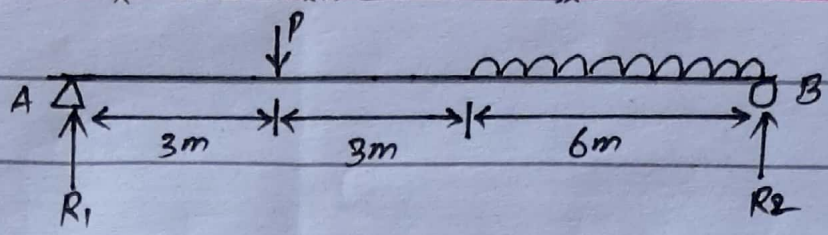
$R_1 = 22643.34$

$R_1 = 11246.66$ KN

$R_2 = 22643.34$ KN

P=2

Question NO. 2

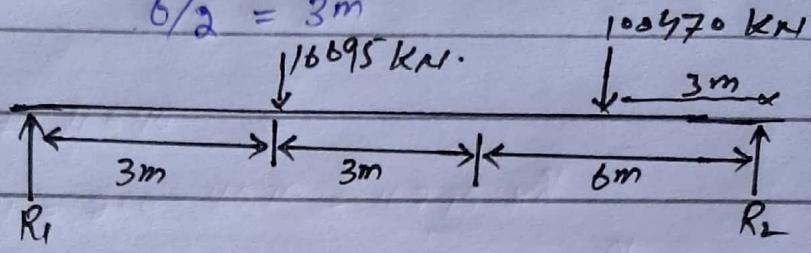


Solution :-

UDL convert to point load.

UDL = 16747 × 6 = 100470 KN at distance 1/2

6/2 = 3m



P_1 = 100 + 16595.
= 16695 KN

P_2 = 150 + 16595
= 16745 KN.

$\sum M_A = 0 : R_2 \times 12 - 100470 \times 9 - 16695 \times 3 =$

$= R_2 \times 12 - 904230 - 50085$

$R_2 \times 12 = 954315$

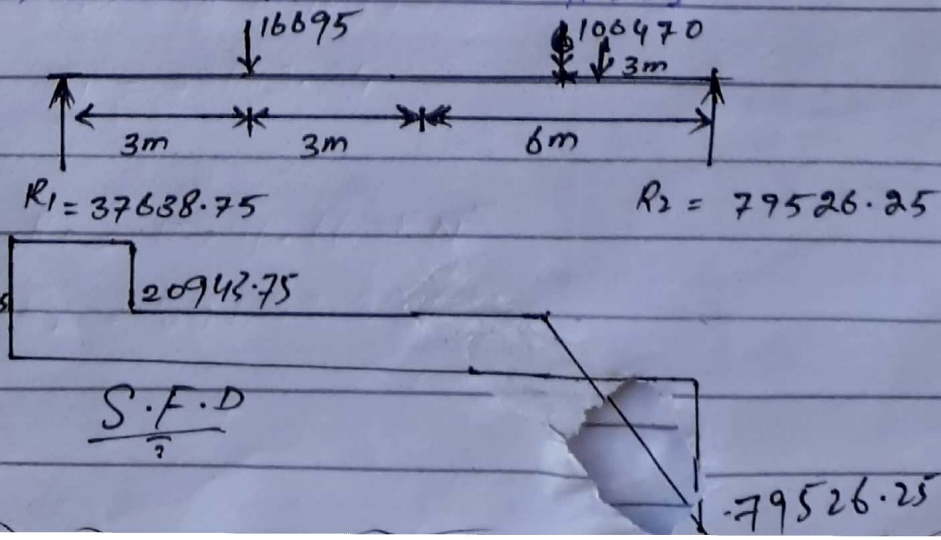
$R_2 = 79526.25$ KN

$\sum M_B = 0 : R_1 \times 12 - 16695 \times 9 - 100470 \times 3$

$R \times 12 = 150255 + 301410$

$R_1 = \frac{451665}{12} = 37638.75$

⇒ SHEAR FORCE DIAGRAM



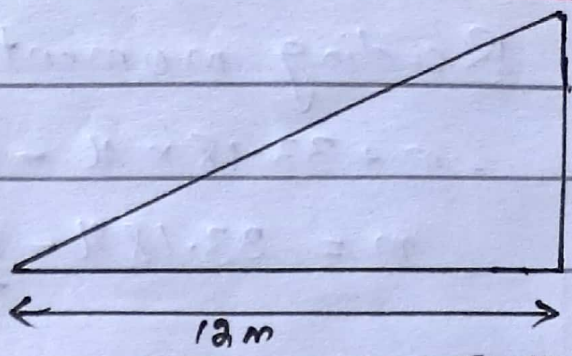
S.F.D

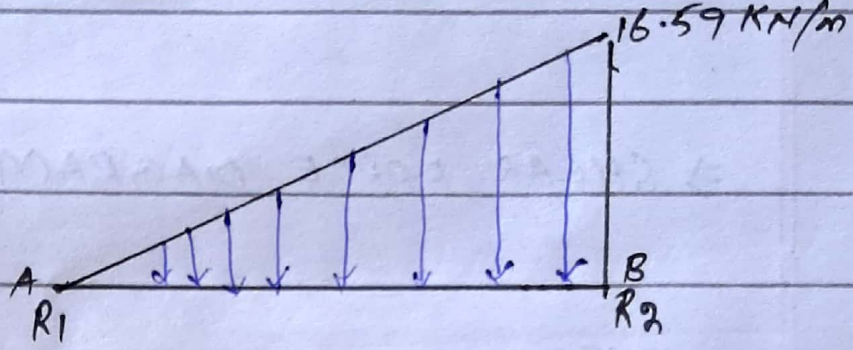
Question No 10.3

Answer:-

load

$\Rightarrow 16595/1000 = 16.5\ KN/m$





$\Sigma M_A = 0$

1) $\Rightarrow 16.59 \times 12/2 \times 12 \times 2/3 = R_2 \times 12$

$R_2 \times 12 = 796.32$

$R_2 = 66.36\ KN$

2) $\Sigma F_y = 0$

$\Rightarrow R_2 + R_1 = 16.59 \times 12/2$

$R_1 = 99.54 - 66.32$

$R_1 = 33.18$

3) Shear Force

$33.18 - 16.59\ x/12\ (x)\ (1/2) - V$

~~$V = 33.18 - 16.59\ x^2$~~ ~~24~~

$V = 33.18 - \frac{16.59x^2}{24}$

If $x = 0$ then $V = 33.18$

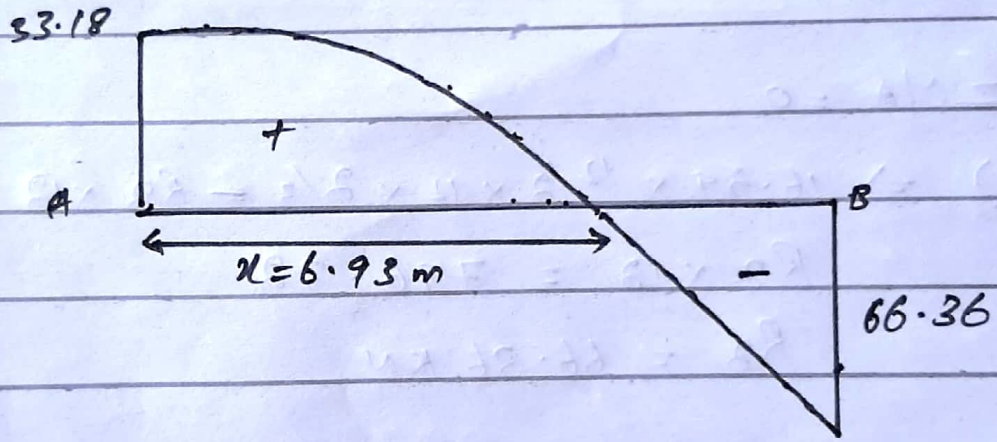
P=4

Bending moment,

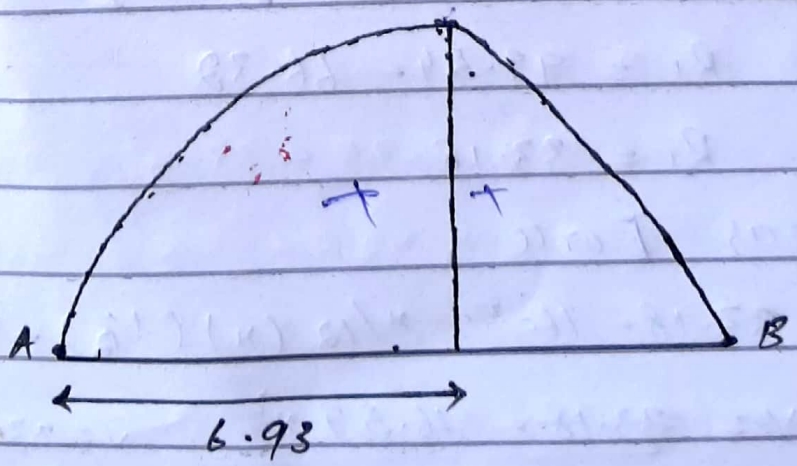
$$-m + 33.18 \times x - 16.59 x/12 (x)(1/2)(x/12) = 0$$

$$m = 33.18x - \frac{16.59 x^3}{288}$$

⇒ SHEAR FORCE DIAGRAM



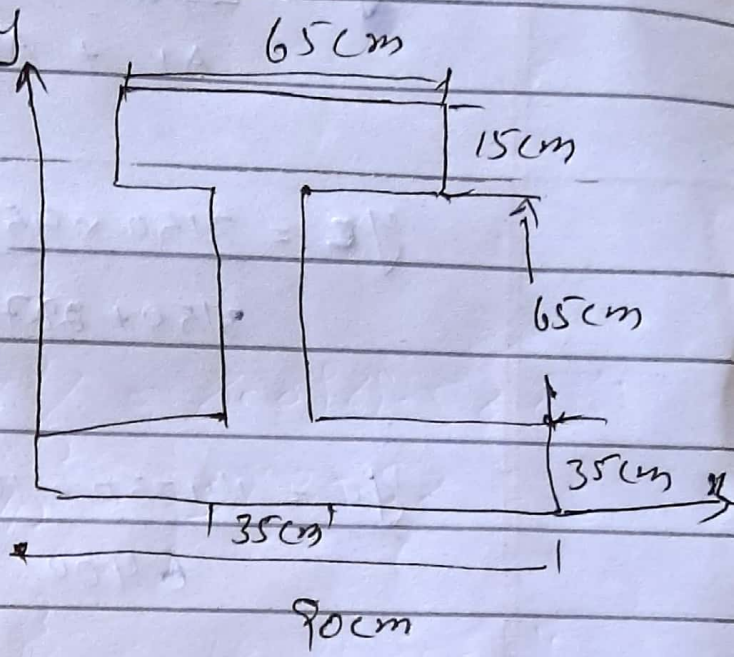
⇒ BENDING MOMENT DIAGRAM



(P=5)

Question NO. 04

(A)



Sol :-

find area

$A_1 = 90 \times 35 = 3150\ cm$

$A_2 = 35 \times 65 = 2275\ cm$

$A_3 = 15 \times 65 = 975\ cm$

$y_1 = 90/2 = 45\ cm$

$y_2 = 45\ cm = 275 + 35/2 = 45\ cm$

$y_3 = 45\ cm \Rightarrow 19.5 + 65/2 = 45\ cm$

$Z_1 = 35/2 = 17.5\ cm$

$Z_2 = 35 + 65/2 = 67.5\ cm$

$Z_3 = 35 + 65 + 15/2 = 107.5\ cm$

P = 6

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

$$y_c = \frac{3150 \times 45 + 2275 \times 45 + 975 \times 45}{3150 + 2275 + 975}$$

$$y_c = \frac{141750 + 102375 + 43875}{6400}$$

$$y_c = \frac{288000}{6400} = 45\,cm$$

$$z_c = \frac{A_1 z_1 + A_2 z_2 + A_3 z_3}{A_1 + A_2 + A_3}$$

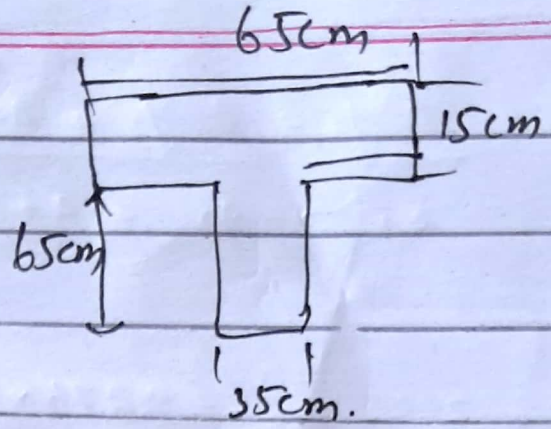
$$z_c = \frac{3150 \times 17.5 + 2275 \times 87.5 + 975 \times 107.5}{3150 + 2275 + 975}$$

$$z_c = \frac{55125 + 199062.5 + 104812.5}{6400}$$

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

P=7

(B)



moment of inertia:

$I_{y_1} = \frac{bH^3}{12} = \frac{35 \times 65^3}{12} = 800989.58\ cm^4$

$I_{z_1} = \frac{bH^3}{12} = \frac{(35)^3 \times 65}{12} = 232239.58$

$I_{y_2} = \frac{bH^3}{12} = \frac{65(15)^3}{12} = 18281.25\ cm^4$

$I_{z_2} = \frac{b^3h}{12} = \frac{(65)^3 \times 15}{12} = 343281.25\ cm^4$

Ans No. 05

WORK :-

In physics work is defined as a force causing the movement or displacement of an object is called work. OR

The dot product of force and displacement is called work.

Methematically :-

$$W = F.d$$

F = force

d = displacement

S.I unit :- Joul

Example.

① → A Horse pulling a plow through a field

② → A student lifting a backpack full of books upon her shoulder.

$E = q$

Energy :-

It is the measure of the ability of an object or a system to perform work.

Unit :- Its unit is Joal denoted by J.

Types of energy

- Kinetic energy
- potential energy
- chemical energy
- gravitational potential energy
- Nuclear energy
- Elastic energy.

① Kinetic energy :-

Energy of a body due to its ~~position~~ motion or speed.

$K.E = \frac{1}{2} mv^2$

② potential Energy :-

- Energy of a body due to its position is called potential energy.

③ Gravitational potential energy :-

- Energy of an object due to its position in a gravitational field.

Elastic potential energy

- Energy stored when an object is stressed or compressed.

chemical energy:

Energy stored in chemical bonds.

Nuclear energy:-

- Energy stored in nuclei

Heat energy

- Energy stored an in object due to their high thermal condition's. or due to high movement of particles inside it.

Example:-

A shopkeeper lift a heavy gas cylinder weighing 500g. from the floor to a second floor 12m high. How much graritational potential energy does it gain? $g = 9.81 N/kg$

Sol:-

$$\Delta EP = 0.500 \times 9.81 \times 12$$

$$\Delta EP = 18.86 J$$

P=11

Power :-

The rate of doing work is called power (OR) the rate at which energy is transfered.

Power = work done / time taken

$P = W/t$

Unit = Joul / second

= watt

Example :-

- How much power does it take to lift 5 kg up 5 meters in 3 seconds.

Sol :-

W = weight (Force) x Right (Distance)

~~W = mgh = (5 kg) x (10 m/s²)~~

$W = mgh = (5\,kg)\ (10\,m/s^2) \times (5\,m) = 250\,J$

- Find How much power is required

$P = W/t$

250 J in 3 seconds ⇒ 83.3 watts.