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Subject :- Engineering mechanics

Exam :- First term

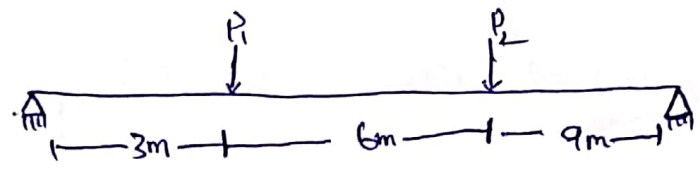
department :- BS (civil) -

Teacher :- M. Majid Naeem :-

Q/NO 11

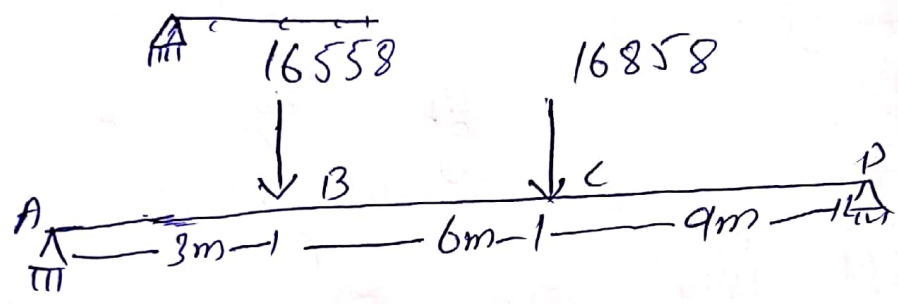
(1)

Answer:-



$$P_1 = 200 + 16358 = 16558$$

$$P_2 = 500 + 16358 = 16858$$



$$\sum M_A = 0$$

$$-R_2 \times 18 + 16558 \times 9 + 16858 \times 3 = 0$$

$$18 R_2 = 199,596$$

$$R_2 = 199,596 / 18$$

$$R_2 = 11,088.66 \text{ unite.}$$

$$\sum M_B = 0$$

$$R_1 \times 18 - 16558 \times 15 - 16858 \times 9 = 0$$

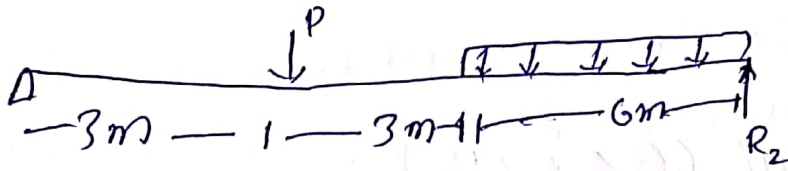
$$18 R_1 = 16558 \times 15 + 16858 \times 9$$

$$R_1 = 400,092$$

$$R_1 = 256,799 \text{ unite.}$$

QNO2

(2)

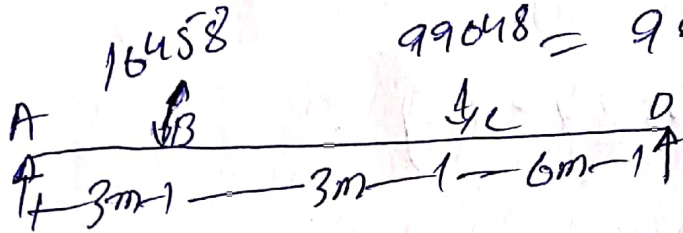


$$P = 100 + 96358 = 16458 \text{ KN}$$

$$UDL = 150 + 16358 = 16508 \text{ KN/m}$$

$$= 16508 \times 6$$

$$99048 = 99,048$$



$$\sum M_A = 0 \quad (\uparrow -)$$

$$-R_2 \times 12 + 99048 \times 9 + 16458 \times 3 = 0$$

$$12 R_2 = 891432 + 49374$$

$$R_2 = \frac{940806}{12} \text{ KN}$$

$$R_2 = 78400.5$$

$$\sum M_D = 0 \quad (\uparrow -)$$

$$-R_1 \times 12 - 16458 \times 9 - 99048 \times 3 = 0$$

$$\frac{12}{12} R_1 = 148,122 + 297,144$$

$$\frac{12}{12} R_1 = 445266/12$$

$$R_1 = 37105.5$$

(3)



$R_1 = 37105.5$

origin A limit $\{0 \leq x \leq 3\}$

$\sum F_y = 0 \uparrow \downarrow$

$R_1 - V_x = 0$

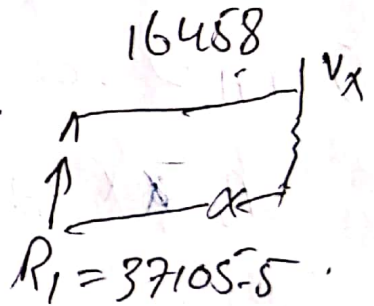
$V_x = 37105.5 \text{ kN}$

origin A limit $\{3 \leq x \leq 6\}$

$\sum F_y = 0 \uparrow \downarrow$

$37105.5 - 16458 - V_x = 0$

$V_x = 20647.5$



origin A limit $\{6 \leq x \leq 12\}$

$\sum F_y = 0 \uparrow \downarrow$

$37105.5 - 16458 - 99048x - V_x = 0$

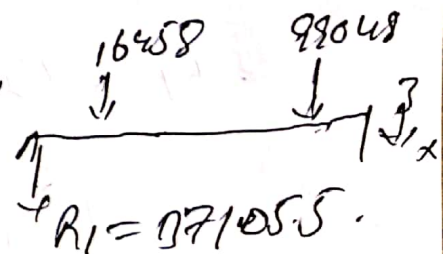
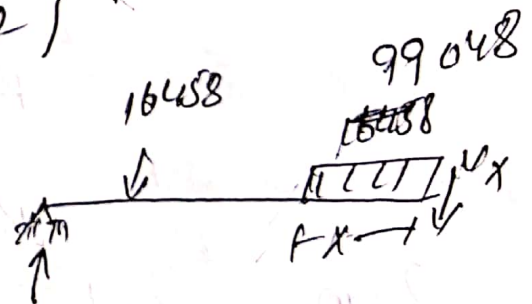
$V_x = 20647.5 - 99048x$

(put value of x)

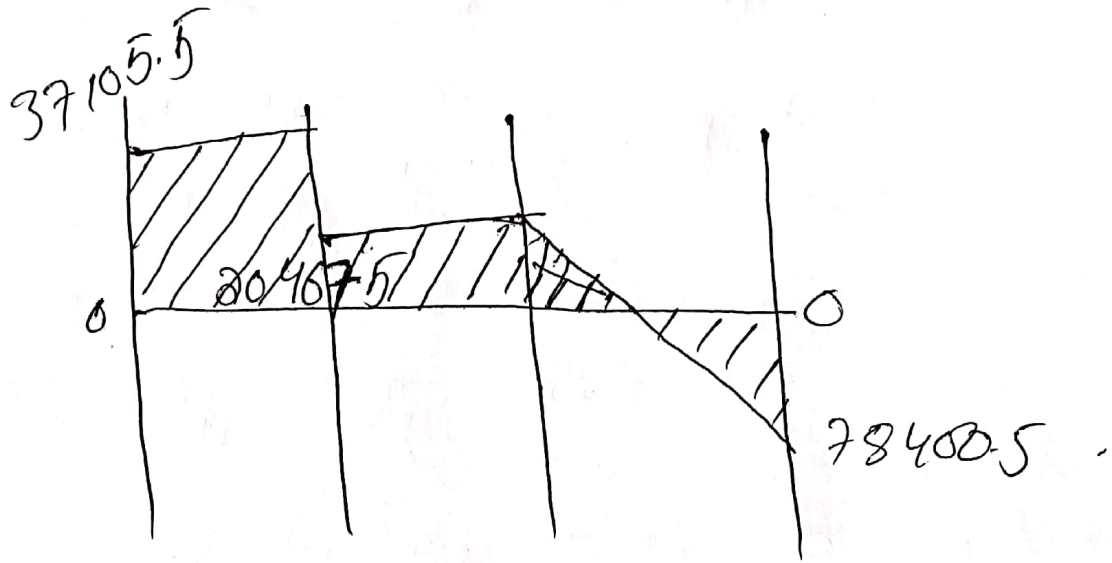
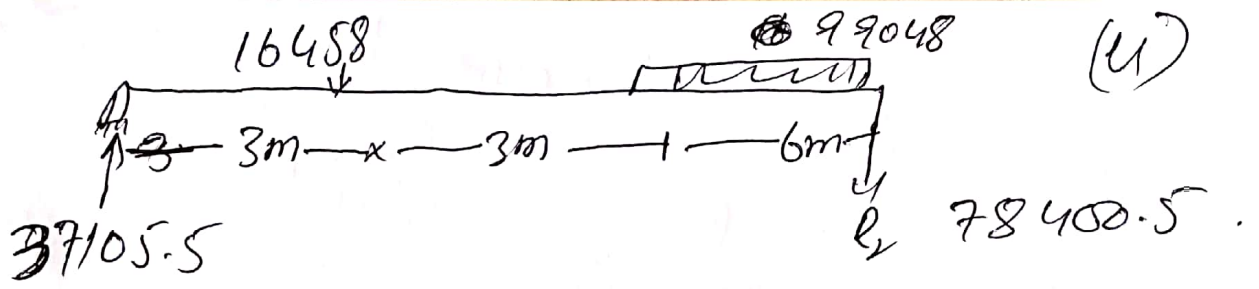
for 3 = 20467.5

for 6 = 274496.5

for 6 = 577640.5



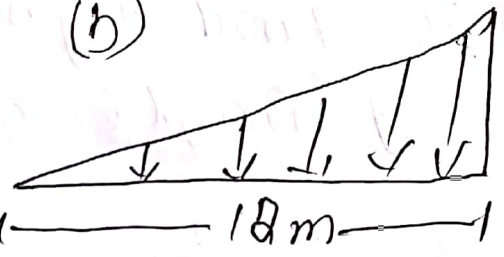
p.t.o.



QNO 3:

(b)

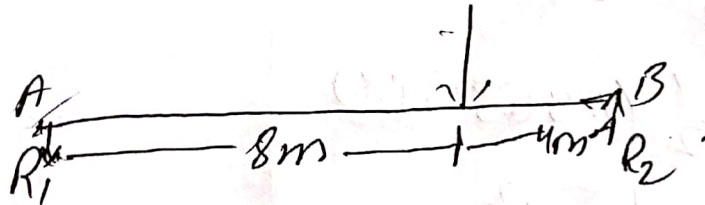
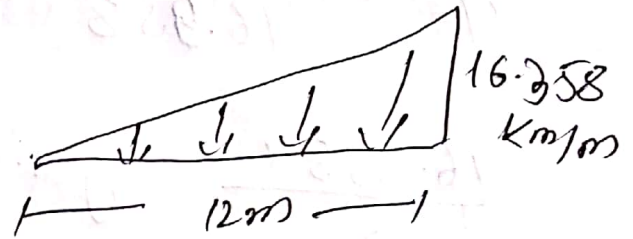
$$U_d = \frac{16358}{1000} = 16.358 \text{ kN/m}$$



$$W_6 = \frac{16.358 \times 12}{2}$$

$$W_6 = \frac{196.296}{2}$$

$$W_6 = 98.148$$



$$\sum M_A = 0 \quad (\uparrow + \rightarrow)$$

$$-R_2 \times 12 + 98.148 \times 8 = 0$$

$$\frac{12R_2}{12} = \frac{785.184}{12}$$

$$R_2 = 65.432 \text{ kN}$$

$$\sum M_B = 0 \quad (\uparrow + \rightarrow)$$

$$R_1 \times 12 - 98.148 \times 4$$

$$\frac{12R_1}{12} = \frac{392.592}{12} \quad R_1 = 32.716$$

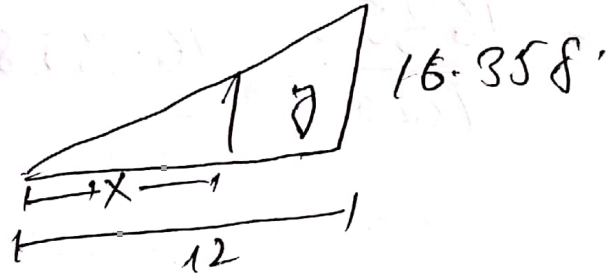
D. to .

To Find y

(6)

By Angle of Similarity.

$$\frac{x}{y} = \frac{12}{16.358}$$



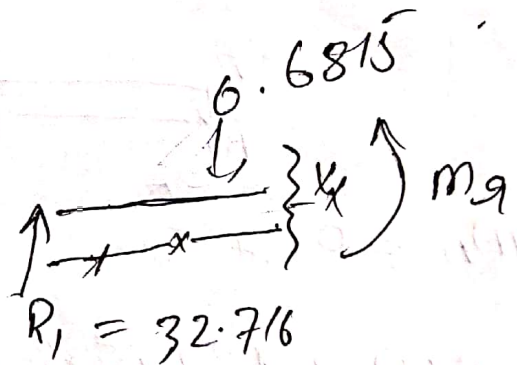
$$\frac{16.358x}{18} = y$$

$$y = 1.3631x$$

$$w_0 = \frac{1}{2}(y)(x)$$

$$= \frac{1}{2}(1.3631)(x)$$

$$w_0 = 0.6815x^2$$



Region A.

limit $0 \leq x \leq 12$

$$\sum F_y = 0 \uparrow + \downarrow$$

$$32.716 - 0.6815x^2 - vx = 0$$

$$v_2 = 32.716 - 0.6815x^2$$

P.T.O.

$$\sum M_{1-1} = 0 \text{ } \uparrow + \downarrow -$$

(7)

$$32.716x - 0.6815x^2 \times \frac{x}{3} - Mx = 0$$

$$Mx = 32.716x - 0.2271x^3$$

x-lengths

	Vx (kN)	m (kN-m)
0		0
6	32.716	388.32
6.93	8.0772	148.261
12	64.632	0

$$32.716 - 0.6815x^2 = 0$$

$$\frac{32.716}{0.6815} = \frac{0.6815}{0.6815} x^2$$

$$48 = x^2$$

$$\sqrt{x^2} = \sqrt{48}$$

$$x = 6.93 \text{ m } \underline{\text{Ans!}}$$

Qno 4 B1

(8)

Given data.

$$\text{area} = 65 \text{ cm} \times 35 \text{ cm}.$$

Required = ?

Moment of Inertia = ?

Radius of Gyration = ?

For moment of Inertia.

$$I_x = \frac{1}{3} b h^3$$

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

$$= \frac{1}{3} (65) (35)^3 = 928958 \text{ mm}^4$$

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

$$= \frac{1}{3} (65)^3 (35) = 3203958 \text{ mm}^4$$

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

$$= \frac{1}{12} (65) (35)^3 = 663541 \text{ mm}^4$$

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

$$= \frac{1}{12} (65)^3 (35) = 800989 \text{ mm}^4$$

$$J_c = \frac{1}{12} b h (b^2 + h^2)$$

$$= \frac{1}{12} (65) (35) (65^2 + 35^2) = 1033229.16 \text{ mm}^4$$

P.T.O.

(b) Radius of gyration

(9)

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

$$A = b \times d$$

$$A = 65 \times 35$$

$$r = \left(\frac{1033229.16}{2275}\right)^{1/2} = 21.31$$

$$A = 2275$$

$$r = 21.31 \text{ mm}$$

(c) - Section moduli

$$S = \frac{bh^3}{6}$$

$$S = \frac{(65)(35)^3}{6}$$

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

Ans

Q No 5:

(10)

Ans:- work: work is define as a force ~~causing~~ causing the movement or displacement of an object. In this case of ~~product~~ constant force work is the product of the force acting on a object and displacement caused by that force through both force and displacement are ~~work~~ ^{vectors} quantities work has no direction due to nature of a scalar product in ~~work~~ vector.

Example of work: These are many example of work in energy Every day life. Few of them are; a father pushing grocery cart down the aisle of grocery store. A student lifting in bag full of the books on his shoulder. A horse pulling a plow through a field and olympian launching the shot out.

mathematical form of the work.

$$W = F \cdot d$$

$$W = 10N \cdot 20m$$

$$\Rightarrow \text{WORK} = 200 \text{ joule}$$

D. t. o .

Energy: the Ability to ⁽¹⁾ do work. It may exist it may exist in various forms of Energy. There are moreover forms of Energy Heat and work. i.e.: Energy is the process of transfer from one form to another form and one body to another body. Energy is always designated according to its nature. Hence Heat transformed may become Thermal Energy while work alone may manifest itself in the form mechanical.

Example of Energy: All form of Energy are associated with motion for example. Any given body has kinetic Energy if it is in motion. A tensioned device such as bow or spring. Through at rest. has the potential for creating motion it contains potential Energy because of its configuration. Similarly nuclear Energy is potential Energy because it results from the configuration of substance particles in the nucleus of an atom. Energy can ~~be~~ neither be created nor be destroyed but can only change its form. The principle is known as conservation of Energy or first law of Thermodynamics.

D.T.O

power: power can be defined as the ⁽¹²⁾ rate of doing work. it is the work done in unit time. the S.I unit of power is watt (W) which is joule per second (J/s). Some time the power of motor vehicle and other machines are given in term of ~~horse~~ horse power (hp). which is approximately equal to 745.7 watt. power is always depend on work done so if a person does work done so it differs at different rate his power as differs at different time.

power formula: power is define as the rate which work is done power is time based quantity the formula of power is mention below.

$$\Rightarrow \text{power} = \text{work}/\text{time} = (P = W/t)$$

unit of power: the unit for standard metric work is joule and standard metric unit for time is second. so the standard metric unit for power is joule/second define as watt and abbreviated is W.

End