



Subject: **Applied Mechanics.**

Model Answer

Exam **W-24**
Subject Code **312312**
12425

Important Instructions to STUDENTS

- 1) The model answer given here are prepared from the answers from the previously uploaded model answers by Board.
- 2) These model answers are not uploaded by the MSBTE official site but MSBTE study resources website prepared it for students. This model answer has question paper also inbuilt in it, no need to download it separate.
- 3) Please remember that answers are not checked word to word but based on keywords which must be present in your answer
- 4) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate
- 5) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn
- 6) For programming language papers, credit may be given to any other program based on equivalent concept
- 7) Students are advised to prepare all the syllabus from recommended book and use these model answers for the purpose of tests.

Q.NO	SUB Q N	ANSWER	Marking Scheme
1.		<p>Attempt any Five.</p> <p>a. State ideal machine & write 2 characteristics?</p> <p>→ The machine whose efficiency is 100% & in which friction is totally absent or zero, then such machine is called as an "<u>Ideal machine</u>".</p> <p>Characteristics :-</p> <ul style="list-style-type: none">(i) Efficiency of an ideal machine is 100%.(ii) There is no loss due to friction, heat, etc. <p>b. Define Statics & Dynamics?</p> <p>→ Static :- It is the branch of applied mechanics which deals with study of forces & their effects acting on rigid <u>body at rest</u>.</p> <p>Dynamics :- It is branch of applied mechanics which deals with study of forces & their effect acting on <u>rigid body in motion</u>.</p>	10 M.



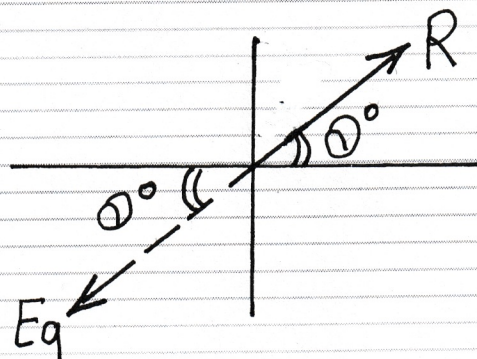
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ANSWER

Marking
Scheme

1. c. State relation between resultant & equilibrant?

→ Equilibrant force is equal in magnitude, opposite in direction & co-linear with resultant force acting on a body.

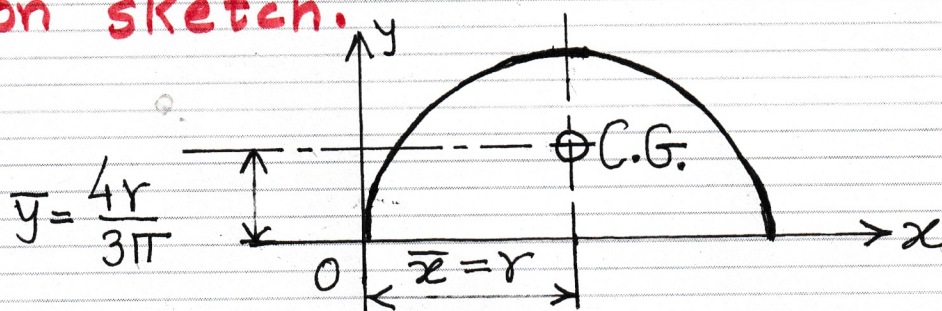


where,
 $R = \text{Resultant}$ &
 $Eq = \text{Equilibrant}$.

d. Define angle of repose?

→ Angle made by an inclined plane with horizontal plane, when a body placed on it is just on the point of moving down the plane with its own weight is called as "angle of repose".
It is denoted by " α ".

e. State centroid of semicircle. show it on sketch.



Position of Centroid

$\bar{x} =$ At a distance of radius from origin.

$\bar{y} =$ At a distance $\frac{4r}{3\pi}$ from base.



Q.NO
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ANSWER

Marking
Scheme

1. f. State V.R. of geared pulley block.?

→ $V.R = \frac{T_1}{T_2} \times \frac{T_3}{T_4}$ where, $T_1 =$ Cogs on effort wheel
 $T_2 =$ Cogs on pinion wheel
 $T_3 =$ Cogs on spur wheel
 $T_4 =$ cogs on load wheel.

If instead of cogs diameters of effort & load wheel are given, then,

$V.R. = \frac{D}{d} \times \frac{T_3}{T_2}$ where, $D =$ diameter of effort wheel
 $d =$ diameter of load wheel
 $T_3 =$ teeth on spur wheel
 $T_4 =$ teeth on pinion wheel.

g. Define force & state its S.I. unit?

→ An external agency which tends to change state of rest or of uniform motion is called as "Force".

Newton (N) is the S.I. unit of force.



Q.NO
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ANSWER

Marking
Scheme

2. Attempt any three. 12.M

a. In a simple lifting machine, a load of 1400N is lifted by 50N effort, while load moves up by 0.2m, effort moves by 6m. Find M.A., V.R., efficiency & ideal effort?

→ Given:- Load $W = 1400\text{N}$ moves by 0.2m.
effort $P = 50\text{N}$ moves by 6m.

$$M.A. = \frac{W}{P} = \frac{1400}{50} \therefore \boxed{M.A. = 28.}$$

$$V.R. = \frac{\text{effort movement}}{\text{Load movement}} = \frac{6}{0.2} \therefore \boxed{V.R. = 30.}$$

$$\text{Efficiency} = \eta = \frac{M.A.}{V.R.} \times 100$$

$$\therefore \eta = \frac{28}{30} \times 100 \therefore \boxed{\eta = 93.33\%}$$

$$\text{Ideal effort } (P_i) = \frac{\text{load}}{V.R.} = \frac{W}{V.R.}$$

$$\therefore P_i = \frac{1400}{30} \therefore \boxed{P_i = 46.67\text{N}}$$

$$\boxed{M.A. = 28.}$$

$$\boxed{V.R. = 30.}$$

$$\boxed{\eta = 93.33\%}$$

$$\boxed{P_i = 46.67\text{N}}$$



Q.NO
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Q N

ANSWER

Marking
Scheme

2. b. Calculate efficiency of screw jack having diameter of effort wheel as 300mm & pitch 6mm. & can lift load of 1200N using effort of 200N?

→ Given :- machine = Screw jack.
effort wheel diameter = $D = 300\text{mm}$

$$L = \text{Radius} \therefore \frac{D}{2} = \frac{300}{2} \therefore L = r = 150\text{mm.}$$

Pitch = 6mm.

Load = $w = 1200\text{N}$ & effort = $P = 200\text{N}$. $\eta = ?$

$$V.R. = \frac{2\pi L}{\text{Pitch}} = \frac{2 \times \pi \times 150}{6} \therefore \boxed{V.R. = 157.08}$$

$$M.A. = \frac{W}{P} = \frac{1200}{200} = \therefore \boxed{M.A. = 6.}$$

$$\text{efficiency} = \eta = \frac{M.A.}{V.R.} \times 100$$

$$\therefore \eta = \frac{6}{157.08} \times 100 \therefore \boxed{\eta = 3.82\%}$$

$$\boxed{\begin{aligned} M.A. &= 6 \\ V.R. &= 157.08 \\ \eta &= 3.82\% \end{aligned}}$$



Q.NO	ANSWER	Marking Scheme
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2. c. For a certain machine, V.R. is 125. To lift load of 11.90 kN, an effort of 190 N is required. Calculate effort required to lift load of 72 kN. Identify type of machine?

→ Given :- V.R. = 125. load $W = 11.90 \text{ kN} = 11900 \text{ N}$.
effort $P = 190 \text{ N}$.

$$M.A. = \frac{W}{P} = \frac{11900}{190} \therefore M.A. = 62.63$$

$$\eta = \frac{M.A.}{V.R.} \times 100$$

$$\therefore \eta = \frac{62.63}{125} \times 100 \therefore \eta = 50.104\%$$

$\therefore \eta > 50\% \therefore$ machine is reversible.

condition (ii) Effort to lift load of 72 kN.
i.e. $w = 72000 \text{ N}$. $P = ?$

Now, $\eta = \frac{M.A.}{V.R.} \times 100$

$$\therefore \frac{\eta \times V.R.}{100} = M.A.$$

$$\therefore \frac{50.104 \times 125}{100} = M.A. \therefore M.A. = 62.63$$

$$\& M.A. = \frac{W}{P} \therefore P = \frac{W}{M.A.}$$

$$\therefore \text{Effort} = P = \frac{72000}{62.63} \therefore P = 1149.608 \text{ N}$$



2. d. Explain law of machine. state its use?

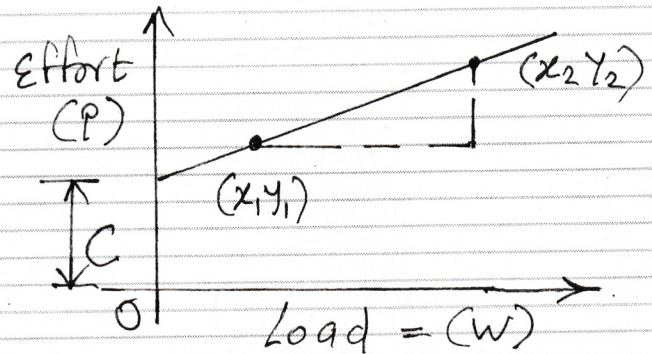
→ Law of machine. $P = mW + C - N.$

where, $P =$ effort.

$W =$ load.

$m =$ slope

$C =$ intercept.



Use of Law of machine, :-

By use of law of machine, we can find effort required to lift certain load.

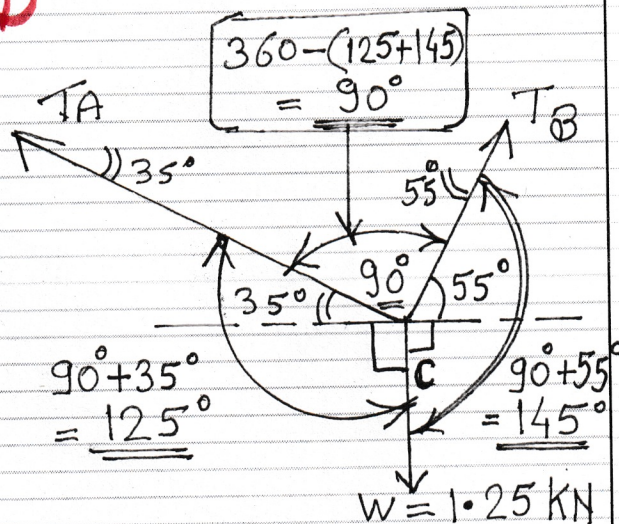
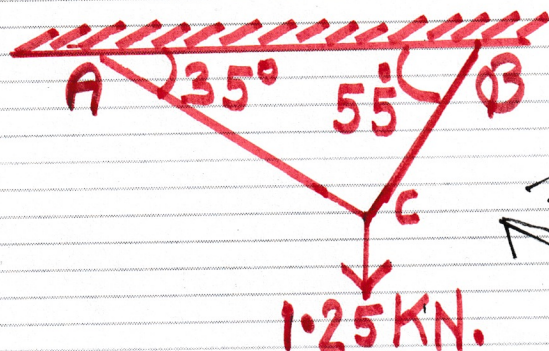
& load can be lifted with available effort.

We can achieve maximum efficiency.

Q.NO SUB QN

3. Attempt any three.
a. A weight of 1.25 kN is attached by two ropes. Calculate tension in ropes?

12-M



Applying Lammis theorem,

$$\frac{W}{\sin(90^\circ)} = \frac{T_A}{\sin(145^\circ)} = \frac{T_B}{\sin(125^\circ)}$$

$$\therefore \frac{T_A}{\sin(145^\circ)} = \frac{W}{\sin(90^\circ)}$$

$$\therefore \frac{T_B}{\sin(125^\circ)} = \frac{W}{\sin(90^\circ)}$$

$$\therefore T_A = \frac{W}{\sin(90^\circ)} \times \sin(145^\circ)$$

$$\therefore T_B = \frac{W}{\sin(90^\circ)} \times \sin(125^\circ)$$

$$\therefore T_A = \frac{1.25}{\sin(90^\circ)} \times \sin(145^\circ)$$

$$\therefore T_B = \frac{1.25}{\sin(90^\circ)} \times \sin(125^\circ)$$

$$T_A = 0.7169 \text{ kN.}$$

$$T_B = 1.0239 \text{ kN.}$$

\therefore Tension at rope A = $T_A = 0.7169 \text{ kN}$
 & Tension at rope B = $T_B = 1.0239 \text{ kN.}$

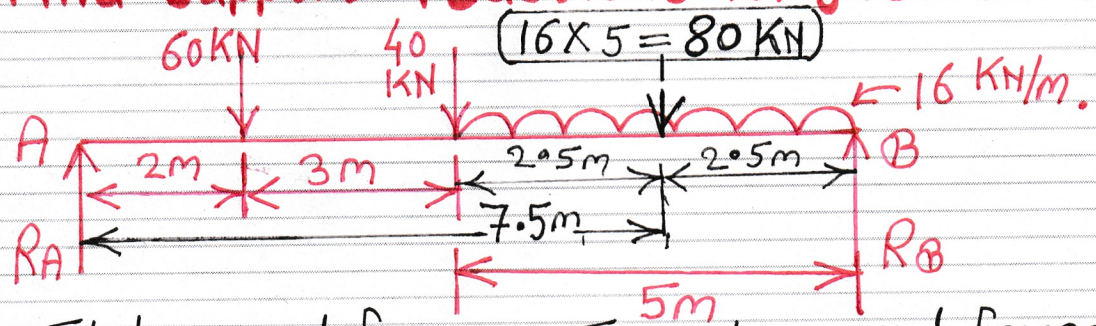


Q.NO
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Q N

ANSWER

Marking
Scheme

3. b. Find support reactions for given S.S.B.



→ Total upward forces = Total downward forces.

$$\therefore R_A + R_B = 80 + 40 + 60$$

$$\therefore R_A + R_B = 180 \text{ KN} \text{ --- eq}^n \text{ ①}$$

$\Sigma M_A = 0$. Taking moment @ "A";

Anticlockwise moments = Clockwise moments.

$$\therefore 10 R_B = (80 \times 7.5) + (40 \times 5) + (60 \times 2)$$

$$\therefore 10 R_B = 920$$

$$\therefore R_B = \frac{920}{10}$$

$$\therefore \boxed{R_B = 92 \text{ KN.}}$$

Now; Put value of R_B in eqⁿ. ①

$$\therefore R_A + R_B = 180 \text{ KN --- eq}^n \text{ ①}$$

$$\therefore R_A + 92 = 180$$

$$\therefore R_A = 180 - 92$$

$$\therefore \boxed{R_A = 88 \text{ KN}}$$

$$\therefore \boxed{\text{Support reactions} = R_A = 88 \text{ KN} \text{ \& } R_B = 92 \text{ KN.}}$$

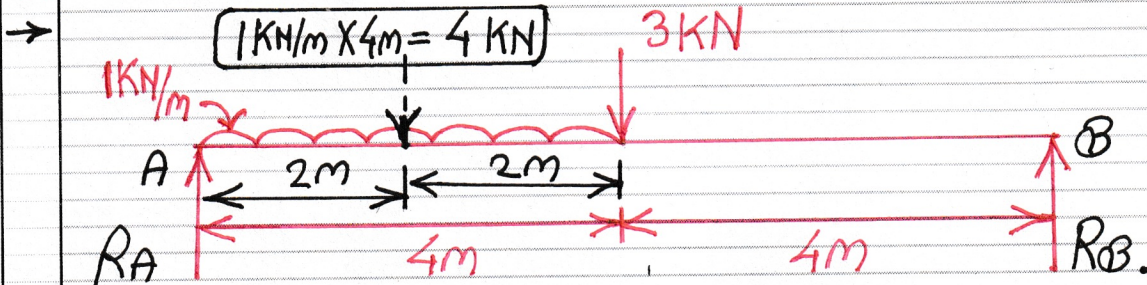


Q.NO
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Q.N

ANSWER

Marking
Scheme

3. c. Calculate reactions by analytical method?



Total upward forces = Total downward forces.

$$\therefore R_A + R_B = 3 + 4$$

$$\therefore R_A + R_B = 7 \text{ KN} \text{ — eq}^n \text{ ①}$$

$\Sigma M_A = 0$. Taking moment @ "A";
Anticlockwise moments = clockwise moments.

$$\therefore 8R_B = (3 \times 4) + (4 \times 2)$$

$$\therefore 8R_B = 20$$

$$\therefore R_B = \frac{20}{8}$$

$$\therefore \boxed{R_B = 2.5 \text{ KN.}}$$

Now, put value of R_B in eqⁿ. ①

$$R_A + R_B = 7 \text{ KN} \text{ — eq}^n \text{ ①}$$

$$\therefore R_A + 2.5 = 7$$

$$\therefore R_A = 7 - 2.5$$

$$\therefore \boxed{R_A = 4.5 \text{ KN.}}$$

\therefore $\boxed{\text{Support reactions } R_A = 4.5 \text{ KN} \\ R_B = 2.5 \text{ KN.}}$



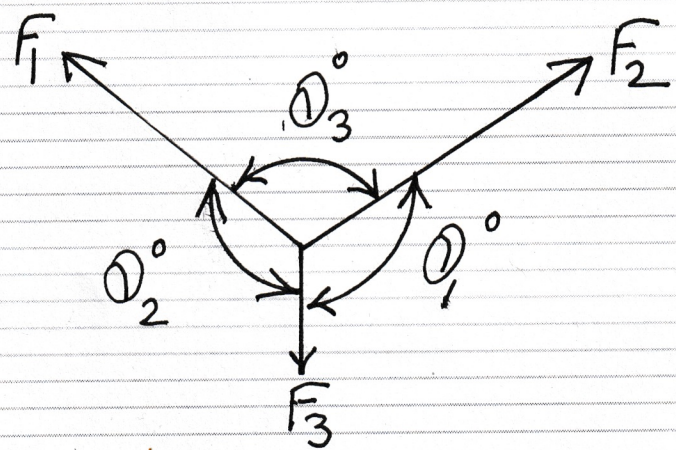
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ANSWER

Marking
Scheme

3. d. State Lam's theorem & its limitations?

→ "If three coplaner forces acting on a body at a point kept in equilibrium, then each force is proportional to sine of angle between other two forces."



Applying Lammi's theorem,

$$\frac{F_1}{\sin(\theta_1)} = \frac{F_2}{\sin(\theta_2)} = \frac{F_3}{\sin(\theta_3)}$$

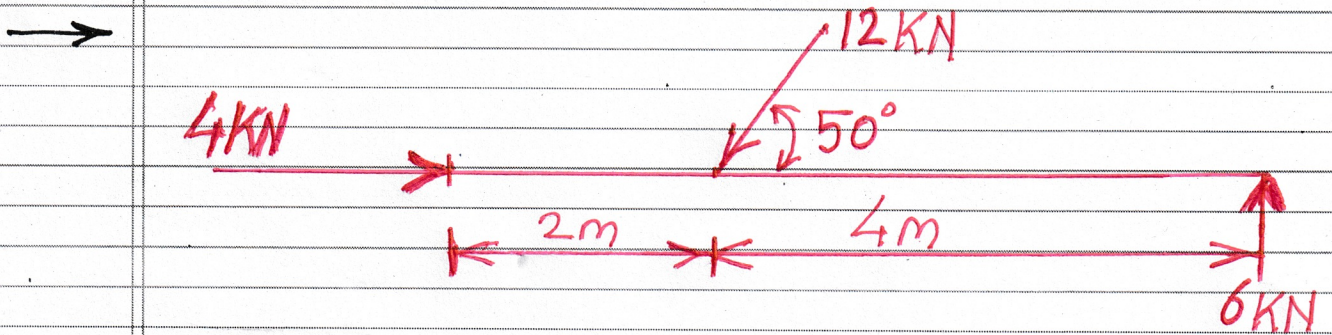
where, F_1, F_2 & F_3 are three coplaner forces & θ_1, θ_2 & θ_3 are angles between them.

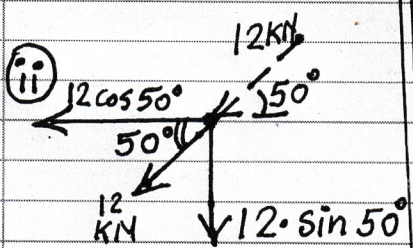
Limitations of Lammi's theorem :-

- i) There should be three forces acting on a body.
- ii) These three forces should be concurrent.
- iii) These three forces should keep the body in equilibrium.

Q.4. Attempt any three. — (12 marks) (12)

a. Determine resultant of coplaner non-concurrent forces as shown in fig.?



Force	"x" Component $F(\cos \theta)$	"y" Component $F(\sin \theta)$
(i) $\rightarrow 4\text{ kN}$	+4	0
(ii) 	$-12 \cos 50^\circ$	$-12 \sin 50^\circ$
(iii) $\uparrow 6\text{ kN}$	0	+6
	$\sum f_x = -3.713 \text{ kN.}$	$\sum f_y = -3.192 \text{ kN}$

$$\text{Resultant} = R = \sqrt{(\sum f_y)^2 + (\sum f_x)^2}$$

$$R = \sqrt{(-3.192)^2 + (-3.713)^2}$$

$$R = 4.896 \text{ N.}$$

$$\theta = \tan^{-1}\left(\frac{\sum f_y}{\sum f_x}\right) = \tan^{-1}\left(\frac{-3.192}{-3.713}\right) \therefore \theta = 40.68^\circ$$

$\therefore \sum f_x$ is -ve & $\sum f_y$ is -ve Resultant in IIIrd quadr

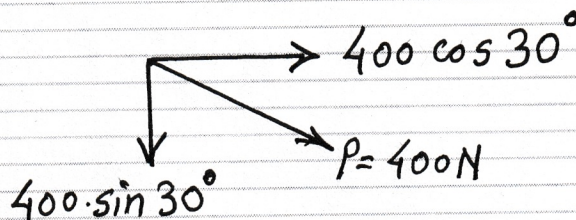
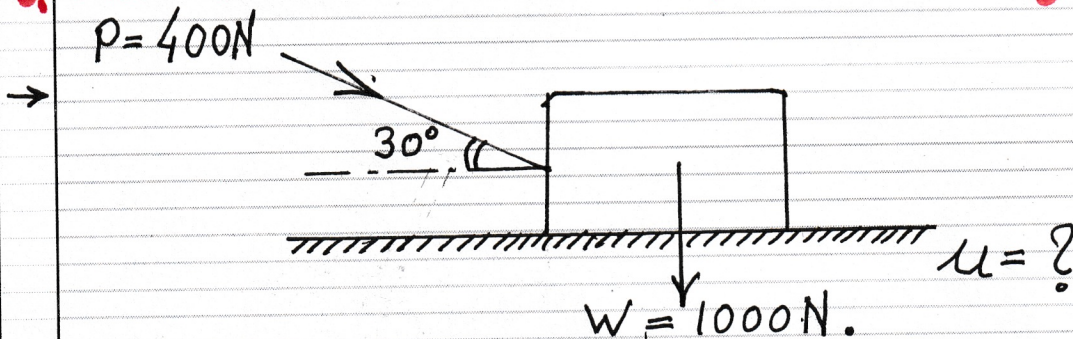


Q.NO SUB
Q.N

ANSWER

Marking
Scheme

4. Attempt any three. 12-M.
b. Find value of μ if body is in limiting equilibrium.



Since the body is in limiting Equilibrium $\sum f_x = 0$.

$$\sum f_x = \mu \cdot R - 400 \cos 30^\circ$$

$$\therefore 0 = \mu \cdot R - 400 \cdot \cos 30^\circ$$

$$\therefore -\mu R = -400 \cos 30^\circ$$

$$\therefore \mu R = 400 \cos 30^\circ$$

$$\therefore \mu = \frac{400 \cos(30^\circ)}{R} \quad \text{--- eq}^n \text{ ①}$$

Resolving forces vertically, we get,

$$\sum f_y = R - 400 \sin(30^\circ) - W$$

$$\therefore 0 = R - 400 \sin(30^\circ) - W$$

$$\therefore W + 400 \sin(30^\circ) = R$$

$$\therefore (1000) + 400 \sin(30^\circ) = R \quad \therefore R = 1200 \text{ N.}$$

Put this value in eqⁿ. ①

$$\mu = \frac{400 \cos(30^\circ)}{R} = \frac{400 \times \cos(30^\circ)}{1200}$$

$$\mu = 0.288 \quad \therefore \mu \cong 0.29.$$



Q.NO SUB QN

ANSWER

Marking Scheme

4. c. Locate position of centroid for shaded lamina.

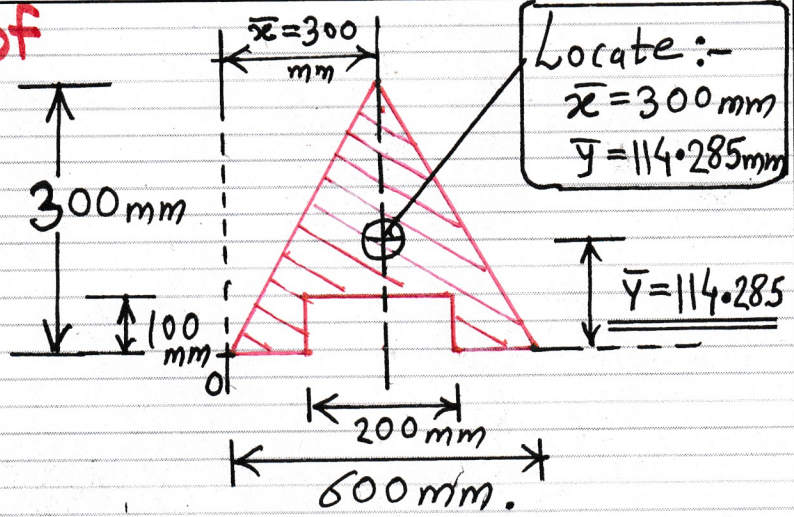
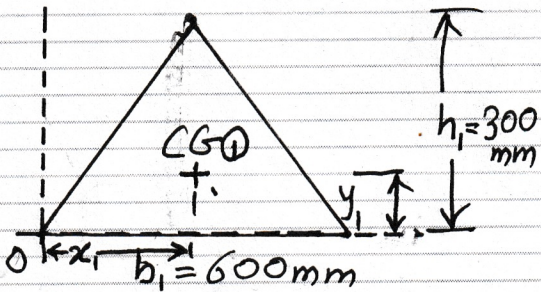


fig ① Triangle



$$A_1 = \frac{1}{2} \times b_1 \times h_1$$

$$A_1 = \frac{1}{2} (600)(300)$$

$$A_1 = 90 \times 10^3 \text{ mm}^2$$

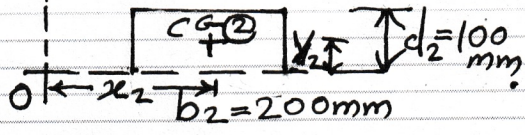
$$y_1 = \frac{h}{3} = \frac{300}{3}$$

$$y_1 = 100 \text{ mm}$$

$$x_1 = \frac{b_1}{2} = \frac{600}{2}$$

$$x_1 = 300 \text{ mm}$$

fig ② Rectangle



$$A_2 = b_2 \times d_2$$

$$A_2 = 200 \times 100$$

$$A_2 = 20 \times 10^3 \text{ mm}^2$$

$$y_2 = \frac{d_2}{2} = \frac{100}{2}$$

$$y_2 = 50 \text{ mm}$$

$$x_2 = \frac{b_1}{2} = 300 \text{ mm}$$

(due to symmetry).

$$\bar{y} = \frac{A_1 y_1 - A_2 y_2}{A_1 - A_2} \therefore \bar{y} = \frac{(90 \times 10^3)(100) - (20 \times 10^3)(50)}{(90 \times 10^3) - (20 \times 10^3)}$$

$$\therefore \bar{y} = 114.285 \text{ mm}$$

Due to symmetry = $x_1 = x_2 = \bar{x} = 300 \text{ mm}$.

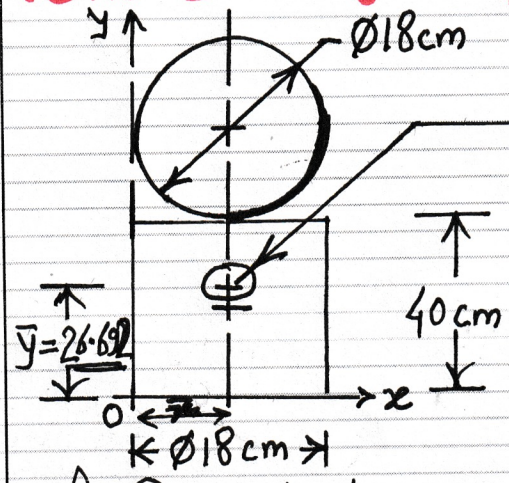


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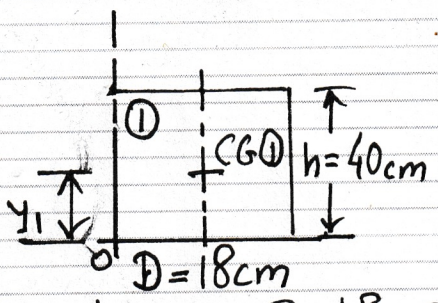
Marking Scheme

4. e. A solid sphere placed on top of cylinder. Find centre of gravity of the combination?



Locate C.G.
 $\bar{x} = 9 \text{ cm}$
 $\bar{y} = 26.692 \text{ cm}$

fig ① cylinder



radius = $r = \frac{D}{2} = \frac{18}{2} = 9 \text{ cm}$.

Volume = $\pi r^2 h$
 $V_1 = \pi \times (9)^2 \times (40)$
 $V_1 = 10178.76 \text{ cm}^3$

$y_1 = \frac{h_1}{2} = \frac{40}{2} = 20 \text{ cm}$

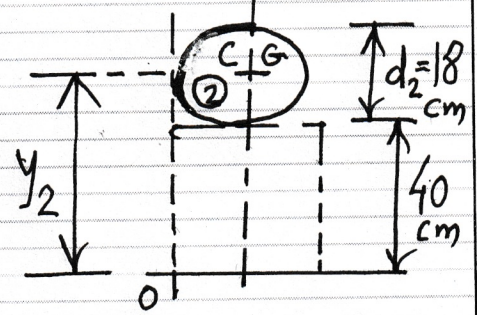
$\bar{y} = \frac{V_1 y_1 + V_2 y_2}{V_1 + V_2} \therefore \bar{y} = \frac{(10178.76)(20) + (3053.628)(49)}{10178.76 + 3053.628}$

$\therefore \bar{y} = 26.692 \text{ cm}$ from base.

\therefore Cylinder & Sphere lying on same axis.

$\therefore x_1 = x_2 = \bar{x} = \frac{18}{2} = 9 \text{ cm}$. $\bar{x} = 9 \text{ cm}$.
from origin.

fig ② Sphere



radius = $r_2 = \frac{18}{2} = 9 \text{ cm}$

Volume = $\frac{4}{3} \pi r_2^3$
 $V_2 = \frac{4}{3} \times \pi \times (9)^3$
 $V_2 = 3053.628 \text{ cm}^3$

$y_2 = 40 + (\frac{18}{2}) = 49 \text{ cm}$

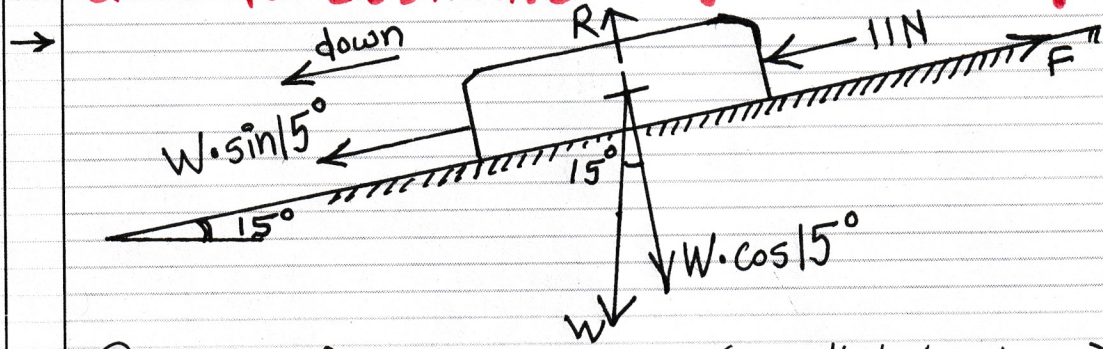


Q.NO SUB Q.N

ANSWER

Marking Scheme

5. Attempt any two. 12-M
a. A block is restion on inclind plane 15° to horizontal. Force 11N parallel to plane, block will just move down. $\mu = 0.40$. Estimate weight of block?



Resolving forces along x axis (parallel to plane)

$$\sum f_x = -11 + F - W \cdot \sin 15^\circ$$

$$0 = -11 + \mu R - W \cdot \sin 15^\circ \quad \text{(limiting equilibrium } \sum f_x = 0 \text{)} \quad \text{eq}^n \text{ ①}$$

Resolving forces along y axis (perpendicular to plane)

$$\sum f_y = R - W \cdot \cos 15^\circ$$

$$\therefore 0 = R - W \cdot \cos 15^\circ \quad \text{[limiting equilibrium } \sum f_y = 0 \text{]}$$

$$\therefore R = W \cos 15^\circ$$

$$\text{But, } 0 = -11 + \mu R - W \cdot \sin 15^\circ \quad \text{--- eq}^n \text{ ①}$$

$$\therefore 0 = -11 + 0.40(W \cos 15^\circ) - W \cdot \sin 15^\circ$$

$$\therefore 0 = -11 + W [(0.40)(\cos 15^\circ) - \sin 15^\circ]$$

$$\therefore 0 = -11 + W [0.2828]$$

$$\therefore 11 = W (0.2828)$$

$$\therefore \frac{11}{0.2828} = W$$

$$\therefore W = 38.896 \text{ N.}$$

Weight of block = $W = 38.896 \text{ N.}$

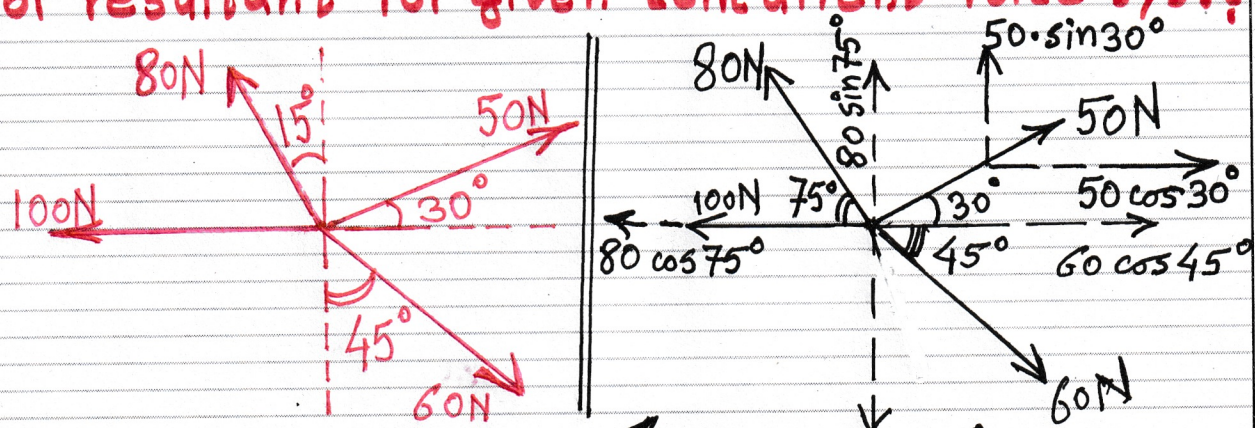


Q.NO SUB QN

ANSWER

Marking Scheme

5. b. Calculate analytically magnetude & direction of resultant for given concurrent force sys.?



Represent angles w.r.t. "x" axis.

Resolving given forces horizontally. (\leftarrow ve | \rightarrow ve).

$$\sum f_x = -100 - 80 \cdot \cos 75^\circ + 50 \cos 30^\circ + 60 \cos 45^\circ$$

$$\sum f_x = -34.978 \text{ N.}$$

Resolving given forces vertically. (\uparrow +ve | \downarrow -ve).

$$\sum f_y = 80 \cdot \sin 75^\circ + 50 \sin 30^\circ - 60 \sin 45^\circ$$

$$\sum f_y = 59.847 \text{ N.}$$

$$\text{Magnetude of } R = \sqrt{(\sum f_x)^2 + (\sum f_y)^2}$$

$$\therefore R = \sqrt{(-34.978)^2 + (59.847)^2}$$

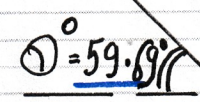
$$\therefore R = 69.319 \text{ N.}$$

$$\theta^\circ = \tan^{-1} \left(\frac{\sum f_y}{\sum f_x} \right)$$

$$\theta^\circ = \tan^{-1} \left[\frac{59.847}{-34.978} \right]$$

$$\theta^\circ = -59.69^\circ. \quad \theta = 59.69^\circ$$

$$R = 69.319 \text{ N}$$



$\because f_x$ -ve & f_y +ve
Resultant lies in IInd quadrant.

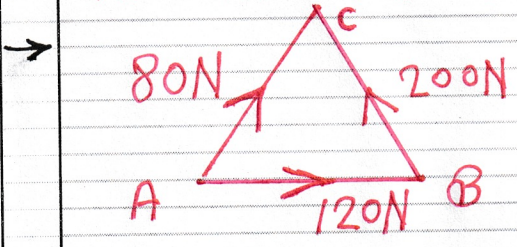


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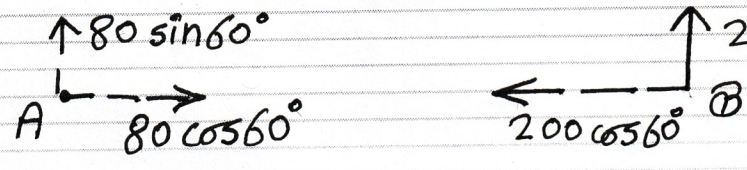
ANSWER

Marking Scheme

5. C Triangle sides AB = BC = CA = 2M. Calculate resultant & it's position w.r.t. point 'A'.



All sides of triangle is 2M
∴ It is an equilateral triangle, every angle is of 60°



Resolving forces horizontally (←ve | →+ve)

$$\sum f_x = 80 \cdot \cos 60 + 120 - 200 \cos 60$$

$$\sum f_x = 60 \text{ N.}$$

Resolving forces vertically. (+ve↑ | ↓-ve)

$$\sum f_y = 80 \sin 60 + 200 \sin 60$$

$$\sum f_y = 242.487 \text{ N.}$$

$$R = \sqrt{(\sum f_x)^2 + (\sum f_y)^2} \therefore R = \sqrt{(60)^2 + (242.487)^2}$$

$$\therefore \text{Resultant } R = 249.799 \text{ N.}$$

$$\theta = \tan^{-1} \left(\frac{\sum f_y}{\sum f_x} \right) \quad \theta = \tan^{-1} \left(\frac{242.487}{60} \right) \quad \theta = 76.10^\circ$$

Taking Moment @ "A" (2+ve | -ve)

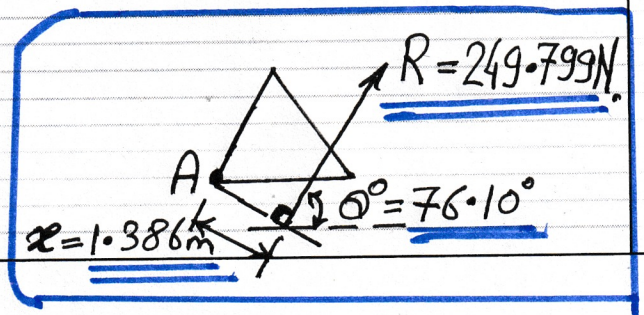
$$\sum M_A = (80 \sin 60 \times 0) + (80 \cos 60 \times 0) + (120 \times 0) + (200 \cos 60 \times 0) - (200 \sin 60 \times 2)$$

$$\therefore \sum M_A = -(200 \sin 60 \times 2) \therefore \sum M_A = 346.41 \text{ N}\cdot\text{m} \text{ (Anti-clockwise)}$$

Applying Varignon's theorem,

$$\sum M_A = R \times x$$

$$\therefore \frac{346.41}{249.799} = x \therefore x = 1.386 \text{ m.}$$





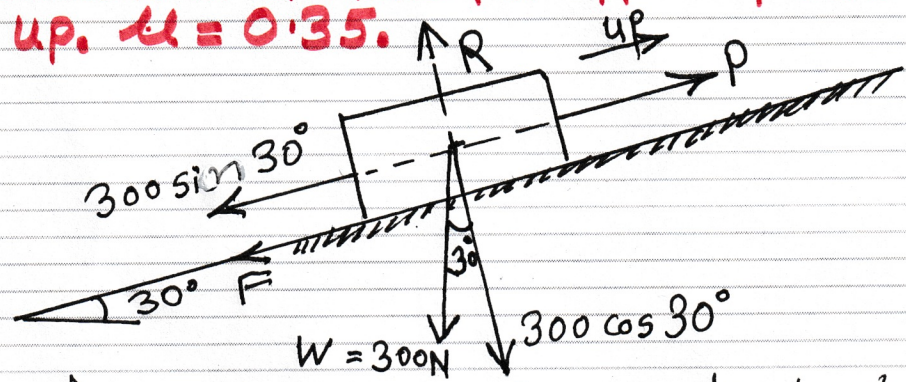
Q.NO SUB Q.N

ANSWER

Marking Scheme

6. Attempt any two.
a. A block weighing 300N resting on inclined plane 30° with horizontal. Calculate pull applied parallel to plane to move up. $\mu = 0.35$.

12 M



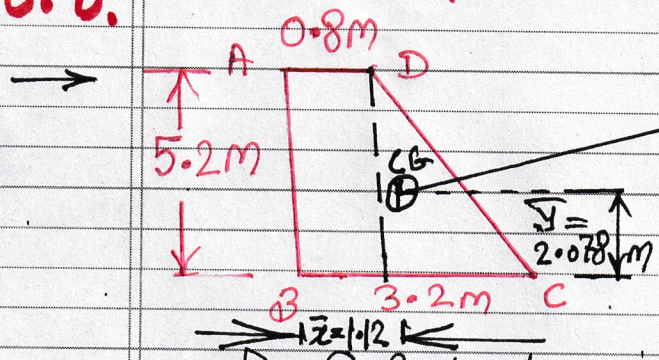
Resolving forces along 'y' axis (perpendicular to plane)
 $\sum f_y = R - 300 \cos 30^\circ$
 $\therefore 0 = R - 300 \cos 30^\circ$ (limiting equilibrium $\sum f_y = 0$)
 $\therefore R = 300 \cos 30^\circ$
 $\therefore R = 259.807 \text{ N}$

Now, $F = \mu R$ \therefore Force of friction (F) = $0.35(259.807)$
 $\therefore F = 90.93 \text{ N}$

Resolving forces along 'x' axis (parallel to inclined plane)
 $\sum f_x = P - F - 300 \sin 30^\circ$
 $\therefore 0 = P - F - 300 \sin 30^\circ$ (limiting equilibrium $\sum f_x = 0$)
 $\therefore 0 = P - (90.93) - 300 \sin 30^\circ$
 $\therefore 0 = P - 240.93$ $\therefore P = 240.93 \text{ N}$

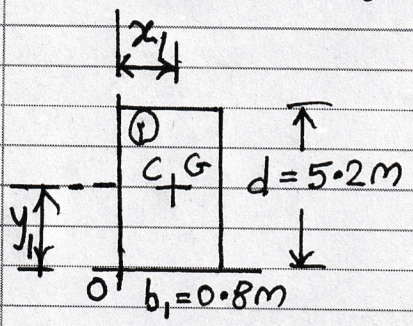
\therefore Pull = $P = 240.93 \text{ N}$

6. b. Calculate position of centroid from B.



Locate
 $\bar{x} = 1.12 \text{ m}$
 $\bar{y} = 2.078 \text{ m}$
 From B.

Fig ① Rectangle



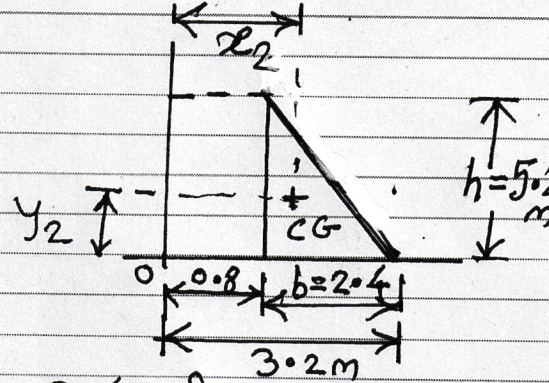
$b_1 = 0.8 \text{ m}$
 $d_1 = 5.2 \text{ m}$

$A_1 = b_1 \times d_1$
 $A_1 = (0.8)(5.2)$
 $A_1 = 4.16 \text{ m}^2$

$y_1 = \frac{d_1}{2} = \frac{5.2}{2}$
 $y_1 = 2.6 \text{ m}$

$x_1 = \frac{b_1}{2} = \frac{0.8}{2}$
 $x_1 = 0.4 \text{ m}$

Fig ② Triangle



$b_2 = 2.4 \text{ m}$ & $h_2 = 5.2 \text{ m}$

$A_2 = \frac{1}{2} b \times h$
 $A_2 = \frac{1}{2} (2.4)(5.2)$
 $A_2 = 6.24 \text{ m}^2$

$y_2 = \frac{h_2}{3} = \frac{5.2}{3}$
 $y_2 = 1.73 \text{ m}$

$x_2 = 0.8 + \frac{b_2}{2} = 0.8 + \frac{2.4}{2}$
 $x_2 = 1.6 \text{ m}$

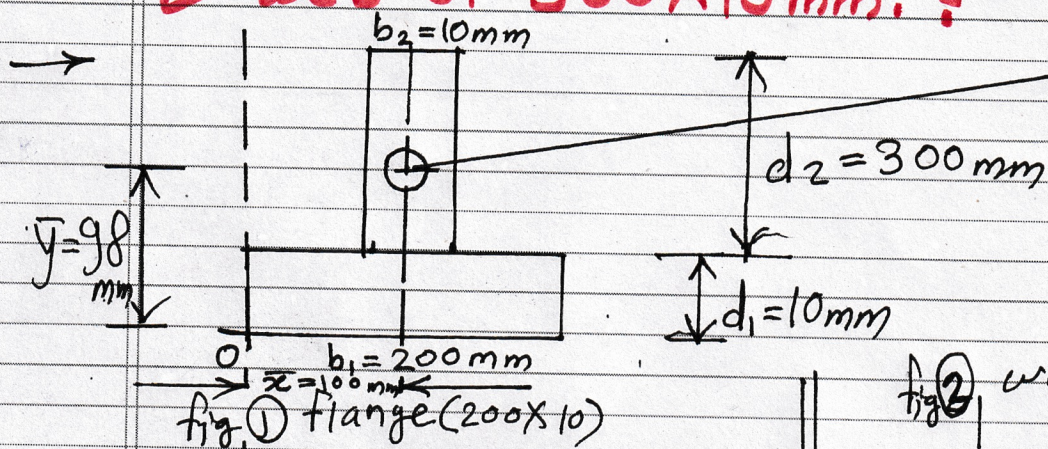
$\bar{y} = \frac{A_1 y_1 + A_2 y_2}{A_1 + A_2} = \frac{(4.16)(2.6) + (6.24)(1.73)}{4.16 + 6.24}$

$\bar{y} = 2.078 \text{ m}$ from Base BC [B.]

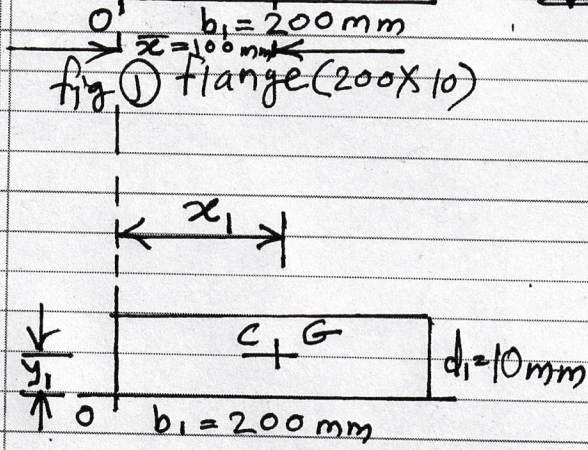
$\bar{x} = \frac{A_1 x_1 + A_2 x_2}{A_1 + A_2} = \frac{(4.16)(0.4) + (6.24)(1.6)}{4.16 + 6.24}$

$\bar{x} = 1.12 \text{ m}$ from L.H.S. AB [B].

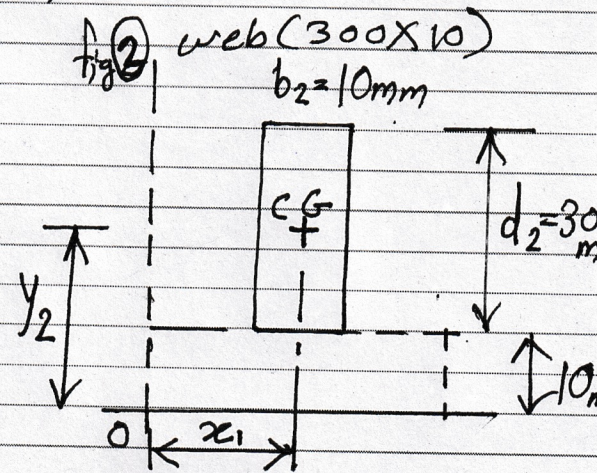
6 C. Find centroid of Inverted T = flange 200×10 mm & web of 300×10 mm. ?



Locate
 $\bar{x} = 100$ mm
 $\bar{y} = 98$ mm.



$b_1 = 200$ mm
 $d_1 = 10$ mm
 $A_1 = b_1 \times d_1$
 $A_1 = 200 \times 10$
 $A_1 = 2000$ mm².
 $y_1 = \frac{d_1}{2} = \frac{10}{2} = 5$ mm



$b_2 = 10$ mm
 $d_2 = 300$ mm
 $A_2 = b_2 \times d_2$
 $A_2 = 10 \times 300$
 $A_2 = 3000$ mm².
 $y_2 = 10 + \frac{d_2}{2} = 160$ mm

$$\bar{y} = \frac{A_1 y_1 + A_2 y_2}{A_1 + A_2} = \frac{(2000)(5) + (3000)(160)}{2000 + 3000}$$

$\bar{y} = 98$ mm

Due to Symmetry $x_1 = x_2 = \bar{x} = \frac{200}{2}$

$\therefore \bar{x} = 100$ mm.