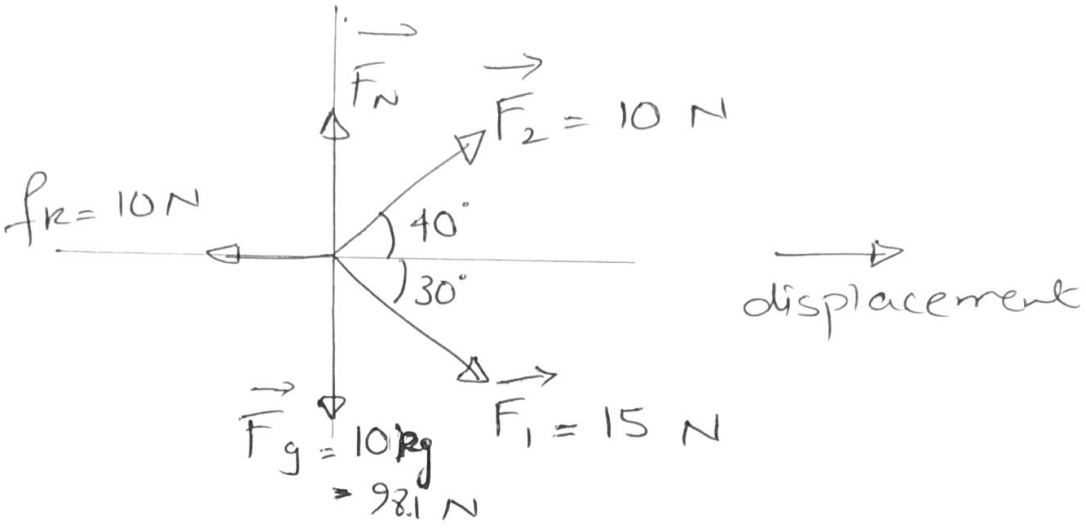
Final Exam Solution

(1)

Question 1



(a) work done :- (12)

$$W.D = F_1 \cos 30 (12\text{m}) + F_2 \cos 40 (12) - 10 (12)$$

$$= 90\sqrt{3} + 91.92 - 120$$

$$= 127.8 \text{ Joules.}$$

(b) $F_N \cos 90 (12) = WD = 0$ (4)

$F_g \cos 90 (12) = WD = 0$

(c) $WD = 15 \cos 30 (12) + 10 \cos 40 (12)$ (9)

$= 90\sqrt{3} + 91.92 = 247.80$ Joules

$$\frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 = 247.80 \text{ Joules}$$

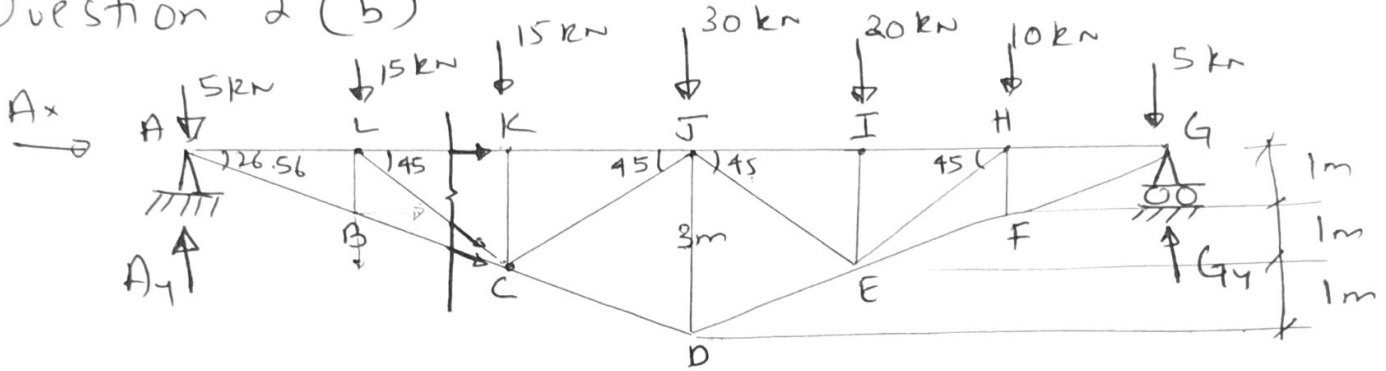
$$\frac{1}{2} (10\text{kg}) v_f^2 = 247.80$$

$$v_f = 7.04 \text{ m/s.}$$

Question 2 (a)

CD, DE, HA, HG, EC, EF = zero

Question 2 (b)



2m 2m 2m 2m 2m 2m

(a)

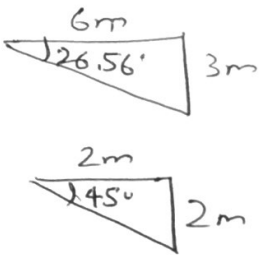
$\Sigma F_x = 0 \quad A_x = 0$

$\Sigma F_y = 0 \quad A_y + G_y = 100 \text{ KN}.$

$\Sigma M_G = 0 \quad A_y(12) = 5(12) + (15)(10) + 15(8) + 30(6) + 20(4) + 10(2)$

$A_y = 50.83 \text{ KN}$ (4)

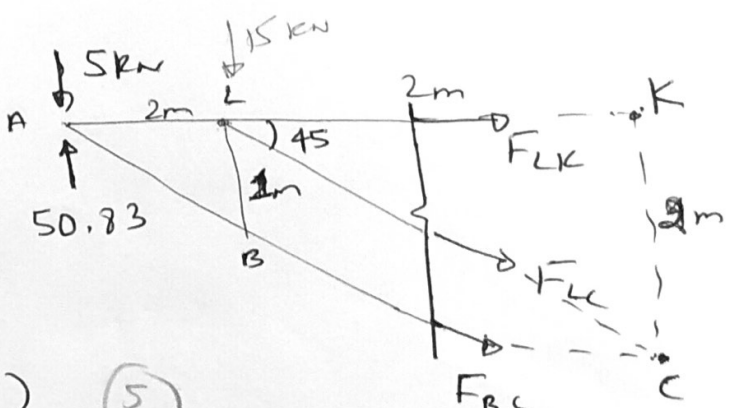
$G_y = 49.17 \text{ KN}$



(b) $\left(\overset{+}{\circlearrowleft}\right) \Sigma M_C = 0$

$-50.83(4) + 5(4) + 15(2) - F_{LK}(2) = 0$

$F_{LK} = -88.33 \text{ KN}$ (C) (5)



15

$\circlearrowleft +\Sigma M_L = 0$

$-50.83(2) + 5(2) + F_{BC}\cos 22.56(1) = 0$

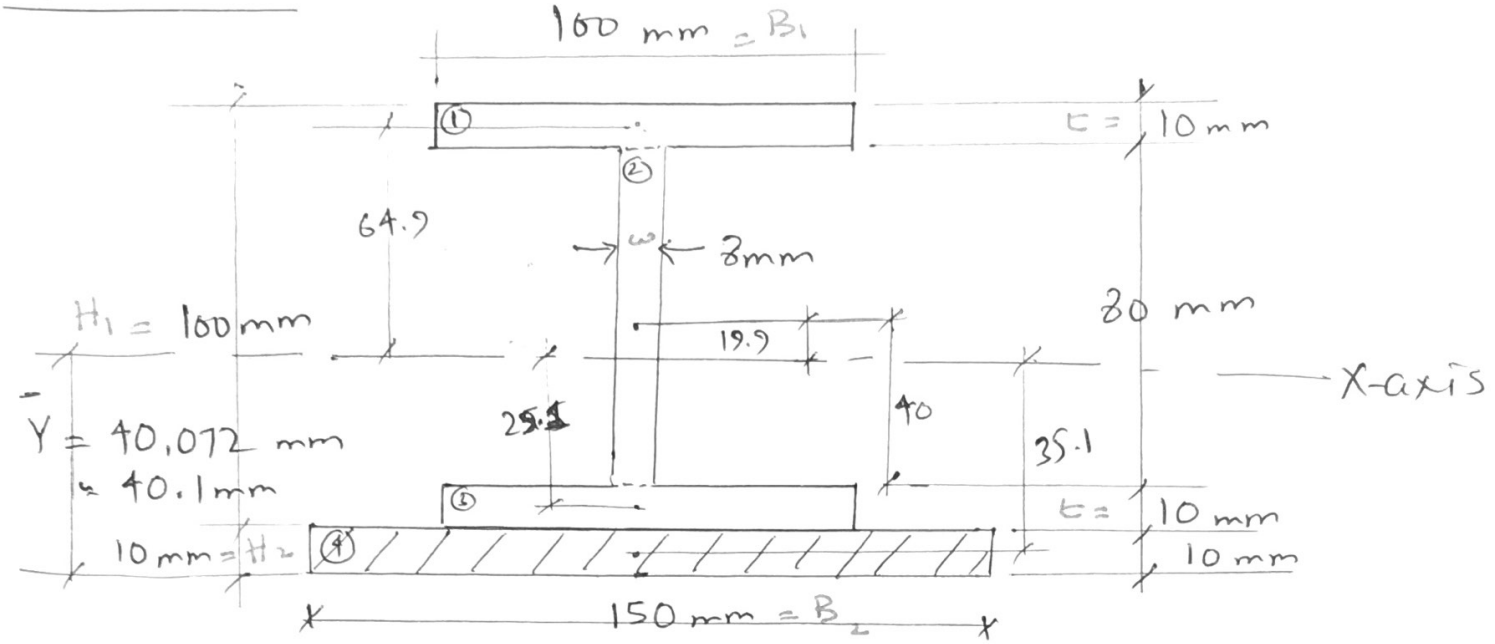
$F_{BC} = 99.26 \text{ kN (T)}$ (5)

$\circlearrowleft +\Sigma M_A = 0$

$15(2) + F_{LC}\sin 45(2) = 0$

$F_{LC} = -21.21 \text{ kN (C)}$ (5)

Question 3



#	Area (mm^2)	$\bar{y}$ (mm)	$A\bar{y}$ (mm^3)
1	1000	105	105000
2	640	60	38400
3	1000	15	15000
4	1500	5	7500
Σ =	4140		165900

$\bar{Y} = 40,072$ mm
$= 40.1$ mm

Question 4

$$I_x = \left(\frac{150\times10^3}{12} + 1500(35.1)^2\right) + \left(\frac{100\times10^3}{12} + 1000(25.1)^2\right)$$
$$+ \left(\frac{8\times80^3}{12} + 640(19.9)^2\right) + \left(\frac{100\times10^3}{12} + 1000(64.9)^2\right)$$
$$= \left(12500 + 1848055\right) + \left(\frac{25000}{3} + 630010\right) +$$
$$\left(\frac{1024000}{3} + \frac{1267232}{5}\right) + \left(\frac{25600}{3} + 4212010\right)$$
$$= 7.313\times10^6 \text{ mm}^4$$