

Q1) 15 Marks

2 Marks

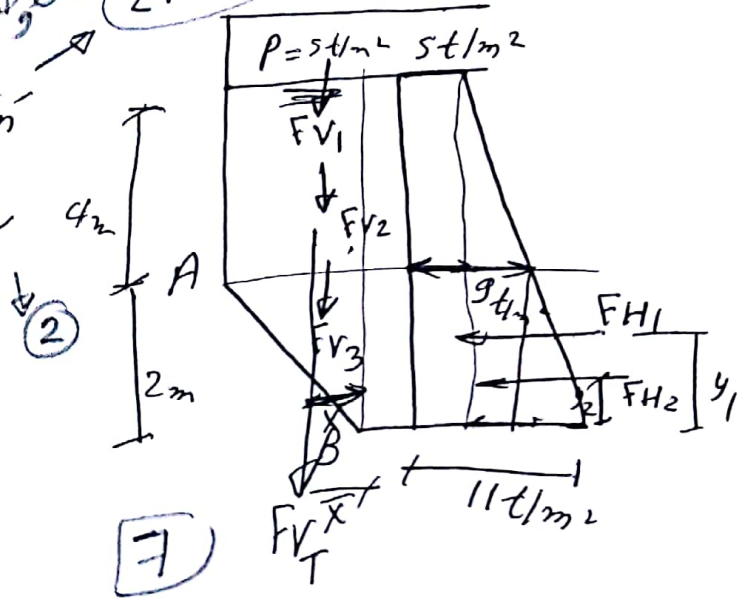
$$F_{H1} = 9 \times 2 \times 1 \times 1 = 18 \text{ t/m}$$

$$F_{H2} = \frac{2 \times 2}{2} \times 1 \times 1 = 2 \text{ t/m}$$

$$F_{HT} = 20 \text{ t/m} \rightarrow \textcircled{1}$$

$$F_{HT} \times \bar{Y} = 18 \times 1 + \frac{2 \times 2}{3}$$

$$\bar{Y} = 0.97 \text{ m} \rightarrow \textcircled{2}$$



7

$$F_{V1} = 5 \times 2 \times 1 = 10 \text{ t/m} \rightarrow \textcircled{2}$$

$$F_{V2} = 4 \times 2 \times 1 \times 1 = 8 \text{ t/m} \rightarrow \textcircled{2}$$

$$F_{V3} = \frac{2 \times 2}{2} \times 1 \times 1 = 2 \text{ t/m} \rightarrow \textcircled{2}$$

8

$$F_{VT} = 20 \text{ t}$$

$$20 \times \bar{X} = \frac{10 \times \frac{2}{2} + 8 \times \frac{2}{2} + 2 \times \frac{2}{3}}{20} = 0.97 \text{ m} \rightarrow \textcircled{2}$$

Q2: (15 Marks)

(2/6)

$$y = 4 = \frac{\omega_1^2 (3)^2}{2 \times 9.81}$$

$$\omega_1 = 2.96 \text{ rad/sec} \rightarrow \textcircled{2}$$

$$S = \frac{\omega_2^2 (X)^2}{2 \times 9.81}$$

$$2 \times \pi (3)^2 = \frac{1}{2} \pi X^2 (S)$$

$$X = 2.68 \text{ m}$$

$$\text{get } \omega_2 = 3.69 \text{ rad/sec} \rightarrow \textcircled{2}$$

$$\omega_1 < \omega_g < \omega_2$$

$$y_1 = \frac{(3-S)^2 X_1^2}{2 \times 9.81}$$

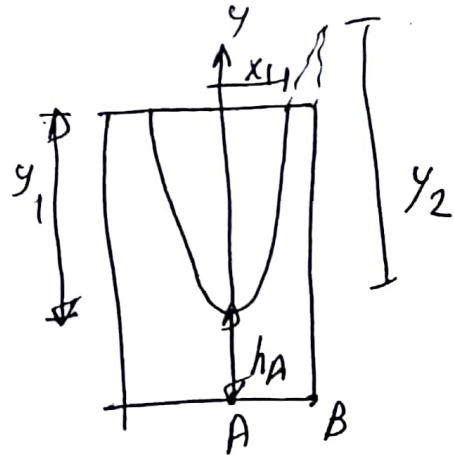
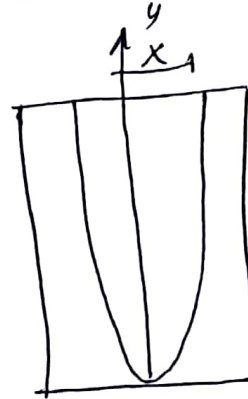
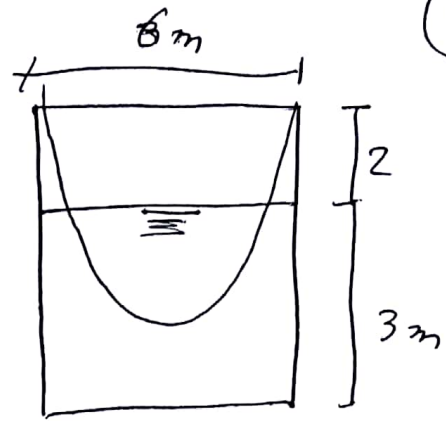
$$2 \times \pi (3)^2 = \frac{1}{2} y_1 (\pi X_1^2)$$

$$36 = y_1 X_1^2$$

$$X_1^2 = \frac{36}{y_1}$$

$$y_1 = \frac{(3-S)^2 \times 36}{2 \times 9.81 y_1}$$

$$y_1 = 4.74 \text{ m} \rightarrow \textcircled{3}$$



$$P_A = \delta h_A = 1(5 - 4.74) = 0.26 \text{ t/m}^2 \rightarrow \textcircled{2}$$

$$y_2 = \frac{(3-5)^2 (3)^2}{2 \times 9.81} = 5.62 \text{ m} \rightarrow$$

$$h_B = 5.62 + 0.26 = 5.88 \text{ m} \rightarrow \textcircled{2}$$

$$P_B = \delta h_B = 5.88 \text{ t/m}^2 \rightarrow \textcircled{1}$$

exposed area = zero  $\downarrow$   $\textcircled{3}$   $w_{\text{given}} < w_2$

$$\textcircled{Q_3} \quad y = \frac{g x^2}{2 v^2}, \quad v = C_V \sqrt{2gH}$$

8 Marks

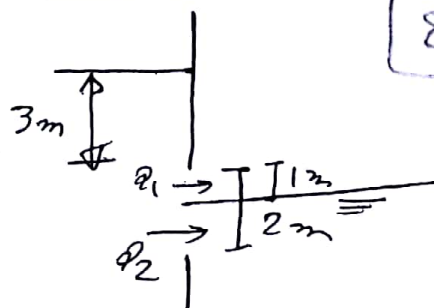
$$y = \frac{g x^2}{2 C_V^2 (2gH)}$$

$$y = \frac{x^2}{4 C_V^2 H}$$

$$4 = \frac{(5)^2}{4(4) C_V^2} \rightarrow C_V = 0.625 \rightarrow \textcircled{4}$$

⑥

$$Q = Q_1 + Q_2$$



8 Marks

(4/6)

$$Q_1 = \frac{2}{3} C_d B \sqrt{g} (H_1^{3/2} - H_2^{3/2})$$

$$Q_1 = \frac{2}{3} \times 0.6 \times 2 \sqrt{2 \times 9.81} [(4)^{3/2} - (3)^{3/2}] = 9.93 \text{ m}^3/\text{sec}$$

↓ (3)

$$Q_2 = C_d A \sqrt{2gH}$$

$$Q_2 = 0.6 \times 2 \times \sqrt{2g(4)} = 20.68 \text{ m}^3/\text{sec} \rightarrow (3)$$

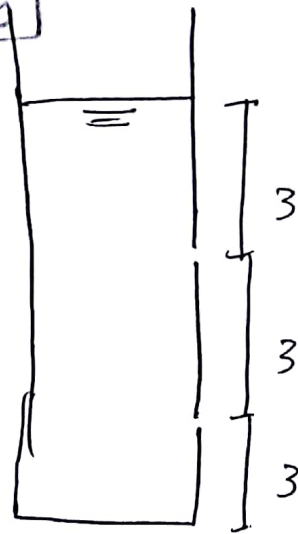
$$Q_T = 9.93 + 20.68 = 30.61 \text{ m}^3/\text{sec} \rightarrow (2)$$

Q4)

17 Marks

$$T = \int_1^3 \frac{A \cdot dh}{Q_1 + Q_2} \quad (3)$$

$$T = \int_1^3 \frac{\pi (2)^2 \cdot dh}{C_d a \sqrt{2gh} + C_d a \sqrt{2g(h+3)}}$$



(3) عدد التفاضل

T = ← التفاضل (5) مرة (1) مرات

Q5 a 17 Marks

$$l_0 = \frac{2fV^2}{2gD} + \frac{2f_1V_1^2}{2gD}$$

$$l_0 = \frac{0.025(1500)V^2}{2 \times 9.81 \times 1} + \frac{0.025(3500)V_1^2}{2g \times 1}$$

$$l_0 = 1.91 V^2 + 4.46 V_1^2 \rightarrow \textcircled{2}$$

$$Q_1 = Q - 0.5 \rightarrow \textcircled{2}$$

$$aV_1 = aV - 0.5$$

$$\frac{\pi}{4}(1)^2 V_1 = \frac{\pi}{4}(1)^2 V - 0.5$$

$$0.785 V_1 = 0.785 V - 0.5$$

$$V = V_1 - 0.64$$

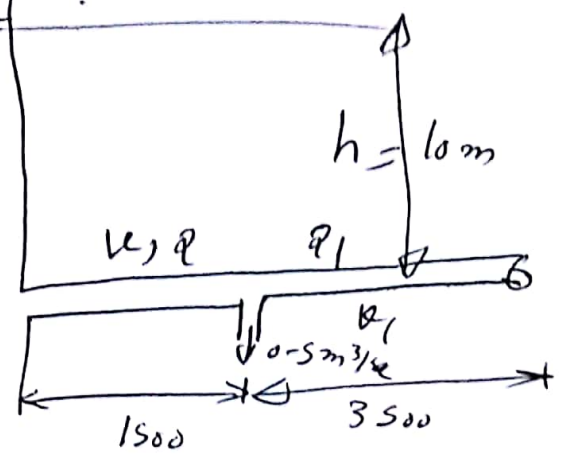
$$l_0 = 1.91 (V_1 - 0.64)^2 + 4.46 V_1^2$$

Solve get  $V_1 = \leftarrow$  get  $Q_1 = \leftarrow \textcircled{3}$

In case of no leakage

$$l_0 = 6.37 V^2 \rightarrow V = \leftarrow$$

$$Q_{old} = \leftarrow \textcircled{2}$$



$\% \text{ change} = \frac{Q_1 - Q_{old}}{Q_{old}} = \pm \%$

e)

$$HP = 20 + \frac{\rho L V^2}{\gamma d} \rightarrow \textcircled{2}$$

8 Marks

$$V = \omega = Q/A$$

$$HP = \omega \quad \textcircled{2}$$

$$\text{power of pump} = \frac{\gamma Q H_p}{75} \rightarrow \textcircled{2}$$

$$= \frac{1000 (4) H_p}{75} = \omega \quad \underline{HP}$$

$\omega = HP \quad \textcircled{1}$  for  $\textcircled{2}$