2) Diameter of Inlet $D_1 = 300mm = 0.3m$

$$A_1 = \frac{\pi d^2}{4} = \frac{3.142 \times 0.3^2}{4} = 0.07m^2$$

Diameter of throat $D_2 = 150mm = 0.15m$

$$A_2 = \frac{\pi d^2}{4} = \frac{3.142 \times 0.15^2}{4} = 0.01767m^2$$

$S_m = 13.6$ (mercury) $\quad S.P = 0.9$ (oil)

Reading of differential manometer, $y = 250mm = 0.25m$.

The differential "h" is given by;

$$h = \left(\frac{P_1}{w} + z_1\right) - \left(\frac{P_2}{w} + z_2\right)$$

$$= y\left[\frac{S_m}{S_p} - 1\right]$$

$$= 0.25\left[\frac{13.6}{0.9} - 1\right]$$

$$= 3.53m \text{ of oil}$$

(A) Discharge of oil Q

$$Q = \frac{Cd \times A_1 A_2 \times \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}}$$

$$Q = \frac{0.98 \times 0.07 \times 0.01767 \times \sqrt{2 \times 9.81 \times 3.53}}{\sqrt{(0.07)^2 - (0.01767)^2}}$$

$$Q = \frac{0.01009}{0.06773}$$

$$Q = 0.149m^3/s$$

(B) Pressure difference between entrance and throat section $P_1 - P_2$

$$h = \left(\frac{P_1}{w} + z_1\right) - \left(\frac{P_2}{w} + z_2\right) = 3.53$$

$$\therefore h = \left(\frac{P_1}{w} - \frac{P_2}{w}\right) - (z_1 - z_2) = 3.53$$

$$z_2 - z_1 = 300mm = 0.3m$$

$$\left(\frac{P_1 - P_2}{w}\right) - 0.3 = 3.53$$

HIKMAT IGANGA
18/ENG03/025
CIVIL ENGINEERING

1) $D_1 = 150mm = 0.15m$, $D_2 = 75mm = 0.075m$, Sp of gravity $= 0.8$
$Z_2 - Z_1 = 150mm = 0.15m$, $Q = 40Lt/sec = 0.04m^3/s$, $Cd = 0.96$
Pressure difference $P_1 - P_2 = ?$

$$A_1 = \frac{\pi d^2}{4} = \frac{3.142 \times 0.15^2}{4} = 0.01767m^2$$

$$A_2 = \frac{\pi d^2}{4} = \frac{3.142 \times 0.075^2}{4} = 0.00442m^2$$

$$Q = \frac{Cd \times A_1 A_2 \times \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}}$$

$$0.04 = \frac{0.96 \times 0.01767 \times 0.00442 \times \sqrt{2 \times 9.81 \times h}}{\sqrt{(0.01767)^2 - (0.00442)^2}}$$

$$0.04 = 0.96 \times 0.004565 \times 4.429\sqrt{h}$$

$$h = \left(\frac{0.04}{0.96 \times 0.004565 \times 4.429}\right)^2$$

$$h = 4.247m$$

$$h = \left(\frac{P_1}{w} + Z_1\right) - \left(\frac{P_2}{w} + Z_2\right)$$

$$h = \left(\frac{P_1}{w} + \frac{P_2}{w}\right) + (Z_1 - Z_2)$$

$$4.247 = \left(\frac{P_1 - P_2}{P_g}\right) - 0.15$$

$$4.247 + 0.15 = \frac{P_1 - P_2}{P_g}$$

$$4.397 = \frac{P_1 - P_2}{P_g}$$

$$P_1 - P_2 = 4.397 \times (0.8 \times 1000 \times 9.81)$$

$$P_1 - P_2 = 4.397 \times 7848$$

$$P_1 - P_2 = 34.51 KN/m^2 //$$

$$= 3451 N/m^2$$

$$\frac{P_1 - P_2}{w} = 3.53 + 0.3$$

$$\frac{P_1 - P_2}{w} = 3.83$$

$P_1 - P_2 = 3.83w$ Recall $w = \rho g$

$P_1 - P_2 = 3.82 \times 9.81 \times 0.9$

$= 33.8 \text{ kN/m}^2$