

SAKA-SHENAYON CLANREWASU 18/ENG02/086

Computer Engineering ENG 214 Assignment

1)  $D_1 = 300\text{mm} = 0.3\text{m}$

$$\text{Area}(A_1) = \frac{\pi}{4} \times 0.3^2 = 0.07\text{m}^2$$

$$D_2 = 150\text{mm} = 0.15\text{m}$$

$$\text{Area}(A_2) = \frac{\pi}{4} \times 0.15^2 = 0.01767\text{m}^2$$

Specific Gravity of Mercury ( $S_{Hl}$ ) = 13.6

Specific Gravity of Oil ( $S_p$ ) = 0.9

Reading on Manometer ( $y$ ) = 250mm = 0.25m

$\therefore$  The differential head in this case is given by

$$y \left[ \frac{S_{Hl}}{S_p} - 1 \right] = 0.25 \left[ \frac{13.6}{0.9} - 1 \right]$$

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

i) Discharge of Oil

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

$$Q = \frac{0.98 \times 0.007 \times 0.01767}{\sqrt{0.07^2 - 0.01767^2}} \times \sqrt{2 \times 9.81 \times 3.53}$$
$$= 0.1489\text{m}^3/\text{s}$$

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

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

$$P_1 - P_2 = 3.83 \times w$$

$$w = (9.81 \times 0.9) = 8.829$$

$$\therefore P_1 - P_2 = 3.83 \times 8.829 = 33.8 \text{ kN/m}^2$$

2. Sp. gravity = 0.8

$$D_1 = 150 \text{ mm} = 0.15 \text{ m}$$

$$D_2 = 72 \text{ mm} = 0.072 \text{ m}$$

$$Z_1 - Z_2 = 150 \text{ mm} = 0.15 \text{ m}$$

$$Q = 40 \text{ litres/sec} = 0.04 \text{ m}^3/\text{s}$$

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

$$A_2 = \frac{\pi}{4} \times 0.072^2 = 0.00407 \text{ m}^2$$

$$Q = C_d \times \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gh} \quad (\text{Using this to find } h)$$

$$0.04 = \frac{0.96 \times 0.01767 \times 0.00407}{\sqrt{0.01767^2 - 0.00407^2}} \times \frac{\sqrt{2 \times 9.81} \times \sqrt{h}}{1}$$

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

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

$$0.96 \times 0.004565 \times 4.429$$

$$\sqrt{h} = 2.0608$$

$$h = 2.0608^2$$

$$\therefore h = 4.247 \text{ m}$$

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

$$4.247 = \left( \frac{p_1 - p_2}{\omega} \right) - 0.15$$

$$\left( \frac{p_1 - p_2}{\omega} \right) = 4.247 + 0.15 = 4.397$$

$$\therefore (p_1 - p_2) = 4.397 \times \omega$$

$$= 4.397 \times (0.8 \times 1000 \times 9.81)$$

$$= 34.51 \text{ KN/m}^2$$