

$$P_1 - P_2 = 1177.2 \text{ kN/m}^2$$

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

Question two

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

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

$$Area_1 = \frac{\pi D_1^2}{4} = \frac{3.142 \times 0.3^2}{4}$$

$$= 0.07 \text{ m}^2$$

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

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

$$P_1 - P_2 = 3.83 \times 9.81 \times 0.7$$

$$Area_2 = \frac{\pi D_2^2}{4} = \frac{3.142 \times 0.15^2}{4}$$

$$P_1 - P_2 = 33.8 \text{ kN/m}^2$$

$$= 0.017 \text{ m}^2$$

$$\text{S.G. of mercury} = 13.6$$

$$\text{S.G. of oil} = 0.9$$

Differential U-tube mercury

$$\text{manometer} = 250 \text{ mm} = 0.25 \text{ m}$$

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

$$= \left[ \frac{\text{S.G. of mercury} - 1}{\text{S.G. of oil}} \right]$$

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

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

i) Discharge of oil

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

$$Q = 0.98 \times 0.07 \times 0.017 \times \sqrt{2 \times 9.81 \times 3.53}$$

$$\sqrt{(0.07)^2 - (0.017)^2}$$

$$Q = 0.142 \text{ m}^3/\text{s}$$

$$Z_2 - Z_1 = 300 \text{ mm} = 0.3 \text{ m}$$

$$z = 0.01767 \text{ m}^2$$

$$A_2 = \frac{\pi D_c^2}{4} = \frac{3.142 \times 0.075^2}{4}$$

$$= 4.4184 \times 10^{-3} \text{ m}^2$$

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

$$0.04 = 0.96 \times 0.01767 \times 4.4184 \times 10^{-3} \times \sqrt{2 \times 9.81 \times h}$$

$$\sqrt{(0.01767)^2 - (4.4184 \times 10^{-3})^2}$$

$$0.04 = 0.0747 \times \sqrt{19.62h}$$

$$\downarrow 0.0171$$

$$0.04 = 0.0749 \times 4.429 \sqrt{h}$$

$$0.0171$$

$$0.04 \times 0.0171 = 0.0749 \times 4.429 \sqrt{h}$$

$$6.84 \times 10^{-4} = 0.331 \sqrt{h}$$

$$\sqrt{h} = 2.072 \times 10^{-3}$$

$$h = (2.072 \times 10^{-3})^2$$

$$h = 4.29 \times 10^{-6} \text{ m}$$

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

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

$$4.29 \times 10^{-6} = \left( \frac{P_1 - P_2}{\rho} \right) - 0.15$$

$$4.29 \times 10^{-6} + 0.15 = \frac{P_1 - P_2}{\rho}$$

$$0.15 \rho = P_1 - P_2$$

$$0.15 \times 0.8 \times 1000 \times 9.81 = P_1 - P_2$$

Question One

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

$$D_2 = 75 \text{ mm} = 0.075 \text{ m}$$

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

$$Q = 4 \text{ litres/sec} = 0.004 \text{ m}^3/\text{sec}$$

$$C_d = 0.96, \text{ relative density} = 0$$

$$A_1 = \frac{\pi D_1^2}{4} = \frac{3.142 \times 0.15^2}{4}$$