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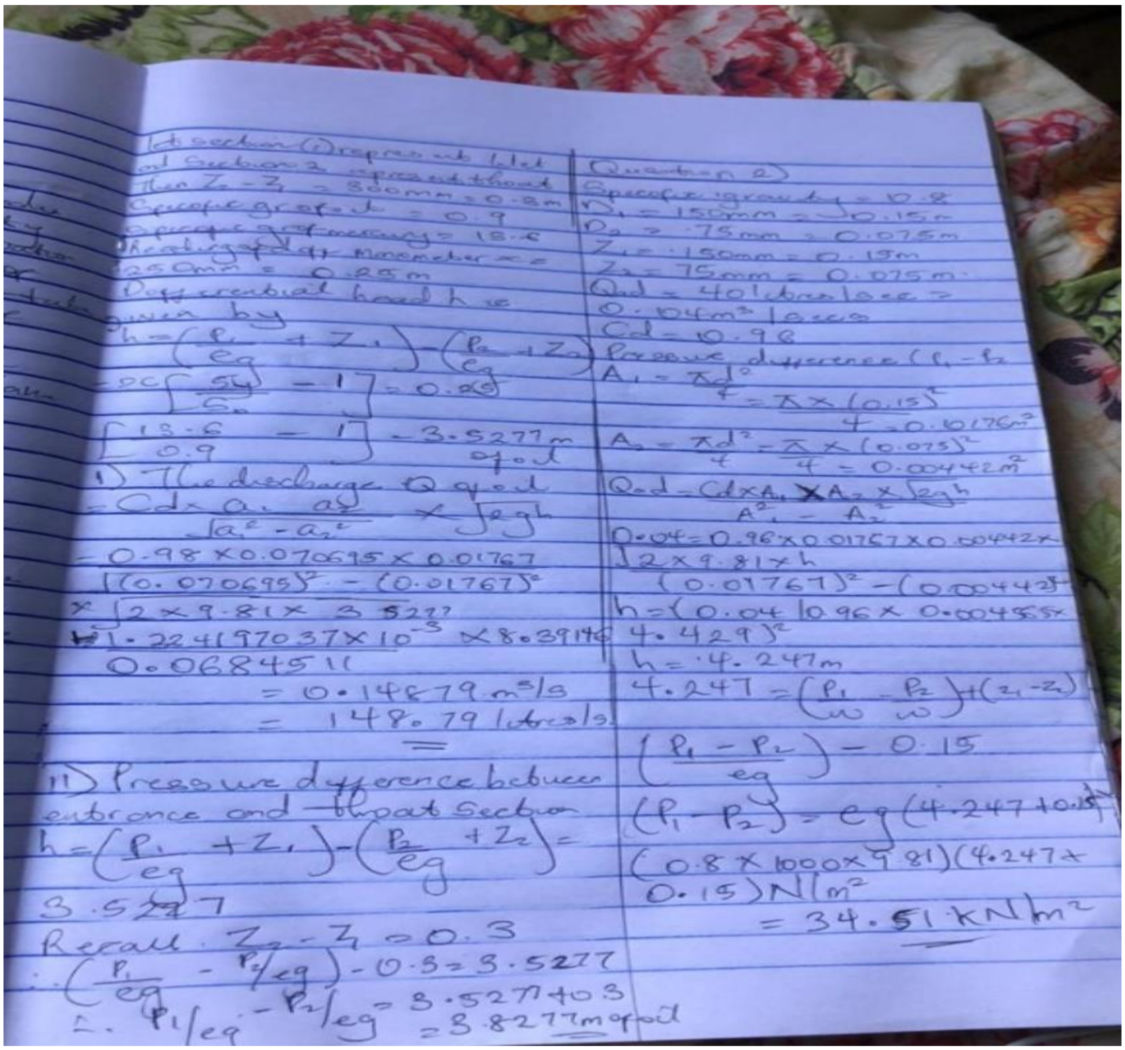
MATRIC NUMBER :18/ENG06/046

DEPARTMENT : MECHANICAL EGINEERING



Let section (1) represent inlet and section 2 represent throat

Then $Z_2 - Z_1 = 300mm = 0.3m$

Specific gravity of oil $= 0.9$

Specific gravity of mercury $= 13.6$

Reading of diff manometer $x = 250mm = 0.25m$

Differential head h is given by

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

$$= x\left[\frac{S_g}{S_o} - 1\right] = 0.25$$

$$\left[\frac{13.6}{0.9} - 1\right] = 3.5277m \text{ of oil}$$

i) The discharge Q of oil

$$= Cd \times \frac{a_1 a_2}{\sqrt{a_1^2 - a_2^2}} \times \sqrt{2gh}$$

$$= \frac{0.98 \times 0.070695 \times 0.01767}{\sqrt{(0.070695)^2 - (0.01767)^2}} \times \sqrt{2 \times 9.81 \times 3.5277}$$

$$= \frac{1.224197037 \times 10^{-3} \times 8.39146}{0.068451}$$

$= 0.14879 m^3/s$

$= 148.79$ litres/s

ii) Pressure difference between entrance and throat section

$$h = \left(\frac{P_1}{\rho g} + Z_1\right) - \left(\frac{P_2}{\rho g} + Z_2\right) = 3.5277$$

Recall $Z_2 - Z_1 = 0.3$

$$\therefore \left(\frac{P_1}{\rho g} - P_2/\rho g\right) - 0.3 = 3.5277$$

$$\therefore P_1/\rho g - P_2/\rho g = 3.5277 + 0.3$$

$= 3.8277m$ of oil

Question 2)

Specific gravity $= 0.8$

$D_1 = 150mm = 0.15m$

$D_2 = 75mm = 0.075m$

$Z_1 = 150mm = 0.15m$

$Z_2 = 75mm = 0.075m$

$Q_{od} = 40$ litres/sec $= 0.04m^3/secs$

$Cd = 0.96$

Pressure difference $(P_1 - P_2)$

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

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

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

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

$h = (0.04 / 0.96 \times 0.004555 \times 4.429)^2$

$h = 4.247m$

$$4.247 = \left(\frac{P_1}{w} - \frac{P_2}{w}\right) + (z_1 - z_2)$$

$$\left(\frac{P_1 - P_2}{\rho g}\right) - 0.15$$

$(P_1 - P_2) = \rho g(4.247 + 0.15)$

$(0.8 \times 1000 \times 9.81)(4.247 + 0.15) N/m^2$

$= 34.51 kN/m^2$

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Question 1

A 300mm × 150mm Venturimeter is provided in a Vertical pipeline Carrying oil of Specific gravity 0.9 flow being upward. the difference in elevation of the throat Section and entrance Section of the Venturimeter is 300mm. The differential U-tube Mercury manometer Shows guage deflection of 250mm. Calculate, (a) the discharge of oil and b) The pressure difference between the entrance Section and the throat Section. Take the Co-efficient of meter as 0.98 and Specific gravity of mercury as 13.6

Question 2

A Vertical Venturimeter Carries a liquid of relative density 0.8 and has inlet and throat diameters of 150mm and 75mm respectively. The pressure Connection at the throat is 150mm above that at the inlet. If the actual flow rate of flow is 40litres/sec and the Cd = 0.96, Calculate the pressure difference between inlet and throat in N/m^2.

Solution

Question 1)

Diameter of Inlet (d) = 300mm = 300×10^{-3} => 0.3m

Area $(A_1) = \frac{\pi d^2}{4} = \frac{\pi (0.3)^2}{4} = 0.070695 m^2$

Diameter of throat (d_2) = 150mm = 150×10^{-3} => 0.15m

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