

Name : FREMASARA HOPE

Department: Mechatronics
Matric No: 18/ENGL05/018

FLUID MECHANICS

1) $V_1 = 5 \text{ ms}^{-1}$ $V_2 = 2 \text{ ms}^{-1}$

Flow at smaller end = 2.5m

$$h_f = \frac{[0.35(V_1^2 - V_2^2)]^2}{2g}$$

$$\therefore L = 2.0 \text{ m}$$

Flow at larger end =

$$L = z_1 - z_2 = 2 \text{ m}$$

$$P_1/\rho + \frac{V_1^2}{2g} + z_1 = P_2/\rho + \frac{V_2^2}{2g} + z_2 + h_f$$

$$P_2/\rho = P_1/\rho + \frac{1}{2g}(V_1^2 - V_2^2) + (z_1 - z_2)h_f$$

$$\Rightarrow 2.5 + \frac{5^2 - 2^2}{2 \times 9.81} + 2 \cdot \frac{[0.35(5-2)]^2}{2 \times 9.81}$$

$$\Rightarrow 2.5 + 1.0 + 1.2 \cdot 0.16055$$

$$P_2 = 5.409 \text{ bar}$$

Pressure at larger end is 5.409 bar

2) inlet diameter = 200mm

throat diameter = 100mm

$$P_1 = 17.688 \text{ m}$$

$$C_d = 0.98$$

3) 300mm of mercury

$$A_2 = \frac{\pi d^2}{4} \times 3.14 = \frac{(20/100)^2 \times 3.14}{4} = 0.0314 \text{ m}^2$$

$$A_2 = \frac{\pi D^2}{4} = \frac{(\frac{10}{100})^2 \times 3.14}{4} = 7.853 \times 10^{-3}$$

y = 300mm (0.3m of mercury)

$$P_1 = 17.658$$

$$= \frac{17.658}{1000} = 1.7658 \times 10^{-3} \text{ N/m}^2$$

$$\frac{P_1}{\rho} = \frac{1.7658 \times 10^{-3}}{9.81} = 1.8 \times 10^{-4} \text{ m}$$

$$P_2/\rho = 0.5 \times 13.6 = -4.08 \text{ of H}_2\text{O}$$

$$h = P_1/\rho - P_2/\rho$$

$$= 1.8 \times 10^{-4} - (-4.08)$$

$$\therefore h = 4.08018 \text{ m/s}$$

$$Q = C_c \times A_1 A_2 \times \sqrt{2gH}$$

$$\Rightarrow 0.98 \times 0.0314 \times 7.853 \times 10^{-3} \times \sqrt{2 \times 9.81 \times 4.08018}$$

$$Q = \frac{0.000241}{0.0307} \times 8.947$$

$$Q = 0.0709 \text{ m}^3/\text{s}$$

$$Q = \frac{C_c A_1 A_2}{\sqrt{A_2^2 - A_1^2}} \times \sqrt{2gH}$$

$$Q = \frac{0.04 \times 0.0176}{\sqrt{(0.0176)^2 - (0.014)^2}} \times \sqrt{2 \times 9.81 \times 7.05}$$

$$Q = \frac{4.35 \times 10^{-3}}{4022}$$

$$Q = 2.33 \times 10^{-3} \text{ m}^3/\text{s}$$

3) $D_1 = 15 \text{ cm}$ $D_2 = 30 \text{ cm}$

500mm of mercury = 0.5m

$C_c = ?$

$$\Rightarrow C_d = 0.9 \quad C_c = 0.64$$

$$A_1 = \frac{\pi d^2}{4} = \frac{(\frac{15}{100})^2 \times 3.14}{4}$$

$$= 0.0176 \text{ m}^2$$

$$A_2 = \frac{\pi D^2}{4} = \frac{(\frac{30}{100})^2 \times 3.14}{4}$$

$$= 0.0706 \text{ m}^2$$

$$h = 0.5 \left[\frac{13.6}{0.9} - 1 \right]$$

$$h = 0.5 \left[\frac{13.6}{0.9} - 1 \right]$$

$$= 7.05 \text{ m}$$

4) $h = 15 \text{ m}$

170mm of Mercury (0.17m)

Sp of Mercury (13.6)

Sp of H_2O water = 1020

$v = ?$

$$h = 0.17 \left[\frac{13.6}{0.9} - 1 \right]$$

$$h = 2.085 \text{ m}$$

$$\therefore v = \sqrt{2gH}$$

$$v = \sqrt{2 \times 9.81 \times 2.085}$$

$$v = 6.39 \text{ m/s}$$

