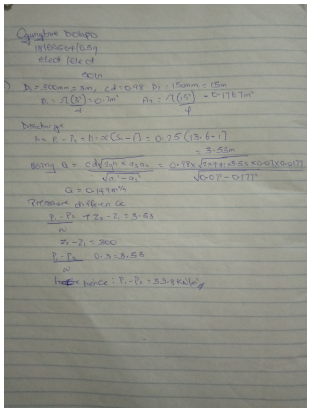


Question Number
19105604/0.89
Effect Reject
Acin

1) $D = 500mm = 3m$, $Cd = 0.98$ $D_2 = 15mm = 15m$

$A_1 = \frac{\pi(D)^2}{4} = 0.1m^2$ $A_2 = \frac{\pi(15)^2}{4} = 0.1767m^2$

Discharge

$h = P_1 - P_2 = \alpha(S_2 - 1) = 0.25(13.6 - 1)$

$= 3.53m$

Using $Q = \frac{Cd\sqrt{2gh} \times A_1 A_2}{\sqrt{A_1^2 - A_2^2}} = \frac{0.98 \times \sqrt{9.81 \times 3.53} \times 0.01 \times 0.0177}{\sqrt{0.01^2 - 0.177^2}}$

$Q = 0.187m^3/s$

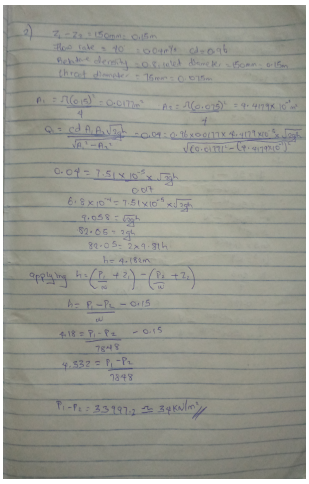
Pressure difference

$\frac{P_1 - P_2}{\omega} + Z_2 - Z_1 = 3.53$

$Z_1 - Z_2 = 300$

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

Force: $P_1 - P_2 = 33.38 KN/m^2$



2) $Z_1 = Z_2 = 15mm = 0.15m$

Flow rate $= 90 = 0.09m^3/s$ $Cd = 0.96$

Relative density $= 0.8$ Inlet Pressure $= 150mm = 0.15m$

Throat diameter $= 76mm = 0.075m$

$A_1 = \frac{\pi(0.15)^2}{4} = 0.0177m^2$ $A_2 = \frac{\pi(0.075)^2}{4} = 9.4778 \times 10^{-3}m^2$

$Q = \frac{Cd\ A_1 A_2 \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}} = 0.09 = \frac{0.96 \times 0.0177 \times 9.4778 \times 10^{-3} \times \sqrt{19.62h}}{\sqrt{(0.0177)^2 - (9.4778 \times 10^{-3})^2}}$

$0.09 = \frac{7.51 \times 10^{-3} \times \sqrt{19.62h}}{0.017}$

$6.18 \times 10^{-4} = 7.51 \times 10^{-3} \times \sqrt{19.62h}$

$9.058 = \sqrt{19.62h}$

$82.05 = 19.62h$

$h = 4.18m$

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

$h = \frac{P_1 - P_2}{\omega} - 0.15$

$4.18 = \frac{P_1 - P_2}{7848} - 0.15$

$4.332 = \frac{P_1 - P_2}{7848}$

$P_1 - P_2 = 33.997.2 \approx 34 KN/m^2$