[illegible]WANDE SMILLA
[illegible]

CIV.1

(1)

$z = 2m$, $V = 6ms^{-1}$, $V_2 = 2ms^{-1}$, $g = 9.81$

$P_1 = 2.5m$, $P_2 = ?$

$P_1 - P_2 = \frac{0.35(V_1 - V_2)^2}{2g}$

$= \frac{0.35(6-2)^2}{2 \times 9.81} = \frac{0.35(2)^2}{19.62}$

$= \frac{3.15}{19.62}$

$= 0.161$

$P_1 - P_2 = 0.161$

$2.5 - P_2 = 0.161$

$-P_2 = 0.161 - 2.5$

$-P_2 = -2.67$

$P_2 = 2.67 m$

(2)

$d_1 = 200mm \rightarrow 0.2m$

$A_1 = \frac{\pi d_1^2}{4}$

$= \frac{\pi(0.2)^2}{4} = 0.0314 m^2$

$P_1 = 17.658 N/cm^2 \rightarrow$ ~~17.6~~ 17658000

$Sg = 13.6$

$\frac{P_1}{w} = \frac{P_1}{\rho g} = \frac{17658000}{1000 \times 9.81}$

$= 1.8 \times 10^{-2}$

[illegible] pressure $= \frac{P_2}{w} = 300mmHg$

$d_2 = 10cm \rightarrow 0.1m$

0.3×1

$A_2 = \frac{\pi d_2^2}{4}$

$\frac{\pi \times 0.1^2}{4} = 7.85 \times 10^{-3} m^2$

$P_1 = 0.3 \times 13.6 = 4.08$

$P_2 = [illegible] 8 \times 10$

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

$Q_{actual} = \frac{C_d A_1 A_2 \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}}$

$= \frac{0.98 \times 0.0314 \times 7.85 \times 10^{-3} \sqrt{2 \times 9.81 \times 4.0800}}{\sqrt{(0.0314)^2 - (7.85 \times 10^{-3})^2}}$

$= 0.0712989665$

(3)

$d_1 = 150mm = 0.15m$

$d_2 = 300mm = 0.3m$

$A_1 = \frac{\pi d_1^2}{4} = \frac{\pi \times 0.15^2}{4} = 0.017 m^2$

$A_2 = \frac{\pi d_2^2}{4} = \frac{\pi \times 0.3^2}{4} = 0.07 m^2$

$y = 500mmHg = 0.50mHg$

$C_d = 0.64$

$Sg = 0.9$

$h = \frac{13.6 - 0.9}{0.9} \times 0.5$

$= 7.06m$

$Q_{actual} = \frac{C_d A_1 A_2 \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}}$

$= \frac{0.64 \times 0.017 \times 0.07 \times \sqrt{2 \times 9.81 \times 7.06}}{\sqrt{0.017^2 - 0.07^2}}$

$= 0.1347 m^3/s$

(4)

Sg of mercury = 13.6

Sg of sea-water = 1.026

y = [illegible] = 170 × 10⁻³

$V = \sqrt{2gH}$

$H = y \times \left(\frac{Sg \text{ of mercury}}{Sg \text{ of sea water}} - 1\right)$

$= 170 \times 10^{-3} \times \left(\frac{13.6}{1.026} - 1\right)$

$H = 2.08m$

$V = \sqrt{2gH}$

$= \sqrt{2 \times 9.81 \times 2.08}$

$= \sqrt{40.8096}$

$= 6.39m/s$

(5)

Actual Flowrate = 5dm³/min → $8.33 \times 10^{-5} m^3/sec$

$\Delta P = 15bar = 15 \times 10^5 N/m^2$

$N = 1700 rev/min \rightarrow \frac{1700}{60}$

$= 28.33 rad/sec$

$T = 15Nm$

Normal displacement = 10cm³/rev → $1 \times 10^{-5} m^3/rev$

(i) Volumetric efficiency $= \frac{\text{Actual Flowrate}}{\text{Ideal Flowrate}} \times 100\%$

N.B. Ideal Flowrate = displacement × speed

$Q = 1 \times 10^{-5} \times 28.33$

$Q = 2.833 \times 10^{-4} m^3/sec$

Volumetric efficiency $= \frac{8.33 \times 10^{-5}}{28.33 \times 10^{-4}} \times 100$

$= 29.4\%$

(ii)

Fluid power $= Q \times \Delta P$

$= 8.33 \times 10^{-5} \times 15 \times 10^5$

$= 124.95$ watts.

(iii) Shaft power $= T \times \omega$

$\omega = 2 \times \pi \times N$

$= 2 \times \pi \times 28.33$

$= 178 rad/sec$.

Shaft power $= T \times \omega$

$= 15 \times 178$

$= 2670$ watts.

Overall efficiency $= \frac{\text{Fluid power}}{\text{Shaft power}} \times 100\%$.

$\frac{124.95}{2670} \times 100\%$

$= 4.68\%$