F93F-6

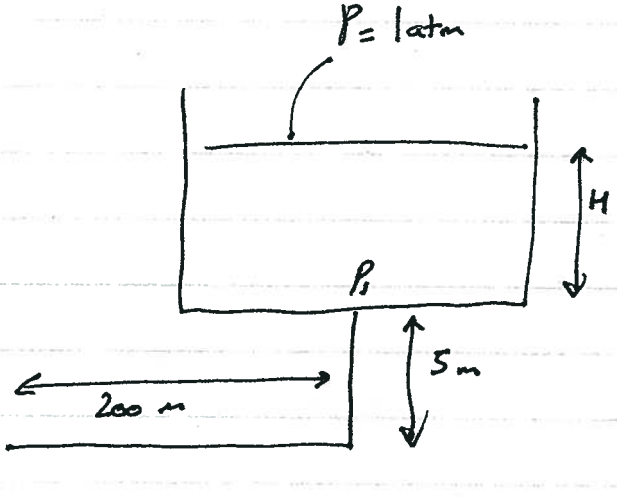
PJ 119

$\rho = 1000\ kg/m^3$

$\mu = 1\ mPa\cdot s = 10^{-3}\ Pa\cdot s$

$D = 0.05\ m$

$Re = 60000$



(a) find H?

so if $Re = \underset{6(10^{4})}{60000}$, from chart $f = 0.006$

$$-\left[\frac{P_2 - P_1}{L} + \rho g \frac{h_2 - h_1}{L}\right] = \frac{2 f \bar{u}^2 \rho}{D}$$

$\bar{u} = \frac{Q}{A}$; but can get from Re

$$Re = \frac{\rho \bar{u} D}{\mu} \quad \text{or} \quad \bar{u} = \frac{\mu Re}{\rho D}$$

$$= \frac{(10^{-3})(60000)}{(1000)(0.05)} = 1.2\ m/s$$

so then can solve for P_1 =

Assume $P_2 = 101325\ Pa$ [question should state this!]

$$-\left[\frac{101325 - P_1}{205} + \frac{(1000)(9.81)(0-5)}{205}\right] = \frac{2(0.006)(1.2)^2(1000)}{0.05}$$

or $\quad 101325 - P_1 = -21798$

$$P_1 = 123123 \text{ Pa}$$

since $P_1 = P_{atm} + \rho g H$

then $\quad 123123 = 101325 + (1000)(9.81)H$

get $H = 2.22$ m

(b) Procedure: ① get $Q = \bar{u}A = \bar{u}\frac{\pi}{4}D^2$

② get Re

③ get f from chart if turbulent

④ if turbulent, use eqn on page 1
or
if laminar, use Hagen-Poiseuille eqn

⑤ solve for P_1

⑥ get H as done above in part (a)