NAME = Talha khan

ID = 7982

Section = "B"

Paper = fluid Mechanics

Question No 1:

Part-a:

Total Energy Head:

It is sum of all energy head at a point in a fluid.

Various form of Energy Head:

kinatic Head:

It is kinatic ~~Head~~ energy per unit weight of the fluid.

$$\frac{K \cdot E}{W} = \frac{1/2 m v^2}{mg} = \frac{1}{2} \frac{v^2}{g}$$

This is also know as velocity head unit is meter.

Potential Head:

It is potential energy per unit weight of fluid.

$$\frac{P.E}{w} = \frac{mgh}{mg} = h$$

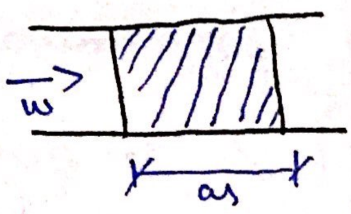
Pressure Head :

The vertical height of a free Surface above any point in a liquid at rest is pressure head or level of fluid due to pressure exterted by fluid.

Now

$$\frac{work}{w} = \frac{F \cdot ds}{w}$$

$$= \frac{P.A \cdot ds}{w}$$



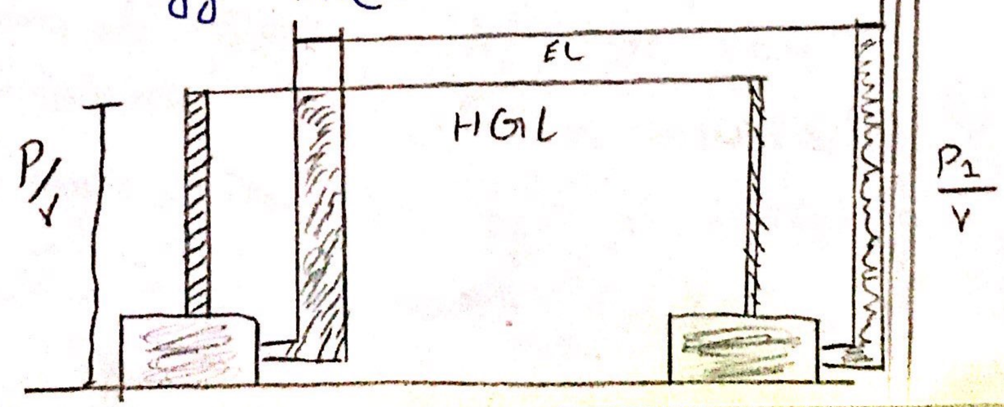
$$\because \frac{P.V}{w} \quad \therefore \frac{P}{\gamma} \text{ is Pressure.}$$

Q1 (Part B)

Hydraulic Grade line:

It is line showing the pressure head & potential head at a point in fluid.

The term $\frac{P}{\gamma} + Z$ is static head or piezometric head because it represent the level to which liquid will raise in piezometric tube. The HGL is a line drawn through top of piezometric colums. The line showing total head of fluid at any point is Energy line. Line joining level of pilot tube is energy line.



Energy line :

A line that represent the elevation of energy head of water flowing in a pipe condult or ~~chemical~~

=> The line is drawn above the hydraulic grade line a distance equal to velocity head of the water Flowing at each section or point along the pipe. ~~or cha~~

Hydraulic Radius :

Hydraulic Radius is the area of the water prism in a pipe or channal divided by the wetted perimeter. Thus, for a round conduit flowing Full or half Full the hydraulic radius is d/4 · Hydraulic ~~mean~~ radius ~~mean~~ measure the flow ~~of~~ efficiency of a pipe. In trénchless techonology it is a function of a shape of the pipe in which the liquid flowing. It does not indicate half of diameter as name suggests. Another term sometimes used for this quantity is hydraulic mean depth

$$\gamma h = Vs/vp = \phi\, vB/sp$$

$$S = \delta\, sP/vB$$

$$r = \phi/s$$

Question No 2 (Part A)

Given :

Velocity = v = 2m/s

Pressure = P = 300 kPa

z = 5m

Solution :

H = Pressure head + K.E + P.E

$$H = \frac{P}{\gamma} + \frac{v^2}{2g} + z$$

$$H = \frac{300 \times 10^3}{9810} + \frac{2^2}{2 \times 9.81} + 5$$

$$\boxed{H = 35.7849 m}$$

Question No2 (Part B)

Given :

$d_1 = 300\,mm$

$d_2 = 200\,mm$

$P_1 = 300\,kpa = 300 \times 10^3\,N/m^2$

$P_2 = 120\,kpa = 120 \times 10^3\,N/m^2$

Datum = z = ?

$Q = \frac{40\,m^3/sec}{1000}$

$d_1 = 300\,mm = 0.3\,m$

$d_2 = 200\,mm = 0.2\,m$

Required:

$z = ?$

Solution:

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

$$A_1 = \frac{3.14 \times (0.3)^2}{4}$$

$$\boxed{A_1 = 0.0706} \, m^2$$

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

$$A_2 = \frac{3.14 \times (0.2)^2}{4}$$

$$\boxed{A_2 = 0.0314 \, m^2}$$

we know that

$$Q_1 = V_1 A_1$$

$$V_1 = \frac{Q}{A_1}$$

$$V_1 = \frac{0.04}{0.0706}$$

$$\boxed{V_1 = 0.566}$$

$$V_2 = \frac{Q}{A_2}$$

$$V_2 = \frac{0.04}{0.0314}$$

$$\boxed{V_2 = 1.27}$$

Now

$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\gamma} + \frac{V^2}{2g} + Z_2$$

$Z = 0$

$\gamma = 9810$

$$\frac{300 \times 10^3}{9810} + \frac{0.566^2}{2(9.81)} + 0 = (20 \times 10^3) + \frac{1.27}{2(9.81)} + Z_2$$

$$30.59 = 12.314 + Z_2$$

$$\boxed{Z_2 = 18.276}$$

Question No 3

Given data:

$l = 500 m$

$dia = 0.2 m$

$S.G = 0.2 m$

$Q = 0.06 m^3/s$

$\mu = 6 \times 10^{-5} N.S/m^2$

Required:-

Pressure lose = ?

Sol:

As we know that

$$f = \left(0.0032 + \left(\frac{0.221}{R^{0.2}}\right)\right)$$

where R = Reynods No is given as

$$R = \frac{v \times d}{\nu}$$

$$\& \ \nu = \frac{\mu}{\rho} = \frac{6 \times 10^{-5}}{900}$$

$V = 6.67 \times 10^{-8}\ m^3/s$

and $v = \frac{Q}{A}$ ∴ for circular pipe

$A = \frac{\pi}{4} d^2$

$= \frac{3.14}{4} (0.02)^2$

$= 0.031\ m^2$

$v = \frac{0.06}{0.031}$

$v = 1.95\ m/s$

Now eq -①

$R = \frac{1.95 \times 0.2}{6.67 \times 10^{-5}} = 5.73 \times 10^{6}$

Now

$f = 0.0032 + \frac{0.221}{(5.73 \times 10^{6})^{0.237}}$

$f = 8.79 \times 10^{-3}$

or

0.00879

Now Bernoulis equation

Head loss $= h_L = \frac{fLv^2}{2gD}$ eq (ii)

Putting valus in eq (ii)

$$h_2 = \frac{(0.00879)(800)(1.95)^2}{2(9.81)(0.2)}$$

$h_2 = 4.259 m$

Now to find pressure loss due to friction

$$h_2 = \frac{\Delta P}{\delta g}$$

$\Delta P = \Delta h_2 \times \delta g$

Put value

$\Delta P = 4.259 \times 900 \times 9.81$

$\boxed{\Delta P = 37602.7 \ Pa}$