NAME ; JAWAD Ali

I.D ; 7351

Subject ; Fluid Mechanic

Submitted to ; Eng. Abdul Waheed.

Dated ; 25/6/2020

Q 1:-

Ans:- Total Energy Head:-

It is the the sum of all energy head at a point in a fluid is known as T.E.H.

$$H = Z + \frac{V^2}{2g} + P/W$$

Forms of Energy Head:-

These are various forms of Energy Head which are as follow.

- **Potential HEAD:-** potential Head is due to the position above some suitable datum line.

Mathematical form:

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

Kinetic Head:- Kinetic head is due to the velocity of flowing liquid.

Mathematical Form:

$$\frac{K.E}{W} = \frac{\frac{1}{2} mv^2}{mg}$$

$$\frac{K.E}{W} = \frac{1}{2} \frac{v^2}{g}.$$

This is also known as velocity head.

Its unit is meter (m)

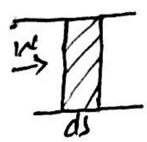
PRESSURE Head:- The vertical hight of the free surface above any point in a liquid at rest is pressure Head.

OR

Level of fluid due to pressure exerted by fluid.

Mathematical Form:

$$P.H = \frac{P.E}{Weight} = P/\gamma$$



OR

$$\frac{F.ds}{W} = \frac{P.A.ds}{W} = P.\frac{V}{W} = P/\gamma$$ is pressure

Q1 b

Ans:- Hydraulic Grade line:-

hydraulic grade line is the surface or profile of water flowing in an open channel or a pipe flowing partially full. If a pipe is under pressure, the hydraulic grade line is that level water would rise to in a small, vertical tube connected to the pipe.

- Energy Line:- A line that represent the elevation of energy head (in ft or meter) of water flowing in a pipe, conduit or channel. The line is drawn above the hydraulic grade line (gradient) a distance equal to the velocity head ($V^2/2g$) of water flowing at each section or point along the pipe.

Hydraulic radius:-

The hydraulic radius (R_h) is the cross sectional area of the flow divided by the wetted perimeter. For a circular pipe flowing full, the hydraulic radius is one fourth of the diameter. For a wide rectangular channel, the hydraulic radius is approximately equal to the depth.

$$R_h = A/P$$

A = Cross sectional Area.

P = Wetted parameter.

Q2 (a)

Given data:-

$Z = 5m$

$V = 2m/sec$

$P = 300 \, KN/m^2$, $W = 9.81 \, KN/m^3$

Sol:- We know that the formula is

$$H = Z + \frac{V^2}{2g} + P/W \rightarrow (*)$$

$$H = 5 + \frac{(2)^2}{2(9.81)} + \frac{300}{9.81}$$

$$H = 35.785 \, Nm/N$$

Q2
b

Given data:-

$d_1 = 300mm$

$d_2 = 200mm$

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

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

Datum = Z = ?

$Q = \frac{40}{100} m^2/sec$

$d_1 = 300mm = 0.3m$

$d_2 = 200mm = 0.2m$

Required:

$Z_2 = ?$

Sol:

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

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

$A_1 = 0.0706 m^2$

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

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

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

We know that

$$Q_1 = V_1 A_1$$

$$V_1 = Q/A_1$$

$$V_1 = \frac{0.04}{0.0706} \qquad \left\{ Q = 40/1000 = 0.04 \right\}$$

$$\boxed{V_1 = 0.566}$$

$$V_2 = Q/A_2$$

$$V_2 = \frac{0.04}{0.0314} = \boxed{V_2 = 1.27}$$

Now

$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + Z_2$$

$$Z_1 = 0 \quad , \quad \gamma = 9810.$$

$$\frac{300\times10^3}{9810}+\frac{0.566^2}{2(9810)}+0=\frac{120\times10^3}{9810}+\frac{127}{2(981)}+Z_2$$

$$30.59=12.314+Z_2$$

$$\boxed{Z_2=18.276}$$

Q3

Given data:-

$L = 500m$

$D = 0.2m$

$S = 0.9$

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

$Q = 0.06\ m^3/sec$

$f = [0.0032 + (0.221/R^{0.237})$

Required: Pressure loss - DP = ?

Sol:

As we know that

$$f = [0.0032 + \left(\frac{0.221}{R^{0.237}}\right)$$

Where R is Renold's no and is given as

$$R = \frac{v \times d}{\nu} \rightarrow (1)$$

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

$\nu = 6.67 \times 10^{-8} m^2/s$

and $V = Q/A$

∵ For circular pipe

$A = \pi/4 \, d^2$

$= \frac{\pi}{4} (0.2)^2 = A = 0.031 m^2$

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

$V = 1.95 \, m/s$

Now eq (1)

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

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

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

or

$f = 0.00879$

Now for bernoulli's equation

Head loss $= h_L = \frac{f L v^2}{2 g D} \rightarrow (ii)$

putting value in eq (1)

$$h_L = \frac{(0.00879)(500)(1.95)^2}{2(9.81)(0.2)}$$

$h_L = 4.259 m.$

Now to find pressure due to friction pressure Head formula is used

$$h_L = \frac{\Delta P}{\rho g}$$

$$\Delta P = h_L \times \rho g$$

Put value

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

$$\Delta P = 37602.7 \ Pa$$

$$\boxed{\Delta P = 37.602 \ KPa}$$