Name :- Mian Zeeshanullah

ID :- 7906

Section :- A

Subject :- Fluid Mechanics (I)

Teacher :- Engr waheed

DATE :- 25 June 2020

Question Part (1(a))

Total Energy Head:-

From Bernoelli principle, the Total energy at a given point in a fluid is the energy associated with moment of fluid, plus energy from ~~height of fluid~~ Static pressure in the fluid energy from height of fluid relative to an orbitary datum height.

OR

The sum of Pressure head (P/y), velocity head ($v^2/2g$) and elevation head "h" is constant along a stream line. This constant along a stream line. This constant is called Total head H.

Forms of Energy Head.

There are three types of energy head which are given below

Potential Head:-

It is potential energy per unit weight It is due to position above some datum line Pressure Head + velocity Head + potential = Total Head

potential head = Total Head − velocity head − pressure head

Kinetic head:-

It represent kinetic energy of fluid. It is height in feet that a flowing fluid will rise in column.

Kinetic Head = Total head − potential head − Pressure head

Pressure Head:-

It is height of liquid column that Corresponds to a Particular Pressure exerted by liquid Column that compounds a Particular pressure exerted by liquid column on the base of container

Pressure Head = Total Head − Kinetic Head − potential Head

Q No 1

(Part - b)

Hydraulic Grade line (HGL) :-

Hydralic grade line refers to the profile of water streaming in an open channel or a pipe streaming in a part full. when a pipe is under pressure, the pressure driven review line is the level to which the water would ascend to in a little, vertical tube associated with a pipe.

It is denoted as (HGL).

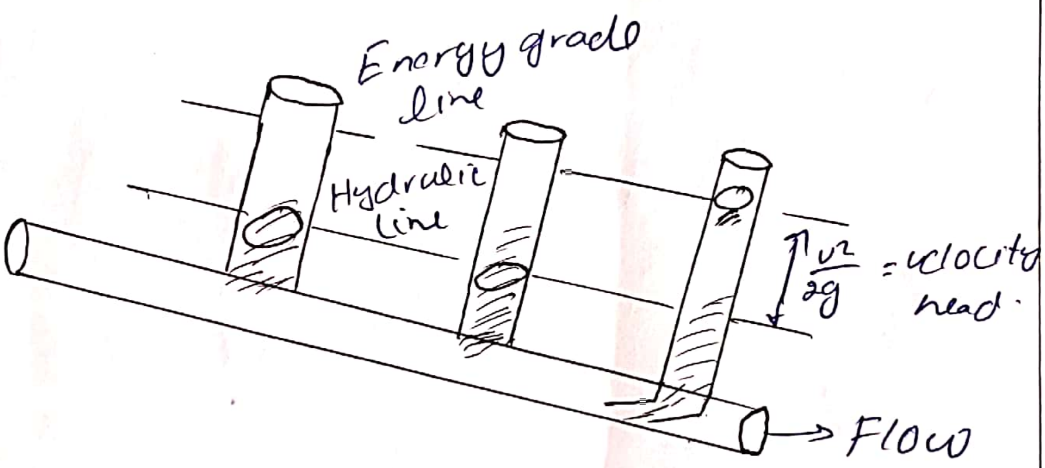
→ The Hydraulic grade line is a line representing the total-head available to the fluid-minus velocity head and can be expressed as

$$HGL = \frac{p}{\gamma + h}$$

where HGL = Hydraulic Gradeline

The Hydralic Grade line lies on velocity head below the Energy line.

P.T.O



Energy line:

Energy Grade line refer to a line that represent to to the height of energy head of water streaming in a pipe course or channel. The line is drawn

P.T.O

over the pressure Hydraulic grade line inclination.

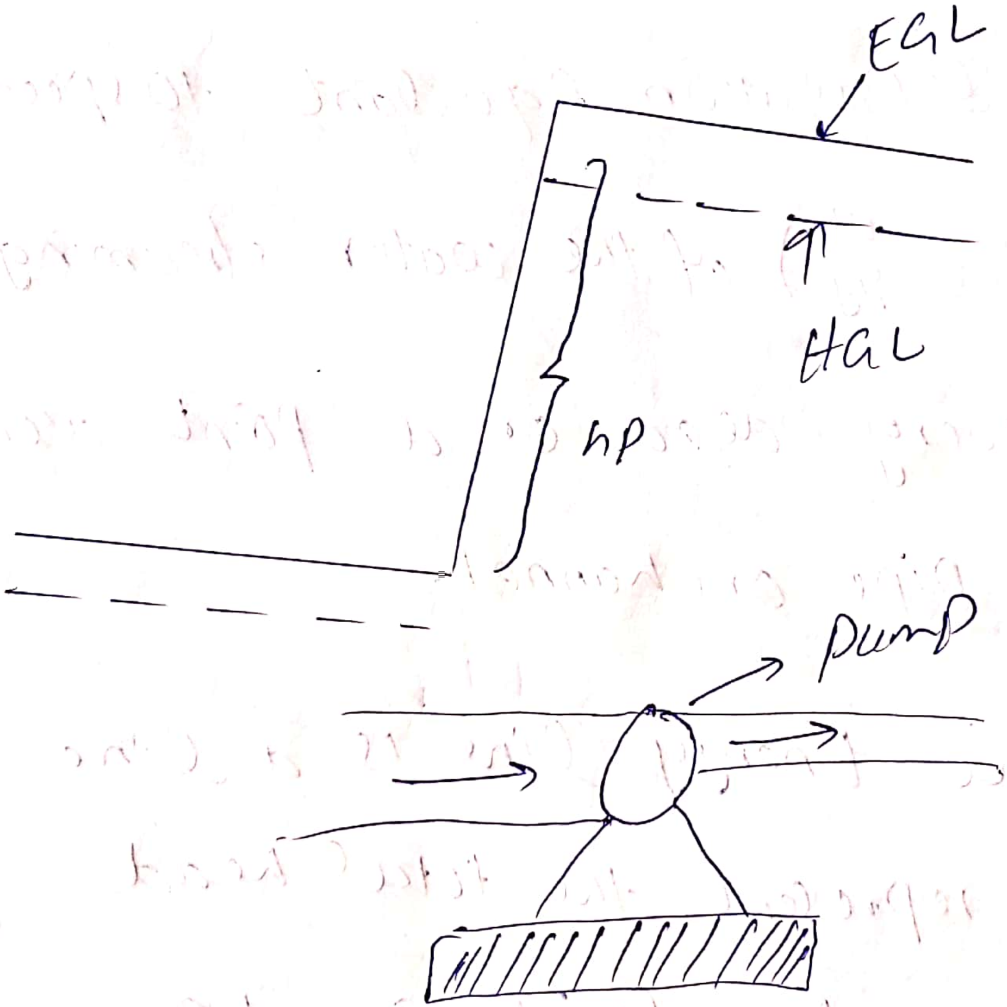
The separation equalant to speed head ($\frac{V^2}{2g}$) of the water streaming at every area or a point along the pipe or channel.

→ The Energy line is a line that represent the total head available the fluid can be represented as,

$$EL = H = \frac{P}{\gamma} + \frac{V^2}{2g+h} = \text{Constt along}$$

a Stream line.

EL = Energy line



Hydraulic Radius:

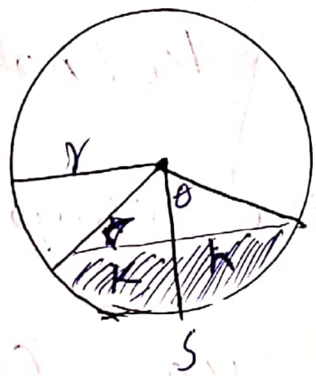
Hydraulic Radius is the area of water prism in a pipe or channel divided by the wetted perimeter.

Thus, for a round conduct flowing full or half fuel, the Hydraulic radius measures the flow efficency of a pipe.

→ In trenchless technology, it is a function of the shap of the pipe in which the liquid is flowing.

→ It doesnot indicate half of the diameter as the ~~---~~ name suggests

→ Another term sometimes used for this quantity is the Hydraulic mean depth.



Question # 02 (a)

Given data:-

$v = 2\ m/sec$

$P = 300\ kPs$

$P = 300 \times 10^3\ N/m^2$

Solution:-

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

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

$$H = \frac{300 \times 10^3}{9810} + \frac{2^2}{2 \times 9.8} + 5m$$

$$\boxed{H = 35.783\ m}$$ Ans

Question # 02

(Part B) :-

Given data :-

Diameter $= d_1 = 300\,mm$

Diameter $= d_2 = 200\,mm$.

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

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

Datum $= Z = ?$

Solution :-

$$Q = \frac{40}{1000}\,m^2/sec = 0.04$$

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

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

Required:

$Z = ?$

Solution:-

As we know that

$$Q = \frac{40}{1000} m^2/sec = 0.04 m^2/sec$$

$d_1 = 0.3m$

$d_2 = 0.2m$

$$A_1 = \frac{\pi d_1^2}{4} = \frac{\pi (0.3)^2}{4}$$

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

$$A_2 = \frac{\pi d_2}{4} = \frac{\pi (0.2)^2}{4}$$

$A_2 = 0.0314 m^2$

As

$Q = v_1 A_1$

$$v_1 = \frac{Q}{A_1} = \frac{0.04}{0.0706}$$

$$\boxed{v_1 = 0.566}$$

Similarly:

$$v_2 = \frac{Q}{A_2} = \frac{0.04}{0.0314}$$

$$\boxed{v_2 = 1.27}$$

Now

$$\frac{P_1}{\gamma} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{v_2^2}{2g} + z_2.$$

(15)

Put $Z_1 = 0$, $\gamma = 9810$

$$\Rightarrow \frac{300\times10^3}{9810} + \frac{(0.566)^2}{2(9.811)} + 0 = \frac{120\times10^3}{9810} + \frac{(1.27)^2}{2(9.81)}$$

$$\Rightarrow 30.597 = 12.314 + Z_2$$

$$\Rightarrow Z_2 = 30.597 - 12.314$$

$$\Rightarrow Z_2 = 18.2834$$

Datum $= Z_2 = 18.2834$

$z \longrightarrow$

QUESTION #03

Given data:-

Length of pipe = l = 500m

Specific gravity of oil = 0.9

diameter = d = 0.2m

flow rate = Q = 0.06 m^3/s

viscosity = μ = 6×10^{-5} $N.s/m^3$

Required:-

Pressure loss = ΔP = ?

As we know that

$$f = \left[0.0032 + \left(\frac{0.221}{R^{0.231}}\right)\right]$$

where R = Reynolds No $= \frac{U \times d}{\nu}$

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

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

$\Delta H = \frac{f L v^2}{2 g D}$ = Head loss —— (1)

Head $= \frac{\Delta P}{\rho g}$ —— (2)

So,

$v = \frac{Q}{A} = \frac{0.06}{\frac{\pi}{4}(0.2)^2}$

$v = 1.911$ m/s

$$R = \frac{1.911 \times 0.2}{6.67 \times 10^{-8}} = 5.73 \times 10^{6}$$

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

$$f = 0.0032 + \frac{0.221}{39.96} = 0.0087$$

$$DH = \frac{f L v^2}{2 g D} = \frac{0.0087 \times 500 \times (1.911)^2}{2 \times 9.81 \times 0.2}$$

$$DH = 4.06\,m$$

$$\text{Head} = \frac{DP}{\rho g} \Rightarrow DP = 4.06 \times 900 \times 9.81$$

$$DP = 35{,}868.61 \text{ Pascal}$$

or

$$DP = 35.8 \text{ KPa}$$ Ans