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SUBJECT : Fluid Mechanic's

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Question NO 1st
Part "A"

Total Energy Head:

From Bernulli principal,
The total energy at a given point in a fluid in the energy associated with movement of fluid. plus energy from static presure in the fluid energy from height of fluid relative to an arbitory datum height.

OR

The Sum of pressure head (P/γ) velocity head ($v^2/2g$) and elevation head is constant along a stream line. This Constant is called total height H.

Forms of energy Head:-

There are three types of energy head which as:

- Potential Head.
- Kinetic Head.
- Pressure Head.

1) POTENTIAL HEAD:

It is potential energy per unit weight. It is due to position above some datum line pressure Head + velosity head + Potential head = Total Head

Potential head = Total head - velocity head - pressure head.

2) KINETIC HEAD:- It Represent the kinetic energy of fluid. It is height in feet that following fluid will rise in Column.

Presure Head :-

It is height of liquid Column that Corresponds to the particular Presure exerted by liquid Column that Corresponds a particular ~~present~~ presure exerted by liquid Column on the base of Contains.

Pressure head = total head − Kinetic head − Pattial head.

1.

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Question No 1st
Part "B"

Hydroulic Gråde line (HGL)

Hydroulic grade line refers to the profile of water streaming in a open chenal or a pipe streaming in a part full.

When the piper is under presure the presure driven review line is the level to which the water would ascend to in a little vertical tube associated with a pipes.

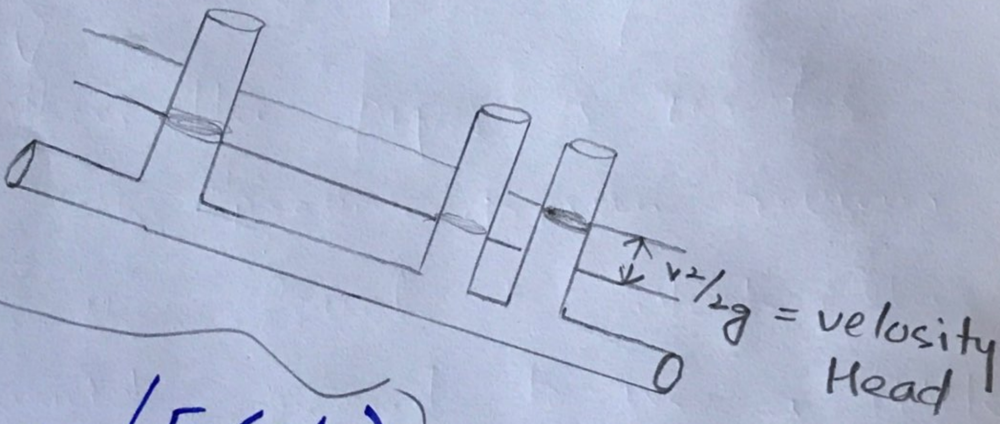
→ It denoted by (HGL)

→ The Hydroulic grade line is representing the total head availible to the fluid minus velocity head and can be expressed as:

$HGL = P/\gamma + h$

Where HGL = Hydroulic grade line

. Hydroulic grade line lies on velocity head below the energy line.



Energy Grade line :(EGL)

Energy Grade line refers to a line that represent to the height of energy. head of water streaming in a pipe. course, or Chenel, the line is drown over the presure Hydroulic grade line.

The Separation equalent to Speed head $(v^2/2g)$ of the water Streaming at every area or a point along the pipe or chenels.

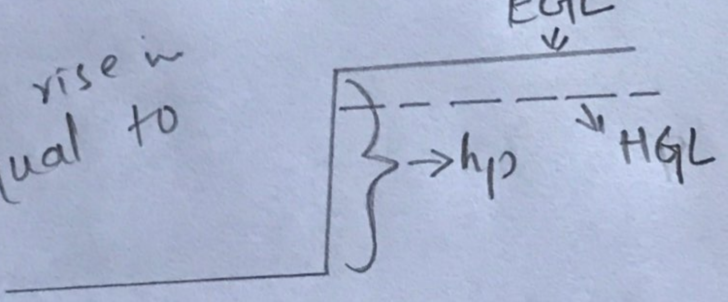
⇒ The Energy line is a line that represent the total head availible the fluid can be expressed as

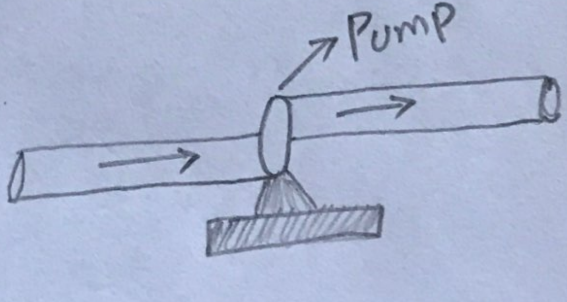
$$EL = H = \frac{P}{\gamma} + \frac{v^2}{2g} + h = \text{constant.}$$

along Stream line

EL = Energy line.

Abrupt rise in EGL equal to hp.





Question NO 2nd (Part A)

Given data:

- velocity = $v = 2\ m/s$
- Pressure = $P = 300\ kpa$.
- datum = $Z = 5m$

Solution:

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

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

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

$$H = 35.7849\ m.$$

Question NO 2nd
Part "B"

Given data:

- Diameter = d_1 = 300 mm.
- Diameter = d_2 = 200mm
- Pressure P_1 = 300 kpa = 300×10^3 N/m²

P_2 = 120 kpa = 120×10^3 N/m²

- Datum = Z = ?
- $Q = \frac{400}{1000}$ m²/sec
- d_1 = 300mm = 0.3 m.
- d_2 = 200 mm = 0.2 m.

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

$$A_2 = \frac{3.14 \times (0.3)^2}{4}$$

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$$A_1 = 0.0706 m^2$$

$A_2 = ?$

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

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

$$A_2 = 0.0314 m^2$$

As we know that

$$Q_1 = V_1 A_1$$

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

$$Q = 40/1000 = 0.04$$

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

$$V_1 = 0.566$$

$V_2 = Q/A_2$

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

$$\boxed{V_2 = 1.27}$$

NOW!

$$\frac{P_1}{\gamma} + \frac{v^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2$$

$Z_1 = 0$

$\gamma = 9810$

SO!

$$= \frac{300 \times 10^3}{9810} + \frac{0.566^2}{2(9.81)} + 0 = \frac{120 \times 10^3}{9810} + \frac{1.27^2}{2(9.81)} + z_2$$

$$= 30.59 = 12.314 + z_2$$

$$\boxed{z_2 = 18.276}$$

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Question NO 3rd:

Given data:

- length of pipe = L = 500m
  dia = d = 0.2m
- Specific gravity of oil = 0.9
- Flowrate = $Q = 0.06 m^3/s$
- vescosity = $\mu = 6 \times 10^{-5} N.s/m^3$

Required data:

Pressure loss = $\Delta P = ?$

Solution:

As we know that

$$f = \left(0.0032 + \left(\frac{0.221}{R^{0.227}}\right)\right)$$

Where R = Reynold's No Eq is given as

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

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

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

And: $v = \frac{Q}{A}$ ∵ for Cicular pipe

$A = \pi/4 (0.207)^2$

$A = 0.031 \ m^2$

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

$v = 1.95 \ m/s$

Now! eq (*) ⇒

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

Now!

$$f = 0.0032 + \frac{0.221}{(5.78\times10^{6})^{0.237}}$$

$$\Rightarrow f = 8.79\times10^{-3}$$

OR

$$f = 0.00879$$

Now! From Bernoulis equation

$$\text{Head loss} = h_L = \frac{fLv^2}{2gD} \quad — (**)$$

putting values in eq (**)

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

$$h_L = 4.259\,m$$

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To find Pressure loss due to ~~find~~ friction.

Preasure Head formula is used

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

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

Putt vallues

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

$$\Delta p = 37602.7\ pa$$

$$\Delta p = 37.602\ kpa.$$

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