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Section A

Subject Fluid Mechanics

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Question No 1

Part (A)

Total Energy Head

From Bernalis principle ;
the total energy at a given point in a fluid in energy associated with movement of fluid. plus energy from static pressure in the fluid relative to orbitary datum height.

Forms of Energy Head

There are three types of enagy head with which are given below.

potential Head

It is the potential energy per unit wait. It is due to position above some datum line pressure head+ velocity Head+ potential Head Total head

Ignetic Head

It represent Ignetic energy of fluid It is height fluid will rise in column

Pressure Head

It is height of liquid coloumn that corresponding to a particular pressure exerted by liquid column that correspond's a

(3)

a particular pressure.
exerted by liquid column on in
base of contains

Question No #1

part B

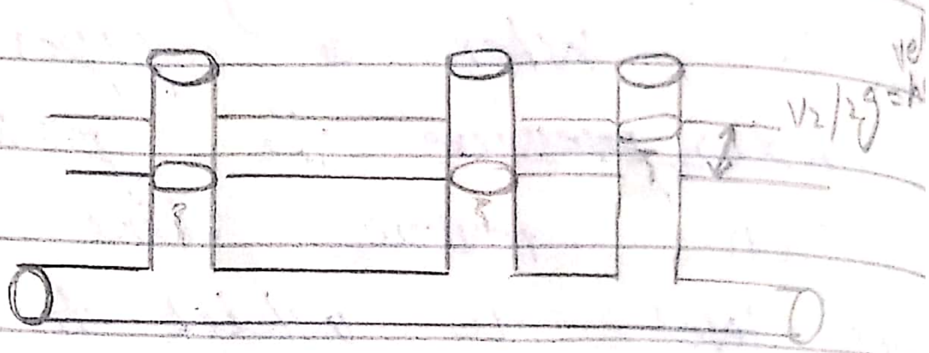
Hydroulic Grade Line

Hydroclic grade line refress to the profile of water streaming in an open channel or pipes streaming in a part full. When a pipes is under pressure the pressure driven review line is the level to which the water would ascend to in a ~~tottet~~ little vertical tube associted with a pipes.

→ It is donated a (HGL)

$$HGL = P/\gamma + h$$

Where HGL = Hydraulic grade line lies on velocity head below the energy level.



Energy line (EGL)

Energy grade line refer to a line that represent to the height of energy head of water streaming in a pipes. course or channel. The line is drawn over the pressure Hydroulic grade line.

Question NO 2 part A

Given Data

velocity = v = 2m/s
pressure = P = 300 kpa
datum = Z = 5m

Solution

H = pressure head + KE + pe

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

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

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

8 :

Question No 2
Part : B

Given Data

Diameter = d_1 = 300m

Diameter = d_2 = 200m

pressure = P_1 = 300kpa = 300×10^3 N/m

P_2 = 120kpa = 120×10^3/N/m

Datum = Z = ?

Solution

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

d_1 = 300mm = 0·3m

d_2 = 200mm = 0·2m

Required

$$Z = ?$$

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

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

$$\boxed{A_1 = 0.0706}$$

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

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

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

We know that

$Q = V_1 A_1$

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

$V_1 = 0.566$

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

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

$V_2 = 1.27$

Now

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

$Z_2 = 0$

$\gamma = 9810$

$$\frac{300\times10^3}{9810}+\frac{0.566}{2(9.81)}+z_1=\frac{12\times10^3}{9810}+\frac{1.27}{2(9.81)}+z_2$$

$$30.60+Z_1=12.314$$

$$\boxed{Z_1=-18.286}$$

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Question 3
part

Given Data

Lenght of pipes = l = 500m
Specific gravity of oil = 0.9

flow rate = Q = 0.06 m^3/s
viscosity = μ = 6×10^{-5} $N \cdot s/m^2$

Required

Pressure loss = Δp = ?

As we know
$$f = \left(0.0032 + \left(\frac{0.221}{R}\right)\right)$$

where R = Reynold's No and is given as;

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

and

$$2 \quad \nu = \frac{\mu}{\rho} = \frac{6\times10^{-5}}{900}$$

$$\nu = 6.67\times10^{-8}\ m^2/s$$

and

$$V = \frac{Q}{A}$$ ∴ for ~~circulator~~ circular pipe

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

$$= \frac{\pi}{4}(0.22)^2$$

$$V = 1.95\ m/s$$

$$\Rightarrow A\ 0.031\ m^2$$

Now eq (i) ⇒

$$R = \frac{1.95\times0.2}{6.67\times10^{-5}} = 5.73\times10^{6}$$

Now

$$f = 0.0032 + \frac{0.221}{(5.23\times10^{6})^{0.237}}$$

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

OR

$$f = 0.00879$$

Now for Bernouli's equation

Head loss $= h_2 = \frac{fLV^2}{2gD}$ → (ii)

putt values in equation (ii)

$$h_2 = \frac{(0.00879)(500)(1.95)^2}{2(9.81)(0.2)}$$

$h^2 = 4.259m$

Now to find pressure loss due to friction

pressure Head formula is used

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

put values

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

$\Rightarrow \Delta p = 37602.7\ pa$

$\Rightarrow \boxed{\Delta p = 37.602\ kpa}$