Haris IQBAL
7926 (A)
(Fluid Mechanics) (1)

Question:-1
Part:-A

Answer

Total Energy Head:- From Bernoulli's Principal the total energy at a given point in a fluid in the energy associated with movement of fluid plus energy from static pressure in the fluid energy from height of fluid relative to an arbitary datum height.

OR
The sum of pressure head (P/γ) velocity head (V²/2g) and elevation head is constant along a stream line. this constant is called total height H.

FORM OF ENERGY HEAD:- These are three types of energy head.

Potential HEAD:- it is the potential energy per ~~unit~~ unit weight. it is ~~the~~ due position above some datum line pressure Head + velocity head + Potential head = 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~~ Fluid will rise column

=> **Pressure Head.**
It is height of liquid column that corresponds to a particular pressure exerted by liquid column that corresponds a particular pressure exerted by liquid column on the base of Contains.

=> Pressure Head = total head - Kinetic head - Potential head.

⇒ **Question - 1**

Part :- B

⇒ **Hydralic Grade Line:-**

Hydraulic Grade line refers to the Profile of water streaming in an open channel or a pipe 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 little vertical tube associated with a pipes.

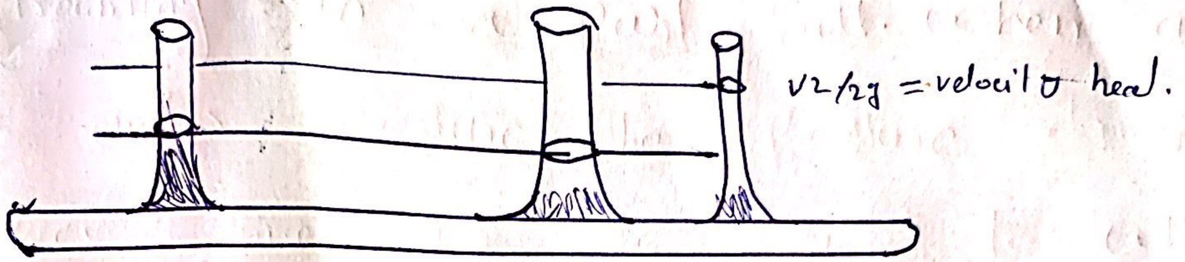
⇒ denoted as (HGL)

⇒ The hydraulic grade line is line representing the total head representing the total head available to the Fluid minus velocity head and can be expressed as.

$HGL = P/\gamma + h$

HGL = hydralic Grade line

FIGURE L



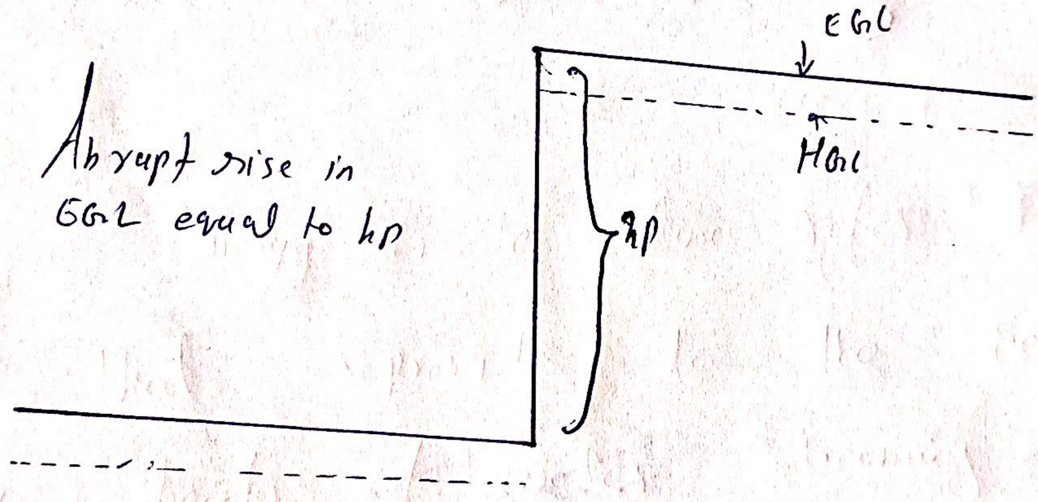
Energy line:-

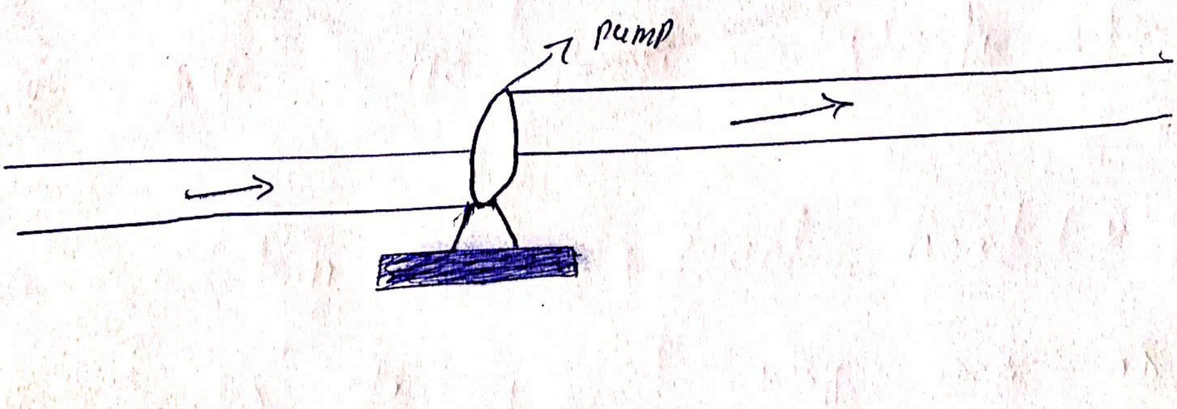
Energy Grade line refers to a line that represents to the height of energy head of water streaming in a pipe course, or channel. The line is drawn over the pressure hydraulic grade line

The seperation to speed head ($v^2/2g$) 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 avalible the fluid Can be expressed as $EL = H = P/\gamma + \frac{v^2}{2g} + h$ = Constant along a streamline.

EL = Energy line.





Question :- 2

Part # A

GIVEN DATA:-

velocity = v = 2m/s

Pressure = P = 300KPa

datum = Z = 5m

Solution:-

H = Pressure head + KE + PE

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

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

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

=> Question# 2

=> Part # B

=> GIVEN DATA:

=> Diameter = d_1 = 300m

=> Diameter = d_2 = 200m

Pressure = $P1$ = 300kpa = $300 \times 10^3 N/m^2$

= $P2$ = 120kpa = $120 \times 10^3 N/m^2$

Datum = Z = ?

$Q = 40/1000$ m^2/sec

$d1 = 300mm = 0.3m$

$d2 = 200mm = 0.2m$

=> Required:

$Z_2 = ?$

=> Solution:

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

$A_1 = \frac{3.14 \times (03)^2}{4}$

$A1 = 0.0706 m^2$

We know that

$Q_1 = V_1 A_1$

$V_1 = Q/A_1$

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

$V_1 = 0.566$

$V_2 = Q/A_2$

$V_2 = 0.04/0.0314$

$\boxed{V_2 = 1.27}$

$\therefore Q = 40/1000$
$Q = 0.04$

Now:-

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

$Z_1 = 0$
$\gamma = 9810$

$$\frac{300 \times 10^3}{9810} + \frac{0.566^2}{2(9.81)} + 0 = \frac{(20)\times 10^3}{9810} + \frac{1.27^2}{2(9.8)} + Z_2$$

$30.59 = 12.314 + Z_2$

$Z_2 = 18.276$

=> **Question # 3**

Solution:-

=> **Given data:-**

=> Length of pipe = $L = 500m$

dia $= d = 0.2m$

=> Specific gravity of oil = 0.9

=> Flow rate = $Q = 0.06 m^3/s$

=> Viscosity = $\mu = 6\times10^{-5}\ N\cdot S/m^2$

=> **REQUIRED:-**

Pressure loss = $\Delta P = ?$

Now:-

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

=> R = Reynold's No

$$R = \frac{V \times d}{\nu} \quad (1)$$

$$\because \nu = \frac{\mu}{\rho} = 6\times10^{-5}$$

$$\nu = 6.67\times10^{-7} m^2/s$$

Now:-

$$V = Q/A$$

$\because$ circular pipe

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

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

$$\boxed{A = 0.031 m^2}$$

(8)

②

$V = 1.95\ m/s$

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

$$\Rightarrow F = 0.00879$$

From Bernoulis equation:

$$\text{Head loss} - h_L = \frac{fLV^2}{2D} \rightarrow (ii)$$

Putting values in eq (ii)

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

$h_2 = 4.259m$

Now Find pressure ~~drop~~ loss due to friction

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

$$\Rightarrow \Delta P = h_2 \times \rho g$$

Putting values:

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

$\Rightarrow \Delta P = 37602.7$ Pa

$\Rightarrow \boxed{\Delta P = 37.6021 \text{ kPa.}}$