Name. Usama Yaqub

ID 7933

Section B

Subject Fluid mechanics

Paper 3.

Qno1:

Answer: Energy Head: The sum of all energy heat.

Kinetic Head: Kinetic energy per unit- head

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

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

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

It is measured in meter.

Potential Head: Potential energy per unit unit.

As:

$$P.E = mgh$$

$$\frac{P.E}{w} = \frac{mgh}{mg}$$

$$\frac{P.E}{w} = h$$

Pressure Head:

It is the level of fluid due to pressure exerted by fluid.

$$P.Head = \frac{P \cdot F}{\omega}$$

Q.no1:

(b)-

Hydraulic Grade Line:

The surface of Profile of water flowing in an open channel or 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 grade line take away the velocity head.

i.e $v^2/2g$

Energy Line:

A line that represents the elevation of energy head of water flowing in a Pipe, conduit or channel.

It line is drawn above the

Hydraulic ~~gas~~ valve line a distance equal to the velocity head of the water flowing at each section or point along the pipe or channel.

Hydraulic Radius:

The cross-sectional area of flow divided by the wetted perimeter, so the calculation of rectangle and trapezoid area and triangle area will be included along with the Perimeter for Each.

$$R_h = V_S / V_P = \emptyset V_B / S_P$$

$$S = S_P / V_B$$

$$n = \emptyset / S$$

Ans 3:

(a) -

Given:

velocity = 5 m/s

Pressure = 300 kPa

Datum = 5 m

Solution:

$$H = P + \text{Head} + V + \text{Datum}$$

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

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

$$H = 35.7 \text{ m}$$

Qno8:

(b)-

Given:

$D_1 = 300mm = 0.3m$

$D_2 = 200m = 0.2m$

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

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

$z = ?$

Solution:

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

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

$$A_1 = 0.0706\ m^2$$

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

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

$$A_2 = 0.0314\ m^2$$

$$Q = V_1 A_1$$

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

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

$$V_1 = 0.566$$

$$V_2 = Q/A_2$$

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

$$V_2 = 1.87$$

$$\frac{P_1}{\gamma} + \frac{v^2}{2g} + z = \frac{P_2}{\gamma} + \frac{v_2^2}{2g} + z_2$$

$$\gamma = 9810$$

$$\frac{300 \times 10^3}{9810} + \frac{0.566}{2(9.81)} + z_1 = \frac{1200 \times 10^3}{9810} + \frac{1.87}{2(9.81)} + 0$$

$$\therefore 30.60 + z_1 = 13.314$$

$$z_1 = -17.286$$

Qno3:

Given:

Length of Pipe = 500m.

$D = 0.3m$

specific gravity of oil = 0.9

flow rate = $0.05 m^3/s$

viscosity = $6 \times 10^{-3} N \cdot s/m^2$

Solution:

As:

$$f = \left[ 0.0039 + \left( \frac{0.221}{R^{0.32}} \right) \right]$$

$R = \frac{V \times D}{\nu}$

$\nu = \frac{\mu}{\rho}$

$\nu = \frac{6 \times 10^{-3}}{900}$

$\nu = 6.67 \times 10^{-6} m^2/s$

$V = Q/A$

$V = \frac{0.05}{0.031}$

$V = 1.95$

$R = \frac{1.95 \times 0.3}{6.67 \times 10^{-6}} = 8.73 \times 10^{4}$

$f = 0.0039 + \frac{0.221}{(8.73 \times 10^{4})^{0.32}}$

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

$$F = 0.00879$$

Head loss $= \frac{FLv^2}{2D}$

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

$$h_2 = 4.959\ m$$

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

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

$$\Delta P = 4.959 \times 900 \times 9.81$$

$$\Delta P = 37602.7\ Pa$$

$$\Delta P = 37.602\ kPa.$$