NAME :-

NAVEED AHMAD

I.D :- 7880

SEC :- B

SUB :- HYDRAULIC ENGG.

INST :- ENGR FAWAD

QUISTION- 1 (a)

GIVEN DATA.

width $b = 8m$.

discharge $= Q = 7880$ l/sec or $7.88 \, m^3/sec$.

Mean velocity $= 7880 - 200 = 7680$?l/sec.

$V = R - 200$

$\Rightarrow 2341.46$.

SOLUTION:-

$Q = qb$.

$q = Q/b = \frac{7.88}{8} \Rightarrow 0.98 \, m^3/sec$

$y_c = (q^2/g)^{1/3}$

$\Rightarrow \left(\frac{(0.98)^2}{9.81}\right)^{1/3}$

$\Rightarrow 0.4608$.

For rectengular section

$$Q = qb \quad \text{— ①}$$
$$Q = AV \quad \text{— ②}$$

Equating eq ① and ②

$$qb = AV$$
$$q\cancel{b} = y\cancel{b}V$$
$$q = y_c$$
$$V_c = \frac{q}{y_c}$$

$$V_c = \frac{0.98}{0.4608}$$

$$\Rightarrow 2.125 \text{ m/sec.}$$

as V is greater than V_2 so its super critical flow.

Hieght of hydraulic jump

As $Q = AV$
$$Q = byV$$
$$y_1 = Q / v_1 b$$

③

$$y_1 = \frac{7.88}{2341.46(8)}$$

$\Rightarrow 0.0004.$

$$y_2 = -\frac{y_1}{2} + \sqrt{\frac{y_1}{4} + \frac{2y_1 v_1^2}{g}}$$

$$y_2 = -\frac{0.0004}{2} + \sqrt{\frac{0.0004}{2} + \frac{(0.0004)(2341.46)^2}{9.81}}$$

$y_2 = 21.14\ m.$

$\Delta y = y_2 - y_1$

$\Delta y = 21.14 - 0.0004.$

$\Delta y = 21.14.$

$\Delta E = E_1 - E_2.$

As $Q_1 = Q_2.$

$A_1 V_1 = A_2 V_2.$

$V_2 = y_1 V_1 / y_2.$

$$V_2 = \frac{0.0004 \times 2341.46}{21.14}.$$

$V_2 = 0.044$

$\Delta E = E_1 - E_2$

$y_1 + \frac{V_1^2}{2g} - y_2 + \frac{V_2^2}{2g}$.

$\left(0.0004 + \frac{(2341.46)^2}{2(9.81)}\right) - \left(21.14 + \frac{(0.044)^2}{2(9.81)}\right)$

$E_1 - E_2 = 119.34 - 1.087$.

$\Rightarrow 118.25\, m$

power observed.

$\Delta P = \rho g Q (E_1 - E_2)$

$\Delta P = 1000 \times 9.81 \times 7.88 \, (118.25)$.

$\Rightarrow 9141056.1 \cdot KN$.

Q-1 <b>

GIVEN DATA:-

Channel width , $b = 4m$.

discharge , Q = 7821 ft³/sec.

h, upstream = 2.9 m

h, down stream = 1.1 m.

SOLUTION:-

Down stream velocity

Spacific energy $E_1 = E_2$.

$$y_1 + \frac{(V_1)^2}{2g} = y_2 = \frac{(V_2)^2}{2g} \quad \text{—— (1)}$$

$$Q_1 = Q_2$$

$$A_1V_1 = A_2V_2.$$

$$by_1V_1 = by_2V_2.$$

$$V_2 = \frac{y_1V_1}{y_2}.$$

$$V_2 = \left(\frac{2.9}{1.1}\right) V_1$$

$$V_2 = 2.63 V_1 \quad \text{——} (2)$$

put eq (2) in (1)

$$2.9 + \frac{(V_1)^2}{2g} = 1.1 + \frac{6.91 (V_1)^2}{2g}$$

$$+\frac{(V_1)^2}{2g} - \frac{6.91 (V_1)^2}{2g} = +1.8$$

$$(V_1)^2 = \frac{1.8 \times 2 \times 9.8}{5.91.}$$

$$V_1 = 2.44 \ m/sec \quad \text{——} (3)$$

put eq (3) in V_2.

$$V_2 = 2.63 (2.44)$$

$$V_2 = 6.41 \ m/sec.$$

Type of flow.

On upstream side

$$Fr_1 = \frac{V_1}{gy_2} = \frac{8.44}{9.81 \times 2.9} = 0.45.$$

$Fr < 1$ so the flow is subcritical.

On down stream side

$$Fr_2 = \frac{V^2}{\sqrt{gy_2}}$$

$$\Rightarrow \frac{6.41}{9.81 \times 1.1}$$

$Fr_2 = 1.95$

So the flow is criticle.

QUESTION - 2 <a>

GIVEN DATA:-

$y = 1.8m.$

$b = 66' \Rightarrow \frac{66}{3.28} \Rightarrow 20.12m.$

$Q = \frac{7880}{(3.28)^3} \Rightarrow 223.31\ m^3/sec$

SOLUTION :.

$Q = AV$

$V = \frac{Q}{A}$

$V = Q/by \Rightarrow \frac{223.31\ m^3/sec}{20.12 \times 1.8}$

$\Rightarrow 6.17$

As $y_c = (q^2/g)^{1/3}$

$= \left(\frac{(11.02)^2}{9.81}\right)^{1/3} = 2.31m.$

Also

$$V = \sqrt{gy}$$

$$V_c = \sqrt{g y_c}$$

$$V_c = \sqrt{9.81 \times 2.31} = 4.76 \text{ m/sec}$$

$$E_1 = E_2.$$

$$y_1 + \frac{V_1^2}{2g} = \frac{V_c^2}{2g} + y_c + P$$

$$1.8 + \frac{(6.17)^2}{2 \times 9.8} = \frac{(4.76)^2}{2 \times 9.8} \times 2.31 + P.$$

$$\Rightarrow \quad 3.70 = 3.46 + P$$

$$P = 0.23 \text{ m.}$$

Q2 - <D>

GIVEN DATA:-

$b = 2.8m$

$d = 1.5m$

$H_1 = 5m$

$H_2 = 5 + 1.5m = 6.5m$

$H = 5 + 0.6m = 5.6m.$

$Cd = 0.7880$

$Q = ?$

SOLUTION:-

As discharge through submerge portion

$$Q_1 = cd \times b \times (H_2 - H) \times \sqrt{2gH}$$

$$= 0.7880 \times 2.8 \times (6.5 - 5.6) \times \sqrt{2 \times 9.81 \times 5.6}$$

$$= 1.985 \times \sqrt{2 \times 9.81 \times 5.6}$$

$$\Rightarrow 20.815 \; m^3/sec.$$

Scanned with CamScanner

Discharge of free portion

$$Q_2 = \frac{2}{3} cd \times b\sqrt{2g}\left[H^{3/2} - H_1^{3/2}\right]$$

$$Q_2 = \frac{3}{2}(0.7880 \times 2.8\sqrt{2\times 9.81}\left[5.6^{3/2} - 5^{3/2}\right]$$

$$Q_2 = 12.588$$

Total discharge.

$$Q = Q_1 + Q_2$$

$$Q = 20.815 + 12.588$$

$$Q = ~~12.588~~ \; 33.403 \; m^3/sec.$$

QUESTION - 3 (a)

GIVEN DATA:-

$P_1 = R + 800 = 7880 + 8800 \Rightarrow 8680$

$d_1 = R - 200 = 7880 - 200 \Rightarrow 7680$ mm.

$\Rightarrow 7.68$ m.

SOLUTION:-

$A_1 = \frac{\pi}{4} d_1^2 = \frac{\pi}{4}(7.68)^2 \Rightarrow 46.325$

$d_2 = R + 3000 = 7880 + 3000 \Rightarrow 10880$ mm

$\Rightarrow 10.880$ m

$A_2 = \frac{\pi}{4} d_2^2 = \left(\frac{\pi}{4}\right)(10.88) = 92.97\ m^2.$

$Q = 0.95\ m^3/sec.$

$V = Q/A.$

$V_1 = \frac{Q}{A_1} = \frac{0.95}{46.3325} = 0.020.$

$V_2 = \frac{Q^2}{A_2} = \frac{0.95}{92.97} = 0.04$ m/sec

1- Head loss due to sudden enlargement.

$$h_e = \left(1 - \frac{A_1}{A_2}\right)^2 \frac{(V_1 - V_2)^2}{2g}.$$

$$h_e = \left(1 - \frac{45.67}{92.97}\right)^2 \frac{(0.02 - 0.01)^2}{2 \times 9.81}.$$

$$h_e = 0.00000129 m.$$

2- power loss due to sudden enlargement

$$P = \rho g Q h_e.$$

$$P = 1000 \times 9.8 \times 0.95 \times 0.00000127.$$

$$P = 0.011.$$

3- pressure in smallest pipe

By Bernaulli's equation.

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + h_e.$$

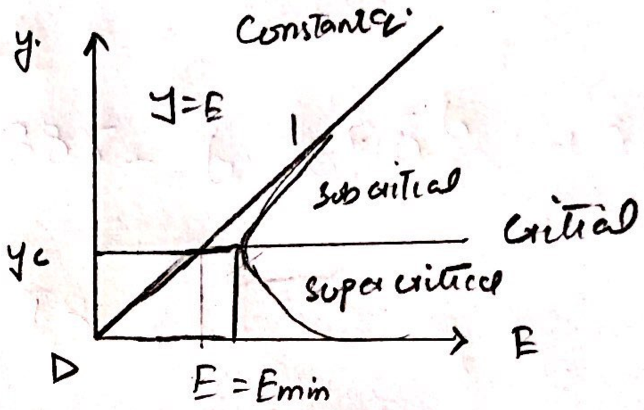
$$\frac{8680}{1000 \times 9.81} + \frac{(0.02)^2}{2 \times 9.81} = \frac{P_2}{1000 \times 9.81} + \frac{(0.01)^2}{2.981} + 0.0000012g.$$

$P_2 = 0.885 - 6.36 \times 10^{-6} + 9810$

(14)

$P_2 \Rightarrow 8720.34.$

Q-3 (b)



ANSWER:-

This graph is plotted between depth flow (y) and specific energy (E). It is made from 3 degree polynomial equation. which shows as the different specific energy for the depth flow which may be either sub critical, critical or super critical

As we know that.

Total energy = PE + KE

$T.E = mgh + \frac{1}{2} mv^2.$

$wh + \frac{1}{2} \frac{w}{g} v^2.$

$$T \cdot E = h + \frac{V^2}{2g} \quad \text{——} (1)$$

As we know that.

$Q = VA$

$V = Q/A$.

Squaring both sides

$V^2 = Q^2/A^2$

Put V^2 in eq(1) we get.

$$E = y + \frac{Q^2}{A^2 \cdot 2g} \quad \text{——} (2)$$

Suppose channel is rectangular.

$A = y \times b$ — (a)

$Q = qb$ —— (b)

put (a) in (b) in (2).

$$E = y + \frac{Q^2}{y^2 b^2 2g} \quad \text{put (a)}$$

$$E = y + \frac{q}{y^2 2g} \quad \text{——} (b)$$

$$E - y = \frac{q^2}{y^2 2g}$$

$$(E - y) y^2 = \frac{q^2}{2g}$$

$$(E - y) y^2 = \text{constant}$$