NAME	SYED ANAS
ID	7648
Assignment	hydraulic engg
Submitted to	ENGR. FAWAD AHMAD.

Assignment (1)

Part 1 Venturi flume:

A venturi flume is a critical flow open flume with a constricted flow which causes a drop in the hydraulic grade line, creating a critical depth.

It is used in flow measurement of very large flow rate usually given in millions of cubic units. A venturi meter would normally measure in millimeters where a venturi flume measures in meters.

Measurement of discharge with venturi flumes requires two measurements one upstream & one at the throat (narrowest cross-section) if the flow passes in a sub-critical state through the flume. If the flumes are designed so as to pass the flow from sub-critical to super-critical state while passing through the flume, a single measurement at the throat is computation of discharge. To ensure the occurrence of critical depth at the throat, the flumes are usually designed in such way as to form a hydraulic jump on the downstream side of the structure. These flumes are called standing wave flumes.

Part 2

$b = 3m$

$Q = 12 m^3 s^{-1}$

a Discharge per unit width:

$$q = \frac{Q}{b} = \frac{12}{3} = 4 m^2 s^{-1}$$

Then for rectangular channel.

$$h_c = \left(\frac{q^2}{g}\right)^{1/3} = \left(\frac{4}{9.81}\right)^{1/3} = 1.177 m$$

Ans : critical depth = 1.18 m.

(b) for rectangular channel.

$$E_c = \frac{3}{2} h_c = \frac{3}{2} \times 1.177 = 1.766 m$$

minimum specific energy = 1.77 m

(c) . As $E > E_c$ there are two possible depth for given specific energy.

$$E = h + \frac{v^2}{2g} \quad \text{where} \quad V = \frac{Q}{A} = \frac{q}{h} \quad \text{(for rectangular channel)}$$

$$\Rightarrow E = h + q^2 / 2gh^2$$

Substituting values in meter-second units.

$$4 = h + \frac{0.8155}{h^2}$$

for the subcritical (slow, deep) solution the first term, associated with potential energy dominating. So rearrange,

$$h = 4 - \frac{0.8155}{h^2}$$

Assignment (2)

Pb 01

Sol, check froude number

$$Fr = \frac{V}{\sqrt{gy}} = \frac{6}{\sqrt{9.81/s^2 \cdot 0.1m}} = 6.06 > 1$$

So the flow is supercritical.

$$E = y + \frac{V^2}{2g} = 0.1m + \frac{(6m/s)^2}{2 \times 9.81} = 1.935m$$

solving for the alternate depth

for an $E = 1.935m$ yield $y = 1.93m$

Pb 02

Sol : $E_1 = y_1 + \frac{V_1^2}{2g} = 3m + \frac{(2m/s)^2}{2 \times 9.81\ m/s} = 3.20m$

$E_2 = E_1 - \Delta z = 3.28m - 0.60m = 2.60m$

Also

$$E_2 = y_2 + \frac{q^2}{2gy_2} = y_2 + \frac{(6m^2/s/m)^2}{2 \times 9.81m/s^2 \cdot y} = 2.60$$

So $y_2 = 2.24m$, $\Delta y = y_2 - y_1 = 0.76m$ so water surface drop $= 0.18m$

for a downword step of 15 cm we have -

$E_2 = E_1 - \Delta z = 3.20m - (-0.15m) = 3.35m$

giving $y_2 = 3.17m$ & $\Delta y = y_2 - y_1 = 0.17m$ so water surface rises 0.02m.

The maximum upstep possible before affecting upstream water surface $= y_2 = y_c$

$$y_c = \sqrt[3]{\frac{V^2}{g}} = \sqrt{\frac{(6m^2/s/m)^2}{9.81\ m/s^2}} = 1.54m$$

$$\boxed{y_c = 1.54\ m}$$

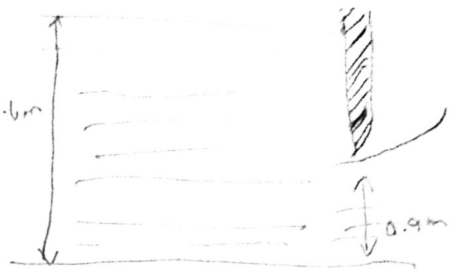
Assignment #03

Given data

$(y_1) = 3.6m$

$(y_2) = 0.9m$

$b = 3.9m$



Sol) As we know that

specific energy on both stream are same

so $E_1 = E_2$

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

Also by discharg formula.

$$Q = A_1V_1 = A_2V_2$$

$$b_1 y_1 \cdot V_1 = b_2 y_2 \cdot V_2$$

$$b \cdot y_1 \cdot V_1 = b \cdot y_2 \cdot V_2$$

$$y_1 \cdot V_1 = y_2 \cdot V_2$$

$$\Rightarrow V_2 = \frac{y_1}{y_2} \times V_1$$

$$= \frac{3.6}{0.9} \times V \Rightarrow \boxed{V_2 = 4V_1} \quad \text{——} 2$$

Puting The value of V_2 in eq(1)

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

$$3.6 + \frac{V_1^2}{2g} = 0.9 + \frac{(4V_1)^2}{2g}$$

$$3.6 + \frac{V_1^2}{2g} = 0.9 + \frac{16V_1^2}{2g}$$

$$\frac{V_1^2}{2g} - \frac{16V_1^2}{2g} = 0.9 - 3.6$$

$$\frac{v_1^2 - 16v_1^2}{2g} = -2.7$$

$$\frac{+15v_1^2}{2g} = +2.7$$

$$\sqrt{v_1^2} = \sqrt{\frac{2.7 \times 2(9.81)}{15}}$$

$$v_1 = 1.879 \text{ m/sec}$$

Putting the value of v_1 in eq (2)

$\Rightarrow v_2 - 4v_1$

$= 4(1.879)$

$$v_2 = 7.516 \text{ m/se}$$

Also $=$ $Q_1 = A_1 v_1$

$= b y_1 \cdot v_1 = 3.9 \times 3.6 \times 1.879$

$$Q_1 = 26.38 \text{ m/sec}$$

$Q_2 = A_2 V_2$

$= b y_2 v_2 \Rightarrow 3.9 \times 0.9 \times 7.516$

$$Q_2 = 26.38 \text{ m/sec}$$

$\Rightarrow Q = Q = Q_2 = 26.38 \text{ m/sec}$