Assignment No 1
ID No 7786
Section A
Ahmed Shahzad

VENTURI FLUME:-

It is a critical-flow open flume with a constructed flow which causes a drop in hydraulic grade line, creating a critical depth. It is used in flow measurement of very large flow rates. venturi meter is normally measures in millimeters, and venturi flume in meters.

Measurement of discharge with venturi flume requires two measurement, one upstream and on at the throat; If the flow passes in subcritical state through flume. a single measurement at throat is enough to measure the discharge.

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Q2)

Solution:-

$b = 3m$

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

Discharge per unit width:-

$$q = Q/b = 12/3 = 4 m^2/s$$

For a rectangular channel:-

$$h_c = (q^2/g)^{1/3} = (4^2/9.8)^{1/3} = 1.177m$$

Critical depth:- $1.18m$

ii) For Rectangular channel:-

$$E_c = \frac{3}{2} h_c = \frac{3}{2} \times 1.177 = 1.76m$$

Answer:- Minimum Specific energy = 1.77m.

c) $E > E_c$, there are two possible depths for a given specific energy.

$$E = h + V^2/2g \quad \text{where } V = Q/A = q/h$$

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

Substituting values in m-sec unit.

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

arrange eq for "h"

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

Iteration (from eq h=4) gives h= 3.948m

For Super critical :-

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

$$h = \sqrt{\frac{0.8155}{-h+4}}$$

~~Put h=0~~ h= 0.4814m.

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Assignment No 2
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Q1) Solution:-

To find the flow we have to find the froud number:-

$$Fr = \frac{V}{\sqrt{gy}} = 6m/s / \sqrt{9.81 \times 0.1}$$

$Fr = 6.06 > 1$

So the flow is super critical

Alternate depth:-

As we know that

$$E = y + \frac{V^2}{2g}$$

$$= 0.1 + \frac{6^2}{2 \times 9.81} = 1.935m$$

The alternate depth for $E = 1.935m$

$Y_{alternate} = 1.93m$

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Q3:- Solution:-

3 Velocity = ?

depth $= y_1 = 3m$

Elevation $\Delta x = 60cm = 0.6m$

downstep $= 15cm = 0.15m$

As we know that

$$E_1 = y_1 + \frac{v_1^2}{2g}$$

$$E_1 = 3 + \frac{2^2}{2 \times 9.81}$$

$E_1 = 3.20m$

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Now, $E_2 = E_1 - \Delta z$

$E_2 = 3.2 - 0.6$

$E_2 = 2.60m$

$E_2 = y_2 + q^2/2gy_2^2$

Arrange the eq for "y".

$2.60 = y_2 + 6^2/2\times9.81 y_2^2$

$y_2 = 2.24m$

$\Delta y = y_2 - y_1$

$\Delta y = 2.24 - 3$

$\Delta y = 0.76m$

So water surface drop is 0.16m

* for a downward steep of 15cm or 0.15m

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

$E_2 = 3.35m$

Now $y_2 = 3.17m$

$\Delta y = y_2 - y_1 = 3.17 - 3$

$\Delta y = 0.17m$

So water surface rises 0.02m

The maximum upstep possible before effecting upstream water surface level is ~~surface~~ for

$y_2 = y_c$

$y_c = \sqrt[3]{q^2/g}$

$y_c = \sqrt[3]{6^2/9.18}$

$y_c = 1.54m$

Assignment No 3
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Data:-

$y_1 = 3.6m$, $y_2 = 0.9m$, $b = 3.9m$

SOLUTION:-

As we know that

$E_1 = E_2$

$$y_1 + \frac{V_1^2}{2g} = y_2 + \frac{V_2^2}{2g} \longrightarrow eq(i)$$

Also, $Q = AV_1 = A_2V_2$

$b_1y_1V_1 = b_2y_2V_2$

$y_1V_1 = y_2V_2$

$V_2 = y_1/y_2 \times V_1$

$V_2 = 3.6/0.9 \times V_1$

$V_2 = 4V_1$

Puttiving value of V_2 in eq(i)

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

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

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

$$\frac{V_1^2 - 16V_1^2}{2g} = -2.7$$

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$$\sqrt{V_1^2} = \sqrt{\frac{2.7 \times 2(9.8)}{15}}$$

$V_1 = 1.879 m/sec$ => put in eq(iii) we get.

$V_2 = 4V_1$ => $V_2 = 4(1.879)$

$V_2 = 7.516 m/s$

As $Q_1 = A_1V_1 = by_1v_1$

$= 3.9 \times 3.6 \times 1.879$

$Q_1 = 26.38 m^3/sec$

$Q_2 = A_2V_2 = by_2v_2$

$= 3.9 \times 0.9 \times 7.516$

$Q_2 = 26.38 m^3/sec$

$Q = Q_1 = Q_2 = 26.38 m^3/sec$

$Q_2 = A_2V_2 = by_2v_2$

$= 3.9 \times 0.9 \times 7.516$

$Q_2 = 26.38 m^3/sec$

$Q = Q_1 = Q_2 = 26.38 m^3/sec$

Fraud No at Upstream Side

$$Fr_1 = V_1/\sqrt{gy_1} = \frac{1.879}{\sqrt{9.81 \times 3.6}} = 0.31$$ (sub critical flow)

Fraud No at downstream Side:-

$$Fr_2 = \frac{V_2}{\sqrt{gy_2}} = \frac{7.516}{\sqrt{9.81 \times 0.9}}$$

$= 2.52$ Super critical flow