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Assignment #1 Hydraulics Engineering.

Q.No1: What is venture flume? Explain with detail.

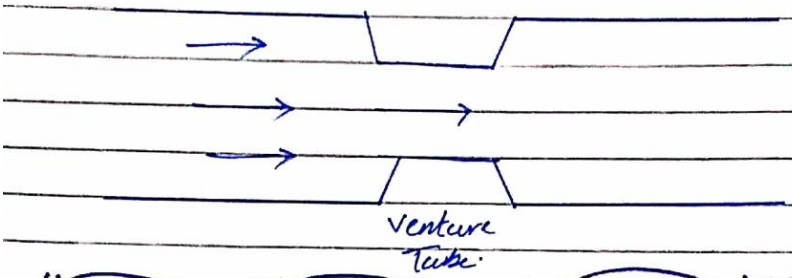
Ans:- Venture flume:-

A venture flume is a critical flow open flume with a constricted flow which causes a drop in the hydraulic gradeline, creating a critical depth.

It is used in flow measurment of very high large flow rate usually given in million of cube units. A venture meter would normaly measure in mm. where as a venture flume measure is meter.

Measurment of discharge with venture flume requires two measurment one upstream and 2nd at the throat, if the flow passes in a subcritical state through the flume. It has the flume is designed so to pass the flow from sub-critical to super critical stat while passing through the flume, a single measurement at a throat is sufficient for compitation of discharge to insure the occurance of critical depth of the throat the flume are usualy designed in such away as to form a hydraulic jump on the down stream side of the structure.

The flume is called Standered wave flume.



Q No2: A 3m wide channel. . . . . when $E = 4m$.

Given data:

$$Q = 12\ m^3/sec$$

$$b = 3m.$$

As we know that.

Discharge per unit width.

$$q = Q/b = \frac{12}{3} = 4\ m^2/sec.$$

for rectangular channel.

$$he = \left(\frac{q}{g}\right)^{1/3}$$

$$he = \left(\frac{(4)^2}{9.8}\right)^{1/3}$$

$$he = 1.177\ m.$$

for rectangular channel.

$$E_c = \frac{3}{2} he = \frac{3}{2}(1.1775) \Rightarrow 1.766.$$

Assigment No# 2.

QNo1: Water flow at a depth - - - - - -
- - - - - - - - - - - - - - - - - depth.

First of all check froud number.

$$Fr = \frac{V}{\sqrt{gy}} = \frac{6m/s}{\sqrt{9.8 \times 0.1m}} = 6.06.$$

Therefore $6.06 > 1$.

So the flow is super critical.

$$E = y + \frac{V^2}{2g} = 0.1 + \frac{(6)^2}{2 \times 9.8}.$$

$$\boxed{E = 1.936m}.$$

Solving the altmate depth for.

$E = 1.936m$ yeild $y_{alt} = 1.93m$.

Q NO: 2:- Water flow with . . . . . .
. . . . . Head losses.

Sol:-

$$E_1 = y + \frac{V_1^2}{2g}$$

$$= 3 + \frac{(2)^2}{2\times 9.8} \Rightarrow E_1 = 3.20\,m.$$

$$E_2 = E_1 - \Delta Z.$$

$$= 3.20 - 0.60 \quad E_2 = 2.60\,m.$$

Also.

$$E_2 = y_2 + \frac{q^2}{2gy}$$

$$y_2 + \frac{6^2}{2\times 9.8\cdot y} = 2.60\,m.$$

So $y_1 = 2.24\,m$ $\Delta y = y_2 - y_1 = 0.76\,m$ So actual water surface depth 0.16m. for downward step of 15cm we have.

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

Giving $y_2 = 3.17m$ and $\Delta y = y_2 - y_1 = 0.17m$.

So water surface rises 0.02m. The maximum rise possible before affecting upstream water surface level is for $y_2 = y$.

$$Y_1 = \left(\frac{q^2}{g}\right)^{\frac{1}{3}} = 1.54\,m.$$

Assignment # 03.

Q1: A water passing from ..... gate is 3.9m.

Determine.

① Discharge.

Froud Number upstream and downstream.

Given data:

$$Y_1 = 3.6m \;,\; y_2 = 0.9 \;,\; b = 3.9m$$

As we know that.

$$E_1 = E_2$$

$$Y_1 + \frac{V^2}{2g} = y_2 + \frac{V^2}{2g} \quad \text{— ①.}$$

Also.

$$Q = A_1 V_1 = A_2 V_2$$

$$b_1 Y_1 V_1 = b_2 y_2 V_2$$

$$Y_1 V_1 = y_2 V_2$$

$$V_2 = \frac{Y_1}{y_2} \times V_1.$$

$$V_2 = \frac{3.6}{0.9} \times V_1$$

$$V_2 = 4 V_1 \quad \text{— ②.}$$

Putting in eq ①.

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

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

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

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

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

$$\frac{-15V_1^2}{2g} = -2.7$$

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

$$V_1 = 1.879 \text{ m/sec.}$$

Putting the values of V_1 in eq (2).

$$V_2 = 4V_1.$$

$$V_2 = 4(1.879).$$

$$V_2 = 7.516.$$

As:

$$Q_1 = A_1V_1 = b_1y_1V_1 = 3.9 \times 3.6 \times 1.879 = 26.38 \text{ m}^3/\text{sec.}$$

$Q_2 = A_2 V_2 = b_2 y_2 V_2 = 3.9 \times 0.9 \times 7.56 = 26.38 \ m^3/sec.$

$Q = Q1 = Q_2 = 26.38 \ m^3/sec.$

Froud number → At upstream side.

$$Fr_1 = \frac{V_1}{\sqrt{g y_1}} = \frac{1.879}{\sqrt{9.8 \times 3.6}} = 0.31$$

$Fr_1 = 0.31 < 1.$

So it is subcritical flow.

Froud number:

$$Fr_2 = \frac{V_2}{\sqrt{g y_2}} = \frac{7.56}{\sqrt{9.8 \times 0.9}} = 2.52.$$

$Fr_2 = 2.52 > 1$

So it is supercritical flow.