Assignment # 01

Name Sheraz

ID 7862

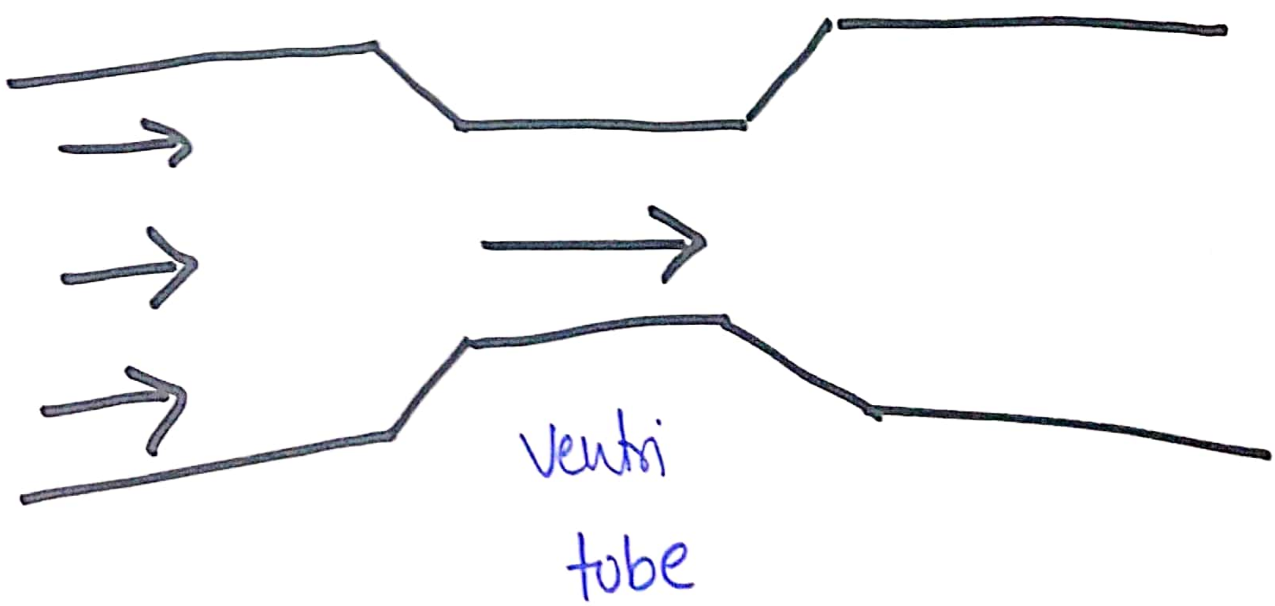
Hydraulic Engineering

Q1 VenTure Flumes

A venture flume is a Critical flow, open flume with a Constricted flow. which lower the drop in hydraulic grade line, creating a Critical depth. it is used in flow measurement of very large flow water, usually give in million of Cubic units.

A venturi meter will usually measure in reason where as a venture fume in Meter.

Measurement of discharge with Venturi flume requires two measurements one upstream and one at the centre. it the flow losses on a sub critical state through the flume. It is the flume designed so to pass the flow from sub-critical to super-critical state while passing through the same. A single measurement let a throat in sufficient for completion of discharge to ensure the occurrence of critical depth of the throat. the flume are unsteady designed in such way as to form "hydraulic Jump" the downstream side of structure.



Q(2)

Given data

$b = 3m$

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

Solution

① Discharge per unit width

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

Then for rectangular section

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

Critical depth $= 1.18 m$

(b) for rectangular Section

$E = \frac{3}{2} h_c = \frac{3}{2} \times 1.177 = 1.76\text{cm}$

Min Specific Energy = 1.77m

(c) As $E > E_c$, there are ~~the~~ two possible depths given (specific engy)

$E = h + \frac{V^2}{2g}$ ∴ $V = \frac{Q}{A} = \frac{q}{h}$

$E = h + \frac{q^2}{2gh}$

Substituting values

$y = h + \frac{0.815}{h^2}$

Now

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

from $(h=4)$ given $h = 3.948m$

So

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

Alternate depth are

$$\boxed{3.95m \quad \text{and} \quad 0.481m}$$

Assignment # 02

NAME SHERA Z KHAN

ID 7862

Hydraulic Engineering

Problem # 01

Given data

depth = 10cm

Velocity = 6m/s

Solution (check frood nomber)

$$Fr = \frac{V}{\sqrt{gy}} = \frac{6}{\sqrt{9.81/s^2 \; 0.1m}}$$

$$Fr = 6.06 > 1$$

So the flow is critical

$$E = y + \frac{V^2}{2g} = 0.1m + \frac{(6)^2}{2 \cdot 9.81}$$

$$E = 1.935m$$

Solving for the alternate depth for an $E = 1.935m$ yields $y_{alt} = 1.93m$

Problem #02

Solution:-

$$E_1 = y_1 + \frac{V_1^2}{2g} = 3 + \frac{(2)^2}{2(9.81)} = 3.20m.$$

$$E_2 = E_1 - \Delta z$$

$$E_2 = 3.20_m - 0.60m = 2.60m$$

Also

$$E_2 = y_2 = \frac{q^2}{2gy_2^2} = y_2^2 + \frac{(6)^2}{2(9.81)} = 2.60m$$

So $y_2 = 2.24m.$

$\Delta y = y_2 - y_1 = -0.76m$ So water

Surface drops 0.16m.

For a downward step of 15cm we have

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

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

So water Surface rise 0.02m.

The maximum upstep possible before affecting upstream water Surface level is for

$$y_2 = y_c$$

$$y_c = \sqrt[3]{\frac{q^2}{g}} = \sqrt[3]{\frac{(6)^2}{9.81}}$$

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

Assignment # 03

ID 7862

Name Sheraz

Q no #03

Given data

$y_1 = 3.6m$ $y_2 = 0.9m$

$b = 3.9m$

As we know that

$$E_1 = E_2$$

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

Also

$$Q = A_1V_1 = A_2V_2$$

$$b_1 y_1 V_1 = b_2 y_2 V_2$$

$$y_1 V_1 = y_2 V_2$$

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

$$V_2 = y V_1$$

Putting the value of V_1 in eq (2)

$$V_2 = 4V_1$$

$$V_2 = 4(1.879)$$

$$V_2 = 7.516 \, m/s$$

As

$$Q_1 = AV_1 = b_1 y_1 V_1$$

$= 3.9 \times 3.6 \times 1.879$

$= 26.38\ m/sec$

$\Rightarrow Q_2 = A_2 V_2 = b y_2 V_2$

$= 3.9 \times 0.9 \times 7.51$

$Q_2 = 26.38\ m^2/se$

$Q = Q_1 = Q_2 = 26.38\ m^2/s$

① Frood no at upstream Side

$$F_{r1} = \frac{V_1}{\sqrt{g y_1}} = \frac{1.879}{9.8 \times 36} = 0.31$$

$Fr = 0.31 < 1$ So it is Sub-critical flow

② froud number

$$Fr_2 = \frac{V_2}{\sqrt{g y_2}} = \frac{7.56}{\sqrt{9.81 \times 0.9}}$$

$Fr = 2.52$

So

$Fr = 2.52 > 1$

Supercritical flow.