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Section	A
Semester	6th
Assignment	01 ,02, 03
Subject	Hydraulic engineering.

Assignment #No 1

QNo 1 What is venture flume? Explain with Detail?

Ans A venturi flume is a critical flow open flume with a constricted flow which causes a drop in the hydraulic grad line creating a critical depth. It is used in flow measurement of very large flow rates 4 sually give a millions of cubic units. A venturi meter would normally measure in millimeter where as a venturi flume measure in meters.

Measurement of discharge with venturi flumes require two measurement one upstream & one at the thort (narrowest Cross Section). It the flow passes in a Subcritical State through the flume. It the flumes from Sub to Super Critical State while passing through the flume a Single measurement at the throat is Sufficent for computation of discharge to ensure the occurrence of critical depth at the throat the flume are usually designed in Such way as to form a hydralic jump on the downstream Side of Structure.

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Q2 Given data

$b = 3m$

$Q = 1{,}2 m^3/sec$

(a) Discharge per unit width.

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

The rectangular ~~unit width~~ channel

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

$\boxed{\text{Critical depth} = 1.18m}$

(b) for rectangular channel.

$E_c = \frac{3}{2} h_c \Rightarrow \frac{3}{2} \times 1.17$

$E_c = 1.766m$

$\boxed{\text{mini Specific energy} = 1.77}$

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

$E = h + \frac{v^2}{2g}$ where $v = \frac{Q}{A} = \frac{q}{h}$

for rectangular channel

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

Substitling values in meter-Second unit.

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

for the Subcritical (Slow deep) Solution the first term associated with potential energy

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

e.g $h = 4$ give $h = 3.948m$

for the Supercritical Solution.

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

$$h = 0.4814 m$$

alternate depth are 3.95 & 0.481.

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Q1

Assignment #02

Given data

$d = 10cm$

$V = 6 m/s$

$y_{alt} = ?$

Solution

By checking froude number:

$$fr = \frac{V}{\sqrt{gy}} \Rightarrow \frac{6}{\sqrt{9.81 \times 0.1}} = 6.06$$

$$\boxed{fr = 6.0671}$$

Flow is Supercritical

$$E = y + \frac{V^2}{2g} = 0.1 + \frac{6}{2 \times 9.81}$$

$$E = 1.935m$$

for alternate depth $E = 1.935m$

$$\boxed{y_{at} = 1.93}$$

Scanned with CamScanner

Q2 Given data

$V_1 = 2 m/s$

$y_1 = 3 m$

$\Delta z = 60 cm \approx 0.6 m$

downstep $= 15 cm = 0.15 m$

Solution.

$$E_1 = y_1 + \frac{V_1^2}{2g}$$

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

$$\boxed{E_1 = 3.20 m}$$

Now

$$E_2 = E_1 - \Delta z$$

$$= 3.2 - 0.6$$

$$\boxed{E_2 = 2.60 m}$$

Also

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

$$2.60 = y_2 + \frac{6^2}{2 \times 9.81 y_2^2}$$

$$\boxed{y_2 = 2.24 m}$$

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$\Delta y = y_2 - y_1$
$= 2.24 - 3$

$\boxed{\Delta y = -0.76 m}$

So water surface drop $= 0.16m$

for a downward step of 15cm or 0.15m we have

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

$\boxed{E_2 = 3.35 m}$

Now $y_2 = 3.17 - 3$

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

$\Delta y = 0.17m$

So water surface rises $0.02m$

→ The max upstep possible before effecting upstream water surface level is for

$y_c = y_c$

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

$y = \sqrt[3]{\frac{62}{9.18}}$

$\boxed{y_c = 1.54m}$

Q1. Assignment No#03

Determine.

a) Discharge Q

b) froud no upstream & downstream.

Give data

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

$b = 3.9m.$

Sol:

$E_1 = E_2$

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

Now

$$Q = A_1 V_1 = A_2 V_2$$

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

$$y_1 \times V_1 = y_2 \times V_2$$

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

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

$$\boxed{V_2 = 4V_1} \quad \text{—— (2)}$$

put in eq/4 —— (1)

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

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

$$3.6 + \frac{(V_1)^2}{2g} = 0.9 + \frac{(4v_1)^2}{2g}$$

$$\frac{(V_1)^2}{2g} - \frac{16v_1^2}{2g} = 0.9 - 3.6$$

$$\frac{V_1^2 - 16v_1^2}{2g} = -2.7$$

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

$$\sqrt{V_1^2} = \sqrt{\frac{2.7 \times (2 \times 9.81)}{15}}$$

$$V_1 = 1.879 \, m/sec$$

put in equ ② we will get

$$V_2 = 4v_1$$

$$V_2 = 4(1.874) = \boxed{7.516 \, m/sec}$$

As

$$Q_1 = A_1 V_1 = y_2 V_2$$

$$= 3.9 \times 3.6 \times 1.879$$

$$\boxed{Q_1 = 26.38 \, m^3/sec}$$

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$Q_2 = A_2 V_2 = b y_2 V_2$

$= 3.9 \times 0.9 \times 7.516$

$Q_2 = 26.38 \, m^3/sec$

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

① froud number → at upstream Side

$F_{r1} = \frac{V_1}{\sqrt{g y_1}} = \frac{1.879}{\sqrt{9.81 \times 3.6}}$

$\boxed{F_{r1} = 0.31}$ Subcritical flow

② froud number → at downstream flow Side

$F_{r2} = \frac{V_2}{g y_2} = \frac{7.516}{\sqrt{9.81 \times 0.9}}$

$\boxed{F_{r2} = 2.52}$

Supercirtical flow.