

Name :- Abdur Rahman Khan

ID :- 7826

Sec :- A

Subject :- Hydraulic Engineering

Submitted :- Engr Fawad
to

Module :- 6th

Date :- 30 June - 20

Assignment # "1"

Q1) What is Venture flume ? Explain with detail?

As:- 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 mm, where as a venture flume measure in meters.

Measurement of discharge with venture flume requires two measurement, one ups stream & one at the throat, if the flow passes in a subcritical state through the flume. If the flume is designed so as to pass the flow from sub-critical to super critical state while passing through the flume, a single measurement at a throat is sufficient for computation of discharge.

To ensure the occurrence of critical depth at the throat, the flume are usually designed in such a way as to form a hydraulic jump on the downstream side of the structure. The flume is called standard wave flume.

Q2) A 3m wide channel carries a total discharge of $12 \text{ m}^3/\text{sec}$. Calculate

- 1) The critical depth
- 2) The minimum specific energy
- 3) The alternate depth when $t = 4 \text{ m}$

Sol:-

$$b = 3 \text{ m}$$

$$Q = 12 \text{ m}^3/\text{sec}$$

a) Discharge per unit width.

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

Then for a rectangular channel

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

So critical depth = 1.18 m

b) For a rectangular channel.

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

So minimum specific energy = 1.77 m

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

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

$$\Rightarrow E = h + \frac{q^2}{2gh^2} \quad \text{Substituting value in meter-sec unit}$$

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

for a sub critical (slow, deep) SD, the first term associated with potential energy dominates so rearrange as

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

Iteration (from e.g., $h = 4$) gives $h = 3.948 \text{ m}$

for the super critical (fast, shallow) SD, the second term associated with K.E dominates so rearrange as:

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

Iteration (from, e.g., $h = 0$) gives $h = 0.481 \text{ m}$

alternate depths are $3.95 \text{ \& } 0.481 \text{ m}$

Name :- Abdul Rahman

ID :- 7826

Sec :- A

module :- 6th

Subject :- Hydraulic Engineering

Submitted :- Engr Fawad
to

Date :- 20-June-20

Assignment # 02 "

Problem # 1

(Q1) Water flow at a depth of 10cm with a velocity of 6m/s in a rectangular channel. Is the flow subcritical or super critical? What is the alternate depth.

Sol:-

Check Froude Number

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

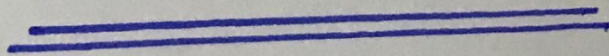
So the flow is super critical

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

$$= 1.935 \text{ m}$$

Solving the alternate depth from an:

$$E = 1.935 \text{ m yields } y_{alt} = 1.93 \text{ m}$$



Problem #2

Water flow with a velocity? Neglect head loss.

Sol:-

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

$$E_2 = E_1 - \Delta z = 3.20m - 0.60m = 2.60m$$

Also

$$E_2 = y_2 + \frac{q^2}{2gy_2^2} = y_2 + \frac{(6m^3/s/m)^2}{2 \times 9.81m/s^2 \cdot y_2^2} = 2.60m$$

$$\text{So } y_2 = 2.24m - \Delta y = y_2 - y_1 = -0.76m$$

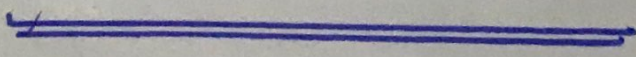
So the water surface drop 0.16m for a down word step of 15cm we have;

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

$$\text{giving } y_2 = 3.17m \quad \{ \Delta y = y_2 - y_1 = 0.17m \}$$

So the water surfaces rise 0.02m - The maximum upstep possible before affecting upstream water surface is for $y_2 = y$

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



Name :- Abdue Rahman

ID :- 7826

Sec :- A

Subject :- Hydraulic Engineering

Submitted :- Eng Fawad
to

Module :- 6th

Date :- 30-June-20

Assignment "#03"

Problem 01:-

A water passing from the slice gate in Dam
.....?

Given data:-

$$y_1 = 3.6 \text{ m} \quad , \quad y_2 = 0.9 \text{ m}$$

$$b = 3.9 \text{ m}$$

Sol:-

as we know that

$$E_1 = E_2$$

$$y_1 + \frac{v_1^2}{2g} = y_2 + \frac{v_2^2}{2g} \quad \text{--- (1)}$$

Also $Q = A_1 v_1 = A_2 v_2$

$$b y_1 \cdot v_1 = b y_2 \cdot v_2$$

$$(b = b_1 = b_2)$$

$$b y_1 v_1 = b y_2 v_2$$

$$y_1 v_1 = y_2 v_2$$

$$v_2 = \frac{y_1}{y_2} \times v_1$$

$$v_2 = \frac{3.6}{0.9} \times v_1 = 4 v_1 \quad \text{--- (2)}$$

putting eq (1)

$$y_1 + \frac{v_1^2}{2g} = y_2 + \frac{v_2^2}{2g} = 3.6 + \frac{v_1^2}{2g} = 0.9 + \frac{(4v_1)^2}{2g}$$

$V_1 = 1.879 \text{ m/sec}$ put in eq (2) we get

$V_2 = 4V_1$

$Q_1 = A_1 V_1 = b y_1 \cdot V_1$
 $= 3.9 \times 3.6 \times 1.879$

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

$\Rightarrow Q_2 = A_2 V_2 = b \cdot y_2 \cdot V_2$
 $= 3.9 \times 3.16 \times 7.516$

$Q_2 = 26.38 \text{ m}^3/\text{sec}$

$Q = Q_1 = Q_2 = 26.38 \text{ m}^3/\text{sec}$

1) Froude Number \rightarrow At upstream side

$F_{r1} = \frac{V_1}{\sqrt{g y_1}} = \frac{1.879}{\sqrt{9.81 \times 3.6}} = 0.31$
 \downarrow
sub critical flow

2) Froude Number \rightarrow At down stream side

$F_{r2} = \frac{V_2}{\sqrt{g y_2}} = \frac{7.516}{\sqrt{9.81 \times 0.9}} = 2.52$
 \downarrow
super critical flow

