NAME:-

NAVEED AHMAD

I.D: 7880

SECTION:-

B

SEMS: 6th.

SUB: HYDRAULIC ENGG.

Assig: 1st.

QUESTION - 1.

What is venture flume? Explain with details

VENTURE FLUME:-

A venturi flume is an ~~artificial~~ critical flow which causes a drop in the hydraullic grade line creating critical depth.

It is used in flow measuments of very large flow rate usually given in millions of cubic ~~meter~~ units. A venturi meter would normally measure in mm whare a venturi flume measure in meter.

Measurment of discharge with venturi flume requires two measurments, one up stream and one at the throught. If the flow passes in a sub critical state through a flume a single measurment through at a throught is sufficient for computation of dishcarge

To ensure the ocurence of critical depth at the throught, the flume are usually design in such a way as to form a hydraullic jump on the down stream side of structure. This flume is called standered wave flume.

QUESTION- 2.

A 3m wide channel caries a total discharge of $12 m^3/sec$. Find
1) Critical depth
2) minimum Sp. energy
3) Alternate depth when E = 4m.

SOLUTION:-

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

a) Discharge per unit width

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

For rectengular channel

$$h_c = \left(\frac{q^2}{g}\right)^{1/3} = \left(\frac{4}{9.81}\right)^{1/3} \Rightarrow 1.17 m$$

Critical depth = 1.18 m.

b) Rectengular channel.

$$E_c = \frac{3}{2} h_c = \frac{3}{2} \times 1.18 = 1.1767 m.$$

c) As $E > E_c$ There are two possible depth for a given specific energy.

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

$$E = h + \frac{q^2}{2gh^2}$$ Substituting value in m-sec unit

$$4 = h + \frac{0.815}{h^2}.$$

For a sub critical (slow, deep) sol. the first term associated with potential energy) dominates so rearrange.

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

iteration from e.g $h = 4$ gives 3.948 m.

For subcritical (fast, shallow) so the second term associated with K.E. dominates so rearrange.

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

Iteration from e.g $h = 0$ gives $h = 0.4814$m

alternate depth are 3.95 & 0.48m.

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ASSIG: 2nd.

PROBLEM - 1.

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

SOLUTION:-

Check Froude number.

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

So the flow is super critical

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

$$\Rightarrow 1.935 m.$$

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

PROBEM- 2 ②

Water flow .... head loss

SOLUTION:

$$E_1 = y_1 + \frac{v_1^2}{2g} = 3m + \frac{2m/s^2}{2\cdot 9.81 m/s} \Rightarrow 3.20m$$

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

Also

$$E_2 = y_2 + \frac{q^2}{2gy^2} = y = \frac{6m^3 s/m^2}{2\times 9.81 m/s^2 y_2^2} = 2.60$$

So $y_2 = 2.24m - \Delta y = y_2 - y_1 = 0.76m.$

So the water surface drop. 0.16m

a down word step of 15cm we have

$$E_2 = E_2 - \Delta s = 320\ m - (-0.15m) = 335\ m.$$

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

So the water surfaces. Nise 0.02. The maximum up step possible before affecting upstream water surface. is for $y_2 = y$.

$$y = \sqrt[3]{\frac{q^2}{g}} = \sqrt[3]{\frac{(6m^3/s/m)^2}{9.8m/s^2}} = 1.54m$$

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SEMS: 6TH

SUB: HYDRAULIC ENGG

ASSIGN: 3rd.

PROBLEM 01.

①

A water passing from ......?

DATA:

$y = 3.6m$, $y_2 = 0.9m$ $D = 3.9m$.

SOLUTION:

As we know that

$E_1 = E_2$

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

Also

$$Q = A_1V_1 = A_2V_2.$$

$$\cancel{D} y_1 V_1 = \cancel{D} y_2 V_2$$

$$\cancel{D} y_1 V_1 = \cancel{D} y_2 V_2$$

$$y_1 V_1 = y_2 V_2$$

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

$$V_2 = \frac{3.6}{3.9} \times V_1 = 4 V_1 \quad \text{——— ②}$$

Putting eq ①

$$y_1 + \frac{V_1^2}{2g} = y_2 + \frac{V_2^2}{2g} = 3.6 + \frac{V_1^2}{2g} = 0.9 + \frac{(4V_1)^2}{2g}$$

$V_1 = 1.879$ m/sec

Put in eq (2)

$V_2 = 4V_1$

$Q_1 = A_1V_1 = by_1V_1$

$\Rightarrow 3.9 \times 3.6 \times 1.88$

$Q = 26.38$ m^3/sec.

$Q_2 = A_2V_2 = b \cdot y_2 \cdot V_2$.

$\Rightarrow 3.9 \times 0.9 \times 7.516$

$Q_2 = 26.38$ m/sec.

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

(1) Froud number. → At upstream side

$$F_{r_1} = \frac{V_1}{\sqrt{gy_1}} = \frac{1.879}{\sqrt{9.81 \times 3.6}} \Rightarrow 0.31$$

(Sub-cr)

(2) Froud number – at down side

$$F_{r_2} = \frac{V_2}{\sqrt{gy_2}} = \frac{7.516}{\sqrt{9.81 \times 0.9}} = 2.52$$

Super crit