Date: / /20

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Sec# B

Assignment:
1, 2, 3

Babar Paper Products   Signature

Venturi flame.

A venturi flame is a critical flow open flume with a constricted flow which causes a drop in the hydrautic grade line creating a critical depth.

It is used in flow measurement at very large flow rates usually given in millions of meter would normally measure in mm where as in meters.

Meaurement of dischange with venturi flumes requires two measuremat one upstream and one at the threat. If the flow

passes in subcritical state though the flume-
If the flumes are designed so as to pass the flow from subcritical to super critical state while passing thought, the plame, a single measurement at the throat is sufficient for compulation of dis-charge To ensure the accerence of erptical depth at the throat the flumes are such away

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Example:

A 3m wide channels carries a total discharge of $12 m^3 s^{-1}$ calculate

a) The critical depth
b) The minimum specific Energy
c) The alternate depth when

$E = 4m$

$b = 3m$

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

A:

Discharge per unit width

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

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

Answer.

Critical depth = 1.18m

B.

For a rectangle channels

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

Answer.

Miniumm specific Energy
$= 1.177\,m$

C:

As E, E_c there are two possiibles depth for a given specific energy

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

For a rectangle channel

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

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Subsituting value in meta
Second unitl s-

For the subcritical (slow, deep)
the first term associated
with P.E $h = h \frac{0.8155}{h^2}$

$$g = 3.45 ft.$$

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PROBLEM: 4.22

Water folws a depth of 10 cm with a velocity of 6 m/s in a rectangler channel is the flow subcritical or supercritical what is the alternate depth

Solution:

Check Froude number

$$Fr = \frac{V}{\sqrt{gy}} = \frac{6 m/s}{\sqrt{9.81/s^2 \; 0.1 m}} = 1.935 m$$

So the flow is supercritical

$$E = y + \frac{V^2}{2g} = 0.1 m + \frac{(6 m/s)^2}{2.981 m/s^2} = 1.935 m$$

solving for alternate depth for an $E = 1.935\,m$ yields

$y_{alt} = 1.93\,m$

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PROBLE - 4.36

Water flows with velocity of 2m/s and at a depth of 3m in a rectangular channel what is the change in depth in water surface elvation produced up word change in bottom elevation of 60cm? what would be the depth and elevation change if there were a gradual downstep of 15cm-? what is the mixium size of setup that could expst before upstream depth changes would result? Neglect head losses.

Solution.

$$E_1 = y_1 + \frac{V_1^2}{2g} = 3m + \frac{2\,m/s^2}{2\cdot 9\cdot 8\cdot 1\,m/s^2}$$

$= 3.20m$

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

$$E_2 = y_2 + \frac{q^2}{2gy^2} = y_2 + \frac{(6m^3/sm)^2}{2\cdot 9.81\,m/s^2}$$

$= 2.60m$

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

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

$= 3.35m$

giving $y_2 = 3.19m$ and $\Delta y = y^2 - y'$

$= 0.19m$ so water surface raises 0.02m -

The maxium upstep possible

before affecting upstream water ~~sup~~ surface levels is for

$$y_2 = y_c$$

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

$$= 1.54\,m.$$

PROBLEM: 1

A water passing from the sofd slice gate in Dam ----?

⇒ GIVEN Data:

$$y_1 = 3.8m$$
$$y_2 = 0.9m$$
$$b = 3.9m$$

Solution.

We know that

$$E_1 = E_2$$

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

⇒ Also

$$Q = A_1V_1 = A_2V_2$$

$$b_1 y_1 - V_1 = b_2 y_2 - V_2$$

$$\cancel{b} y_1 V_1 = \cancel{b} y_2 V_2 \qquad b = b_1 = b_2$$

$$y_1 V_1 = y_2 V_2$$

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

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

$$V_2 = 4V_1$$

$\Rightarrow$ Put eq (1)

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

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

$\Rightarrow V_1 = 1.879$ m/sec

put in eq (2)

$\Rightarrow V_2 = 4V_1$

$\Rightarrow Q = A_1V_1 = by_1V_1$

$= 3.9 \times 3.6 \times 1.879$

$\Rightarrow Q_1 = 26.38$ m^3/sec

$\Rightarrow Q_2 = A_2V_2 = b \cdot y_2 - V_2$

$\Rightarrow 3.9 \times \overset{0.9}{\cancel{3.16}} \times 7.516$

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

$\Rightarrow Q = Q_1 = Q_2 = 26.38 m^3/se$

1) Froud Number → At downsteam

$Fr_1 = \frac{V_1}{\sqrt{gy_1}} = \frac{1.879}{\sqrt{9.81 \times 3.6}} = 0.316$

Subcritical flow.

2) Froud Number At down steam side

$Fr_2 = \frac{V_2}{\sqrt{gy_2}} = \frac{7.516}{9.81 \times 0.9}$

$= 2.52$ super crPtical flow.

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