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Section	"A"
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Assignment	1, 2, 3
Subject	Hydrulic Engineering
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Best Quality

Assignment #01

Q1 What is The Venture Flume? Explain with detail?

Venture Flume:—

A venture Flume is a critical flow open ~~flow~~ Flume with a constricted flow which Cause a drop in The Hydraulic grade line creating a critical depth

⇒ it is Used in flow meausment of very large flow rate, Usually given in million of ~~cub~~ cubic Unit

⇒ A venturi meter would Normally measure in millimeter where venture flume measure in meter.

⇒ measurment of discharge with Venture Flume required two measurment one upstream and one at The Throat in the flow passes in a sub critical state to Super critical state while passing Through at The flume a single measurment at The Throat is sufficient for computation of ~~d~~ discharge

⇒ To ensure The occurance of critical depth at The Throat The flume are usually designed in such away as to form The Structure.

Q#02 A 3m wide channel carries a total discharge of $12 m^3/sec$ Calculate
- The critical depth
- The minimum specific Energy
- The alternate depth where $E = 4m$.

Given Data:-

Wide of The channel $= b = 3m$
Discharge $= Q = 12 m^3/sec$

Solution:-

- **Critical depth:-**

⇒ Discharge per Unit width

$q = Q/b = 12/3$

$q = 4 m/sec$

For Rectangular channel

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

$h_c = 1.18m$

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b) Minimum specific Energy (E_c)

For Rectangular channel

$E_c = 3/2\, h_c = 3/2 \times 1.18$

$E_c = 1.77m$

c) The Alternate depth $E = 4m$

As $E > E_c$ there are two possible depth for a given S. Eergy.

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

$E = h + q^2/2gh^2$

$4 = h + 0.8155/h^2$

For the subcritical solution the first term isolated with potential Energy

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

$\Rightarrow$ iteration (from $h=4$) gives
$h = 3.948m$

for the sub critical (first shallow) solution the secon term

(4)

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assolated with Kinetic Energy dominates rearrange as

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

=) iteration (from h=0) gives
$h = 0.4814m$

So Alternate depth are 3.95 m &
0.4814m.

Assignment #02

Q#01

Given Data:-

Depth of water = 10 cm
velocity = 6 m/s

Requirment:-

* flow are subcritical or super critical?
* what is the alternate depth?

Solution:-

first of all we find the froud number to find the flow

As we know that

$$F_r = V/\sqrt{gy} = \frac{6\ m/s}{\sqrt{9.81 \times 0.1}}$$

$$F_r = 6.0671$$

so flow is super critical.

Alternate depth:-

As we know that

$$E = y + V^2/2g$$
$$= 0.1 + \frac{6^2}{2 \times 9.81} = \boxed{1.935\ m}$$

so Alternate depth for $E = 1.935\ m$ yields $\boxed{y_{alternate} = 1.93\ m}$

Q#02

Given Data :-

velocity = $U_1 = 2 m/s$
depth = $y_1 = 3m$
Elevation $\Delta Z = 60cm = 0.6m$

down step = $15cm = 0.15m$

Required :-

* Change in depth and water surface elevation = ?
* what would be the depth and elevation change if there a gradual down step of 15cm

Solution :-

As we know that

$$E_1 = y_1 + U_1^2/2g$$

$$E_1 = 3 + 2^2/2\times9.81$$

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

Now

$$E_2 = E_1 - \Delta Z$$
$$E_2 = 3.2 - 0.6$$

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

Also

$$E_2 = y_2 + q^2/2g y_2^2$$

$$2.60 = y_2 + 6^2/2 \cdot 9.81 \cdot y_2^2$$

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

$$\Delta y = y_2 - y_1$$

$$\Delta y = 2.24 - 3$$

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

So water surface drop = 0.16m

* For a downward step of 15cm or 0.15m we have

$$E_2 = E_1 - \Delta z = 3.20 - (0.0.15)$$

$$\boxed{E_2 = 3.35m}$$

Now $y_2 = 3.17m$

&

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

$$\boxed{\Delta y = 0.17m}$$

So water surface rise 0.02m

* The maximum upstep possible before effecting upstream water surface level is for.

$$y_2 = y_c$$

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

$$y_c = \sqrt[3]{6^2/9.81}$$

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

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Assignment #03

Q#01

Given Data :-

Depth of water at upstream side $y_1 = 3.6m$
Depth of water at downstream side $y_2 = 0.9m$

Width of the sluice gate $= b = 3.9m$

Required :-

Determine
* Discharge
* Froud Number and down stream

Solution :-

As we know that
Specific Energy on both stream are same

So $E_1 = E_2$

$$y_1 + V_1^2/2g = y_2 + V_2^2/2g \rightarrow (1)$$

Also by Discharge formula

$$Q = A_1V_1 = A_2V_2$$

$$b_1 y_1 V_1 = b_2 y_2 V_2 \qquad b = b_1 = b_2$$

$$y_1 V_1 = y_2 V_2$$

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$V_2 = y_1/y_2 \times V_1$

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

$V_2 = 4V_1 \longrightarrow (2)$

Putting the value of V_2 in eq (1)

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

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

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

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

$+15V_1^2 = +2.7 \times 2g$

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

$V_1 = 1.879 m/sec$

putting the value of V_1 in eq(a)

$V_2 = 4V_1$

$V_2 = 4(1.879)$

$V_2 = 7.516\ m/sec$

Also $Q_1 = A_1 V_1$

$Q_1 = b_1 y_1 V_1 = 3.9 \times 3.6 \times 1.879$

$Q_1 = 26.38\ m^3/sec$

$Q = A_2 V_2$

$Q_2 = b y_2 V_2 = 3.9 \times 0.9 \times 7.516$

$Q_2 = 26.38\ m^3/sec$

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

Froud Number at upstream side :-

By formula.

$Fr_1 = \frac{V_1}{\sqrt{g y_1}}$

$= \frac{1.879}{\sqrt{9.81 \times 3.6}}$

$Fr_1 = 0.31 < 1$

it is sub critical flow.

Froud Number at down stream side:-

$$F_{r_2} = \frac{V_2}{\sqrt{g y_2}}$$

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

$$F_{r_2} = 2.52 > 1$$

it is Super Critical flow.