Objective Questions:-

1. The phenomenon occurring in an open channel when a rapidly flowing stream abruptly changes to slowly flowing stream causing a distinct rise of liquid surface, is
   a. Water hammer
   b. Hydraulic jump
   c. Critical discharge
   d. None of the above
2. For a given discharge in a horizontal frictionless channel two depths may have the same specific force. These two depths are known as
   a. Specific depths
   b. Sequent depths
   c. Alternate depths
   d. Normal depth and critical depth

3 Shooting flow can never occur

   a. Directly after a hydraulic jump
   b. In a horizontal channel
   c. In a mild slope channel
   d. In a steep slope channel

4. A Surge travels upstream at a velocity of 3m/s. If the steady state velocity in the channel was, 0.6m/s and flow depth in channel is 1m. The celerity would be
   a. 3.6 m/s
   b. 3.0 m/s
   c. 2.4m/s

d. 1 m/s

5. In the above problem the height of the surge is given by
   a. 1.20 m
   b. 0.2m
   c. 1 m
   d. 2 m

6. Development of surges in the open channel is
   a. Gradually varied flow
   b. Rapidly varied flow
   c. Steady flow
   d. Normal flow

Answer:-

1(b) 2(b) 3(b) 4(a) 5(b) 6(b)

Subjective Questions

1 What do you mean by hydraulic jump? Write down its applications.

2 What do you mean by following?

a. Undulating jump
b. Weak jump
c. Oscillating jump
d. Strong jump

3 Derive the expression for the energy loss during a hydraulic jump also write down the assumption made.

4 Show that for a hydraulic jump in a horizontal rectangular channel, the alternate depths are related by the expression:

$$y_2 = \frac{y_1}{2}\left[\sqrt{8F_1^2 + 1} - 1\right] \; with\ usual\ notations.$$

5 Obtain an expression for a hydraulic jump in a horizontal triangular channel in terms of r and F_r^2. Where both terms are defined as,

$$r = \frac{y_2}{y_1}; \quad F_{r1} = \frac{V_1}{\sqrt{gy_1}}$$

6 Derive the expression of celerity for the positive surge in open channel.

7 Show that approximate amount of energy of the surge is given by $E = ¥h^2 B$ where B is top width and h is surge height.

(Hint: E=P.E+K.E. $P.E = \frac{¥}{2} h^2 B$ and $K.E = \frac{¥}{2g} v^2 yB$)

8 Write a short note on hydraulic jump as an energy dissipater.

9 A trapezoidal channel having bottom width 8m and side slope 1 Horizontal to 1 vertical, carries a discharge of 100 cumecs. Find the depth conjugate to initial depth of 1.0m before the jump. Also determine the energy loss of the jump. (*Ans 4.15m and 0.68m*)

10 Find the sequent depth and energy loss in a hydraulic jump in a rectangular channel 4.3m wide 0.5m deep. The discharge through channel is 8.9cumec. (*Ans. 1.08m and 0.09m*)

11 A rectangular channel is provided with a energy dissipater. It is required to have an energy loss of 4.5m. The inlet Froude number is 9.6. Find the sequent depth. (*Ans. 0.13 and 4.5m*)

12 The depth of flow of water, at a certain section of a rectangular channel of 6m wide, is 1m. The discharge through the channel is 24 cumecs. If a hydraulic jump takes place as the d/s side, find the depth of flow after the jump. (*Ans. 1.31m*).

13 A hydraulic jump occurs in horizontal rectangular channel with sequent depths of 0.25m and 4.9 m. Calculate the rate of flow per unit width, energy loss and initial Froude number. (*Ans. 14.21, 5.56 cumec/m, 20.52m respectively*)

14 A rectangular channel wit slope of 0.077 and depth 1.93m carries a flow of 64 cumec/m. Estimate sequent depth, length of jump and energy loss in the hydraulic jump. (*Ans. 19.86m, 25.82m,127.26m,58m respectively*)

15 Sluice gate has a discharge of 27cumec. The gate opening is 0.8m and coefficient of contraction is 0.6. The width is 3.2m. Estimate type of hydraulic jump when tail water is 6.1m. (*Ans. 5.26m*)

16 A surge travels upstream at a velocity of 5m/s in a channel. Prior to the generation of surge flow was steady, with a depth of 2.0m and velocity of 1.5 m/s. Calculate the surge height. (*Ans. 1.26m*)

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