53 (CE 714) OCFL

2021

OPEN CHANNEL FLOW

Paper : CE 714

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. *(a)* Derive the condition for critical flow. Also derive the equation for minimum specific energy for the rectangular and triangular section. 10

   (b) Explain the phenomenon of the depth of the flow for the channel transition (a) with hump (b) with increase in channel width. 10

2. Write short notes on : 5×4=20

(a) Types of channels

(b) Types of hydraulic jump

(c) Classification of flow profiles

(d) Classification of flow in open channel.

3. (a) A rectangular channel carries a flow with a velocity of $0{\cdot}65 m/s$ and depth of $1{\cdot}9m$. If the discharge is abruptly increased threefold by a sudden lifting of a gate on the upstream, estimate the velocity and the height of the resulting surge. 10

(b) In a tidal river, the depth and velocity of flow are $0{\cdot}9m$ and $1{\cdot}25 m/s$ respectively. Due to tidal action a tidal bore of height $12m$ is observed to travel upstream. Estimate the height and speed of the bore and the speed of flow after the passage of the bore. 10

4. Sketch the possible GVF profiles in the following serial arrangement of channels and control. The flow is from left to right : 5×4=20

(a) mild–sluice gate–steep–horizontal–sudden drop

(b) steep–steeper–mild–milder slope

(c) steep–mild–sluice gate–mild–sudden drop

(d) sluice gate–adverse–horizontal–steep slope

5. (a) If y_1 and y_2 are alternate depth in a rectangular channel and y_c is critical depth then show that

$$\frac{2y_1^2 y_2^2}{(y_1 + y_2)} = y_c^3 .$$ 10

(b) In a rectangular channel F_1 and F_2 are the Froude numbers corresponding to alternate depths of a certain discharge. Show that

$$\left(\frac{F_2}{F_2}\right)^{2/3} = \frac{2 + F_2^2}{2 + F_1^2} .$$ 10