Total No. of printed pages = 3

PG/1st Sem/PCEW 102

2021

OPEN CHANNEL FLOW

Full Marks – 100

Time – Three hours

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

Answer any *five* questions.

1. (a) If y_1 and y_2 are alternate depths in a triangular channel and y_c is critical depth then show that

$$\frac{4y_1^4 y_2^4}{(y_1^2 + y_2^2)(y_1 + y_2)} = y_c^5 \qquad 10$$

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

$$\left(\frac{F_1}{F_2}\right) = \frac{(4 + F_1^2)^{5/2}}{(4 + F_2^2)} \qquad 10$$

[Turn over

2. (a) The velocity distribution of a rectangular channel of width B and depth of flow y was approximated as $v = ky^{4/3}$ in which k is constant. Calculate the average velocity for the cross-section and the correction coefficients α and β. 10

(b) A trapezoidal channel has a bottom width of 6.0m and side slopes of 1:1. The depth of flow is 1.5m at a discharge of 15 m^3/s. Determine the specific energy and alternate depth. 10

3. What are the 12 water surface profiles exists in gradually varied flow ? Sketch them with real life examples. 20

4. Write short notes on : 5×4=20

(a) Spatially varied flows

(b) Types of hydraulic jump

(c) Oblique flows

(d) Dam break analysis.

5. 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 – milder slope – steep sudden drop

(b) steep – mild – steeper – milder slope

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

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

6. (a) A rectangular channel carries a flow with a velocity of 0.85 m/s and depth of 1.90m. 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 0.9m and 1.25 m/s respectively. Due to tidal action a tidal bore of height 1.4m 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