

Total number of printed pages:2

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 rectangular channel and  $y_c$  is critical depth then show that 10

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

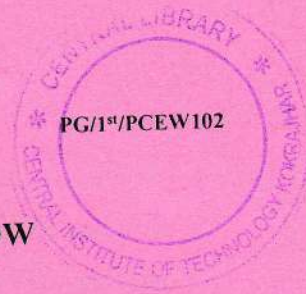
- b) In a rectangular channel  $F_1$  and  $F_2$  are the Froude numbers corresponding to alternate depths of a certain discharge. Show that 10

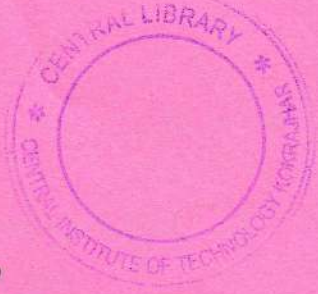
$$\left(\frac{F_2}{F_1}\right)^{2/3} = \frac{2 + F_2^2}{2 + F_1^2}$$

- 2 a) The velocity distribution of a rectangular channel of width  $B$  and depth of flow  $y$  was approximated as  $v=ky^{5/3}$  in which  $k$  is constant. Calculate the average velocity for the cross section and the correction coefficients  $\alpha$  and  $\beta$ . 10

- b) Derive the condition for critical flow. Also derive the equation for minimum specific energy for the rectangular section and trapezoidal section. 10

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





- 4 Write short notes on: 4 x 5=20
- a) Types of Channels
  - b) Types of hydraulic Jump
  - c) Classification of flow profiles
  - d) Classification of flow in open channel.
- 5 Sketch the possible GVF profiles in the following serial arrangement of channels and control. The flow is from left to right: 4 x 5=20
- (a) mild – sluice gate– horizontal – steep – sudden drop
  - (b) steep–mild – milder slope– steeper
  - (c) steep – steeper– sluice gate – mild – 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 1.90 m. 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 0.9 m and 1.25 m/s respectively. Due to tidal action a tidal bore of height 1.4 m 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