53 (CE 605) HDEN

2021

HYDRAULIC ENGINEERING

Paper : CE 605

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

1. Derive an expression for Prandtl universal velocity distribution for turbulent flow in pipe. 20

2. *(a)* Water is flowing in a long pipe which is $0{\cdot}15m$ diameter and $6{\cdot}25mm$ thick with a velocity of $1{\cdot}2\,m/s$ and it is suddenly brought to rest by the closing of a valve. Calculate the inertia pressure and the theoretical stress produced in the pipe near the valve.

   'K' of water = $207 \times 10^4\ kN/m^2$, 'E' for pipe = $206 \times 10^6\ kN/m^2$. 10

Contd.

(b) A hydraulic jump takes place in a rectangular channel with sequent depth of $0{\cdot}25m$ and $1{\cdot}5m$ at the beginning and end of the jump separately. Estimate — *(i)* Discharge per unit width of channel and *(ii)* Energy loss 10

3. (a) If y_1 and y_2 are alternate depths 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

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

4. (a) Distinguish between deformation drag, surface drag and form drag. In case of sphere, discuss their relative importance at various increasing values of Reynolds number. 10

(b) Write in details about the Kárán vortex trails is turbulent flow. 10

5. (a) Derive the dynamic equation for gradually varied flow. 10

(b) Derive the momentum equation for hydraulic jump for frictionless, horizontal and rectangular channel. 10

6. Write short notes on : 5×4=20

(a) Terminal fall velocity

(b) Surge tank

(c) Water Hammar

(d) Boundary Layer Separation.