53 (CE 605) HDEN

2019

HYDRAULIC ENGINEERING

Full Marks : 100

Time : Three hours

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

Answer ***all*** *questions.*

1. Answer the following : 5×2=10

   (a) What will be the Chezy's formula, if m, i, C and V are, respectively, the hydraulic mean depth, slope of channel, Chezy's constant and average velocity of flow ?

   (b) What will be the critical depth of a rectangular channel of width 4.0m for discharge of 12 m^3/s ?

Contd.

(c) Whenever a plate is submerged at an angle with the direction of flow of liquid, it is subjected to some pressure. What is the component of this pressure in the direction of flow of liquid, known as ?

(d) Which phenomenon will occur when the valve at the discharge end of a pipe connected to a reservoir is suddenly closed ?

(e) Why flow separation occurs in boundary layer ?

2. Write short notes on the following : 4×5=20

(a) Magnus effect

(b) Prandtl's mixing length theory in turbulent flows

(c) Rapidly varied flow

(d) Efficiencies of turbine.

3. Derive the expression for a drag on submerged torpedo. The parameters are, size of torpedo 'L', the velocity of torpedo 'V', viscosity of water 'μ', and density of water is 'ρ'. The size of torpedo may be represented by its diameter or its length. 10

4. A pump in a water tank directs a water jet at 25 m/s and 0.3 m^3/s against a vane as given in *Figure* 1.

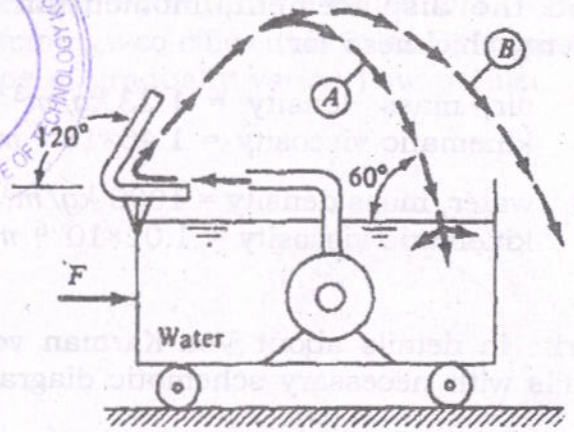

Figure 1

(i) Compute the force 'F' to hold the cart stationary if the jet follows path 'A'.

(ii) Compute the force 'F' to hold the cart stationary if the jet follows path 'B'. The tank holds 50 m^3 of water at this instant. 10

5. Derive the momentum equation for hydraulic jump for frictionless, horizontal and rectangular channel. 10