U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Semester End Main Examinations

Programme: B.E.
Branch: Civil Engineering
Course Code: 23CV4PCHYE
Course: Hydraulic Engineering

Semester: IV
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			CO	PO	Marks
		UNIT – I			
1	a)	A flow of 100 litres/second flows down in a rectangular laboratory flume of width 0.6 m and having adjustable bottom slope. If Chezy's constant is 56, determine the bottom slope necessary for uniform flow with a depth of flow 0.3 m.	*CO* 1	*PO1*	**6**
	b)	With a neat sketch derive the expression for discharge under uniform flow condition in an open channel.	*CO* 1	*PO1*	**6**
	c)	A most efficient trapezoidal channel section is required to give a maximum discharge of 21.5 m^3/s of water. Slope of the channel bottom is 1 in 2500. Taking Chezy's constant C = 70, determine the dimensions of the channel.	*CO* 1	*PO2*	**8**
		UNIT – II			
2	a)	With a neat sketch explain the venturi flume and its applications.	*CO* 1	*PO1*	**6**
	b)	For a constant specific energy of 1.8 N.m/N, calculate the maximum discharge that may occur in a rectangular channel 5.0 m wide.	*CO* 1	*PO1*	**6**
	c)	Show that for a given discharge, specific energy in a given channel section is the minimum when the flow is in the critical state.	*CO* 1	*PO1*	**8**
		UNIT - III			
3	a)	A 4 m wide rectangular channel has the Froude's number before the hydraulic jump equal to 2.2. If the height of the jump is 2.0 m, calculate the depth of flow before and after the jump. Also, find the loss of energy due to the jump and Froude's number after the jump.	*CO* 1	*PO2*	**10**
	b)	Derive the dynamic equation for the gradually varied flow in an open channel and state the assumptions made during the analysis.	*CO* 1	*PO1*	**10**
		OR			

	4	a)	Discuss the classification of the channel bottom slopes. Illustrate the gradually varied flow profiles in a mild slope channel. Discuss the characteristics of the profiles.	***CO*** 1	***PO1***	**10**
		b)	Determine the approximate water surface slope with respect to the channel bed, at a point in a rectangular channel in which the discharge is 0.84 cumecs, bed width is 3 m, depth of flow is 0.75 m and bed slope is 0.15 m per km. Assume Chezy's constant C as 55 for the channel.	***CO*** 1	***PO2***	**10**
			UNIT – IV			
	5	a)	Differentiate between Dirichlet and Neumann boundary conditions used in CFD. Give one example for both from the real world.	***CO*** 2	***PO1***	**6**
		b)	Discuss Navier-Stoke equations used to represent the fluid flow dynamics in computational fluid dynamics models.	***CO*** 2	***PO1***	**7**
		c)	Define a model and discuss the general steps involved in the computational model development.	***CO*** 2	***PO1***	**7**
			UNIT – V			
	6	a)	(i) List the type of similarities that must exists between the prototype and its model. (ii) A geometrically similar model of an air duct is built to 1/25 scale and tested with water which is 50 times more viscous and 800 times denser than air. Under dynamically similar conditions, the pressure drop is 200 kN/m^2 in the model. Determine the corresponding pressure drop in the full scale prototype.	***CO*** 3	***PO1***	**10**
		b)	Using Rayleigh's method show that the resistance R to the motion of a sphere of diameter D moving with a uniform velocity V through a real fluid having density ρ and viscosity μ is given by $$R = \rho D^2 V^2 f\left(\frac{\mu}{\rho V D}\right)$$	***CO*** 3	***PO1***	**10**
			OR			
	7	a)	Explain (i) Buckingham's π theorem, (ii) steps involved in applying this method to derive dimensionless parameters and (iii) discuss the importance of dimensionless parameters in a mathematical equation.	***CO*** 3	***PO1***	**10**
		b)	Using Buckingham's π theorem, show that the discharge over a siphon spillway is given by $$Q = VD^2 f\left(\frac{\sqrt{gD}}{V}, \frac{H}{D}\right)$$ Where, V = the velocity of flow, D = depth at the throat of the siphon, H = head of water and g = acceleration due to gravity.	***CO*** 3	***PO1***	**10**

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