U.S.N.										

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

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV4PCHYE **Max Marks: 100**
Course: Hydraulic Engineering

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

		UNIT - I	CO	PO	Marks
1	a)	Illustrate the velocity distribution across a cross section of a rectangular channel and based on that discuss how the average velocity is measured.	CO1	PO1	5
	b)	An earthen channel with a base width 2 m and side slope of 1 horizontal to 2 vertical carries water with a depth of 1 m. The bed slope is 1 in 625. Calculate the discharge if Manning's n = 0.03.	CO1	PO 1	7
	c)	A rectangular channel 4 m wide has depth of water 1.5 m. Bed slope of the channel is 1 in 1000 and value of Chezy's constant C = 55. It is desired to increase the discharge to a maximum by changing the dimensions of the section for constant area of cross section, slope of the bed and roughness of the channel. Determine the new dimensions of the channel and the increase in discharge.	CO1	PO 2	8
		UNIT - II			
2	a)	With a neat sketch explain the working principle of a venturi flume.	CO1	PO 1	5
	b)	For a given discharge, show that the specific energy in a rectangular channel is the minimum when the flow is critical.	CO1	PO 1	7
	c)	A rectangular channel, which is laid on a bottom slope of 0.0064 is to carry 20 m^3/s of water. Determine the width of the channel when the flow is in critical condition. Take Manning's n = 0.015.	CO1	PO 1	8
		UNIT - III			
3	a)	Discuss the differential equation for the water surface slope in a non-uniform flow. State the assumptions made in deriving the same from the basic energy equation.	CO1	PO 1	5
	b)	Determine the slope of the free water surface in a rectangular channel of width 20 m, having a depth of flow 5 m. Discharge through the channel is 50 m^3/s. The channel bed is having a slope of 1 in 4000. Assume Chezy's constant as 60.	CO1	PO2	7

		c)	Illustrate the non-uniform flow surface profiles in a mild slope channel.	*CO1*	*PO 1*	**8**
			OR			
	4	a)	Explain different types of hydraulic jumps in a horizontal rectangular channel depending upon the value of Froude number of the incoming flow.	*CO1*	*PO 1*	**5**
		b)	For a horizontal rectangular channel, derive the relation between the conjugate depths of a hydraulic jump. Also, state the assumptions made in the analysis.	*CO1*	*PO 1*	**7**
		c)	A horizontal rectangular channel 4 m wide carries a discharge of 16 m^3/s. Determine whether a jump occur at an initial depth of 0.5 m or not. If a jump occurs, determine the sequent depth to this initial depth. Also determine the loss of energy in the jump.	*CO1*	*PO2*	**8**
			UNIT - IV			
	5	a)	Discuss the importance of boundary conditions in solving the governing equations in CFD, and different types of boundary conditions commonly used.	*CO2*	*PO 1*	**5**
		b)	Discuss Navier-Stokes equation and the methods to solve the same in CFD.	*CO2*	*PO 1*	**7**
		c)	Define a model and discuss the general steps involved in the computational model development.	*CO2*	*PO 1*	**8**
			UNIT - V			
	6	a)	Discuss the Froude model law derived from the principle of similarity between the model and the prototype.	*CO 3*	*PO 1*	**4**
		b)	State the Fourier's principle of dimensional homogeneity. Discharge Q over a rectangular weir of length L with end contraction is given by $Q = 1.84(L - 0.1nH)H^{3/2}$, where n is the number of end contractions and H is the head over the weir. Check the dimensional homogeneity of the equation.	*CO 3*	*PO 1*	**6**
		c)	The pressure drop Δp in a pipe of diameter D and length l depends on mass density ρ and viscosity μ of the flowing fluid, mean velocity of flow V and average height k of the roughness projections on the pipe surface. Derive the dimensionless expression for Δp, and hence show that $h_f = \frac{flV^2}{2gD}$ where h_f is the head loss due to friction ($h_f = \Delta p/\gamma$), γ is the specific weight of the fluid and f is the coefficient of friction.	*CO 3*	*PO 1*	**10**

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