U.S.N.										

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

Autonomous Institute Affiliated to VTU

February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV4PCHYE / 23CV4PCHYE **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.

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.

			UNIT – I	CO	PO	Marks
1	a)		Illustrate the difference between pipe and open channel flow.	CO 1	PO1	6
	b)		Prove that for most economical rectangular channel section, the bottom width is twice the depth of flow.	CO 1	PO1	6
	c)		An earthen channel with a base width 2 m and side slope 1H: 2V carries water with a depth of 1 m. The bed slope is 1 in 625. Calculate the discharge if n = 0.03. Also calculate the average shear stress at the channel boundary.	CO1	PO2	8
			OR			
2	a)		Derive the expression for the discharge through a channel using Chezy's formula.	CO 1	PO1	6
	b)		Show that for most economical trapezoidal section has a mean hydraulic radius equal to half the half the depth of flow.	CO 1	PO1	6
	c)		A power canal of trapezoidal section has to be excavated through hard clay at minimum cost. Determine the dimensions of the channel to carry a discharge of $14 m^3/s$. Assume bed slope as 1 in 2500 and Manning's roughness coefficient as 0.02.	CO1	PO2	8
			UNIT – II			
3	a)		Explain critical flow and its characteristics.	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)		For purpose of discharge measurement the width of a rectangular channel is reduced gradually from 3 m to 2 m and the floor is raised by 0.3 m at a given section. When the approaching depth of flow is 2 m, determine the rate of flow indicated by a drop of 0.15 m in the water surface elevation at the contracted section.	CO1	PO2	8
			OR			
4	a)		With a neat sketch, explain the specific energy diagram.	CO 1	PO1	6
	b)		The discharge of water through a rectangular channel of width 8 m is 15 m^3/s, when the depth of flow of water is 1.2 m. Calculate (i) specific energy of the flowing water (ii) critical depth and critical velocity.	CO 1	PO1	6

		c)	Show that in a rectangular channel when the discharge is maximum for a given specific energy, the critical depth is given by 2/3 of the specific energy.	***CO1***	***PO1***	**8**
			UNIT - III			
	5	a)	A rectangular channel 7.5 m wide has a uniform depth of flow of 2.0 m and has a bed slope of 1 in 3000. If due to weir constructed at the downstream end of the channel, water surface at a section is raised by 0.75 m, determine the water surface slope with respect to horizontal at this section. Assume Manning's n = 0.02.	***CO*** 1	***PO1***	**10**
		b)	Derive relationships between conjugate depths of hydraulic jump in rectangular channel. State the assumptions made in arriving at the relationships.	***CO*** 1	***PO1***	**10**
			OR			
	6	a)	Derive an expression for gradually varied flow in a wide rectangular channel using Manning's equation.	***CO*** 1	***PO1***	**10**
		b)	A hydraulic jump is formed on a horizontal rectangular channel with Froude's number before jump as 10. If the head loss during the jump is 4 m, find the depths before and after the jump, and Froude's number after the jump.	***CO*** 1	***PO1***	**10**
			UNIT – IV			
	7	a)	With appropriate example, differentiate between analytical and numerical models.	***CO*** 2	***PO1***	**10**
		b)	Explain Navier-Stoke equations and discuss its importance in computational fluid modeling.	***CO*** 2	***PO1***	**10**
			OR			
	8	a)	Define a model. Explain the advantages and limitations of model studies with an appropriate example.	***CO*** 2	***PO1***	**10**
		b)	Define variables, governing equations and parameters of a mathematical model and explain the same taking a typical case study.	***CO*** 2	***PO1***	**10**
			UNIT – V			
	9	a)	Define the following terms (i) dimension (ii) unit (iii) prototype (iv) dimensional homogeneity (v) dimensionless number	***CO*** 3	***PO1***	**10**
		b)	Find an expression for drag force F on a smooth sphere of diameter D, moving with a uniform velocity V in a fluid of mass density ρ and dynamic viscosity μ.	***CO*** 3	***PO1***	**10**
			OR			
	10	a)	Differentiate between geometric and kinematic similarity.	***CO*** 3	***PO1***	**8**
		b)	The discharge Q over a small rectangular weir is known to depend upon the head H over the weir, the weir height P, gravity g, width of the weir L and fluid properties density ρ, dynamic viscosity μ, and surface tension σ. Express the relationship between the variables in dimensionless form.	***CO*** 3	***PO1***	**12**

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