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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

Branch: Civil Engineering **Duration: 3 hrs.**

Course Code: 23CV4PCHYE / 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.

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)	List the characteristics of uniform flow and derive the expression for discharge in an open channel under uniform flow condition.	CO 1	PO1	10
	b)	Compute the depth and bottom width of an irrigation channel to carry a discharge of 14 cumecs at a velocity of 0.9 m/s, bed slope of 1 in 2500 and side slope 1:1. The values of Chezy's *C* for this channel for different values of hydraulic radius *R* are as tabulated below.	CO 1	PO1	10

Hydraulic Radius R	*0.7*	*0.8*	*0.9*	*1.0*	*1.1*	*1.2*	*1.3*	*1.4*
Chezy's C	*34*	*35*	*37*	*38*	*39*	*40*	*41*	*41*

		OR			
2	a)	Derive the expression for an open channel section to be the most efficient for the given cross-sectional area.	CO 1	PO1	10
	b)	An irrigation channel of trapezoidal section, having side slopes 3 horizontal to 2 vertical, is to carry a flow of 10 cumec on a longitudinal slope of 1 in 5000. The channel is to be lined for which the value of the friction coefficient in Manning's formula is n = 0.012. Compute the dimensions of the most economical section of the channel.	CO 1	PO1	10
		UNIT - II			
3	a)	Define specific energy. With the help of the specific energy diagram, explain the different states of flow.	CO 1	PO1	6
	b)	With a neat diagram, discuss the Parshall flume and its application.	CO 1	PO1	6

		c)	A rectangular channel, 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.	***CO*** 1	***PO1***	**8**
			OR			
	4	a)	With a neat diagram, discuss the Venturi flume and its application.	***CO*** 1	***PO1***	**6**
		b)	Discuss the characteristics of critical flow in an open channel.	***CO*** 1	***PO1***	**6**
		c)	A trapezoidal channel has a bottom width of 6 m and side slopes of 2 horizontal to 1 vertical. If the depth of flow is 1.2 m at a discharge of 10 m^3/s, compute the specific energy and critical depth	***CO*** 1	***PO1***	**8**
			UNIT - III			
	5	a)	Define hydraulic jump, list its applications, and derive the expression for energy loss in a hydraulic jump.	***CO*** 1	***PO1***	**10**
		b)	A 3.0 m wide rectangular channel has a slope of 150 mm/km and Manning's n = 0.02. When the discharge in the channel is 0.85 m^3/s, estimate the slope of the water surface in the channel with respect to horizontal at a point where the depth of flow is 0.75 m.	***CO*** 1	***PO2***	**10**
			OR			
	6	a)	Define Gradually Varied Flow (GVF) and with a neat sketch, derive the dynamic equation for GVF.	***CO*** 1	***PO1***	**10**
		b)	A horizontal rectangular channel 4 m wide carries a discharge of 16 m^3/sec. i) Determine whether a hydraulic jump occurs at an initial depth of 0.5 m or not. If a jump occurs, determine the sequent depth corresponding to this initial depth. ii) Determine the critical depth of flow, type of jump and the energy loss in the jump.	***CO*** 1	***PO2***	**10**
			UNIT - IV			
	7	a)	Elaborate on the general steps in CFD model development. Also, list the advantages and drawbacks of CFD modelling.	***CO*** 2	***PO1***	**10**
		b)	Discuss the advantages and limitations of analytical and numerical modeling techniques in open channel hydraulics.	***CO*** 2	***PO1***	**10**
			OR			
	8	a)	Differentiate between a scale model and a mathematical model. With an appropriate example, explain the variables, governing equations and parameters of a mathematical model.	***CO*** 2	***PO1***	**10**

		b)	Differentiate between Dirichlet and Neumann boundary conditions used in CFD. List the different type of boundaries commonly used in hydraulic modelling.	***CO*** 2	***PO1***	**10**
			UNIT - V			
	9	a)	With appropriate example, explain Rayleigh's method of dimensional analysis.	***CO*** 3	***PO1***	**10**
		b)	State the principle of dimensional homogeneity. Check the dimensional homogeneity of the following equations. i) $Q = 1.84(L - 0.1nH)H^{3/2}$ where, Q = discharge over a rectangular weir of length L with end contraction, n is the number of end contractions and H is the head over the weir. ii) $Q = \frac{1}{n}AR^{2/3}{S_o}^{1/2}$, where Q is the discharge in an open channel of wetted area A and hydraulic radius R at a bed slope of S_o.	***CO*** 3	***PO1***	**10**
			OR			
	10	a)	Pressure gradient Δp in a circular pipeline depends on the effective roughness k, fluid of density ρ , dynamic viscosity μ and mean velocity V. Obtain an expression for the pressure gradient as a function of non-dimensional groups.	***CO*** 3	***PO1***	**10**
		b)	Explain the three types of similarities to be established between the model and prototype. Discuss the dynamic similarity in detail and explain the commonly used model laws to establish the dynamic similarity.	***CO*** 3	***PO1***	**10**

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