U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. — **Semester: IV**
Branch: Civil Engineering — **Duration: 3 hrs.**
Course Code: 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.

			CO	PO	Marks
		UNIT – I			
1	a)	Define an open channel flow. Distinguish between pipe flow and an open channel flow.	CO 1	PO1	**06**
	b)	A rectangular channel 6 m wide and 1.5 m deep has a longitudinal slope of 1 in 900 and is lined with smooth concrete to have Manning roughness coefficient of 0.012. It is proposed to increase the discharge to a maximum by changing the dimensions of the channel, but keeping the amount of lining to be the same as before. Compute the new dimensions of the rectangular channel and also the percentage increase in discharge.	CO 1	PO1	**08**
	c)	With a neat sketch derive the expression for discharge under uniform flow condition in an open channel.	CO 1	PO1	**06**
		UNIT – II			
2	a)	Define critical flow in an open channel. For a rectangular channel derive the expressions for the depth of flow and specific energy for the critical flow condition.	CO 1	PO1	**10**
	b)	A 3.6 m wide rectangular channel carries water at a depth of 1.8 m. In order to measure the discharge, the channel width is reduced to 2.4 m and a hump of 0.3 m is provided at the bottom. Calculate the discharge if the water surface in the contracted section drops by 0.15 m. Assume that the total energy remains the same.	CO 1	PO2	**10**
		UNIT - III			
3	a)	Derive the dynamic equation for gradually varied flow in an open channel with neat sketch, and mention the assumptions made during the analysis.	CO 1	PO1	**10**
	b)	A rectangular channel has a bed width 4 m, bottom slope = 0.0004 and Manning's roughness coefficient 0.02. The normal depth of flow in this channel is 2.0 m. If the channel empties into a pool at the downstream end and the pool elevation is 0.60 m higher than the channel bed elevation at the downstream end, identify the surface profile in the region where the channel meets the pool.	CO 1	PO2	**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)	If in a hydraulic jump occurring in a horizontal rectangular channel, the Froude number before the jump is 10 and energy loss is 3.20 m, estimate the i) sequent depths ii) the discharge intensity and iii) the Froude number after the jump.	***CO*** 1	***PO2***	**10**
			UNIT – IV			
	5	a)	List the advantages and drawbacks of CFD modelling.	***CO*** 2	***PO1***	**6**
		b)	Discuss the application of the Navier-Stokes equation to an open channel flow scenario.	***CO*** 2	***PO1***	**7**
		c)	Elaborate the two different types of boundary conditions used by the designers for CFD modeling in the context of fluid dynamics. Provide examples for each.	***CO*** 2	***PO1***	**7**
			UNIT – V			
	6	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)	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. Express the relationship between the variables in dimensionless form using Buckingham's π theorem.	***CO*** 3	***PO1***	**10**
			OR			
	7	a)	(i) Define dimensional analysis and dimensional homogeneity. Also, discuss their applications in fluid mechanics. (ii) Write Manning's formula for uniform velocity of flow V in an open channel in terms of hydraulic radius R, channel bed slope S_o, Manning's coefficient n. Determine the dimensions of n in this equation.	***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**

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