Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024

Subject Code:3160618 Date:05-12-2024

Subject Name:Open Channel flow

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Show that for a very wide rectangular channel the hydraulic radius is equal to the depth of flow in the channel.	**03**
	(b)	Draw definition sketch to derive the equilibrium equation: $\tau = w\,RS_0$ for uniform steady flow.	**04**
	(c)	Discuss the practical utility and application of hydraulic jump.	**07**
Q.2	**(a)**	Draw a definition sketch to show hydraulic grade line and energy line to show the difference between pipe flow and open channel flow.	**03**
	(b)	Show that for a rectangular channel the critical depth $y_c = (\frac{q^2}{g})^{0.333}$. The terms have usual meaning.	**04**
	(c)	Water flows in a rectangular channel 1 meter wide with 0.1 meter depth of flow, average velocity 1.5 meter/s and viscosity 10^{-6} meter square per second, find the state of flow.	**07**
		OR	
	(c)	For a constant specific energy 2.4 joules per newton calculate the maximum discharge that may occur in a rectangular channel 4 meter wide.	**07**
Q.3	**(a)**	Explain Froude number as a ratio of flow velocity to celerity so give reasons why ripples do not travel upstream in a supercritical flow.	**03**
	(b)	State the assumptions made in the derivation of dynamic equation of gradually varied flow profile.	**04**
	(c)	Describe the Shields curve and discuss its salient features.	**07**
		OR	
Q.3	**(a)**	For an open channel steady gradually varied flow draw a control volume show the forces acting on this control volume to apply the momentum equation across the two sections.	**03**
	(b)	Use Manning's equation to explain the terms normal flow and normal discharge for a uniform flow.	**04**
	(c)	Cite the practical situations in which M_1 and M_2 type of profiles occur and explain their characteristics using the dynamic equation of the gradually varied flow.	**07**
Q.4	**(a)**	Give the physical interpretation and importance of hydraulic radius.	**03**

	(b)	Explain the term section factor for a uniform flow.	**04**
	(c)	In a wide rectangular channel other factors remaining constant if the normal depth is increased by 20% find the increase in discharge using Chezy's equation.	**07**

OR

Q.4	**(a)**	Explain grain shear stress and form shear stress for a mobile boundary channel.	**03**
	(b)	Explain hydrostatic pressure for channels of large slope and channels of small slope.	**04**
	(c)	Explain in detail channels of the first and the second kind	**07**
Q.5	**(a)**	Use Chezy's equation to explain conveyance of flow in a uniform steady open channel flow.	**03**
	(b)	Draw hydrostatic pressure diagram for a surface concave upwards and having a normal acceleration "a_n"	**04**
	(c)	A sewer pipe is proposed to be laid on a slope of 1 in 3000 and is required to carry a discharge of 2 cumec. What size of the pipe should be used if you plan it to flow half full? Take Manning's n = 0.014.	**07**

OR

Q.5	**(a)**	Give the reasons why positive surges have a stable profile and preserved shape while negative surge have an unstable profile.	**03**
	(b)	Draw the definition sketch giving causes of occurrence for (i) positive surge moving upstream and a positive surge moving downstream (ii) negative surge moving upstream and negative surge moving downstream.	**04**
	(c)	Use specific energy diagram to explain the variation of upstream and downstream depth of flow for a rectangular channel due to provision of hump (i) when approaching depth is sub critical (ii) when approaching depth is supercritical	**07**

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