Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 3140611 Date: 27-11-2024

Subject Name: Fluid Mechanics & Hydraulics

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.**

Q.1	**(a)**	Define: Dynamic Viscosity and Capillarity	**03**
	(b)	Differentiate between Piezometer and U-tube manometer.	**04**
	(c)	State and prove Pascal's law.	**07**
Q.2	**(a)**	Define Buoyancy, Center of Pressure, and Metacentric height.	**03**
	(b)	Explain equilibrium in floating bodies.	**04**
	(c)	Derive the expression for total pressure for a vertical plate submerged in the liquid.	**07**
		OR	
	(c)	Prove that the rate of increase of pressure in a vertically downward direction must be equal to the specific weight of the fluid at that point.	**07**
Q.3	**(a)**	Describe the velocity distribution in an open channel flow.	**03**
	(b)	Explain the importance of the parameters contained in the Reynolds number to categorize the flow as laminar and turbulent flow.	**04**
	(c)	Explain the components of a venturimeter with a neat proportionate sketch.	**07**
		OR	
Q.3	**(a)**	Differrentiate between small & large orifice.	**03**
	(b)	State Bernoulli's equation. What are the practical applications of Bernoulli's equation?	**04**
	(c)	Define flow net and write in detail characteristics, applications and limitations of flow net.	**07**
Q.4	**(a)**	Define: (i) Total energy line (ii) Hydraulic gradient line	**03**
	(b)	Write down the Chezy's equation and Manning's equation along with their assumptions.	**04**
	(c)	Enlist the major and minor loses in pipes. Derive the Darcy-Weisbach equation for calculating head loss due to friction.	**07**
		OR	
Q.4	**(a)**	Define rapid varied flow and gradually varied flow.	**03**
	(b)	Explain with diagram the Specific Energy Curve.	**04**
	(c)	Derive for the most economic a trapezoidal channel section is: "Half of the top width is equal to one of the sloping sides"	**07**
Q.5	**(a)**	Explain method of selecting repeating variables.	**03**
	(b)	Derive the Hagen-Poiseuille equation for laminar flow in the circular pipe.	**04**

	(c)	A 2m long pipeline tapers uniformly from 10cm diameter to 20cm diameter at its upper end. The pipe cemtreline slopes upward at an angle of 30° to the horizontal and the flow direction is from smaller to bigger cross section. If the pressure gauges installed at the lower and upper ends of the pipeline read 200 KPa and 230 KPa respectively. Determine the flow rate and the fluid pressure at the mid length of pipeline. Assume no energy losses.	**07**

OR

Q.5	**(a)**	Define super critical flow, Froude's number and hydraulic jump.	**03**
	(b)	What is Dimensional Homogeneity? What are the applications of Dimensional Homogeneity?	**04**
	(c)	Explain the Buckingham's π-theorem in dimensional analysis	**07**

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