Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - IV EXAMINATION - WINTER 2025

Subject Code: 3140611 **Date: 24-11-2025**

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.

			Marks
Q.1	**(a)**	Define density, specific weight and specific gravity.	**03**
	(b)	Explain Buoyancy and Centre of Buoyancy.	**04**
	(c)	The velocity distribution for flow over a flat plate is given by u = $\frac{2}{3}y - y^2$ in which u is the velocity in meter per second at a distance y meter above the plate. Determine the shear stress at y =0.15 m. Take dynamic viscosity of fluid as 8.6 poise.	**07**
Q.2	**(a)**	Define the terms: (1) Velocity potential function and (2) Stream function.	**03**
	(b)	Explain the term velocity of approach. Find an expression for the discharge over a rectangular weir with velocity of approach.	**04**
	(c)	Describe Buckingham's π theorem. How are the repeating variables selected for dimensional analysis?	**07**
		OR	
	(c)	The efficiency η of a fan depends on the density ρ, dynamic viscosity μ, the angular velocity ω, Diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters.	**07**
Q.3	**(a)**	Classify different types of orifices according to its size, shapes and discharge.	**03**
	(b)	What is pitot-tube? How the velocity at any point is determined with the help of pitot-tube.	**04**
	(c)	Derive an expression for the discharge through triangular notch.	**07**
		OR	
	(a)	Define coefficient of contraction, coefficient of velocity and coefficient of discharge for the orifice.	**03**
	(b)	Write down the advantages of triangular notch over a rectangular notch.	**04**
	(c)	What is venturimeter. Derive an expression for the discharge through a venturimeter.	**07**

Q.4	**(a)**	Define: (i) Total energy line (ii) Hydraulic gradient line	**03**
	(b)	Derive an expression for loss of head due to sudden enlargement of a pipe.	**04**
	(c)	Derive an expression for the loss of head due to friction in pipes.	**07**

OR

	(a)	Describe major energy losses and minor energy losses in pipe.	**03**
	(b)	Explain the phenomenon of water hammer.	**04**
	(c)	Derive the Hagen-Poiseuille equation for laminar flow in the circular pipe.	**07**
Q.5	**(a)**	Explain the terms (1) Rapidly varied flow and (2) Gradually varied flow.	**03**
	(b)	A rectangular channel of width 4.5 m is having a bed slope of 1 in 1500. Find the maximum discharge through the channel. Take value of C = 50	**04**
	(c)	Derive the geometrical conditions for the most economical section of a trapezoidal channel.	**07**

OR

	(a)	Differentiate between: (1) Uniform flow and non-uniform flow (2) Steady and unsteady flow.	**03**
	(b)	Find the velocity of flow and rate of flow of water through a rectangular channel of 6.5 m wide and 3 m deep, when it is running full. The channel is having bed slope as 1 in 2000. Take Chezy's constant C = 55.	**04**
	(c)	Draw specific energy curve and than derive expressions for critical depth and critical velocity.	**07**

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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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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2023

Subject Code:3140611 Date:24-01-2024

Subject Name: Fluid Mechanics & Hydraulics

Time: 10:30 AM TO 01:00 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: Fluid statics, Fluid Kinematics, Kinematic viscosity	**03**
	(b)	State the Newton's law of viscosity.	**04**
	(c)	State and derive Pascal's law.	**07**
Q.2	**(a)**	Define the terms metacentre, metacentric height and absolute pressure.	**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)	For a most economical trapezoidal channel section, show that half of top width is equals to length of one of the slopping sides.	**07**
Q.3	**(a)**	Define coefficient of contraction, coefficient of velocity and coefficient of discharge for the orifice.	**03**
	(b)	Give classification of Orifices. Give the difference between an orifice and a mouthpiece.	**04**
	(c)	A pipe of diameter 100 mm conveys water. The pressure difference between two points 50 m apart is 0.6 m of water. Calculate discharge through the pipe. Take friction factor f = 0.025.	**07**
		OR	
Q.3	**(a)**	Which are the assumptions made in Bernoulli's theorem ?	**03**
	(b)	What are the advantages of triangular notch over a rectangular notch?	**04**
	(c)	A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure rate of water. The reading of differential manometer connected to the venturimeter is 20 cm of mercury. Determine the rate of flow. Take coefficient of discharge equal to 0.98	**07**
Q.4	**(a)**	Draw velocity distribution in pipe flow and open channel flow.	**03**
	(b)	Explain Prandtl's mixing length theory.	**04**
	(c)	State Bernoulli's theorem for steady flow of an incompressible fluid. Derive Bernoulli's expression	**07**
		OR	
Q.4	**(a)**	Define: (i) Total energy line (ii) Hydraulic gradient line	**03**
	(b)	Explain with diagram the Specific Energy Curve.	**04**
	(c)	Enlist the major and minor loses in pipes. Derive the Darcy-Weisbach equation for calculating head loss due to friction.	**07**
Q.5	**(a)**	Differentiate between pipe flow and open channel flow.	**03**

(b) Derive the Hagen-Poiseuille equation for laminar flow in the circular pipe. **04**

(c) Fluid of density ρ and viscosity μ flows at an average velocity V through a circular pipe diameter d. show by dimensional analysis that the shear stress of the pipe wall. **07**

$$\tau_o = \rho V^2 f\left[\frac{\rho V d}{\mu}\right]$$

OR

Q.5 **(a)** How repeating variables are selected in the dimensional analysis. **03**

(b) Discuss briefly various similarities between the model and the prototype. **04**

(c) Explain the Buckingham's π-theorem in dimensional analysis **07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(NEW) EXAMINATION – WINTER 2022

Subject Code:3140611 Date:17-12-2022

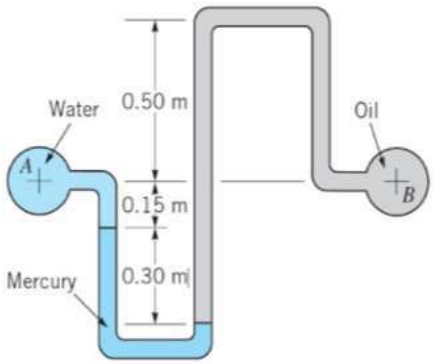
Subject Name:Fluid Mechanics & Hydraulics

Time:10:30 AM TO 01:00 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)**	Define: Dynamic Viscosity, Surface tension, Capillarity	**03**
	(b)	Explain Buoyancy and Centre of Buoyancy	**04**
	(c)	State and prove Pascal's law.	**07**
Q.2	**(a)**	Define the terms metacentre, metacentric height and absolute pressure	**03**
	(b)	Differentiate between: (a) Compressible and incompressible flow (b) Uniform and Non Uniform flow	**04**
	(c)	Derive the expression for total pressure for a vertical plate submerged in the liquid.	**07**
		OR	
	(c)	The mercury manometer shown below indicates a differential reading of 0.3m when a pressure in Pipe A is 30 mm of mercury (Hg) vacuum. Determine the pressure in pipe B (in Pa.)	**07**



Q.3	**(a)**	Classify different types of orifices according to its shapes, size, discharge.	**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)	Derive an expression for the discharge through triangular notch	**07**
Q.4	**(a)**	Define: (i) Total energy line (ii) Hydraulic gradient line	**03**

	(b)	Explain Prandtl's mixing length theory.	**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)	The pressure drop (ΔP) in a pipe depends upon the mean velocity of flow (v), length of pipe (l), diameter of pipe (d), viscosity of fluid (μ), average height of roughness projections on the inside surface (k) mass density of fluid (ρ). By using Buckingham's pi-theorem, obtain a dimensionless expression ΔP.	**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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