Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 3 – EXAMINATION – SUMMER 2026

Subject Code: 3131307 **Date: 02/07/2026**

Subject Name: Basics of Environmental 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 the term (i) Surface tension (ii) Weight Density (iii) Capillarity.	**03**
	(b)	Distinguish dynamic viscosity and kinematic viscosity. State their unit	**04**
	(c)	Illustrate an expression for Bernoulli's equation and mention the Assumptions.	**07**
Q.2	**(a)**	Define the term Compressible and Incompressible Flow.	**03**
	(b)	Explain the U-tube Differential manometer.	**04**
	(c)	Illustrate an expression for the discharge through a Venturimeter.	**07**
		OR	
Q.2	**(c)**	State and prove the Pascal's law.	**07**
Q.3	**(a)**	Define the term Laminar flow and Turbulent Flow.	**03**
	(b)	An oil of viscocity 0.5 stokes is flowing through a pipe of 30 cm diameter at a rate of 320 liter per second. Calculate the head loss due to friction for the pipe length of 60 m.	**04**
	(c)	Illustrate Darcy-Weisbach formula for calculating loss of head due to friction in pipe.	**07**
		OR	
Q.3	**(a)**	Define Major Loss and Minor Loss.	**03**
	(b)	Calculate the diameter of pipe of length 2500 m when the rate of flow of water through the pipe is 225 liter/sec and the head lost due to friction is 5 m. take the value of C = 60 in Chezy's formulae.	**04**
	(c)	List the minor losses and Illustrate formula for calculating loss of head due to sudden contraction.	**07**
Q.4	**(a)**	Classification of Orifice.	**03**
	(b)	A horizontal pipe 150 mm in diameter, is jointed by sudden enlargement to a 200 mm diameter pipe. Water is flowing through it a rate of 3 m3/min. find the loss of head due to sudden enlargement.	**04**
	(c)	Illustrate an expression for time of emptying a tank through an orifice of circular horizontal tank.	**07**
		OR	
Q.4	**(a)**	Classification of Mouthpieces.	**03**
	(b)	A pipe carries water at 50 liters per second. If the pipe of 200 mm diameter reduces in diameter abruptly to 150 mm diameter, find the pressure loss across the contraction. Take the co-efficient of contraction as 0.62.	**04**
	(c)	Illustrate an expression for time of emptying a tank through an orifice of rectangular tank.	**07**

Q.5	**(a)**	Define notches and weirs.	**03**
	(b)	Distinguish between Notches and Weirs.	**04**
	(c)	Illustrate an expression for the discharge over a trapezoidal notch or weir.	**07**

OR

Q.5	**(a)**	Classification of flow in channels.	**03**
	(b)	Explain the Classification of Notches and weirs with suitable examples.	**04**
	(c)	Illustrate with equation how the Most economical section of an open channel is determined,	**07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III EXAMINATION – SUMMER 2025

Subject Code:3131307 Date:06-06-2025

Subject Name:Basics of Environmental 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: (i) specific gravity (ii) viscosity (iii) mass density	**03**
	(b)	Compare steady vs unsteady flow and laminar vs turbulent flow.	**04**
	(c)	Explain different types of fluids with figure.	**07**
Q.2	**(a)**	Differentiate between: cohesion and adhesion	**03**
	(b)	State and explain Pascal's law.	**04**
	(c)	A rectangular plate 3 m wide and 4 m long is immersed in water in such a way as (i) Horizontally 1 m below the free surface of water (ii) vertically, 3 m side is parallel to the water surface and 1 m below the free surface of water. Find (a) Total pressure on the plate (b) position of centre of pressure.	**07**
		OR	
	(c)	A reservoir of carbon tetrachloride has a mass of 600 kg and volume of 0.35 m^3. Find weight, mass density, specific weight and relative density.	**07**
Q.3	**(a)**	State Bernoulli's theorem and write down the assumptions for it.	**03**
	(b)	List the major and minor losses of energy in pipes.	**04**
	(c)	Derive an expression for equation of continuity in a 3D flow in cartesian coordinates system.	**07**
		OR	
Q.3	**(a)**	Draw simple sketch and explain working of piezometer with its limitations.	**03**
	(b)	Explain the EGL and HGL.	**04**
	(c)	Derive an expression for Euler's equation of motion.	**07**
Q.4	**(a)**	Differentiate between open channel and pipe flow.	**03**
	(b)	Explain small orifice and vena contracta.	**04**
	(c)	A vertical sharp-edged orifice of 140 mm diameter is discharging water at the rate of 100 lit/s under a constant head of 10 m. A point, on the jet, measured from the vena-contracta of the jet has co-ordinates 4.3 m horizontal and 0.6 m vertical. Determine the co-efficient Cc, Cv and Cd of the orifice.	**07**
		OR	
Q.4	**(a)**	Define: (i) depth of flow (ii) wetted perimeter (iii) hydraulic radius	**03**
	(b)	Give classification of orifices and mouthpieces.	**04**
	(c)	Derive an expression for discharge through a large rectangular orifice.	**07**
Q.5	**(a)**	Give the classification of notches and weirs.	**03**
	(b)	A rectangular weir of crest length 60 cm is used to measure the rate of flow of water in rectangular channel. The channel is 90 cm wide and 80 cm deep. Find the discharge in the channel if the water level is 90 mm above the crest of weir. Take velocity of approach in to consideration and value of C_d =0.63.	04
	(c)	What do you mean by "most economical section" of an open channel? How it is determined? What are the conditions for the rectangular channel for best conditions?	**07**
		OR	
Q.5	**(a)**	Explain the concept of velocity of approach.	**03**
	(b)	A cipolletti weir of crest length 80 cm discharges water. The head of water over the weir is 340 mm. determine the discharge over the weir if the channel is 60 cm wide and 60 cm deep. Assume C_d =0.62.	**04**

(c) Derive an expression for most efficient and economical cross section for rectangular cross section of open channel. **07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2024

Subject Code:3131307 Date:06-07-2024

Subject Name: Basics of Environmental 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 (i) Mass Density (ii) Kinematic Viscosity (iii) Specific Gravity.	**03**
	(b)	Distinguish dynamic viscosity and kinematic viscosity. State their unit.	**04**
	(c)	Define the term Capillarity and derive the expression for height of capillary rise for a liquid. $h=4\sigma\cos\theta/\rho gd$.	**07**
Q.2	**(a)**	List the Application of Bernoulli's theorem.	**03**
	(b)	Explain the differential manometer with Sketch.	**04**
	(c)	Derive an expression for the discharge through an Orificemeter.	**07**
		OR	
	(c)	State and prove the Pascal's law.	**07**
Q.3	**(a)**	Explain Pitot tube in details.	**03**
	(b)	State the difference between venturimeter and Orificemeter.	**04**
	(c)	List the minor losses and derive formula for calculating loss of head due to sudden Enlargement.	**07**
		OR	
Q.3	**(a)**	Define HGL and TEL	**03**
	(b)	State the various losses of energy when fluid flows through pipe.	**04**
	(c)	Derive Darcy-Weisbach formula for calculating loss of head due to friction in pipe.	**07**
Q.4	**(a)**	Define Co-efficient of Discharge and Co-efficient of Velocity.	**03**
	(b)	Explain vena-contracta and how does it occur?	**04**
	(c)	Derive an expression for time of emptying a tank through an orifice of circular horizontal tank.	**07**
		OR	
Q.4	**(a)**	Give detail Classification of Mouthpiece.	**03**
	(b)	Derive an expression for loss of head due to sudden contraction	**04**
	(c)	Derive an expression for time of emptying a tank through an orifice of rectangular tank.	**07**
Q.5	**(a)**	Classification of flow in channels.	**03**
	(b)	Write short note on flow through Pipes in Parallel.	**04**
	(c)	Derive an expression for the discharge over a Triangular notch or weir.	**07**
		OR	
Q.5	**(a)**	Give the advantages of triangular notch over a rectangular notch.	**03**
	(b)	Distinguish between Notches and Weirs.	**04**
	(c)	What do you mean by "Most economical section" of an open channel? How it is determined?	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(NEW) EXAMINATION – SUMMER 2023

Subject Code:3131307 Date:01-08-2023

Subject Name:Basics of Environmental 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 following terms: Specific weight(ii) specific gravity(iii) adhesion	**03**
	(b)	Explain the effect of temperature on viscosity of liquids and gases.	**04**
	(c)	If the velocity profile of a fluid over a plate is parabolic with vertex 20cm from the plate, where the velocity is 120cm/s. Calculate the velocity gradients and shear stress at a distance of 0,10,20 cm from the plate, if the viscosity of the fluid is 8.5 poise.	**07**
Q.2	**(a)**	Define the following terms: (i)Absolute pressure (ii)gauge pressure(iii) centre of pressure	**03**
	(b)	With a neat sketch explain the U tube manometer.	**04**
	(c)	A u tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to the atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U tube is 10 cm and the free surface of mercury is in the level with Centre of the pipe. if the pressure of water in pipe line reduced to $9810 N/m^2$. Calculate the new difference in the level of mercury. Sketch the arrangements in both cases.	**07**
		OR	
	(c)	Derive an expression for the force exerted on submerged vertical plane surface by the static liquid and locate the position of center of pressure.	**07**
Q.3	**(a)**	Define following terms: (i)steady flow (ii) Laminar flow (iii) Uniform flow	**03**
	(b)	The following cases represent the two velocity components, determine the third component of velocity such that they satisfy the continuity equation: (i) $u= x^2 +y^2+z^2$; $v = xy^2-yz^2+xy$ (ii) $v=2y^2$;$w = 2xyz$	**04**
	(c)	A fluid flow field is given by $V = x^2yi+ y^2zj-(2xyz+yz^2)k$ prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at point (2,1,3).	**07**
		OR	
Q.3	**(a)**	State Bernoulli's equation of motion. Also mention the assumption made for such derivation.	**03**

	(b)	A pipe through which water is flowing is having diameters 20 cm and 10 cm at the cross section 1 and 2 respectively. The velocity of water at section 1 is 4 m/s. find the velocity head at section 1 and 2 and also rate of discharge.	**04**
	(c)	Derive the equation of discharge for orifice meter.	**07**
Q.4	**(a)**	Explain losses of energy in pipe	**03**
	(b)	Prove that rectangular channel will be most economical when hydraulic depth is half of the depth of flow.	**04**
	(c)	Derive an equation of loss of head due to sudden enlargement.	**07**
		OR	
Q.4	**(a)**	Explain the minor energy losses in pipe.	**03**
	(b)	Derive an equation for loss of head due to sudden contraction.	**04**
	(c)	Write a short note on (i) flow through pipes in series (ii) flow through parallel pipes.	**07**
Q.5	**(a)**	Give the classification of orifices	**03**
	(b)	Derive an equation of coefficient of velocity (C_v) and co efficient of vena contracta.	**04**
	(c)	Derive an equation for time emptying a hemispherical tank.	**07**
		OR	
Q.5	**(a)**	Give the classification of mouthpieces.	**03**
	(b)	Derive an equation for discharge over a rectangular notch or weir.	**04**
	(c)	Derive an expression for discharge through a triangular notch.	**07**

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2022

Subject Code:3131307 Date:18-07-2022

Subject Name:Basics of Environmental 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 the following terms: (1) Mass Density (2) Gauge Pressure (3) specific gravity	**03**
	(b)	Explain the effect of temperature on the viscosity of liquids and gases.	**04**
	(c)	Explain the different types of fluids with figure.	**07**
Q.2	**(a)**	Explain piezometer with simple sketch.	**03**
	(b)	The weight of $5m^3$ of a certain oil is 45 kN. Calculate its specific weight, mass density and specific gravity.	**04**
	(c)	Derive an expression for Euler's equation of motion.	**07**
		OR	
	(c)	Derive an expression for Bernoulli's equation and mention the assumptions.	**07**
Q.3	**(a)**	Explain EGL and HGL.	**03**
	(b)	Explain steady, unsteady, rotational and irrotational flow.	**04**
	(c)	Derive Darcy Weisbach equation for loss of head due to friction in a pipe line.	**07**
		OR	
Q.3	**(a)**	State and prove Pascal's Law.	**03**
	(b)	Differentiate between Laminar and Turbulent flow.	**04**
	(c)	The water is flowing through a taper pipe of length 110 m having diameters 500 mm at the upper end and 250 mm at the lower end at the rate of 60 liters/s. The pipe has a slope of 1 in 50. Determine the pressure at the lower end if the pressure at the higher level is 70 kN/m^2 .	**07**
Q.4	**(a)**	Classify various energy (Major Loss and Minor) losses in pipe.	**03**
	(b)	The diameter of a pipe at the section 1-1 and 2-2 are 150 mm and 250 mm respectively. If the velocity of water flowing through the pipe at section 1-1 is 4.5 m/s. Calculate discharge through the pipe and velocity of water at section 2-2.	**04**
	(c)	Derive an expression for the equation of continuity in a 3D flow in Cartesian co-ordinate system.	**07**
		OR	
Q.4	**(a)**	Distinguish between pathlines, stream lines and streak lines.	**03**
	(b)	What is vena-contracta and how does it occur?	**04**
	(c)	Derive an expression for most efficient and economical cross section for rectangular cross section.	**07**

Q.5	**(a)**	Give classification of Mouthpieces	**03**
	(b)	Distinguish between Notches and Weirs.	**04**
	(c)	Derive an expression for the discharge through a large orifice.	**07**

OR

Q.5	**(a)**	Give classification of orifice.	**03**
	(b)	Give the advantages of triangular notch over a rectangular notch.	**04**
	(c)	Derive an expression for the discharge through a triangular notch.	**07**

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