

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI EXAMINATION – SUMMER 2025****Subject Code: 3160618****Date:30-05-2025****Subject Name: Open Channel flow****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) Differentiate between pipe flow and open channel flow.	03
	(b) Write a short note on velocity distribution in open channel flow.	04
	(c) Explain the concept of first hydraulic exponent in detail.	07
Q.2	(a) Explain equivalent roughness in channel.	03
	(b) Explain channel transition with a hump.	04
	(c) Describe the hydraulically-efficient channel section. Also explain the relationship between the geometric elements to form an efficient section.	07
OR		
	(c) Explain the compound channel section in detail.	07
Q.3	(a) Define the terms: regime flow, ripples, dunes.	03
	(b) Draw the definition sketch of specific energy and explain it.	04
	(c) Explain Shield's analysis method for studying incipient motion in channels.	07
OR		
Q.3	(a) Discuss the requirements for the selection of type of canal lining.	03
	(b) Explain the Shear stress distribution for uniform flow in lined canals.	04
	(c) Explain the stepwise procedure to design the channel using tractive force method.	07
Q.4	(a) What data or information are generally needed for computing a flow profile?	03
	(b) Write a note on Mannings roughness coefficient.	04
	(c) Describe the procedure of designing lined canal.	07
OR		
Q.4	(a) State the rule regarding the direction of computation of flow profiles.	03
	(b) Explain why H1 and A1 profiles are practically not possible.	04
	(c) Describe different types of bottom slopes of open channels.	07
Q.5	(a) Write the practical applications of hydraulic jumps.	03
	(b) Differentiate between Sharp crested weir and broad crested weir.	04
	(c) Classify the hydraulic jumps in horizontal rectangular channels according to USBR.	07
OR		
Q.5	(a) Define Rapidly varied flow. Also give the characteristics of rapidly varied flow.	03
	(b) Explain positive and negative surges in open channel.	04
	(c) Write a detailed note on sluice gates.	07

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2024****Subject Code: 3160618****Date: 24-05-2024****Subject Name: Open Channel flow****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) Differentiate between pipe flow and open channel flow.	03
	(b) Differentiate between Kennedy's theory and Lacey's regime the theory	04
	(c) What is hydraulic jump? How it is formed? What are the different uses of hydraulic jump?	07
Q.2	(a) Explain with neat sketch velocity distribution and pressure distribution in open channels.	03
	(b) Define normal depth, critical depth, alternate depth and conjugate depths.	04
	(c) Explain importance and prediction of regimes of flow in detail.	07
	OR	
	(c) Explain in details with neat sketch "Specific Energy Curve"	07
Q.3	(a) Derive Chezy's equation $V = C\sqrt{RS}$ with usual notations.	03
	(b) Define critical flow. Derive an expression for minimum energy in terms of critical depth.	04
	(c) A 5.5m wide channel conveys water at a depth of 2.0m. The bed slope of the channel is 0.001. Find the width to be provided in the transition so as to obtain critical depth. Alternately with the same width of 5.5m, find the rise in bed level required to produce critical flow in the channel. Take Manning's coefficient $N = 0.018$	07
	OR	
Q.3	(a) Explain various factors affecting Manning's roughness coefficient.	03
	(b) Derive an expression showing relation between Y_1 and Y_2 and F_r for hydraulic jump in horizontal rectangular channel.	04
	(c) Compute the discharge over an ogee weir with coefficient of discharge equal to 2.40 at a head of 2.20 m. The length of spillway is 110m. The weir crest is 8.20 m above the bottom of the approach channel having same width as that of spillway. Consider velocity of approach	07
Q.4	(a) Define wave. Explain different types of waves.	03
	(b) Find the width and depth of rectangular channel to convey a discharge of $2.0 \text{ m}^3/\text{s}$ at a velocity 0.6 m/s. take Chezy's constant equal to 60 and bed slope equal to 0.00012.	04
	(c) Derive conditions for most economic (i) Rectangular Section (ii) Trapezoidal Section.	07
	OR	
Q.4	(a) Explain Shield's analysis for critical tractive force.	03

- (b) A circular channel of 2.20m diameter carries water at a depth of 0.9m. If the bed slope of the channel is 1600, find the discharge through the channel. Take Chezy's constant $C = 60$. **04**
- (c) An irrigation canal has side slope 1:1 and bottom width 3.50m. It runs at a depth of 1.20m with a bed slope of 1 in 2500. Determine whether the canal will be silting or scouring or remain stable. Take Manning's coefficient $N = 0.028$ in. Use value of $m=1$ in Kennedy's theory. **07**
- Q.5** (a) Define (i) Gradually Varied Flow and (ii) Rapidly Varied Flow. **03**
- (b) Differentiate between back water curve and drop down curve. **04**
- (c) Draw S1, S2, and S3 type surface profiles using basic equations of gradually varied flow with examples of their occurrence. **07**
- OR**
- Q.5** (a) Explain positive and negative surge moving downstream. **03**
- (b) If the grain size of a bed material of an alluvial channel is 1mm, specific gravity is 2.65, bed slope of channel is 0.0001, find the depth in wide rectangular channel when sediment just begin to move. **04**
- (c) Derive differential equation of Gradually varied flow with assumption made in it. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2023****Subject Code:3160618****Date:14-07-2023****Subject Name:Open Channel flow****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) Differentiate between pipe flow and open channel flow.	03
	(b) In the measurement of discharge in the river, it was found that the depth increases at a rate of 0.75m per hour. If the discharge in a river at that section is 20 m ³ /sec and the surface width of the river is 20m. estimate the discharges at a section 1.4 km upstream.	04
	(c) A trapezoidal channel of 12m bottom width, side slope 1.5H:1V, has a bed slope of 0.0003. The value of n is 0.012, If the depth of flow is 4m, compute average velocity, discharge, and bed shear.	07
Q.2	(a) Explain various factors affecting Manning's roughness coefficient.	03
	(b) Derive an expression showing a relation between alternate depths and Froude number for a hydraulic jump in a horizontal rectangular channel.	04
	(c) Show that the critical depth y_c is related to alternate depths y_1 and y_2 in a rectangular channel by the equation,	07
	$y_c = \left(\frac{2y_1^2 y_2^2}{y_1 + y_2} \right)^{1/3}$ OR	
	(c) A 5.5m wide channel conveys water at a depth of 2.0m. The bed slope of the channel is 0.001. Find the width to be provided in the transition so as to obtain critical depth. Alternately with the same width of 5.5m, find the rise in bed level required to produce critical flow in the channel. Take Manning's coefficient N = 0.018	07
Q.3	(a) Differentiate between Kennedy's theory and Lacey's regime the theory.	03
	(b) A circular channel of 2.50m diameter carries water at a depth of 1.1m. If the bed slope of the channel is 1700, find the discharge through the channel. Take Chezy's constant C = 60.	04
	(c) Derive conditions for most economic (i) Rectangular Section (ii) Trapezoidal Section.	07
	OR	
Q.3	(a) Differentiate between the back water curve and drop-down curve.	03
	(b) A Rectangular channel conveys a discharge of 2.25 m ³ /s at a velocity of 0.8 m/s. take Chezy's constant equal to 60 and bed slope equal to 0.00012. Calculate the width and depth of the rectangular channel	04
	(c) Discuss in detail with neat sketch "Specific Energy Curve"	07
Q.4	(a) Explain with neat sketch velocity distribution and pressure distribution in open channels.	03
	(b) An ogee weir with a coefficient of discharge equal to 2.60 at a head of 2.40 m. The length of the spillway is 105m. The weir crest is 8.00 m above the bottom of the approach channel having the same width as that of the spillway. Calculate the discharge over the weir by considering the velocity of the approach.	04

- (c) Explain the concept of shield's analysis for uniform flow in mobile boundary channels **07**
- OR**
- Q.4** (a) Explain the first hydraulic exponent (M) for the rectangular channel. **03**
- (b) An irrigation canal has a side slope of 1:1 and bottom width of 3.50m. It runs at a depth of 1.20m with a bed slope of 1 in 2500. Determine whether the canal will be silting or scouring or remain stable. Take Manning's coefficient $N = 0.028$ in. Use a value of $m=1$ in Kennedy's theory. **04**
- (c) Discuss in detail (i) Standing Wave Flume & (ii) Parshall Flume. **07**
- Q.5** (a) Derive Chezy's equation $V = C\sqrt{RS}$ with usual notations. **03**
- (b) Explain with a neat sketch the permissible velocities in rigid boundary channels. **04**
- (c) What is a hydraulic jump? How it is formed? What are the different uses of hydraulic jump? **07**
- OR**
- Q.5** (a) Discuss various characteristics of Rapidly Varied Flow. **03**
- (b) Discuss (i) Undular jump, (ii) Weak jump, (iii) Oscillating jump, & (iv) steady jump **04**
- (c) Draw M1, M2, and M3 type surface profiles using basic equations of gradually varied flow with examples of their occurrence. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2022****Subject Code:3160618****Date:10/06/2022****Subject Name:Open Channel flow****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) | Differentiate between Gradually varied flow and Rapidly varied flow. | 03 |
| (b) | Explain various types of channels. | 04 |
| (c) | Derive the expressions for critical depth in channels of circular and trapezoidal sections. | 07 |

- Q.2**
- | | | |
|-----|--|-----------|
| (a) | Define (1) Specific energy (2) Section factor (3) Froude Number. | 03 |
| (b) | Obtain the value of first hydraulic exponent (M) for the rectangular and triangular channels. | 04 |
| (c) | A trapezoidal channel is 10 m wide and has a side slope of 1.5(H) : 1(V). The bed slope is 0.0003. The channel is lined with smooth concrete of $n=0.012$. Compute the mean velocity and discharge for a depth of flow of 3.0 m.
Also find the bottom slope necessary to carry only 50 m ³ /s of the discharge at a depth of 3.0 m. | 07 |

OR

- | | | |
|-----|---|-----------|
| (c) | Explain concept of shield's analysis for uniform flow in mobile boundary channels | 07 |
|-----|---|-----------|
- Q.3**
- | | | |
|-----|--|-----------|
| (a) | Explain the second hydraulic exponent (N). | 03 |
| (b) | A square conduit of side s , placed with its diagonal vertical acts as an open channel. Show that the channel carries maximum discharge when $y = 0.95 D$ | 04 |
| (c) | A spillway discharges a flood flow at a rate of 7.75 m ³ /s per metre width. At the downstream horizontal apron, the depth of flow was found to be 0.50 m. What tailwater depth is needed to form a hydraulic jump? If a jump is formed, find its (a) type, (b) length, (c) head loss, (d) energy loss as a percentage of the initial energy. | 07 |

OR

- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Briefly explain incipient motion condition in uniform flow. | 03 |
| (b) | Derive the expression for estimating equivalent roughness of a channel. | 04 |
| (c) | Explain critical slope and limit slope. | 07 |
- Q.4**
- | | | |
|-----|---|-----------|
| (a) | Draw the typical section of a lined irrigation canal. | 03 |
| (b) | Give the classification of flow profiles | 04 |

- (c) A trapezoidal channel is to carry a discharge of $50 \text{ m}^3/\text{s}$. The maximum slope that can be used is 0.004. The soil is hard. Design the channel as (a) a lined canal with concrete lining and (b) an unlined non-erodible channel. **07**
- Take, For lined canal
 $m=1.0$, n for concrete = 0.013, For $B/y_0=8.0$, $\omega = 0.03108$
 For unlined canal,
 $m=1.0$, n for hard soil surface = 0.020, For $B/y_0=8.0$, $\omega = 0.03108$

OR

- Q.4** (a) Distinguish between direct step method and standard step methods for computation of flow profiles. **03**
- (b) Describe the flow profiles in divided channels. **04**
- (c) Write the steps to design lined channel using different empirical equations. **07**
- Q.5** (a) Draw the schematic sketch of Gradually varied flow. **03**
- (b) Discuss the characteristics of jump in rectangular channel. **04**
- (c) Explain (1) Parshall Flume (2) Standing Wave Flume. **07**

OR

- Q.5** (a) Discuss positive surge and negative surge. **03**
- (b) Describe the characteristics of Sluice-Gate flow. **04**
- (c) Derive the equation of motion for Gradually Varied Unsteady Flow (GVUF) in a prismatic channel. **07**
