Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - VI EXAMINATION - SUMMER 2025

Subject Code: 3161306 **Date: 22-05-2025**

Subject Name: Design of water Treatment Units

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.**

			Marks
Q.1	**(a)**	Draw and label a process flow diagram of a conventional surface water treatment plant.	**03**
	(b)	Differentiate between surface water and groundwater as potential sources for drinking water.	**04**
	(c)	Design a rectangular sedimentation tank to treat 2.4 million litres of raw water per day. Assume detention period to be 2 hours.	**07**
Q.2	**(a)**	What is the purpose of coarse and fine screens in water treatment?	**03**
	(b)	Write down typical design criteria for rectangular sedimentation tank.	**04**
	(c)	Design a rapid mixer for a water treatment plant treating 10,000 m^3/day with a detention time of 60 seconds.	**07**
		OR	
	(c)	Enlist and explain types of rapid mixers. Write down the design criteria for Rapid Mixer.	**07**
Q.3	**(a)**	Define and explain the significance of the velocity gradient (G).	**03**
	(b)	How is the required surface area of tube settlers calculated?	**04**
	(c)	Explain the design criteria and step-by-step procedure for designing a coarse screen, including consideration of peak flow, bar dimensions, spacing, velocity, and angle.	**07**
		OR	
	(a)	What are the standard detention times for primary settling tanks? What is the typical surface loading rate used for the design of primary sedimentation tanks?	**03**
	(b)	Differentiate between orthokinetic and perikinetic flocculation.	**04**
	(c)	Design a Clariflocculator for design flow of 250m^3/h. Assume, Detention time for flocculator = 20 min, Height for flocculator = 2.5 m, G= 40 $second^{-1}$, SOR of clarifier = 40 m^3/m^2/day.	**07**
Q.4	**(a)**	What are the advantages of using rapid sand filters in municipal water treatment plants?	**03**
	(b)	Differentiate between slow sand filters and rapid sand filters.	**04**

	(c)	Write design criteria for Chlorine Contact Tank.	**07**

OR

	(a)	Discuss the importance of hydraulic gradient line (HGL) in water treatment plant design.	**03**
	(b)	Explain the significance and process of the backwashing process in a rapid sand filter.	**04**
	(c)	Discuss different types of sludge dewatering devices in detail.	**07**
Q.5	**(a)**	What are the main types of residuals generated in a conventional water treatment plant?	**03**
	(b)	Draw a neat sketch of Cascade Aeration and explain in detail.	**04**
	(c)	Explain two methods used for defluoridation of drinking water.	**07**

OR

	(a)	Describe the characteristics of residuals (physical, chemical, biological) from WTP.	**03**
	(b)	Enlist arsenic removal techniques and explain any one.	**04**
	(c)	Explain the lime-soda softening process with chemical reactions, dosage calculations, and sludge management.	**07**

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