Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3161306 Date:05-12-2023

Subject Name:Design of Water Treatment Units

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)**	Draw a conventional drinking water treatment diagram considering hard ground water as a source of water.	**03**
	(b)	Enlist & explain location criteria for drinking water treatment plant considering river as source of water.	**04**
	(c)	Design a tube settler module of rectangular cross section with following data: i. Design flow = 1.2 MLD ii. Angle of inclination = 45^0 to horizontal iii. Diameter of tube = 50 mm	**07**
Q.2	**(a)**	Explain Cascade aeration with figure.	**03**
	(b)	Explain Nalgonda technique with reaction chemistry.	**04**
	(c)	Write a short on effects of iron, manganese, arsenic & fluoride on human health.	**07**
		OR	
	(c)	What is water softening? Explain the chemical precipitation methods for water softening.	**07**
Q.3		Design a Rapid Sand Filter for design flow of 0.4 m^3/s. Assume all other suitable data.	**14**
		OR	
Q.3		Design a Clariflocculator for design flow of 8 MLD. Assume the following data: i. Detention time for flocculator = 28 minutes ii. Height for flocculator = 3.5 m iii. Area of paddles= 20% of sectional area of plane iv. G= 30 $second^{-1}$ v. Detention time for clarifier = 2.5 hours	**14**
Q.4	**(a)**	Enlist types of rapid mixers & explain any one with figure.	**03**
	(b)	Enlist types of flocculators & explain any one with figure.	**04**
	(c)	A water treatment plant is to be designed to treat a flow of 0.17 m^3/s of water. For the rapid mix tank if the detention time is 60 s and velocity gradient is 600 s^{-1}, calculate the volume of tank and power input. Assume $\mu = 1.002 \times 10^{-3}$ NS/m^2	**07**

OR

Q.4 Design a bar screen for a peak flow of 42 MLD. Assume following conditions: **14**

i. Diameter of sewer = 1.5 m
ii. Depth of flow at peak design flow = 1 m
iii. Velocity at peak design flow = 0.8 m/s
iv. Drop of screen chamber flow with respect to sewer invert = 0.08 m

Q.5 **(a)** Write the reaction chemistry of chlorine as disinfectant at different pH. **03**

(b) Write the design criteria for parshall flume. **04**

(c) Design chlorine tonner requirement for 100 MLD drinking water treatment plant assume chlorine dose = 2 mg/L & standard capacity of 1 chlorine tonner = 900 kg. **07**

OR

Q.5 **(a)** Enlist sources & types of treatment plant residuals from conventional water treatment plant. **03**

(b) Write the design criteria for sedimentation tank. **04**

(c) Discuss the step of management for sludge & liquid residuals from water treatment plant. **07**

****