Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3161306 Date:03/06/2022

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define and highlight the importance of following parameters in design of sedimentation tank:(i) SOR (ii) WOR (iii) Scour Velocity	**03**
	(b)	Two sedimentation tanks operate in parallel. The combined flow to the two tanks is 0.1000 m3 /s. The depth of each tank is 2.00 m and each has a detention time of 4.00 h. What is the surface area of each tank and what is the surface overf1ow rate of each tank in m3 / m2.d?	**04**
	(c)	Draw a neat sketch of conventional water treatment plant and explain the functions of different units	**07**
Q.2	**(a)**	Write down the design criteria for rectangular Sedimentation tank	**03**
	(b)	Enlist the parameters to be considered for selection of water treatment units and explain any two in detail..	**04**
	(c)	Draw a flow diagram for treating ground water with Iron or manganese or both and explain the different treatment units.	**07**
		OR	
	(c)	What is the permissible limit for fluoride as per IS :10500 ? Explain defluoridation method with chemical reactions.	**07**
Q.3	**(a)**	Design a clarifloculator for a design flow of 0.2314 m^3/s. Assume suitable design criteria.	**14**
		OR	
Q.3	**(a)**	Differentiate between Rapid mixer and flocculator	**03**
	(b)	Write down the design criteria for flocculator	**04**
	(c)	Design a tube settler module of rectangular cross section for a design flow of 1.5 MLD. Assume cross section of tube as 50 mm x 50mm.	**07**
Q.4	**(a)**	Write down the specifications of sand to be used in a RSF	**03**

(b) Explain the terms and write down the design criteria for Rapid Sand Filter : **04**
(i)Effective Size (ii) Uniformity coefficient

(c) Design a Rapid Sand Filter to treat a flow of 20,000 m^3/d. determine : **07**

(i) Number and size of filter bed
(ii) Depth of sand bed
(iii) Depth of gravel bed.
Also calculate the rate of filtration when one bed is out of service due to backwashing.

OR

Q.4 **(a)** Write down the chemical reactions involved in water softening process. **03**

(b) In a 50 MLD treatment plant , an alum [Al2(SO4)3.14H2O] dose of 125 mg/L is being applied to the raw water which contains about 15 mg/L of SS. Estimate the maximum dry sludge solids which must be removed from the plant and volume of wet sludge which has concentrated to 2 % (by weight). **04**

(c) Design an under drainage system for filter bed having an area of 28 m^2 (5.6 m x 5.0m). Assume suitable design criteria. **07**

Q.5 **(a)** Write down the design criteria for Chlorine contact tank. **03**

(b) Write a short note on Parshall flume **04**

(c) Enlist the various types of sludge dewatering devices and explain any one with sketch. **07**

OR

Q.5 **(a)** A square rapid mixing tank with a depth of water equal to 1.25 times the width is to be designed for a flow of 7570 m^3/d . The velocity gradient is to be 790 /s , detention time is 40s and value of $\mu = 0.00131$ N-s/m^2. Determine the basin dimensions and the power required. **03**

(b) Define and explain the terms thickening and conditioning of sludge. **04**

(c) A coarse screen is to be designed for a flow of 20 MLD . Find out the number of bars required. Also check for the head loss through the screen. **07**
Assume :
Mean velocity through screen = 0.8 m/s
Spacing between the bars =30 mm
Angle of inclination = 45^0
Shape of bar = rectangular with dimensions 12mm x 50mm
Water depth in approach channel = 1 m^2

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