Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII EXAMINATION – SUMMER 2016

Subject Code:181303 **Date:07/05/2016**

Subject Name:Treatment Process Design and Drawing

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.**

Q.1	**(a)**	Design a continuous flow completely-mixed activated sludge process to yield an effluent BOD_5 of 20 mg/L and suspended solids of 23 mg/L. The influent BOD_5 following primary clarification is 200 mg/L. The waste flow is 0.2 m^3/sec. Take Y = 0.65, kd = 0.05, θc = 10 days, MLVSS = 3000 mg/L, return-sludge concentration as 15000 mg/L of suspended solids and MLVSS ratio = 0.8.	**14**
Q.2	**(a)**	Define: Flow through velocity, settling velocity, overflow rate, volumetric loading, solids retention time, food-microorganism ratio, weir loading rate	**07**
	(b)	Draw a neat sketch of wastewater treatment plant treating municipal wastewater along with the unit processes and unit operations involved at each level of treatment	**07**
		OR	
	(b)	Enlist the design steps for screen	**07**
Q.3	**(a)**	Design a secondary settling tank of an activated sludge treatment plant for 45 mld (peak flow) operating with an MLSS of 3000 mg/L.	**07**
	(b)	Write the procedure to design a clariflocculator	**07**
		OR	
Q.3	**(a)**	Draw a neat sketch of venturi scrubber	**07**
	(b)	Calculate the no. of trains, no. of stages, overall organic loading, hydraulic loading of a rotating biological contactor for the flow of 4000 m^3/d having BOD, soluble BOD and TSS of 140, 90 and 70 mg/L respectively. The effluent leaving the unit should possess the characteristics as BOD = 20 mg/L, soluble BOD = 10 mg/L and TSS = 20 mg/L.	**07**
Q.4	**(a)**	Design an upflow anaerobic sludge blanket reactor that removes 90% COD from the influent wastewater having 1 MLD flow. Assume both non-soluble portion of influent COD and biodegradable fraction of influent VSS = 60%. The following data are given: Influent COD = 1300 mg/L, influent soluble COD = 1000 mg/L, VSS = 200 mg/L, effluent volatile suspended solids = 120 mg/L, Y = 0.08, Kd = 0.03 d^{-1}, K = 4.375 d^{-1}, Ks = 160 mg/L.	**14**
		OR	
Q.4	**(a)**	A sharp filter sand has the sieve analysis shown below. The porosity of the unstratified bed is 0.39 and that of the stratified bed is 0.42, the lowest temperature anticipated of the water to be filtered is 4 ºC. Find the head loss if the sand is to be used in (i) a slow-sand filter 30 in. deep operated at superficial velocity of $1.08*10^{-4}$ m/s and (ii) a rapid-sand filter 30 in. deep operated at superficial velocity 0.00135 m/s. assume volume shape factor as 0.77	**14**

Sieve size	Average size (mm)	x_i
14-20	1.0	0.01
20-28	0.70	0.05
28-32	0.54	0.15
32-35	0.46	0.18
35-42	0.38	0.18
42-48	0.32	0.20
48-60	0.27	0.15
60-65	0.23	0.07
65-100	0.18	0.01

Q.5 **(a)** Design a cyclone separator of maximum particle collection efficiency for 50000 m^3/hr of gas stream at 100 ºC temperature. Consider the gas to be releasing 600 g/s of dust. Dust mean diameter is 12 µm and the density of particle is 1500 kg/m^3. Take density and viscosity of gas as 1500 kg/m^3 and $2.1*10^{-5}$ kg/m.s **07**

(b) Discuss the design criteria of membrane bioreactor **07**

OR

Q.5 **(a)** Write a short note: flow measuring devices **07**

(b) What are the factors affecting choice of treatment process? **07**

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