Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VIII - EXAMINATION – WINTER-2014

Subject Code: 181303 Date:02/12/2014

Subject Name: Treatment Process Design and Drawing

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.**

Q.1 Design a conventional activated sludge plant to treat 28000 m^3/d of settled sewage of BOD is 220 mg/L. The effluent BOD is 15 mg/L. F/M ratio is 0.22, MLSS is 3000 mg/L and SVI is 90. Determine volume of aeration basin, hydraulic retention time, volumetric loading rate, air requirements and diffused air - aeration design. **14**

Q.2 **(a)** Explain in detail flow measuring devices. **07**

(b) Draw a neat process flow diagram of sewage treatment plant and show unit operations and unit processes. **07**

OR

(b) Prepare preliminary designs for a rotating bio-disc type installation to serve 1000 persons. Assume 80 percent BOD removal at an organic load of 20 g BOD/m^2.d and 3 m diameter discs spaced 5 cm apart on centres. Take 200 litre flow per person/d and 54 g BOD person/d. **07**

Q.3 **(a)** Explain the terms: Hydraulic retention time, cross flow velocity, surface loading rate, organic loading rate **07**

(b) The cumulative flow of wastewater reaching a treatment plant in a day varies as shown in Table. Determine the capacity of an equalization tank for the given flow variation. The given flow fluctuations are as under: **07**

Time (h)	0	2	4	6	8	10	12
Cumulative flow	0	25	50	75	100	120	130

Time (h)	14	16	18	20	22	24
Cumulative flow	140	150	160	170	198	225

OR

Q.3 **(a)** Design an upflow anaerobic sludge blanket reactor for an average flow of 10.0 MLD of wastewater with the following data: **14**

(i) BOD of wastewater = 300 mg/L
(ii) COD of wastewater = 790 mg/L
(iii) Influent TSS = 350 mg/L
(iv) Influent VSS = 250 mg/L

Assume BOD removal efficiency of 70% and up flow velocity 0.6 m/h. Determine BOD removed per day, total sludge production, hydraulic retention time, solids retention time, overall size of the reactor, and biogas production rate.

Q.4 **(a)** The activated sludge bioreactor facility of a certain plant is to be expanded. The results of a settling cylinder test of the existing bioreactor suspension are as follows: **07**

MLSS (mg/L)	1410	2210	3000	3500	4500	5210	6510	8210
Vc (m/h)	2.93	1.81	1.20	0.79	0.46	0.26	0.12	0.084

$Q_o + Q_R$ is 10000 m^3/day and the influent MLSS is 3500 mg/L. Determine the size of the clarifier that will thicken the sludge to 10000 mg/L of underflow concentration.

(b) Enlist the points to be considered while selecting the treatment process train. **07**

OR

Q.4 **(a)** Design a clariflocculator for the flow of 13330 m^3/d. **14**

Q.5 **(a)** Measurement of the dust distribution of a certain industrial operation yields the results shown in the table below. These results are to be used to design a standard conventional cyclone. The airstream is 21.0 m^3/s and the diameter of the cyclone is 2.0 m. The temperature is 650 °C and the specific gravity of the particle is 2.0. What are the diameter and the terminal settling velocity of the particle that is removed 100%? Assume volume shape factor β equals 0.90, density of air at 650 °C = 0.59 kg/m^3, viscosity of air at 650 °C = 4 * 10^{-5} kg/m.s **14**

Particle size (µm)	Wt %
0-10	8
10-20	10
20-30	12
30-40	15
40-50	19
50-60	14
60-70	13
70-80	9

OR

Q.5 **(a)** A bag house is to be constructed to control emissions from a grain elevator. The filter bags to be used measure 0.3 m in diameter and 6.0 m in length. The system is used to control 21 m^3/s of waste-air flow (having temperature 45°C) having inlet dust concentration of 5.0 g/m^3. Assume air/cloth ratio 0.9 m/min. Take viscosity of air as 1.8 * 10^{-5} kg/m.s. Determine (a) the number of bags required. If one compartment is isolated for cleaning then determine quantity of bags per compartment. Calculate (b) filtration time for the bagfilter. Take values of t_r and t_c as 9 and 2.5 respectively. (c) Determine Resistance of filter medium (in cm H_2O) for the test results shown below: **14**

Time (min)	- ΔP (N/m^2)
0	151
5	379
10	506
20	611
30	694
60	992

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