Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER–VIII • EXAMINATION – SUMMER • 2014

Subject Code: 181303 **Date: 03-06-2014**

Subject Name: Treatment Process Design and Drawing

Time: 10.30 am - 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 complete mixed ASP to treat 20 MLD domestic wastewater. BOD_5 of settled wastewater to the reactor is 200 mg/L and desired BOD_5 of treated effluent is 30 mg/L. Assume that the plant will be operated at following conditions: **14**

MLVSS in the reactor, X = 3500 mg/L

Concentration of recycled sludge, X_r = 10000 (mg of MLSS/L)

MCRT = 10 d

Effluent contains 25 mg/L of biological solids of which 65% is biodegradable

BOD_5/BOD_L = 0.68 and BOD rate constant K = 0.1 per day

Q.2 (a) Write a short note: Flow measuring devices **07**

(b) Design a rotating biological contactor to treat 10 MLD flow of municipal wastewater having BOD_5 concentration of 250 mg/L. The primary treatment removes 30 % raw BOD_5 and desired effluent BOD_5 is 30 mg/L. Assume 0.05 m^3/m^2-d hydraulic loading **07**

OR

(b) Enlist the major treatment units used in domestic wastewater treatment plant along with their functions. **07**

Q.3 (a) A sand consisting of the following sizes is used: **07**

Sieve number	14-20	20-28	28-32	32-35	35-42	42-48	48-60	60-65	65-100
% of sand retained on sieve, * 10^2	1.10	6.60	15.94	18.60	19.10	17.60	14.30	5.10	1.66
Geometric mean sand size, ft*10^{-3}	3.28	2.29	1.77	1.51	1.25	1.05	0.88	0.75	0.59

The filter bed measures 20 * 20 ft^2 and is 2 ft deep. The sand has a porosity of 0.40 and a shape factor of 0.95. The filtration rate is 4 gal/min-ft^2. Assume the viscosity is 3 * 10^{-5} lb-s/ft^2. Find the head loss through the clean sand.

(b) Explain the following terms briefly: Food-microorganism ratio, mean cell residence time, hydraulic retention time, cross flow velocity, transmembrane pressure, silt density index, MWCO **07**

OR

Q.3 (a) For the flowrate and BOD concentration data given in the following table, determine (i) the in-line storage volume required to equalize the flowrate and (ii) the effect of flow equalization on the BOD mass-loading rate: **14**

Time	M-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11
Avg. flow, m^3/s	0.275	0.220	0.165	0.130	0.105	0.100	0.120	0.205	0.355	0.410	0.425
Avg. BOD conc., mg/L	150	115	75	50	45	60	90	130	175	200	215

Time	11-N	N-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
Avg. flow, m^3/s	0.430	0.425	0.405	0.385	0.350	0.325	0.325	0.330	0.365	0.400	0.400
Avg. BOD conc., mg/L	220	220	210	200	190	180	170	175	210	280	305

Time	10-11	11-M	Avg
Avg. flow, m^3/s	0.380	0.345	0.307
Avg. BOD conc., mg/L	245	180	-

Q.4 (a) Assuming suitable design criteria and following characteristics of domestic wastewater, design a UASB reactor system to treat an average 5.0 MLD flow of wastewater. Assume up flow velocity of 0.5 m/h: **14**

Influent BOD = 320 mg/L, Influent COD = 850 mg/L, influent TSS = 400 mg/L, Influent VSS = 300 mg/L, Desired effluent BOD = 100 mg/L or less.

OR

Q.4 (a) Write a short note on MBBR **07**

(b) Explain the design criteria for Membrane Bioreactor **07**

Q.5 (a) Design two identical bar rack screens for a treatment plant handling the peak flow of 210 MLD. Assume the other conditions as follows: **14**

Velocity through screen at peak flow = 1.2 m/s
Clear spacing between bars = 25 mm
Bar size = 50 mm * 10 mm
Angle of bars with horizontal = 80°
Peak factor = 2
Depth of flow in chamber = 1.1 m

OR

Q.5 (a) Enlist the design steps of cyclone separator with all the necessary equations **07**

(b) Explain the operational problems involved with venturiscrubber **07**

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