Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2024

Subject Code:3171306 Date:24-05-2024

Subject Name:Wastewater Engineering

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.**

Marks

Q.1 **(a)** Draw diagram of various conventional Treatment schemes for domestic wastewater, municipal wastewater and industrial wastewater with appropriate labels. **03**

(b) Draw different phases of SBR and distinguish between static fill and mixed fill. **04**

(c) Explain the phenomena involved in secondary treatment through Activated Sludge process. **07**

Q.2 **(a)** Enlist and explain various types of waste stabilization ponds **03**

(b) Discuss the working of sludge digester and Sludge thickener. **04**

(c) The data of wastewater generated by a community on an hourly basis is tabulated below. Design equalization basin using the given data. **07**

Time (h)	1	2	3	4	5	6	7	8	9	10	11	12
Flow (m3/min)	2.0	7.2	7.5	6.7	8.3	9.3	20.0	25	31	27.5	24	20
Time (h)	13	14	15	16	17	18	19	20	21	22	23	24
Flow (m3/min)	21	19	15	10	6.5	7.6	7.2	6.8	5.5	4.5	3.5	3.0

OR

(c) Assuming suitable design criteria and peaking factor of 1.5, design a screen chamber for 3 MLD average flow of effluent. Also estimate the quantity of screening to be handled. following are assumptions for a coarse screen chamber: **07**

(i) Peak wastewater flow = 30 MLD
(ii) Depth of incoming sewer = 1.3 m
(iii)Depth of water in incoming sewer = 1.0 m
(iv) Velocity of flow during peak condition in sewer = 0.8 m/sec
(v) Drop of screen with respect to sewer invert = 0.08 m
Determine the number of bars, spacing between bars, length of bar and total width of screen chamber and check for headloss.

Q.3 **(a)** Define the following parameters and explain its importance in design (1) SOR (2) WOR (3) Detention Time **03**

(b) Determine Length and Width of Aerated Grit Chamber for average wastewater flow of 8 MLD. Also determine air requirement. Assume following data: Peaking Factor = 2.5, Provision of 2 grit chambers in one unit, Detention time = 5 min, Depth = 2 m, Width to Depth Ratio = 2:1, Air supply rate = 0.3 m^3/min×meter **04**

(c) Design Rotating biological contactor to treat 12 MLD domestic wastewater having BOD_5 concentration of 280 mg/L. 27 % BOD_5 removes in primary treatment. **07**

Desired effluent BOD_5 is 30mg/L. Assume 0.06 m^3/m^2-d hydraulic loading. Also assume necessary data.

OR

Q.3 **(a)** Write operational problems of Anaerobic Treatment units. **03**

(b) Design a bio-tower system to treat a wastewater flow of 8 MLD having settled BOD_5 = 175 mg/L & to be operated at 25℃. The depth of modular plastic media to be used is 6.0 m & recirculation ratio will be 2:1. The treatability constant determined at 20℃ = 0.06 min^{-1} & desirable concentration of effluent is 20 mg/L. **04**

(c) Design complete mix activated sludge process to treat 25 MLD municipal wastewater having following wastewater characteristics **07**
Influent BOD_5 = 234 mg/L
Desired BOD_5 =30 mg/L
MLVSS in reactor = 3500 mg/L
MLSS/L in recycled sludge = 10000 mg/L
Designed mean cell residence time = 10 Days
K =0.1 per day

Q.4 **(a)** Write design criteria for Aerated Grit Chamber. **03**

(b) Discuss the Design consideration of Sequencing Batch Reactor and write its design steps. **04**

(c) Assuming suitable design criteria and design primary settling tank (Circular) using the data given below. Total average flow: 50 MLD , Peak Factor = 2.5, Suspended solids = 325 mg/L, Number of unit = 4 , SWD= 3 m. **07**

OR

Q.4 **(a)** Write design criteria for Oil and Grease Trap. **03**

(b) Briefly discuss the function of the following: (1) Skimming Tank (2) Contact Beds **04**

(c) Assuming suitable design criteria and following characteristics of domestic wastewater, design a UASB reactor system to treat an average 4.0 MLD flow of wastewater. Assume up flow velocity = 0.5 m/h. Given data: Influent BOD = 300 mg/L Influent COD = 800 mg/L Influent TSS = 350 mg/L Influent VSS = 300 mg/L Desired effluent BOD = 100 mg/L or less. **07**

Q.5 **(a)** Enlist various steps of Anaerobic Sludge Digestion Process **03**

(b) Explain bulking of sludge and how to overcome this problem. **04**

(c) Determine number and size of Sludge Drying Beds to dewater the digested sludge produced from sewage treatment plant for 50000 population. Assume following Data: Dry Solids Concentration in Primary and Activated Mix Sludge = 70 gm/Capita/Day. Dry Solids Loading Rate = 100 Kg/m2/year , Sludge contain 70% solids , Specific Gravity of Sludge = 1.02 **07**

OR

Q.5 **(a)** Differentiate between Attached Growth Process and Suspended Growth Process. **03**

(b) Explain working of septic tank. **04**

(c) Explain the working mechanism of Rotating Biological Contractor with neat sketch. **07**