

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2023****Subject Code:3163510****Date:04-07-2023****Subject Name:Waste Water Treatment- III****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)** Enlist wastewater discharge standards for following parameters for disposal in to marine areas. **03**
1. Ammonical Nitrogen
 2. Oil & Grease
 3. Biochemical Oxygen Demand
- (b)** What do you mean by Bioaggrumentation? Explain in brief. **04**
- (c)** Assuming the food to microorganisms ration equal to 0.25 and hydraulic residence time of 6 hours, compute the value of MLVSS to be maintained in the reactor of a conventional activated sludge plant designed to treat 5 MLD settled wastewater with 200 mg/L of BOD₅. **07**
- Q.2 (a)** Draw a neat sketch of Up flow anaerobic sludge blanket reactor. **03**
- (b)** With a help of a neat sketch explain the working of oxidation ditch. **04**
- (c)** Write a note on role of microorganism in wastewater treatment. **07**
- OR**
- (c)** Raw sewage with BOD of 220 mg/L is applied to a conventional sewage treatment plant based on activated sludge process. If the primary treatment units remove 25% of BOD, determine the MLVSS to be maintained in the reactor to control an F/M ration of 0.6 assuming a wastewater flow rate of 0.5 MLD. **07**
- Q.3 (a)** With the help of a neat sketch explain fluidized bed reactor in brief. **03**
- (b)** Enlist types of modifications in activated sludge process and explain any one in brief. **04**
- (c)** Classify the biological treatment process according to operational conditions. **07**
- OR**
- Q.3 (a)** With the help of a neat sketch explain packed bed reactor in brief. **03**
- (b)** An activated sludge plant is to be designed for 10 MLD domestic wastewater flow to operate at 10 days MCRT and 6 hours HRT. Assuming BOD₅ as 175 mg/L in influent to the aeration tank, sludge wasting flow equal to 70 m³/day and return sludge concentration equal to 8000 mg/L, determine the concentration of MLVSS to be maintained in the aeration tank to achieve effluent BOD₅ of 30 mg/L. Also determine the recirculation ratio at which plant should be operated. Assume the kinetic coefficients $K_d = 0.06 \text{ d}^{-1}$ and $Y = 0.6$ **04**
- (c)** Enlist at least five point of difference between attached growth process & suspended growth process. **07**

- Q.4** (a) Explain different types of trickling filter in brief. **03**
 (b) Explain with a help of neat sketch complete mix activated sludge process. **04**
 (c) Define the following: **07**
1. Specific Growth Rate
 2. Yield Coefficient
 3. Half Velocity Constant
 4. Endogenous Decay Coefficient
 5. Mean Cell Residence Time
 6. Food to Microbe Ratio
 7. Detention Time

OR

- Q.4** (a) Draw a neat sketch of bio tower and explain in brief. **03**
 (b) With a help of a neat sketch explain the working of rotating biological contactor. **04**
 (c) Determine the values of bio-kinetic constants using the following table derived from the laboratory experiments carried out on the CFSTR model of an activated sludge process without recycle. **07**

Unit no	Influent substrate concentration S_0 (mg/L)	Reactor substrate concentration S (mg/L)	Detention time, Θ (days)	Reactor biomass concentration, X (mg/L)
1	350	12	3.8	132
2	350	20	2.6	130
3	350	34	1.8	132
4	350	60	1.3	123
5	350	70	1.2	119

- Q.5** (a) Enlist different Culture media and its type for important for bacterial growth. **03**
 (b) Explain in brief three basic steps involved in anaerobic stabilization of organic matter. **04**
 (c) If a BOD_5 of a wastewater sample measure at 20°C is 250 mg/L and the reaction constant K is 0.35 d^{-1} , compute the ultimate and the 3-day BOD, at 20°C **07**

OR

- Q.5** (a) Explain in brief the concept of waste stabilization pond. **03**
 (b) With the help of a neat sketch explain microbial growth pattern curve in detail. **04**
 (c) Compute the mean cell residence time and recirculation ratio and volume of a reactor from the following data to design a conventional activated sludge process. Compare the recirculation if the effluent biomass concentration of 15 mg/L is considered in the mass balance analysis. **07**
- Daily average wastewater flow $Q_0 = 20\text{ MLD}$
 - Sludge wasting flow $Q_w = 140\text{ m}^3/\text{day}$
 - Biomass concentration in reactor $X = 4000\text{ mg/L}$
 - Returned biomass concentration $X_r = 10000\text{ mg/L}$
 - Hydraulic retention time $\Theta = 4\text{ hours}$