Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2025

Subject Code:3171306 Date:19-05-2025

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)**	What is the purpose of an equalization tank in wastewater treatment?	**03**
	(b)	Write a short note on Operational Problems of following Primary Treatment Units: (1) Screens (2) Grit Chamber (3) Equalization Tank	**04**
	(c)	Determine the surface area and depth of Oil and Grease Trap to remove 150 mg/L of Oil and Grease from flow of 50000 m^3/day. Assume detention time 5 min and 250 m^2 surface area requirement for wastewater flow of 1 m^3/s.	**07**
Q.2	**(a)**	Write the functions of the following (1) Bio Tower (2) Aerators (3) Return Sludge	**03**
	(b)	Discuss design considerations of Primary Settling Tank	**04**
	(c)	Design a bar screen for 5 MLD flow assuming suitable data.	**07**
		OR	
	(c)	Assuming suitable criteria, design a grit chamber with a proportional flow weir for treating the wastewater having 900 m^3/h average flow.	**07**
Q.3	**(a)**	What are the operational challenges associated with manual and mechanical cleaning of coarse screens?	**03**
	(b)	How does the shape of the aerated grit chamber influence its performance?	**04**
	(c)	Design a Primary Sedimentation tank to treat the domestic waste water flow of town having 5,00,000 Population Strength of Wastewater generated = Medium; Average rate of water supply =250 lpcd; waste water generation rate =80%; suspended solids in wastewater = 250 mg/lit, BOD_5=200 mg/lit; Detention Time =2,0 hrs. Surface Loading rate = [At Daily average flow=40 m^3/m^2-d (m/d)], [At Peak flow=100m^3/m^2-d (m/d)]	**07**
		OR	
Q.3	**(a)**	What are the advantages and disadvantages of aerobic wastewater treatment?	**03**
	(b)	What are the advantages of using an aerated grit chamber over a conventional one?	**04**
	(c)	Design a secondary settling tank of Activated Sludge Process for average flow of 20,000 m^3/day. Assume MLSS concentration 3500 mg/L. Assume suitable design criteria.	**07**
Q.4	**(a)**	Briefly discuss the following terms: 1. Rate of reaction 2. Heterogenous reaction 3. SRT	**03**
	(b)	Enlist the key design parameters for anaerobic digesters used in sludge treatment?	**04**
	(c)	Design a rotating biological contactor to treat 8 MLD flow of municipal wastewater having BOD_5 concentration of 290 mg/l. The primary	**07**

treatment removes 30% raw BOD5 and desired effluent BOD5 is 30 mg/l. Assume 0.05 m^3/m^2-d hydraulic loading and other suitable data if needed.

OR

Q.4	**(a)**	How does aerobic biological treatment remove organic matter from wastewater?	**03**
	(b)	Discuss about operational issues of attached growth process.	**04**
	(c)	Design a bio-tower system to treat a wastewater flow of 10 MLD having settled BOD_5 equal to 190 mg/l and to be operated at 25°C. The depth of modular plastic media to be used is 5.0 m and the recirculation ratio will be 2:1. The treatability constant determined at 20°C is found to be 0.06 min-1 and desirable concentration of effluent BOD_5 is 20 mg/l.	**07**
Q.5	**(a)**	Draw a labeled diagram of UASB reactor and explain its component.	**03**
	(b)	Determine volume of anaerobic sludge digestor for following data: Wastewater Flow =12 MLD Suspended Solids Concentration = 250 mg/L Volumetric Loading Rate = 55 m^3 digestor volume per 1200 persons Solids contribution = 70 gm/Capita/Day.	**04**
	(c)	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 = 0.5 m/h. Given data: Influent BOD = 280 mg/L Influent COD = 750 mg/L Influent TSS = 350 mg/L Influent VSS = 300 mg/L Desired effluent BOD = 100 mg/L or less.	**07**

OR

Q.5	**(a)**	What is a sludge digester and how does it function in sludge treatment?	**03**
	(b)	Define& briefly explain: (1) Specific growth rate (2) Endogenous decay coefficient (3) Maximum substrate utilization rate constant (4) Substrate utilization rate	**04**
	(c)	Design sludge drying beds to dewater the digested sludge produced from wastewater treatment plant based on the activated sludge process designed for 40000 population. Dry solid concentration of in ASP: 70 g/Capita/day. Assume all necessary data for calculation.	**07**

****