

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VII EXAMINATION – WINTER 2025

Subject Code:3171306

Date:24-11-2025

Subject Name:Wastewater Engineering

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) With the help of a neat sketch explain on-line and offline equalization.	03
	(b) Define the following terms and explain its importance as design parameters: (i) SOR (ii) WOR (iii) Detention time (iv) Scour velocity	04
	(c) Determine the size of rectangular aerated grit chamber for average flow of 8 MLD. Assume peaking factor 2.5. Also determine air requirement.	07
Q.2	(a) Define the terms : F/M ratio, SRT , SVI	03
	(b) Design an oil and grease trap to remove 180mg/L of Oil and Grease from a flow of 40,000 m ³ /d of domestic wastewater. Assume detention time = 5 minutes and surface area requirement = 250m ² / 1 m ³ of flow/sec.	04
	(c) Design a parabolic channel and rectangular weir type Grit chamber for a design flow of 16 MLD. Assume flow through velocity as 0.25 m/s.	07
	OR	
	(c) Design a rectangular channel and proportional weir type Grit chamber for design flow of 50000 m ³ /d.	07
Q.3	(a) Explain 'rising sludge' in Activated sludge process.	03
	(b) Assuming MCRT = 10 days and other suitable design criteria , determine volume of Anaerobic Sludge digester to treat primary sludge generated from 8 MLD domestic wastewater treatment plant.	04
	(c) Design a rectangular sedimentation tank to treat domestic wastewater with following data: • Peak flow = 85 x 10³m³/d • Suspended solids concentration = 250 mg/L • SOR = 40 m³/ m² -d • Detention time = 2 hrs	07
	OR	
Q.3	(a) Explain 'bulking sludge' in Activated sludge process.	03
	(b) Assuming 3 kg VS/d m ³ as loading rate and other suitable design criteria, determine the volume of Anaerobic sludge digester to treat primary sludge generated from 8 MLD domestic wastewater treatment plant.	04
	(c) A wastewater treatment plant is to be designed to treat 20000 m ³ /d. Assume SOR = 18 m ³ /m ² -d. Determine the size of circular sedimentation tank.	07
Q.4	(a) Differentiate between Surface and diffused aeration systems	03

- (b) Raw sewage flow of 4000 m³/day, having a BOD of 400 mg/L is treated in an activated sludge plant where the aeration tank is 1200 m³ in volume and the MLVSS is 2500 mg/L. Find the F/M ratio. **04**
- (c) A wastewater has flow rate of 27536 m³/d ; influent BOD of 160 mg/L and treated effluent should have a soluble BOD of 6 mg/L. If the biomass concentration in ASP is 2400 mg/L and in Return Activated Sludge it is 8000mg/L , $k_d=0.06 \text{ d}^{-1}$, $Y= 0.5$ and MCRT = 10d. Calculate volume of tank, Sludge wasting rate , HRT , F/M ratio and Recycle ratio. **07**

OR

- Q.4** (a) Enlist the advantages and disadvantages of RBC. **03**
- (b) With the help of a neat sketch explain the working of Sequencing Batch reactor. **04**
- (c) Design a RBC to treat a flow of 5 MLD, primary treated wastewater having BOD₅ of 200mg/L. Assume first stage sBOD loading rate as 15 g/m²-d. The desired treated effluent BOD₅ is 30 mg/L. **07**

- Q.5** (a) Enlist the four zones and components of UASB with neat sketch. **03**
- (b) Differentiate between domestic wastewater and industrial wastewater. **04**
- (c) Design a bio-tower system to treat a wastewater flow of 10 MLD having settled BOD₅ = 165 mg/L & to be operated at 25°C. The depth of modular plastic media to be used is 6.2 m & recirculation ratio will be 2:1. The treatability constant determined at 20°C = 0.06 min⁻¹ & desirable concentration of effluent is 10 mg/L. **07**

OR

- Q.5** (a) Draw a neat flow diagram for Sewage treatment plant and label its components. **03**
- (b) With the help of a neat sketch, explain waste stabilization ponds. **04**
- (c) Given below is the data of wastewater generated by a community on an hourly basis. Design equalization basin using the given data. **07**

Time (h)	1	2	3	4	5	6	7	8	9	10	11	12
Flow (m ³ /min)	6.17	5.26	4.47	3.94	3.44	3.44	3.48	5.79	7.87	8.59	8.82	8.82
Time (h)	13	14	15	16	17	18	19	20	21	22	23	24
Flow (m ³ /min)	8.82	8.67	8.4	8.4	8.14	7.61	7.34	7.34	7.12	6.17	5.9	6.59
