GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2024

Subject Code:2171306   **Date:19-11-2024**

Subject Name:Wastewater Engineering

Time:10:30 AM TO 01:30 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)**	Discuss design criteria for screen	**03**
	(b)	Compare domestic and industrial wastewater	**04**
	(c)	Discuss the design criteria of an UASB reactor	**07**
Q.2	**(a)**	Enlist the design criteria for the aerated grit chamber	**03**
	(b)	Discuss basic design considerations for treatment plants	**04**
	(c)	Explain the design steps for the Equalization basin	**07**

OR

	(c)	A wastewater treatment facility handles wastewater flow that changes throughout the day. On average, it receives 5,000 cubic meters of wastewater daily, but during peak hours, this can increase to 8,000 cubic meters. To regulate this fluctuation and ensure a steady flow for downstream treatment, the facility plans to construct an equalization basin with a capacity of 10,000 cubic meters. For the data given above calculate the following: average detention time in the equalization basin based on the average flow rate, maximum detention time in the equalization basin based on the peak flow rate. Furthermore, If the plant experiences a peak flow for 4 hours, what percentage of the equalization basin will be filled?	**07**

Q.3	**(a)**	Define: OLR, SLR, and MCRT	**03**
	(b)	Discuss the operational problems of physical unit operations	**04**
	(c)	Design a rotating biological contactor to treat 10 MLD flow of wastewater having BOD_5 of 250 mg/L. The primary treatment removes 30% raw BOD_5 and desired effluent BOD_5 is 30 mg/L. Assume 0.05 cu.m/sq.m.d hydraulic loading and other data if needed.	**07**

OR

Q.3	**(a)**	Define: F/M, HRT and SRT	**03**
	(b)	Discuss the operational problems of chemical unit processes	**04**
	(c)	Design a bio-tower system to treat the wastewater flow of 1 MLD having settled BOD_5 as 175 mg/L and is operated 25 °C. The depth of modular plastic media to be used is 6.0 m and the recirculation ratio will be 2:1. The treatability constant determined at 20 °C is found to be 0.06 1/min and the desirable concentration of effluent BOD_5 is 20 mg/L.	**07**

Q.4	**(a)**	Discuss in brief design of screen chamber	**03**
	(b)	Design an oil and grease trap to remove 160 mg/L of oil and grease from a flow of 50 MLD domestic wastewater	**04**

(c)	Design a UASB reactor for the flow of 8000 cu.m/d of preliminary treated municipal sewage having COD and BOD of 820 and 350 mg/L respectively. Assume VSS and TSS as 270 and 395 mg/L. The treated effluent must meet the criteria for land irrigation. Take sulfate concentration in the influent as 105 mg/L.		**07**

OR

Q.4 **(a)** Discuss types of grit chambers in brief — **03**

(b) With a neat diagram explain why and where you would provide an equalization tank in a treatment system — **04**

(c) Calculate the sludge production rate, sludge wasting rate from recycled line and from the reactor for an activated sludge process designed to operate at mean cell residence time of 10 days to maintain 10,000 mg/L concentration of recycled sludge. Take reactor volume as 5000 cu.m MLSS concentration in the reactor 3000 mg/L. — **07**

Q.5 **(a)** Explain the basic principles behind the dewatering and drying mechanisms in sludge drying beds? — **03**

(b) Evaluate the advantages and limitations of using filter press technology compared to other solid-liquid separation methods — **04**

(c) Synthesize best practices for optimizing the design and operation of sludge drying beds to maximize solids removal and minimize odor emissions. — **07**

OR

Q.5 **(a)** Discuss the important sludge characteristics — **03**

(b) Analyze the factors influencing the filtration efficiency and cake formation characteristics in a filter press. — **04**

(c) Analyze the advantages and limitations of using centrifuges compared to other dewatering technologies — **07**

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