Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3151303 **Date: 25/05/2026**

Subject Name: Physico-chemical Treatment Technology

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.**

Q.1	**(a)**	List six major physical and chemical characteristics of wastewater.	**03**
	(b)	Discuss the components of wastewater flows and why statistical analysis is required for treatment design.	**04**
	(c)	Analyze the relationship between pH, alkalinity, and the optimum Alum dose using the Jar Test procedure.	**07**
Q.2	**(a)**	List the different types of screens based on their opening sizes and cleaning mechanisms.	**03**
	(b)	Explain why screens are fundamentally necessary before any subsequent treatment of wastewater.	**04**
	(c)	Compare and contrast the four types of settling in sedimentation tanks.	**07**
		OR	
Q.2	**(c)**	What is Stokes Law? Apply it to calculate the settling velocity of a discrete particle with a diameter of 0.1 mm and specific gravity of 2.65.	**07**
Q.3	**(a)**	State the primary assumptions made for an ideal sedimentation tank.	**03**
	(b)	Illustrate the mechanism of 'Charge Neutralization' versus 'Interparticle Bridging' in coagulation.	**04**
	(c)	With the help of a neat sketch, explain the construction and working of Slow Sand Filter.	**07**
		OR	
Q.3	**(a)**	Describe the term 'Zeta Potential' and its role in colloidal stability.	**03**
	(b)	A rectangular sedimentation tank has a length of 12 m and a width of 10 m. For a flow rate of 2.5 MLD, calculate the Weir Overflow Rate.	**04**
	(c)	Analyze the operational difficulties of a Rapid Sand Filter, including air binding and sand boiling.	**07**
Q.4	**(a)**	Explain the phenomenon of 'Mud-ball formation' in rapid sand filters.	**03**
	(b)	Describe the chemistry of metallic coagulants (like Alum) and their reaction with alkalinity.	**04**
	(c)	Define and explain following terms: (i) Free available chlorine, (ii) Super chlorination, (iii) Plain chlorination, (iv) Post chlorination, (v) Pre chlorination and (vi) Double chlorination.	**07**
		OR	

Q.4	**(a)**	Summarize the factors that influence the efficiency of the disinfection process.	**03**
	(b)	Explain the mechanism of headloss in screens and how it affects plant operation.	**04**
	(c)	Analyze the different disinfection methods based on their mechanisms and byproduct formation.	**07**
Q.5	**(a)**	Identify the various sources of sludge generated in a conventional treatment plant.	**03**
	(b)	Explain the design considerations for sludge drying beds to minimize odor and maximize drying efficiency.	**04**
	(c)	Mention the type of digester and explain them with neat diagram.	**07**

OR

Q.5	**(a)**	Briefly explain the principle behind the thickening of waste sludges.	**03**
	(b)	Compare the suitability of aerobic vs. anaerobic sludge digestion methods for large-scale plants.	**04**
	(c)	Write down the definitions: Dewatering, Thickening, Leachate, Sludge conditioning, Bio solid, Landfill and Incineration.	**07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – SUMMER 2025

Subject Code:3151303 Date:15-05-2025

Subject Name:Physico-chemical Treatment Technology

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)**	Give the classification of screen with opening size.	**03**
	(b)	Explain Average daily flows, Maximum dry weather flows, Peak wet weather flows, Minimum hourly flows and Sustained flows.	**04**
	(c)	Draw a detailed sketch of ground water treatment (with high Iron & Manganese conc.) for drinking purpose and explain each unit in detail.	**07**
Q.2	**(a)**	Distinguish between discrete and flocculant settling.	**03**
	(b)	Draw neat sketch and explain Conventional Water Treatment Plant.	**04**
	(c)	Explain various physical and chemical and biological characteristics of water and waste-water.	**07**
		OR	
	(c)	Describe electric double layer theory with neat sketch.	**07**
Q.3	**(a)**	Define effective size and uniformity co-efficient.	**03**
	(b)	A bar screen is inclined at 60 angle from horizontal. The rectangular bars have width 15 mm & spacing 20 mm. Total number of spacing are 25. Determine the headloss when the bars are clean and velocity approaching 1 m/s. Assume bar shape factor is 1.83.	**04**
	(c)	Enlist and explain the mechanisms of coagulation.	**07**
		OR	
Q.3	**(a)**	Find the settling velocity of a discrete particles in water under conditions when Reynolds's number is less than 0.5. The diameter & specific gravity of particle is 5×10^{-3} cm and 2.65, respectively. Water temperature is 20˚C and kinematic viscosity is 1.01×10^{-6} m^2/sec.	**03**
	(b)	Discuss settling column test of discrete particles.	**04**
	(c)	Enlist and explain filtration mechanisms.	**07**
Q.4	**(a)**	Determine the amount of $Fe(OH)_3$ produced and amount of alkalinity consumed when 65 mg/L of $FeCl_3$ is added to water.	**03**
	(b)	Prepare a list of different chemical coagulants. Explain chemical reactions when alum is used as coagulants.	**04**
	(c)	Define and explain following terms: (i) Free available chlorine, (ii) Super chlorination, (iii) Plain chlorination, (iv) Post chlorination, (v) Pre chlorination and (vi) Double chlorination.	**07**

OR

Q.4	**(a)**	Write a note on operational difficulties of Rapid Sand Filter.	**03**
	(b)	Write a short not on Break-point chlorination.	**04**
	(c)	With the help of a neat sketch, explain the construction and working of Slow Sand Filter.	**07**
Q.5	**(a)**	What materials do include in Grit? Write the purpose of Grit Removal.	**03**
	(b)	Write down the definitions: (i) Sludge conditioning, (ii) Leachate, (iii) Bio solid and (iv) Thickening	**04**
	(c)	Derive the Newton's law for settling velocity of discrete particle.	**07**

OR

Q.5	**(a)**	Enlist sources of sludge in water and wastewater treatment separately.	**03**
	(b)	Explain aerobic and anaerobic sludge digestion.	**04**
	(c)	With the help of a neat sketch explain the concept of "Break point Chlorination."	**07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3151303 Date:18-05-2024

Subject Name:Physico-chemical Treatment Technology

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)**	Why do wastewater flow rates fluctuate? Explain the variations that are significant to the design of the treatment plant.	**03**
	(b)	Explain the procedure for statistical analysis of wastewater flow rate data.	**04**
	(c)	Draw neat sketch and explain Conventional Waste-water Treatment Plant and explain the different units along with their functions.	**07**
Q.2	**(a)**	Define 'Grit Chamber'. State its purpose.	**03**
	(b)	What is unit process? List down different unit processes used for waste water treatment.	**04**
	(c)	Enlist functional zones of sedimentation tank and explain sludge and outlet zone in detail.	**07**
		OR	
	(c)	Explain types of Grit Chambers with neat and labeled sketches.	**07**
Q.3	**(a)**	State the equations of Head-loss across coarse and fine screens.	**03**
	(b)	Discuss in brief: Mechanism of flocculation.	**04**
	(c)	Explain a jar test procedure for determining the optimum dose of chemical coagulant and what is the relationship between pH, alkalinity and the alum dose?	**07**
		OR	
Q.3	**(a)**	Define screens and screenings? State the purpose of screens.	**03**
	(b)	Enlist all the mechanisms of coagulation and explain them.	**04**
	(c)	Prepare a list of different types of chemical coagulants and explain along with chemical reactions involved.	**07**
Q.4	**(a)**	Enlist the assumptions for ideal sedimentation tank.	**03**
	(b)	Describe Newton's law (Stokes law) for settling velocity of discrete particles.	**04**
	(c)	Explain the construction and working of Slow Sand Filter with neat sketch.	**07**
		OR	
Q.4	**(a)**	Write a short note on tube settler.	**03**
	(b)	Find terminal settling velocity of spherical particle with diameter of 0.05mm of specific gravity 2.65 settling through water having kinematic viscosity 1.004 x 10 -4 m^2 /sec.	**04**

	(c)	Draw a neat sketch of Rapid Sand Filter (RSF) and explain its construction and working.	**07**
Q.5	**(a)**	Explain Thickening of waste sludge.	**03**
	(b)	Describe the various factors that affect efficiency of wastewater disinfection.	**04**
	(c)	Explain Sludge Drying bed and its design criteria.	**07**

OR

Q.5	**(a)**	Explain why chlorination is mostly used for disinfection of domestic wastewater.	**03**
	(b)	Explain aerobic and anaerobic sludge digestion.	**04**
	(c)	Explain Break-point chlorination and its significance to determine the chlorine demand	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- V EXAMINATION-SUMMER 2023

Subject Code: 3151303 Date: 26/06/2023

Subject Name: Physico-chemical Treatment Technology

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)**	Give classification for types of wastewaters	**03**
	(b)	Define for terminology used for statistical analysis of wastewater flows	**04**
	(c)	Derive the expression for terminal settling velocity with clearly mentioning the assumptions	**07**
Q.2	**(a)**	Show with the help of a neat sketch various parts of bar rack screen	**03**
	(b)	Produce a neat sketch of aerated grit chamber	**04**
	(c)	Differentiate: Coagulation and Flocculation	**07**
		OR	
	(c)	Classify Filtration equipment	**07**
Q.3	**(a)**	Describe the purpose of disinfection. Compare the same with sterilisation	**03**
	(b)	Discuss in brief Cylinder test for settling	**04**
	(c)	Explain with the kinetic equations Chick's law	**07**
		OR	
Q.3	**(a)**	Enlist the methods and mechanisms for disinfection	**03**
	(b)	Explain Jar test apparatus in detail. Show how the results of the shame are helpful	**04**
	(c)	Show with the help of a neat sketch break point chlorination	**07**
Q.4	**(a)**	Explain how to estimate the bulk density of sludge	**03**
	(b)	Summarize the sources of sludge	**04**
	(c)	With the help of a neat sketch, show various mechanisms for filtration	**07**
		OR	
Q.4	**(a)**	Explain design of sludge drying bed	**03**
	(b)	Enlist various methods of dewatering	**04**
	(c)	Describe the chemistry for metallic coagulants	**07**
Q.5	**(a)**	List the various filtration devices used for sludge dewatering	**03**
	(b)	Explain chemical conditioning in brief	**04**
	(c)	Explain analysis of discrete settling in detail	**07**
		OR	
Q.5	**(a)**	Write about Elutriation	**03**
	(b)	Compare aerbic digestion and anaerobic digestion	**04**
	(c)	Explain analysis of flocculant settling in detail	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3151303 Date:04/06/2022

Subject Name:Physico-chemical Treatment Technology

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.**

Q.1	**(a)**	Give the classification of Screens.	**03**
	(b)	Enlist characteristics of wastewater and explain physical characteristics in detail.	**04**
	(c)	Discuss aerated grit chamber with neat sketch. Also explain advantages and disadvantages of it.	**07**
Q.2	**(a)**	Differentiate between electrophoresis and electro osmosis.	**03**
	(b)	Classify the properties of colloidal dispersion.	**04**
	(c)	Describe electric double layer theory with neat sketch.	**07**
		OR	
	(c)	Describe DLVO theory with neat sketch.	**07**
Q.3	**(a)**	Distinguish between discrete and Flocculant settling.	**03**
	(b)	Define effective size and uniformity co-efficient.	**04**
	(c)	Write a short note on tube settler with neat sketch.	**07**
		OR	
Q.3	**(a)**	Define following terms: 1. SOR 2. WOR 3. Scour velocity	**03**
	(b)	Give the detail classification of filtration.	**04**
	(c)	Enlist functional zones of sedimentation tank and explain sludge and outlet zone in detail.	**07**
Q.4	**(a)**	Give the detail classification of treatment.	**03**
	(b)	Find terminal settling velocity of spherical particle with diameter of 0.05mm of specific gravity 2.65 settling through water having kinematic viscosity 1.004×10^{-4} m^2/sec.	**04**
	(c)	A 50 MLD treatment uses an alum dose of 125 mg/L for raw water which contains about 15 mg/L suspended solids. Estimate maximum kg/day of dry sludge solids which must be removed from plant and volume of wet sludge which has 2 % by weight. Take specific gravity of sludge as 1.02. Assume $Al_2(SO_4)_3.14\ H_2O$ as alum.	**07**
		OR	
Q.4	**(a)**	Differentiate between flocculation and coagulation.	**03**
	(b)	Determine the head loss through bar screen when 50% of flow area is clogged due to accumulation of coarse particles. Assume Vapp = 0.6 m/sec, Vscreen = 0.9 m/sec , open area for flow through clear bar screen = 0.9 m^2, head loss coefficient C(clean) = 07 and C(Clogged) = 0.6	**04**

	(c)	Discuss settling column test of discrete particles.	**07**
Q.5	**(a)**	How to estimate the SVI?	**03**
	(b)	Enlist methods of dewatering and explain any one in detail.	**04**
	(c)	Write a short note on breakpoint chlorination with neat sketch.	**07**

OR

Q.5	**(a)**	Enlist sources of sludge.	**03**
	(b)	Differentiate between aerobic and anaerobic digestion.	**04**
	(c)	What do you understand by the term disinfection of water? Why it is necessary to disinfect the water for public water supply schemes?	**07**

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