

GUJARAT TECHNOLOGICAL UNIVERSITY

5 SEMESTER – OLD PAPER – S22 TO S26 – QUESTION BANK

Subject Name & Code: Physico-chemical Treatment Technology - 3151303

Chapter 1: Introduction

Repeated Questions:

1. Wastewater Flows and Statistical Analysis:

- Q. Explain the procedure for statistical analysis of wastewater flow rate data. (WINTER 2022, 4 Marks; WINTER 2023, 3 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks)

2. Treatment Plants and Flow Sheets:

- Q. Draw neat sketch and explain Conventional Waste-water Treatment Plant and explain the different units along with their functions. [Diagram required – refer to the original question paper] (SUMMER 2024, 7 Marks; WINTER 2024, 7 Marks)
- Q. Draw a neat sketch of conventional water treatment plant and explain the function of each unit. [Diagram required – refer to the original question paper] (WINTER 2022, 7 Marks)

3. Unit Processes and Unit Operations:

- Q. What is unit process? List down different unit processes used for waste water treatment. (WINTER 2022, 3 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 4 Marks)
- Q. Differentiate between Unit process and unit operations. / Difference between unit operation and unit process. (WINTER 2024, 3 Marks; WINTER 2025, 3 Marks)

Other Important Questions:

1. Characteristics and Classification of Water and Wastewater:

- Q. List six major physical and chemical characteristics of wastewater. (SUMMER 2026, 3 Marks)
- Q. Enlist and explain 4 physical parameters of water along with sources and effects of each parameter. (WINTER 2025, 4 Marks)
- Q. Give classification for types of wastewaters. (SUMMER 2023, 3 Marks)
- Q. Enlist characteristics of wastewater and explain physical characteristics in detail. (SUMMER 2022, 4 Marks)
- Q. Give the detail classification of treatment. (SUMMER 2022, 3 Marks)
- Q. Explain various physical and chemical and biological characteristics of water and waste-water. (SUMMER 2025, 7 Marks)

2. Wastewater Flows and Statistical Analysis:

- Q. Discuss the components of wastewater flows and why statistical analysis is required for treatment design. (SUMMER 2026, 4 Marks)
- Q. Define for terminology used for statistical analysis of wastewater flows. (SUMMER 2023, 4 Marks)
- Q. Why do wastewater flow rates fluctuate? Explain the variations that are significant to the design of the treatment plant. (SUMMER 2024, 3 Marks)
- Q. Explain Average daily flows, Maximum dry weather flows, Peak wet weather flows, Minimum hourly flows and Sustained flows. (SUMMER 2025, 4 Marks)

3. Treatment Plants and Flow Sheets:

- Q. Draw a detailed sketch of surface water (River water) treatment for drinking purpose and explain each unit in detail. [Diagram required – refer to the original question paper] (WINTER 2025, 7 Marks)

- **Q.** Draw a detailed sketch of ground water treatment (with high Iron & Manganese conc.) for drinking purpose and explain each unit in detail. [Diagram required – refer to the original question paper] **(SUMMER 2025, 7 Marks)**
- **Q.** Draw neat sketch and explain Conventional Water Treatment Plant. [Diagram required – refer to the original question paper] **(SUMMER 2025, 4 Marks)**

Chapter 2: Preliminary treatment of water and wastewaters

Repeated Questions:

1. Screens: Classification, Types and Purpose:

- **Q.** Give the classification of screen with opening size. / Give the detail classification of Screens with their opening size. (SUMMER 2022, 3 Marks; WINTER 2022, 3 Marks; WINTER 2023, 3 Marks; SUMMER 2025, 3 Marks)
- **Q.** Why are screens necessary before the treatment of wastewater? / Explain why screens are fundamentally necessary before any subsequent treatment of wastewater. (WINTER 2022, 4 Marks; WINTER 2024, 3 Marks; SUMMER 2026, 4 Marks)

2. Grit Removal and Grit Chambers:

- **Q.** Define 'Grit Chamber'. State its purpose. (SUMMER 2024, 3 Marks; WINTER 2024, 3 Marks)
- **Q.** Write a short note on grit removal mechanism. (WINTER 2023, 4 Marks OR; WINTER 2024, 4 Marks)
- **Q.** Discuss aerated grit chamber with neat sketch. Also explain advantages and disadvantages of it. [Diagram required – refer to the original question paper] (SUMMER 2022, 7 Marks; WINTER 2024, 7 Marks)
- **Q.** Explain the types of Grit chamber with neat sketch. / Explain types of Grit Chambers with neat and labeled sketches. [Diagram required – refer to the original question paper] (SUMMER 2024, 7 Marks OR; WINTER 2025, 7 Marks)

3. Screens: Numerical Problems:

- **Q.** 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. (SUMMER 2025, 4 Marks; WINTER 2025, 4 Marks)

Other Important Questions:

1. Screens: Classification, Types and Purpose:

- **Q.** List the different types of screens based on their opening sizes and cleaning mechanisms. (SUMMER 2026, 3 Marks)
- **Q.** What is screen? Write importance of screen in Water and wastewater treatment. (WINTER 2025, 3 Marks)
- **Q.** Show with the help of a neat sketch various parts of bar rack screen. [Diagram required – refer to the original question paper] (SUMMER 2023, 3 Marks)
- **Q.** Define screens and screenings? State the purpose of screens. (SUMMER 2024, 3 Marks OR)
- **Q.** Define screen. State the purpose of screen. (WINTER 2024, 3 Marks OR)
- **Q.** Explain the classification of screens in detail with neat and labeled sketches. [Diagram required – refer to the original question paper] (WINTER 2024, 4 Marks OR)

2. Screens: Headloss (Theory):

- **Q.** Explain the mechanism of headloss in screens and how it affects plant operation. (SUMMER 2026 P2, 4 Marks)
- **Q.** Write the different empirical formula for determination of headloss through fine and coarse screen. (WINTER 2025, 4 Marks)
- **Q.** State the equations of Head-loss across coarse and fine screens. (SUMMER 2024, 3 Marks)

3. Grit Removal and Grit Chambers:

- **Q.** Produce a neat sketch of aerated grit chamber. [Diagram required – refer to the original question paper] (SUMMER 2023, 4 Marks)

- **Q.** Write a short note on Aerated Grit Chamber. **(WINTER 2022, 3 Marks)**
- **Q.** Write a short note on vortex type Grit Chamber. **(WINTER 2023, 3 Marks)**
- **Q.** What materials do include in Grit? Write the purpose of Grit Removal. **(SUMMER 2025 P2, 3 Marks)**

4. Screens: Numerical Problems:

- **Q.** Determine the head loss through bar screen when 50% of flow area is clogged due to accumulation of coarse particles. Assume $V_{app} = 0.6$ m/sec $V_{screen} = 0.9$ m/sec open area for flow through clear bar screen = 0.9 m^2 , head loss coefficient $C(\text{clean}) = 0.7$ and $C(\text{Clogged}) = 0.6$. **(SUMMER 2022, 4 Marks OR)**

Chapter 3: Primary Treatment of water and wastewater

Repeated Questions:

1. Coagulation and Flocculation: Coagulants and Jar Test:

- **Q.** Analyze the relationship between pH, alkalinity, and the optimum Alum dose using the Jar Test procedure. / 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? / Explain jar test procedure for determining the optimum dose of chemical coagulant. What is the relation between pH, alkalinity & alum? [Diagram required – refer to the original question paper] (**WINTER 2022, 7 Marks; WINTER 2023, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2026, 7 Marks**)
- **Q.** Prepare a list of different chemical coagulants and explain along with chemical reactions involved. / Prepare a list of different chemical coagulants. Explain chemical reactions when alum is used as coagulants. (**WINTER 2022, 7 Marks; SUMMER 2024, 7 Marks OR; WINTER 2024, 7 Marks OR; SUMMER 2025, 4 Marks**)
- **Q.** Briefly explain the jar test in detail with a diagram. [Diagram required – refer to the original question paper] (**SUMMER 2023, 4 Marks OR-2; WINTER 2025, 4 Marks**)

2. Coagulation and Flocculation: Fundamentals and Mechanisms:

- **Q.** Enlist and explain the mechanisms of coagulation. (Along with diagram). (**SUMMER 2024, 4 Marks OR; WINTER 2024, 4 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks**)
- **Q.** Differentiate between flocculation and coagulation. / Differentiate: Coagulation and Flocculation. (**SUMMER 2022, 3 Marks OR; SUMMER 2023, 7 Marks; WINTER 2023, 7 Marks OR; WINTER 2024, 3 Marks**)
- **Q.** Explain the phenomenon of flocculation for water and waste-water treatment. (**WINTER 2022, 4 Marks OR; WINTER 2025, 3 Marks**)

3. Coagulation and Flocculation: Colloids and Colloidal Stability:

- **Q.** Describe electric double layer theory with neat sketch. [Diagram required – refer to the original question paper] (**SUMMER 2022, 7 Marks; SUMMER 2025, 7 Marks OR**)
- **Q.** Write a short note on "Colloidal Stability". What are the mechanisms of Destabilization of colloids? (**WINTER 2022, 7 Marks OR; WINTER 2023, 7 Marks OR**)

4. Coagulation and Flocculation: Numerical Problems:

- **Q.** Determine the amount of $\text{Fe}(\text{OH})_3$ produced and amount of alkalinity consumed when 62 / 65 mg/L of FeCl_3 is added to water. (**SUMMER 2025, 3 Marks - 65 mg/L; WINTER 2025, 3 Marks OR - 62 mg/L**)

5. Sedimentation: Fundamentals, Settling Theory and Types of Settling:

- **Q.** Enlist the assumptions for ideal sedimentation tank. / State the primary assumptions made for an ideal sedimentation tank. (**WINTER 2022, 3 Marks OR; WINTER 2023, 4 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 4 Marks OR; SUMMER 2026, 3 Marks**)
- **Q.** Derive the Newton's law for settling velocity of discrete particle. / Derive the expression for terminal settling velocity with clearly mentioning the assumptions. (**SUMMER 2023, 7 Marks; WINTER 2023, 4 Marks; WINTER 2024, 7 Marks OR; SUMMER 2025 P2, 7 Marks; WINTER 2025, 7 Marks**)
- **Q.** Distinguish between discrete and Flocculant settling. (**SUMMER 2022, 3 Marks; SUMMER 2025, 3 Marks**)
- **Q.** Describe Newton's law (Stokes law) for settling velocity of discrete particles. (**WINTER 2022, 4 Marks; SUMMER 2024, 4 Marks**)

6. Sedimentation: Tanks, Design Terms, Tube Settlers and Flotation:

- **Q.** Write a short note on tube settler. / Write a note on tube settlers highlighting its benefits and limitations. / Write a short note on tube settler with neat sketch. **(SUMMER 2022, 7 Marks; WINTER 2023, 3 Marks OR; SUMMER 2024, 3 Marks OR; WINTER 2024, 4 Marks; WINTER 2025, 3 Marks OR)**
- **Q.** Enlist functional zones of sedimentation tank and explain sludge and outlet zone in detail. **(SUMMER 2022, 7 Marks OR; SUMMER 2024, 7 Marks)**

7. Sedimentation: Numerical Problems:

- **Q.** Find terminal settling velocity of spherical particle with diameter of 0.05 mm of specific gravity 2.65 settling through water having kinematic viscosity $1.004 \times 10^{-4} \text{ m}^2/\text{sec}$. **(SUMMER 2022, 4 Marks; SUMMER 2024, 7 Marks OR)**

8. Filtration: Sand Filters:

- **Q.** With the help of a neat sketch, explain the construction and working of Slow Sand Filter along with a neat sketch. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks OR; WINTER 2023, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2025 P2, 7 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Write a note on "Operational difficulties of RSF". / Analyze the operational difficulties of a Rapid Sand Filter, including air binding and sand boiling. **(WINTER 2022, 3 Marks; WINTER 2023, 4 Marks; WINTER 2024, 3 Marks OR; SUMMER 2025 P2, 3 Marks; SUMMER 2026, 7 Marks OR)**
- **Q.** With the help of a neat sketch, explain the construction and working of Rapid Sand Filter. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks; WINTER 2023, 7 Marks OR; WINTER 2025, 7 Marks)**
- **Q.** Explain the phenomenon of 'Mud-ball formation' in rapid sand filters. / Write a short note on Mud-ball formation in Sand filter. **(WINTER 2022, 4 Marks; SUMMER 2026, 3 Marks)**
- **Q.** Define effective size and uniformity co-efficient. **(SUMMER 2022, 4 Marks; SUMMER 2025, 3 Marks)**

9. Disinfection: Chlorination:

- **Q.** 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. **(SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks OR; SUMMER 2026, 7 Marks)**
- **Q.** Explain Break-point chlorination and its significance to determine the chlorine demand. / With the help of a neat sketch explain the concept of "Break point Chlorination." [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks OR; SUMMER 2023, 7 Marks OR-2; WINTER 2023, 3 Marks; SUMMER 2024, 7 Marks OR; WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks OR; SUMMER 2025 P2, 4 Marks)**

10. Disinfection: Concepts, Disinfectants and Factors:

- **Q.** Enlist and explain the factors affecting the efficiency of disinfection process. / Summarize the factors that influence the efficiency of the disinfection process. / Describe the various factors that affect efficiency of wastewater disinfection. **(WINTER 2022, 4 Marks OR; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks; SUMMER 2026 P2, 3 Marks)**
- **Q.** Describe the purpose of disinfection. Compare the same with sterilisation. / Explain disinfection and sterilization. Give an example of each one. **(SUMMER 2023, 3 Marks OR; WINTER 2025, 3 Marks OR)**

Other Important Questions:**1. Coagulation and Flocculation: Fundamentals and Mechanisms:**

- **Q.** Illustrate the mechanism of 'Charge Neutralization' versus 'Interparticle Bridging' in coagulation. **(SUMMER 2026, 4 Marks)**
- **Q.** Discuss in brief: Mechanism of flocculation. **(SUMMER 2024, 4 Marks)**

- **Q.** Enlist the different types of mixing equipments & explain any one with sketch. [Diagram required – refer to the original question paper] **(WINTER 2023, 7 Marks)**

2. Coagulation and Flocculation: Colloids and Colloidal Stability:

- **Q.** Describe the term 'Zeta Potential' and its role in colloidal stability. **(SUMMER 2026, 3 Marks OR)**
- **Q.** Differentiate between electrophoresis and electro osmosis. **(SUMMER 2022, 3 Marks)**
- **Q.** Classify the properties of colloidal dispersion. **(SUMMER 2022, 4 Marks)**
- **Q.** Describe DLVO theory with neat sketch. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks OR)**

3. Coagulation and Flocculation: Coagulants and Jar Test:

- **Q.** Describe the chemistry of metallic coagulants (like Alum) and their reaction with alkalinity. **(SUMMER 2026, 4 Marks)**
- **Q.** Describe the chemistry for metallic coagulants. **(SUMMER 2023, 7 Marks OR)**

4. Sedimentation: Fundamentals, Settling Theory and Types of Settling:

- **Q.** Compare and contrast the four types of settling in sedimentation tanks. **(SUMMER 2026, 7 Marks)**
- **Q.** Discuss in brief Cylinder test for settling. **(SUMMER 2023, 4 Marks OR)**
- **Q.** Explain analysis of discrete settling in detail. **(SUMMER 2023, 7 Marks)**
- **Q.** Explain analysis of flocculant settling in detail. **(SUMMER 2023, 7 Marks OR)**
- **Q.** Enlist and explain different types of settling phenomena observed in sedimentation tank. **(WINTER 2023, 4 Marks OR)**
- **Q.** Why sedimentation operation is important for water and wastewater treatment? **(WINTER 2024, 4 Marks OR)**
- **Q.** Discuss settling column test of discrete particles. **(SUMMER 2025, 4 Marks OR)**

5. Sedimentation: Numerical Problems:

- **Q.** 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. **(SUMMER 2026, 7 Marks OR)**
- **Q.** 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. **(SUMMER 2026, 4 Marks OR)**
- **Q.** For a circular clarifier of 22 m diameter and flow rate of 10 MLD. Determine Weir Overflow Rate (WOR). **(WINTER 2025, 3 Marks)**

6. Sedimentation: Tanks, Design Terms, Tube Settlers and Flotation:

- **Q.** Draw a neat sketch of functional zone of sedimentation tank for horizontal flow. [Diagram required – refer to the original question paper] **(WINTER 2025, 4 Marks OR)**
- **Q.** Define following terms along with equation and explain its importance for design of sedimentation tank: (i) Detention time, (ii) Surface overflow rate, (iii) Weir overflow rate and (iv) Scour velocity. **(WINTER 2025, 7 Marks OR)**
- **Q.** Define following terms: (1) SOR (2) WOR (3) Scour velocity. **(SUMMER 2022, 3 Marks OR)**
- **Q.** Explain with neat sketch: dissolved air flotation for surface water treatment. [Diagram required – refer to the original question paper] **(WINTER 2023, 7 Marks)**

7. Filtration: Sand Filters:

- **Q.** Differentiate between Slow Sand Filter and Rapid Sand Filter. **(WINTER 2025, 7 Marks OR)**
- **Q.** Write a short note on 'Filter backwashing'. **(WINTER 2023, 3 Marks OR)**
- **Q.** What are the advantages of dual media filters as compared to single media filters? **(WINTER 2023, 4 Marks)**

8. Filtration: Classification, Mechanisms and Other Filters:

- **Q.** Classify Filtration equipment. **(SUMMER 2023, 7 Marks)**
- **Q.** With the help of a neat sketch, show various mechanisms for filtration. [Diagram required – refer to the original question paper] **(SUMMER 2023, 7 Marks)**
- **Q.** Draw neat sketches of Micro-filtration treatment for surface water. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks)**
- **Q.** Give the detail classification of filtration. **(SUMMER 2022, 4 Marks OR)**
- **Q.** Enlist and explain filtration mechanisms. **(SUMMER 2025, 7 Marks OR)**

9. Disinfection: Concepts, Disinfectants and Factors:

- **Q.** Analyze the different disinfection methods based on their mechanisms and byproduct formation. **(SUMMER 2026 P2, 7 Marks)**
- **Q.** Write down the characteristics of an ideal disinfectant. **(WINTER 2025, 4 Marks OR)**
- **Q.** Explain with the kinetic equations Chick's law. **(SUMMER 2023, 7 Marks OR)**
- **Q.** Enlist the methods and mechanisms for disinfection. **(SUMMER 2023, 3 Marks OR-2)**
- **Q.** Enlist and explain the disinfectants used for water treatment. **(WINTER 2022, 3 Marks OR)**
- **Q.** What do you understand by the term disinfection of water? Why it is necessary to disinfect the water for public water supply schemes? **(SUMMER 2022, 7 Marks OR)**
- **Q.** What do you mean by disinfectant? Discuss the objectives of Disinfection. **(WINTER 2024, 3 Marks)**

10. Disinfection: Chlorination:

- **Q.** Explain why chlorination is mostly used for disinfection of domestic wastewater. **(SUMMER 2024, 3 Marks OR)**
- **Q.** Enlist and explain the factors affecting the process of chlorination. **(WINTER 2022, 4 Marks)**

Chapter 4: Sludge dewatering, treatment and disposal

Repeated Questions:

1. Sources, Characteristics and Objectives of Sludge Treatment:

- Q. Enlist sources of sludge. / Identify the various sources of sludge generated in a conventional treatment plant. / Describe the usual sources of sludge and the characteristics of sludge generated in a conventional wastewater treatment plant. (SUMMER 2022, 3 Marks OR; SUMMER 2023, 4 Marks; WINTER 2023, 7 Marks; SUMMER 2025, 3 Marks OR; SUMMER 2026 P2, 3 Marks)

2. Sludge Drying Beds:

- Q. Explain Sludge Drying bed and its design criteria. / Explain the design considerations for sludge drying beds to minimize odor and maximize drying efficiency. (WINTER 2022, 4 Marks OR; SUMMER 2023, 3 Marks OR; WINTER 2023, 3 Marks; SUMMER 2024, 7 Marks; WINTER 2024, 4 Marks OR; SUMMER 2026 P2, 4 Marks)

3. Sludge Digestion:

- Q. Explain aerobic and anaerobic sludge digestion. / Explain the process of aerobic and anaerobic digestion. (WINTER 2023, 4 Marks OR; SUMMER 2024, 4 Marks OR; SUMMER 2025, 4 Marks OR; WINTER 2025, 4 Marks OR)
- Q. Compare aerobic digestion and anaerobic digestion. / Compare the suitability of aerobic vs. anaerobic sludge digestion methods for large-scale plants. (SUMMER 2022, 4 Marks OR; SUMMER 2023, 4 Marks OR; WINTER 2023, 4 Marks OR; SUMMER 2026, 4 Marks OR)

4. Sludge Thickening, Conditioning and Dewatering:

- Q. Enlist methods of dewatering and explain any one in detail. / Enlist various methods of dewatering. (SUMMER 2022, 4 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 4 Marks OR)
- Q. Why sludge treatment is required? Explain sludge thickening. / Explain Thickening of waste sludge. (WINTER 2023, 3 Marks OR; SUMMER 2024, 3 Marks)

5. Sludge Disposal and Terminology:

- Q. Write down the definitions: (i) Sludge conditioning, (ii) Leachate, (iii) Bio solid and (iv) Thickening. (SUMMER 2025 P2, 4 Marks; WINTER 2025, 4 Marks; SUMMER 2026, 7 Marks OR)
- Q. Describe the methods normally used to process the sludge before its final disposal. (WINTER 2022, 7 Marks OR; WINTER 2023, 7 Marks OR; WINTER 2024, 7 Marks OR)

Other Important Questions:

1. Sludge Digestion:

- Q. Mention the type of digester and explain them with neat diagram. [Diagram required – refer to the original question paper] (SUMMER 2026 P2, 7 Marks)
- Q. Explain anaerobic sludge digestion in detail. (WINTER 2023, 4 Marks OR)

2. Sludge Thickening, Conditioning and Dewatering:

- Q. Briefly explain the principle behind the thickening of waste sludges. (SUMMER 2026, 3 Marks OR)
- Q. Why dewatering of sludge is required? (WINTER 2025, 3 Marks)
- Q. List the various filtration devices used for sludge dewatering. (SUMMER 2023, 3 Marks)
- Q. Explain chemical conditioning in brief. (SUMMER 2023, 4 Marks)
- Q. Write about Elutriation. (SUMMER 2023, 3 Marks OR)
- Q. Define decanter and explain in Details. (WINTER 2024, 3 Marks OR)

3. Sources, Characteristics and Objectives of Sludge Treatment:

- Q. Explain how to estimate the bulk density of sludge. (SUMMER 2023, 3 Marks)
- Q. Discuss the objectives of treatment of sludge. (WINTER 2022, 3 Marks OR)

- **Q.** How to estimate the SVI? **(SUMMER 2022, 3 Marks)**

4. Numerical Problems:

- **Q.** 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 $\text{Al}_2(\text{SO}_4)_3 \cdot 14\text{H}_2\text{O}$ as alum. **(SUMMER 2022, 7 Marks)**
