

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CHEMISTRY

QUESTION BANK



VII SEMESTER

1921701 - Wastewater Treatment

Regulation 2019

(Common to all branches)

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Prepared by

The Department of Chemistry



UNIT I - WATER QUALITY AND PRELIMINARY TREATMENT

Water Quality-physical-chemical and biological parameters of water-Water quality requirement - potable water standards-Wastewater effluent standards-water quality indices. Water purification systems in natural systems- physical processes-chemical processes and biological processes-Primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification-sedimentation; Types-aeration and gas transfer-coagulation and flocculation, coagulation processes.

S. No	Part-A (2 Marks)	BT Level	Competence
1.	List any two physical parameters used to assess water quality.	1	Remembering
2.	What are unit operations?	2	Understanding
3.	Design the process involved in sedimentation.	2	Understanding
4.	If a water sample has a pH of 4.5, is it suitable for drinking? Justify.	3	Applying
5.	How does turbidity differ from total suspended solids (TSS) in water?	2	Understanding
6.	Define aeration.	1	Remembering
7.	What does WQI (Water Quality Index) represent?	4	Analyzing
8.	Define coagulant.	1	Remembering
9.	Mention any two examples for coagulant.	2	Understanding
10.	What is the permissible limit of BOD in drinking water as per WHO standards?	1	Remembering
11.	Compare flocculation and sedimentation.	4	Analyzing
12.	What is the purpose of a clarifier in water treatment?	1	Remembering
13.	Why is maintenance essential for primary treatment units?	4	Analyzing
14.	List out the unit operations in primary treatment.	3	Applying
15.	Define sedimentation.	1	Remembering
16.	What is Flocculation? Give an example.	2	Understanding
17.	Illustrate the applications of water quality indices.	2	Understanding
18.	List the different types of aeration.	3	Applying



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19.	Differentiate between unit operations and unit processes in Wastewater treatment.	2	Understanding
20.	What is meant by gas transfer?	5	Evaluating
21.	Execute the term biofiltration.	4	Analyzing
22.	Describe unit processes with examples.	2	Understanding
23.	Demonstrate the role of aerobic processes in biological unit operations.	2	Understanding
24.	Differentiate aerobic processes from anaerobic processes.	4	Analyzing
25.	If water has a foul odor, which treatment process would you recommend?	3	Applying

S. No	Part-B	BT Level	Competence
1.	i. Mention the requirements of good quality of water?	2	Understanding
	ii. Discuss any four physical water quality parameters with examples.	1	Remembering
2.	Briefly describe the chemical and biological water quality parameters.	4	Analyzing
3.	Explain how turbidity, pH, and dissolved oxygen (DO) influence water quality. How are these parameters measured?	3	Applying
4.	Explain water quality indices with steps involved and with WQI data.	1	Remembering
5.	Organize the block diagram for conventional wastewater treatment and narrate the primary treatment process.	3	Applying
6.	List the primary, secondary, and tertiary treatment methods used in wastewater treatment plants.	1	Remembering
7.	Compare the coagulation and Flocculation in water treatment.	2	Understanding
8.	Demonstrate the physical and chemical unit operations with their applications.	1	Remembering
9.	Explain the principle and process of aeration and gas transfer.	4	Analyzing
10.	Explain the coagulation processes.	1	Remembering
11.	i. How are coagulation and Flocculation carried out? Give its advantages and disadvantages	4	Analyzing
	ii. Give detailed notes on mixing, clarification and	1	Remembering



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	sedimentation.		
12.	Describe the clarification process in water treatment.	2	Understanding
13.	Illustrate briefly on aeration and gas transfer.	3	Applying
14.	i. With a neat sketch, discuss the various steps involved in Biological treatment.	2	Understanding
	ii. Explain how coagulation processes are carried out.	3	Applying
15.	Define aeration and list its applications in water and wastewater treatment.	3	Applying
16.	i. Discuss the term alkalinity and explain its causes and effects.	4	Analyzing
	ii. Explain the causes and effects of acidity, the chemical water quality parameter.	3	Applying
17.	Write in detail about the term water quality indices	3	Applying

S. No	Part-C	BT Level	Competence
1.	Explain the physical, chemical and biological parameters of water and its quality.	2	Understanding
2.	Describe the key physico-chemical characteristics of sewage and critically evaluate their environmental impacts	4	Analyzing
3.	Explain the mechanisms of coagulation in water treatment, including charge neutralization, sweep coagulation, and inter-particle bridging.	5	Evaluating
4.	Write in detail on the processes of primary, secondary and tertiary treatment in water purification.	1	Remembering
5.	Demonstrate the unit operations for physical, chemical and biological processes.	3	Applying



UNIT II - INDUSTRIAL WATER TREATMENT

Filtration-size and shape characteristics of filtering media-sand filters hydraulics of filtration design considerations-radial, upflow, highrate and multimedia filters, pressure filter. Water softening-lime soda, zeolite and demineralization processes – Boiler troubles-scale, sludge, priming, foaming, caustic embrittlement and boiler corrosion.

S. No	Part-A (2 Marks)	BT Level	Competence
1.	Define filtration in water treatment.	1	Remembering
2.	Name two common materials used as filter media in sand filters.	3	Applying
3.	Analyze the zeolite process.	4	Analyzing
4.	What is the effective size range for sand used in rapid sand filters?	1	Remembering
5.	Write the chemical formula for zeolite.	1	Remembering
6.	Define scale and sludge.	1	Remembering
7.	What are the types of filtration?	2	Understanding
8.	Name two chemicals used in lime-soda softening process.	1	Remembering
9.	What is meant by sand filter?	5	Evaluating
10.	Discuss the advantages and disadvantages of the lime-soda process.	6	Creating
11.	Recognize caustic embrittlement with a suitable example	3	Applying
12.	Define water softening.	1	Remembering
13.	What is the difference between priming and foaming in boilers?	3	Applying
14.	Name two common boiler feedwater problems.	2	Understanding
15.	Compare temporary and permanent hardness of water.	4	Analyzing
16.	What is a pressure filter?	5	Evaluating
17.	Design the process involved in the ion exchange method.	6	Creating
18.	Mention any two disadvantages of the zeolite process.	2	Understanding
19.	Examine sand filter sizes.	4	Analyzing
20.	Differentiate zeolite and ion exchange processes.	2	Understanding
21.	What is the primary purpose of backwashing in filters?	2	Understanding



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22.	Execute the materials used in filtering medium.	3	Applying
23.	Organize the advantages of sand filters.	4	Analyzing
24.	Why is pH control important in boiler water treatment?	4	Analyzing
25.	Identify the disadvantages of the demineralization process.	2	Understanding

S. No	Part-B	BT Level	Competence
1.	What are sand filters? Discuss its types.	2	Understanding
2.	What is filtration? Explain the size and shape characteristics of filtering media.	4	Analyzing
3.	Criticize dual, multimedia and pressure filters.	5	Evaluating
4.	i. What is a sand filter? What are its quality requirements?	1	Remembering
	ii. Write the advantages and disadvantages of the ion exchange process.	1	Remembering
5.	Illustrate briefly the lime-soda water softening process. Discuss its advantages and disadvantages.	3	Applying
6.	Discuss Zeolites. How are they used in softening of water? Draw a diagram for explanation.	4	Analyzing
7.	i. How do we conclude high-rate filters for the removal of impurities?	3	Applying
	ii. Discuss in brief the design and operation of high rate filters.	2	Understanding
8.	Write the merits and demerits of external treatment of water.	2	Understanding
9.	Explain the process of design considerations in high-rate filters with a block diagram. Narrate its advantages and disadvantages.	4	Analyzing
10.	Compare lime-soda and zeolite processes.	4	Analyzing
11.	How do zeolite processes soften water?	4	Analyzing
	Give detailed note on the lime-soda process.	1	Remembering
12.	Draw a suitable diagram and describe the Ion exchange process for the softening of boiler water.	2	Understanding
13.	How will you regenerate the exhausted ion exchange resins and zeolites?	2	Understanding
	Write brief notes on the disadvantages of using the zeolite process.	4	Analyzing
14.	i. What is boiler-feed water? Discuss its requirements.	1	Remembering
	ii. Discuss the reasons towards the boiler corrosion.	3	Applying
15.	Organize the troubles caused for the boiler due to boiler feed water.	4	Analyzing
16.	Support the following boiler troubles with examples.	5	Evaluating
	(a) Scale and Sludge		
	(b) Priming and foaming		



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17.	Are caustic embrittlement and boiler corrosion the reason for boiler troubles? Defend your points.	5	Evaluating
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S. No	Part-C	BT Level	Competence
1.	What are zeolites? How do they function in water softening? Specify its advantages and disadvantages.	2	Understanding
2.	What parameters must we consider for filtration for the following filters; High rate multimedia filters and pressure filters?	4	Analyzing
3.	Execute the advantages and disadvantages of lime soda, zeolite and demineralization process.	5	Evaluating
4.	Describe in detail on principle and chemical reaction of the demineralization process.	1	Remembering
5.	Design the lime soda process in industrial water treatment.	5	Evaluating

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UNIT III - CONVENTIONAL TREATMENT METHODS

Taste and odour control-Adsorption-activated carbon treatment-removal of color-iron and manganese removal-aeration, oxidation, ion exchange and other methods-effects of fluorides fluoridation and defluoridation-desalination-Corrosion prevention and control-factors influencing corrosion-Langelier index-Corrosion control measures.

S. No	Part-A (2 Marks)	BT Level	Competence
1.	What is the conventional treatment method?	2	Understanding
2.	What are the two forms of activated carbon used in water treatment?	2	Understanding
3.	Explain how activated carbon helps in removing taste and odour from water.	4	Analyzing
4.	Define the term adsorption.	1	Remembering
5.	Analyze the constituents that are commonly affected by aeration.	4	Analyzing
6.	Distinguish physical adsorption and chemical adsorption.	2	Understanding
7.	Investigate what activated carbon can absorb.	6	Creating
8.	What are the permissible limits of iron and manganese in drinking water as per WHO standards?	4	Analyzing
9.	Illustrate the term electro dialysis.	3	Applying
10.	Classify the types of aeration.	3	Applying
11.	Name the commonly used chemical oxidants in water treatment.	1	Remembering
12.	Assess the level of fluoride used in industrial waste supply.	5	Evaluating
13.	Summarize the few effects of fluorides.	2	Understanding
14.	Defend water fluoridation.	4	Analyzing
15.	What is de-fluoridation?	2	Understanding
16.	Describe the characteristics of de-fluoridation process.	1	Remembering
17.	Interpret few corrosion control techniques in industrial effluents.	2	Understanding



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18.	What is Langelier index?	2	Understanding
19.	How is LIS calculated?	3	Applying
20.	Examine the term Langelier index in wastewater.	4	Analyzing
21.	Show the causes for taste and odor in water.	3	Applying
22.	Categorize the prevention measures for taste and odor control.	4	Analyzing
23.	Define the term physisorption with example.	1	Remembering
24.	List out some of the applications of activated carbon.	2	Understanding
25.	Explain why excess fluoride in water is harmful.	1	Remembering

S. No	Part-B	BT Level	Competence
1.	i. Discuss the principle of adsorption.	2	Understanding
	ii. Examine the measures for the taste and odour control.	4	Analyzing
2.	i. Distinguish physisorption from chemisorption.	3	Applying
	ii. Classify the applications of activated carbon.	2	Understanding
3.	Explain the mechanisms by which activated carbon removes taste and odour compounds.	4	Analyzing
4.	i. Analyze the aeration technique for wastewater treatment.	4	Analyzing
	ii. Compile the aeration and oxidation process for the removal of iron and manganese from wastewater treatment.	3	Applying
5.	Construct a suitable diagram and criticize the ion exchange method for the removal of iron and manganese from wastewater.	6	Creating
6.	Discuss a treatment method employed for the removal of iron and manganese from wastewater.	2	Understanding
7.	What do you mean by de-fluoridation? Investigate conventional methods for the removal of de-fluoridation.	5	Evaluating



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8.	i. Inspect the effects of fluorides.	4	Analyzing
	ii. What is desalination? Describe the Reverse Osmosis method for the desalination of wastewater with a suitable diagram	1	Remembering
9.	Illustrate in detail the Nalgonda technique with a suitable block diagram.	4	Analyzing
10.	Outline the various factors influencing corrosion.	1	Remembering
11.	How will you prevent corrosion by changing the nature of metal and environment.	3	Applying
12.	Summarize the corrosion control method by modifying the design and metal.	2	Understanding
13.	Describe corrosion control techniques. (a) Sacrificial anodic protection (b) Impressed current cathodic protection (c) Organic lining	1	Remembering
	Explain Langelier saturation index (SI) with suitable procedure	2	Understanding
14.	Execute the manganese zeolite process for the removal of iron and manganese in the wastewater.	3	Applying
15.	Inspect the advantages and disadvantages of Nalgonda technique.	4	Analyzing
16.	Differentiate de-fluoridation with fluoridation.	3	Applying
17.	Analyze the electrodialysis process for water desalination, discussing its working principle, advantages over other desalination methods, and key applications in water treatment.	4	Analyzing



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S. No	Part-C	BT Level	Competence
1.	Formulate the aeration, filtration and oxidation process of wastewater treatment.	6	Creating
2.	Propose a detailed plan to implement the Nalgonda technique for defluoridation of fluoride-contaminated wastewater. Discuss its chemical principles, operational steps, advantages, and limitations.	3	Applying
3.	Define the term desalination and mention its types. Explain the method of desalination in detail.	2	Understanding
4.	Compose the corrosion control process of refinery wastewater effluent used in the industry.	6	Creating
5.	Critically evaluate the treatment processes for iron and manganese removal from groundwater, covering chemical principles and operational mechanisms.	5	Evaluating

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UNIT IV - WASTEWATER TREATMENT

Wastewater treatment-pre and primary treatment-equalization neutralization-screening and grid removal-sedimentation-oil separation gas stripping of volatile organics-biological oxidation lagoons and stabilization basins-aerated lagoons-activated sludge process-trickling filtration anaerobic decomposition-Break point chlorination.

S. No	Part-A (2 Marks)	BT Level	Competence
1.	Define wastewater treatment.	1	Remembering
2.	Name two devices used for screening in wastewater treatment.	3	Applying
3.	Why is grit removal essential before primary sedimentation?	2	Understanding
4.	Illustrate the various processes of primary treatment.	4	Analyzing
5.	Compare preliminary and primary treatment.	3	Applying
6.	Define the purpose of equalization tanks in wastewater treatment.	1	Remembering
7.	How does neutralization adjust wastewater pH for biological treatment?	2	Understanding
8.	Compare and contrast the difference between equalization and neutralization.	4	Analyzing
9.	Execute the term sedimentation.	5	Evaluating
10.	List two methods for oil removal in wastewater.	1	Remembering
11.	Explain how gas stripping reduces volatile organic compounds (VOCs).	2	Understanding
12.	Why are aerated lagoons more efficient than natural oxidation ponds?	5	Evaluating
13.	Write down the process involved in sedimentation.	6	Creating
14.	Explain the term aerated lagoons.	2	Understanding
15.	Define biological oxidation.	1	Remembering
16.	Explain the role activated sludge process.	2	Understanding
17.	What are the key factors which influence the activated sludge process?	3	Applying



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18.	Examine the trickling filter medium.	4	Analyzing
19.	Explain the terms SVI and F/M ratio.	5	Evaluating
20.	Differentiate MLSS and MLVSS.	3	Applying
21.	Examine the term equalization.	3	Applying
22.	Defend neutralization.	4	Analyzing
23.	Demonstrate the purpose of neutralization.	3	Applying
24.	Identify two byproducts of anaerobic digestion.	2	Understanding
25.	Why is ammonia removal critical before breakpoint chlorination?	4	Analyzing

S. No	Part-B	BT Level	Competence
1.	Define waste water treatment. List out the preliminary and primary treatment methods.	1	Remembering
2.	Describe the role of neutralization in protecting biological treatment processes from pH shocks.	2	Understanding
3.	Discuss the term equalization. What are the applications of equalization in industrial wastewater treatment?	1	Remembering
4.	Summarize neutralization with its purpose and methods with suitable block diagram.	2	Understanding
5.	Explain how screening and grit removal contribute to the efficiency of subsequent treatment processes.	4	Analyzing
6.	What is meant by sedimentation tank? Explain its types with a neat sketch.	1	Remembering
7.	Contrast the gas stripping of volatile organics with a neat diagram.	2	Understanding
8.	How does the oil separator work in the water treatment process? Explain different types of oil separators.	3	Applying
9.	Illustrate waste stabilization ponds and their classification and working principle.	3	Applying
10.	Describe briefly about the biological oxidation with types of lagoons.	2	Understand



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11.	Demonstrate the types, methods and processes of aerated lagoons.	3	Applying
12.	Define aerated lagoons and their role in wastewater treatment.	3	Applying
13.	Summarize in detail with neat sketches about the trickling filters and state the various advantages and disadvantages of conventional trickling filters.	4	Analyzing
14.	Describe the various types of processes involved in anaerobic decomposition with a flow chart.	4	Analyzing
15.	List the operational parameters monitored in activated sludge plants.	5	Evaluating
16.	Implement the process, progress and influencing factors of the activated sludge process with a neat block diagram.	3	Applying
17.	i. Discuss the advantages and disadvantages of the activated sludge process.	2	Understanding
	ii. Defend the advantages and disadvantages of trickling filter method.	2	Understanding

S. No	Part-C	BT Level	Competence
1.	Execute and draw the process of screening and sedimentation with their advantages and disadvantages.	4	Analyzing
2.	Examine and illustrate the components and the operational principles of activated sludge process with neat sketch. Write its advantages and disadvantages.	3	Applying
3.	Describe aerated lagoons and narrate their types, methods, process, advantages and disadvantages with neat diagram.	4	Analyzing
4.	Evaluate the need, principle, advantages, disadvantages and applications of trickling filter method	3	Applying
5.	Explain the process of anaerobic decomposition in wastewater treatment, detailing the stepwise conversion of organic matter into biogas.	3	Applying



UNIT V - ADSORPTION AND OXIDATION PROCESS

Chemical process-Adsorption-theory of adsorption-Ion exchange process-chemical oxidation-advanced oxidation process-sludge handling and disposal-Miscellaneous treatment processes.

S. No	Part-A (2 Marks)	BT Level	Competence
1.	Why is activated carbon commonly used as an adsorbent?	3	Applying
2.	Define adsorption in wastewater treatment.	1	Remembering
3.	Classify the various types of adsorption.	2	Understanding
4.	Enumerate the factors which affect adsorption.	5	Evaluating
5.	Distinguish physisorption and chemisorption	4	Analyzing
6.	List the advantages and disadvantages of UV-based AOPs.	1	Remembering
7.	Explain the advantages and disadvantages of aeration.	5	Evaluating
8.	State the principle of demineralization by ion exchange.	6	Creating
9.	Differentiate demineralization and desalination.	3	Applying
10.	Write about ozone-based AOPs.	3	Applying
11.	Implement the purpose of hydroxyl radical in an advanced oxidation process.	2	Understanding
12.	Construct the steps involved in the ion exchange process.	6	Creating
13.	Define chemical oxidation.	1	Remembering
14.	List two common chemical oxidants used in wastewater treatment.	2	Understanding
15.	Illustrate the oxidation process.	1	Remembering
16.	Compare the terms oxidation and reduction.	4	Analyzing
17.	Demonstrate the disadvantages of ozone-based AOPs.	5	Evaluating
18.	Organize some of the sludge processing/disposal methods.	3	Applying
19.	Identify the advantages of ozone-based AOPs.	2	Understanding
20.	Distinguish between oxidizing agent and reducing agent.	4	Analyzing
21.	What are the common methods used in chemical processes for wastewater treatment	1	Remembering
22.	Justify the role of chemical precipitation in the chemical processes.	4	Analyzing
23.	Name the chemicals which are used in chemical oxidation	2	Understanding



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	processes.		
24.	How does the Fenton's reagent process work in AOP?	3	Applying
25.	Examine the advanced oxidation process.	4	Analyzing

S. No	Part-B	BTL	Competence
1.	Explain the chemical processes involved in wastewater treatment.	5	Remembering
2.	Examine the principle of adsorption with the flowchart and how adsorption is calculated. Explain.	3	Applying
3.	Illustrate the various types of adsorption and write down the applications of adsorption technologies.	3	Applying
4.	What is chemical precipitation? Appraise that with the following: (a) Alum (b) lime (c) ferrous sulphate	5	Evaluating
5.	Discuss the Ion exchange method of water softening with a sketch.	2	Understanding
6.	What is meant by softening? Explain the different methods of Water Softening.	4	Analyzing
7.	Discuss in detail the methods of demineralization.	2	Understanding
8.	Explain briefly about the methodology involved in chemical advanced oxidation processes.	5	Evaluating
9.	Write in detail about the technologies used to produce Hydroxyl radicals.	1	Remembering
10.	Distinguish various methods of sludge disposal adopted for the treatment of wastewater.	4	Analyzing
11.	Define sludge thickening. Explain the methods used for the sludge thickening process. Also, discuss the recent advances in sludge treatment.	1	Remembering
12.	Enumerate and explain the various stages of sludge digestion, and discuss the factors which affect the same.	4	Analyzing
13.	Describe in detail the sludge handling process.	2	Understanding
14.	Explain in detail about sludge conditioning and dewatering with a neat sketch.	6	Creating
15.	Illustrate the chemical oxidation process by ozonation and	3	Applying



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	chlorination.		
16.	Execute the advanced oxidation process via ozone-based AOPs with its advantages and disadvantages	4	Analyzing
17.	Develop Fenton's related AOPs for the advanced oxidation process.	6	Creating
S. No	Part-C	BTL	Competence
1.	Describe the chemical processes with their applications.	1	Remembering
2.	Explain the various ion exchange processes involved in the treatment of wastewater and mention their applications.	2	Understanding
3.	Experiment with the Ozone based, UV-based and Fenton's related AOPs with suitable equations.	4	Analyzing
4.	Is aeration part of miscellaneous treatment processes? Justify.	5	Evaluating
5.	Analyze sludge handling and disposal with a suitable block diagram	5	Evaluating

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