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

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.	What is potable water?	1	Remembering
2.	What are unit operations?	2	Understanding
3.	Design the process involved in sedimentation.	6	Creating
4.	List out the unit operations used in the treatment.	3	Applying
5.	Define detention time.	1	Remembering
6.	Define aeration.	1	Remembering
7.	Examine water quality indices.	4	Analyzing
8.	Define coagulant.	1	Remembering
9.	Mention any two examples for coagulant.	2	Understanding
10.	Mention any two requirements of portable water.	1	Remembering
11.	Compare coagulation and Flocculation.	4	Analyzing
12.	Distinguish coagulation and sedimentation.	2	Understanding
13.	Why is maintenance important 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 example.	5	Evaluating
17.	Illustrate the applications of water quality indices.	6	Creating
18.	List the different types of aeration?	3	Applying
19.	Differentiate between unit operations and unit processes in Waste water treatment.	2	Understanding
20.	What is meant by gas transfer?	5	Evaluating

21.	Execute the term biofiltration.	3	Applying
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.	Report the role of mixing in wastewater treatment.	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.	Criticize how water purification in natural systems.	5	Evaluating
4.	Explain water quality indices with steps involved and with WQI data.	1	Remembering
5.	Organize the block diagram for conventional waste water treatment and narrate the primary treatment process.	3	Applying
6.	Implement the flow diagram for conventional waste water treatment and explain the secondary and tertiary treatment process.	4	Analyzing
7.	Compare the coagulation and flocculation in water treatment.	2	Understanding
8.	Demonstrate the physical and chemical unit operations with its 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 is coagulation and flocculation carried out? Give its advantages and disadvantages	4	Analyzing

	ii. Give detailed note on mixing, clarification and sedimentation.	1	Remembering
12.	Describe clarification process in water treatment.	2	Understanding
13.	Illustrate briefly on aeration and gas transfer.	3	Applying
14.	i. With a neat sketch of various steps involved in Biological treatment.	2	Understanding
	ii. Explain how coagulation processes carried out?	3	Applying
15.	Compare waste water effluent and potable water standards.	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.	Explain the various physio-chemical characteristics of sewage and state their environmental significance.	4	Analyzing
3.	Outline the various stages on water purification in natural systems.	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.	What is the principle of filtration?	1	Remembering
2.	List out any two examples of ion exchange resins.	3	Applying
3.	Analyze zeolite process.	4	Analyzing
4.	Mention any two advantages of ion exchange method.	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.	Explain boiler corrosion with suitable example.	1	Remembering
9.	What is meant by sand filter?	5	Evaluating
10.	Discuss the advantages and disadvantages of lime-soda process.	6	Creating
11.	Recognize caustic embrittlement with suitable example	3	Applying
12.	Define water softening.	1	Remembering
13.	Compare priming and foaming.	3	Applying
14.	How is boiler water treated?	2	Understanding
15.	How is the regeneration process achieved in ion exchange method?	4	Analyzing
16.	What is pressure filter?	5	Evaluating
17.	Design the process involved in ion exchange method.	6	Creating
18.	Mention any two disadvantages of zeolite process.	2	Understanding
19.	Examine sand filter sizes.	4	Analyzing
20.	Differentiate zeolite and ion exchange processes.	2	Understanding
21.	Describe the term filtration.	2	Understanding
22.	Execute the materials used in filtering medium.	3	Applying

23.	Organize the advantages of sand filter.	4	Analyzing
24.	Examine the advantages and disadvantages of high rate filters.	4	Analyzing
25.	Identify the disadvantages of 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 sand filter? What are its quality requirements?	1	Remembering
	ii. Write advantages and disadvantages of ion exchange process.	1	Remembering
5.	Illustrate briefly on 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 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 block diagram? Narrate its advantages and disadvantages.	4	Analyzing
10.	Compare lime-soda and zeolite process.	4	Analyzing
11.	How is water softened by zeolite processes?	4	Analyzing
	Give detailed note on 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 zeolite process.	4	Analyzing
14.	i. What is boiler feed water? Discuss its requirements.	1	Remembering
	ii. Compare scale and sludge with suitable examples.	3	Applying
15.	Organize the troubles caused for boiler due to boiler feed water.	4	Analyzing
16.	Support the following boiler troubles with examples. (a) Scale and Sludge (b) Priming and foaming	5	Evaluating
17.	Is caustic embrittlement and boiler corrosion are the reason for boiler troubles? Defend with your points.	5	Evaluating

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 we need to 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, chemical reaction of the demineralization process.	1	Remembering
5.	Argue that the lime soda process and zeolite process plays a major role in industrial water treatment.	5	Evaluating

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 fluoridation-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 conventional treatment method?	2	Understanding
2.	How will you purify the coloured water?	2	Understanding
3.	Why do you get the rid of the smell of wastewater?	4	Analyzing
4.	Define adsorption.	1	Remembering
5.	Examine adsorption in wastewater treatment.	4	Analyzing
6.	Distinguish physical adsorption and chemical adsorption?	2	Understanding
7.	Investigate What can activated carbon absorb?	6	Creating
8.	Analyze how to minimize the problem due to iron and manganese in distribution mains.	4	Analyzing
9.	List out the constituents that are commonly affected by aeration?	3	Applying
10.	Mention the types of aerator.	3	Applying
11.	Name the commonly used chemical oxidants in water treatment.	1	Remembering
12.	State the level of fluoride used in industrial waste supply.	5	Evaluating
13.	Give any four 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.	Summarize few corrosion control techniques in industrial effluents.	2	Understanding
18.	What is Langelier index?	2	Understanding
19.	How is LIS calculated?	3	Applying
20.	Outline the term Langelier index in wastewater.	4	Analyzing

21.	Select the causes for taste and odor in water.	3	Applying
22.	Appraise the prevention measures for taste and odor control.	4	Analyzing
23.	Describe the term physisorption with example.	1	Remembering
24.	Identify some of the applications of activated carbon	2	Understanding
25.	Define fluorosis.	1	Remembering

S. No	Part-B	BT Level	Competence
1.	i. Briefly describe the principle of adsorption.	2	Understanding
	ii. Outline the measures for the taste and odor control.	4	Analyzing
2.	i. Differentiate physisoprtion from chemisorption.	3	Applying
	ii. Discuss the application of activated carbon.	2	Understanding
3.	Defend the wastewater treatment process with activated carbon.	5	Evaluating
4.	i. Why is aeration technique important for wastewater treatment?	4	Analyzing
	ii. Explain the aeration and oxidation process for the removal of iron and manganese from wastewater treatment.	3	Applying
5.	Draw a suitable diagram and describe the ion exchange method for the removal of iron and manganese from wastewater.	4	Analyzing
6.	Explain anyone treatment employed for the removal of iron and manganese from wastewater.	2	Understanding
7.	What do you mean by de-fluoridation? Defend conventional method for the removal of de-fluoridation.	5	Evaluating
8.	i. Examine the effects of fluorides.	4	Analyzing
	ii. What is desalination? With a neat diagram describe the Reverse Osmosis method for the desalination of wastewater.	1	Remembering
9.	Construct Nalgonda technique with suitable block diagram.	6	Creating
10.	Discuss the various corrosion prevention measures besides	1	Remembering

	nature of the metal		
11.	How will you prevent corrosion by changing the nature of environment	3	Applying
12.	Elaborate the process for corrosion control by modifying the design and metal.	2	Understanding
13.	Describe corrosion control techniques. (a) sacrificial anodic protection (b) organic lining	1	Remembering
14.	Organize Langelier saturation index (SI) with suitable procedure	2	Understanding
15.	Bring out the manganese zeolite process carried out for the removal of iron and manganese in the wastewater treatment.	3	Applying
16.	i. Organize the advantages and disadvantages of Nalgonda technique.	4	Analyzing
	ii. Compare de-fluoridation with fluoridation.	3	Applying
17.	Defend electrodialysis process with its advantages and applications.	5	Evaluating

S. No	Part-C	BT Level	Competence
1.	Compile the various treatments like aeration, filtration and oxidation process of wastewater treatment.	6	Creating
2.	Describe the mechanism of Nalgonda techniques in the absence of alternate low fluoride source for drinking water.	3	Applying
3.	Define the term desalination. Name the different methods of desalination. Explain any one in detail.	2	Understanding
4.	Investigate the corrosion control process of refinery wastewater effluent used in the industry.	6	Creating
5.	Judge whether aeration and oxidation or manganese zeolite process is better for the removal of iron and manganese from water.	5	Evaluating

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.	Differentiate unit operations and unit processes in wastewater treatment.	3	Applying
3.	Enumerate the steps accomplished for waste water treatment.	2	Understanding
4.	Illustrate the various processes of primary treatment.	4	Analyzing
5.	Compare preliminary and primary treatment.	3	Applying
6.	State few purposes of equalization in industrial wastewater treatment.	1	Remembering
7.	Generalize the methods used for mixing in equalization process.	6	Creating
8.	Compare and contrast the difference between equalization and neutralization.	4	Analyzing
9.	Execute the term sedimentation.	5	Evaluating
10.	Examine the purpose of sedimentation.	1	Remembering
11.	Report the factors which influencing the sedimentation.	6	Creating
12.	Evaluate the design criteria for screen chamber.	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 influences the activated sludge process?	3	Applying
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.	Describe lagoons and its impact with wastewater.	2	Understanding
25.	Select the types of bacteria works in most lagoon system.	5	Evaluating

S. No	Part-B	BT Level	Competence
1.	Define waste water treatment. List out the preliminary and primary treatment methods.	1	Remembering
2.	Explain the types of processes involved in the neutralization. Also give its control measures.	1	Remembering
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.	Write the design criteria (types) for screening and brief its objectives and purpose. Draw block diagram for grit removal in screening process.	5	Evaluating
6.	What is meant by sedimentation tank? Explain its types with neat sketch.	1	Remembering
7.	Contrast the gas stripping of volatile organics with neat diagram.	2	Understanding
8.	How does the oil separator works in water treatment process? Explain different types of oil separators.	3	Applying
9.	Illustrate waste stabilization ponds and its classification and working principle.	3	Applying
10.	Describe briefly about the biological oxidation with types of lagoons.	2	Understand

11.	Demonstrate the types, methods and process of aerated lagoons.	3	Applying
12.	Organize the advantages and disadvantages of aerated lagoons.	6	Creating
13.	Summarize in detail with neat sketches about the trickling filters and state the various advantages and disadvantages of conventional trickling filter.	4	Analyzing
14.	Describe the various types of process involved in anaerobic decomposition with flow chart.	4	Analyzing
15.	Execute the pros and cons of stabilization basin with neat diagram.	5	Evaluating
16.	Implement the process, progress and influencing factors of activated sludge process with neat block diagram.	3	Applying
17.	i. Discuss the advantages and disadvantages of 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.	1	Remembering
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.	Appraise the need, principle, advantages, disadvantages and applications of trickling filter method	5	Evaluating
5.	Demonstrate anaerobic decomposition and narrate how the organic matter in the waste and wastewaters is transformed to 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.	Appraise any three advanced oxidation process	3	Applying
2.	Define adsorption.	1	Remembering
3.	Classify the various types of adsorption.	2	Understanding
4.	Enumerate the factors which affecting adsorption.	5	Evaluating
5.	Distinguish physisorption and chemisorption	4	Analyzing
6.	List out 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 advanced oxidation process.	2	Understanding
12.	Construct the steps involved in ion exchange process.	6	Creating
13.	Define chemical oxidation.	1	Remembering
14.	Mention the techniques involved in chemical oxidation process.	2	Understanding
15.	Define 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 process for wastewater treatment	1	Remembering
22.	Justify the role of chemical precipitation in chemical	4	Analyzing

	processes.		
23.	Name the chemicals which are used in chemical oxidation processes.	2	Understanding
24.	Execute the term chemical disinfection. Give example.	3	Applying
25.	Examine advanced oxidation process.	4	Analyzing

S. No	Part-B	BTL	Competence
1.	What are the chemical processes involved in waste water treatment? Explain briefly.	1	Remembering
2.	Examine the principle of adsorption with 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 about 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 about the methods of demineralization.	2	Understanding
8.	Explain briefly about the 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 sludge thickening process. Also discuss about the recent advances in sludge treatment.	1	Remembering
12.	Enumerate and explain the various stages of sludge	4	Analyzing

	digestion, also the factors which affecting the same.		
13.	Describe in detail about the sludge handling process.	2	Understanding
14.	Explain in detail about sludge conditioning and dewatering with a neat sketch.	6	Creating
15.	Organize chemical oxidation process by ozonation and chlorination.	3	Applying
16.	Execute the advanced oxidation process via ozone based AOPs with its advantages and disadvantages	4	Analyzing
17.	Develop Fenton's related AOPs for advanced oxidation process.	6	Creating

S. No	Part-C	BTL	Competence
1.	Describe the chemical processes with its applications.	1	Remembering
2.	Explain the various ion exchange processes involved in the treatment of wastewater and mention its applications on it.	2	Understanding
3.	Experiment 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.	Defend sludge handling and disposal with suitable block diagram	5	Evaluating