P. P. SAVANI UNIVERSITY

Fifth Semester of B.Sc. Examination
December-2021
SSES3010–Advanced Wastewater Treatment Technologies I
07.12.2021, Tuesday Time: 12:30 p.m. to 03:00p.m. Maximum Marks: 60

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

Section-I (Total Marks - 30)

Q.1 Short Questions **[10]**

1.1 Objectives **[05]**

1.1a Nitrification is performed by a small group of_____

- **A** Autotrophic bacteria
- **B** Eutrophic bacteria
- **C** Fungi
- **D** Viruses

1.1b Which compound affect the effluent turbidity?

- **A** Colloidal particles
- **B** VOC
- **C** Refractory compounds
- **D** Nitrate

1.1c In denitrification, _____ serves as the electron acceptor in energy metabolism.

- **A** Nitrate
- **B** Ammonium
- **C** Nitrogen
- **D** Ammonia

1.1d What is the phosphorus available for a biological process called?

- **A** Phosphate
- **B** Orthophosphate
- **C** Polyphosphate
- **D** Biophosphorus

1.1e _____ undergo hydrolysis and revert to the orthophosphate forms.

- **A** Orthophosphate
- **B** Phosphate
- **C** Polyphosphate
- **D** Bio phosphorus

1.1f What does PAO stand for?

- **A** Poly-ammonium oxygenate
- **B** Poly-ammonium organisms
- **C** Polyphosphate-accumulating organisms
- **D** Phosphate-ammonium organisms

1.1g Which compound are carcinogens?

- **A** Colloidal particles
- **B** VOC
- **C** TSS
- **D** Nitrate

1.1h Which compound is responsible for methemoglobinemia?

- **A** Colloidal particles
- **B** VOC
- **C** TSS
- **D** Nitrate

1.1i Which of the following autotrophic bacteria used for nitrification process?

- **A** Nitrosomonas
- **B** Nitrobactor
- **C** Nitrococcus
- **D** All of above

1.1j What is the amount of phosphorous present in municipal wastewater?

- **A** 1-2mg/L
- **B** 2-8 mg/L
- **C** 4-10 mg/L
- **D** 5-20 mg/L

1.2 Answer the Following (Fill in the blanks/Definition/True or False) **[05]**

1.2a Presence of high TDS may cause disease.

a) True

b) False

1.2b Define Denitrification.

1.2c Define Post anoxic and pre anoxic denitrification.

1.2d Enlist the name of Nitrification bacteria at least two.

1.2e Define Advanced wastewater Treatment.

Q.2 Short Notes (Attempt any two) **[06]**

A Highlight the need of advanced wastewater treatment technologies in environmental field.

B Write a short note on Nitrification along with chemical reaction and its microbiology.

C Write a short note on Phosphorous removal with Direct precipitation.

Q.3 Explain in detail (Attempt any two) **[14]**

A Enlist and explain biological method of phosphorous removal.

B Explain process description of Nitrification.

C Explain biological denitrification with chemical reaction and write microorganisms involved in the process.

Section-II (Total Marks - 30)

Q.1 Short Questions [10]

1.1 Objectives [05]

1.1a ___ contains retained constituents.

- **A** Feed
- **B** Concentrate
- **C** Permeate
- **D** Product

1.1b Damage to membranes occur due to presence of ____

- **A** Acid
- **B** Colloids
- **C** Calcium Sulfate
- **D** Metal oxides

1.1c Typical operating range of RO is ____ micron-meter.

- **A** 0.08-2.0
- **B** 0.0001-0.001
- **C** 0.005-0.2
- **D** 0.001-0.01

1.1d Which of the following impurity is not removed by Nanofiltration?

- **A** TSS
- **B** Bacteria
- **C** Hardness
- **D** Protozoan cysts

1.1e In _____, membrane is cast on the inside of a support tube.

- **A** Hollow fiber membrane module
- **B** Tubular modules
- **C** Plate and frame modules
- **D** Pressure vessel

1.1f Acrylonitrile material could be used for ____ membrane technology.

- **A** MF
- **B** UF
- **C** NF
- **D** RO

1.1g Size of Macropores is ____ nm.

- **A** <1
- **B** 1-25
- **C** >25
- **D** <0.01

1.1h ___ Adsorbent is widely used in the wastewater treatment.

- **A** Synthetic polymer
- **B** Alum
- **C** Activated carbon
- **D** Silica

1.1i Char is activated at ___ °C range in presence of oxidizing gases for production of activated carbon.

A 700-800
B 800-900
C 600-700
D 500-600

1.1j In adsorption, ____ involves movement of organic material to be adsorbed through the bulk liquid to the boundary layer of fixed film of liquid surrounding the adsorbent.

A Bulk solution transport
B Film diffusion transport
C Pore transport
D Adsorption

1.2 Answer the Following **[05]**

1.2a Brine water has TDS greater than ___ mg/L.

1.2b ____ process works on separation mechanism of ion exchange with selective membrane.

1.2c Define adsorption.

1.2d What is x/m in Adsorption isotherms?

1.2e Write down the formula of Langmuir isotherm.

Q.2 Short Notes (Attempt any two) **[06]**

A Write a note on Hollow fiber and Spiral Wound Membrane configuration.

B Explain Freundlich isotherm.

C Explain adsorption treatment using fixed bed.

Q.3 Explain in detail (Attempt any two) **[14]**

A Write a note on Membrane Fouling.

B Write a note on Electrodialysis along with its advantages and disadvantages.

C Determine the coefficients for the following GAC adsorption test data. The liquid volume used in the batch adsorption tests was 3.5 L. The initial concentration of the adsorbate in solution was 7.67 mg/L. Equilibrium obtained after 7 days as below table:

Sr. No.	M	C_e
1	0.001	7.67
2	0.004	6.24
3	0.05	5.45
4	0.09	3.5
5	0.1	2.48
6	0.22	1.2