

P. P. SAVANI UNIVERSITY

Fifth Semester of B.Sc. Examination
December-2021

SSES3030-Advanced Wastewater Treatment Technologies II

08.12.2021, Wednesday 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 Water softening process is an example of ____ advanced treatment technology.

- A MBR
- B AOP
- C Electrochemical oxidation processes
- D Ion Exchange process

1.1b In MBR, low concentration of ____ is maintained in backflush water to inactivate and remove microbes.

- A Ozone
- B Chlorine
- C UV
- D Hypochlorite

1.1c What is the unit of F/M ratio?

- A g COD/ g MLVSS. d
- B g COD/ g MLSS. d
- C g COD/ g MLVSS. hr.
- D g COD/ g MLSS. hr

1.1d MBR removes particles with nominal size range ____ micron-meter

- A 0.1-0.2
- B 0.05-0.1
- C 0.1-0.4
- D 0.4-0.8

1.1e MBR can also be operated at ____ Volumetric loading rate and ____ HRT

- A Shorter, Shorter
- B Higher, Higher
- C Higher, Shorter
- D Shorter, Higher

1.1f MBR is two in one process, combination of ____ & ____

- A Secondary Clarifier, Filtration
- B Coagulation, Flocculation
- C Primary Clarifier, RO
- D Activated sludge process, Disinfection

- 1.1g Which of the following is an example of strong acid cation?
A R-OH
B R-COOH
C R-SO₃H
D R-NH₃OH
- 1.1h Which of the following is an example of weak base anion?
A R-NH₃OH
B R-SO₃H
C R-COOH
D R-OH
- 1.1i Which of the following is not the application of Ion exchange process?
A Removal of TDS
B Removal of TSS
C Removal of Nitrogen
D Removal of heavy metals
- 1.1j _____ is used as a regenerator of Anion Exchange Bed in Ion exchange bed.
A Dil. HCL
B Dil. NaCl
C Dil. NaOH
D Dil. H₂SO₄

1.2 Answer the Following

- 1.2a Full form of HRT. [05]
1.2b Name any one natural ion exchange resin.
1.2c Full form of MBR.
1.2d Define Ion Exchange.
1.2e Capital cost of MBR is very less. True or False

Q.2 Short Notes (Attempt any two)

- A Write a note on Integrated MBR with immersed membrane. [06]
B Mention the advantages and Disadvantages of MBR.
C Write a note on Typical Ion exchange reactions involved.

Q.3 Explain in detail (Attempt any two)

- A Explain membrane fouling control. [14]
B Write a note on Ion exchange process.
C Write a note on application of Ion exchange in Nitrogen removal.

Section-II (Total Marks - 30)

Q.1 Short Questions

[10]

1.1 Objectives

[05]

1.1a _____ is produced by during the photolysis of ozone in water in O₃/UV technology.

- A H₂O₂
- B OH Radical
- C Pure oxygen
- D Excited oxygen atom

1.1b At what wavelength (nm) AOP technology Ozone+UV is carried out?

- A <310
- B <410
- C <280
- D <480

1.1c Which of the following is not an example if oxidizing agent for AOP?

- A Fluorine
- B Ozone
- C Chlorine
- D Nitrate

1.1d What is the process used in AOP?

- A Oxidation
- B Reduction
- C Substitution
- D Chlorination

1.1e The cost of AOP is high because of _____

- A High pumping cost
- B Continuous input of energy
- C Expensive chemical reagents
- D UV radiations

1.1f Which among the following is sacrificial due to oxidation?

- A Anode
- B Cathode
- C Both
- D None

1.1g The conductive metal plates are placed in ____ in EC process.

- A Parallel
- B Series
- C Both
- D None

1.1h Which gas bubbles are generated in EC process?

- A H₂
- B O₂
- C N₂
- D He

1.1i What is the minimum number of electrodes required for the electro-coagulation process?

- A 1
- B 2
- C 3
- D 4

1.1j Electro-coagulation process cannot remove.

- A Suspended solids
- B Bacteria
- C Color
- D Heavy metals

1.2 Answer the Following

1.2a In an electro-coagulation process electrodes are connected externally to a _____ Power source. [05]

1.2b In electro-coagulation process an oxidation occurs on an anode electrode. (True or False)

1.2c What is direct Oxidation?

1.2d In Advanced Oxidation Process wastewater compounds are _____ rather than transferred.

1.2e Production of hydroxyl radicals increases the efficiency of Advanced Oxidation Process. (True or False)

Q.2 Short Notes (Attempt any two)

A What is Advanced Oxidation Process? How it differs than the other treatments processes? [06]

B Enlist the factors affecting the efficiency of electro-coagulation process and explain any three.

C Write down advantages and disadvantages of electro-coagulation process.

Q.3 Explain in detail (Attempt any two)

A Explain electro-coagulation process with figure. [14]

B Enlist the ozone-based processes and explain anyone in detail with figure.

C Explain the Fenton's process with figure.