



M.E DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

First Semester

ENVIRONMENTAL ENGINEERING

P18EET1002: Physio-Chemical Process for Water and Wastewater Treatment

COURSE OUTCOMES

- CO1:** Implement the working principles and mechanisms of various Unit operation/Processes reactors.
- CO2:** Design the various water/wastewater Unit operation/treatment processes.
- CO3:** Apply the suitable advanced wastewater treatment processes in conjunction with the unit operation/processes.
- CO4:** Design and select an appropriate biological treatment process based on the kinetics study and organic loading.
- CO5:** Design of low cost and natural water treatment systems.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. **Assertion :** The BOD test is conducted for 5days at 20 degree CO1 [K₂]
Reason: The amount of oxygen utilized by microorganisms
 - a) Both A and R are Individually true, and R is the correct explanation of A
 - b) Both A and R are individually true, and R is the not correct explanation of A
 - c) A is true but R is false
 - d) A is false but R is true
2. Balancing the excess acidity or alkalinity in waste water CO2 [K₂]
 - a) Neutralization
 - b) Equivalization
 - c) Electrodialysis
 - d) Reverse Osmosis
3. The gas coming out from a sludge digestion tank is CO3 [K₁]
 - a) Methane
 - b) Carbon dioxide
 - c) 70% methane and 30% carbon dioxide
 - d) 30% methane and 70% carbon dioxide
4. Matching type item with multiple-choice code CO2 [K₂]

List I	List II
A. Comminution	i. Blending chemicals with wastewater
B. Mixing	ii. Temporary storage to equalize flowrates
C. Flow Equalization	iii. Grinding of coarse solids to reduce the size
D. Flotation	iv. Removal of finely divided suspended solids

	A	B	C	D
a)	i	iii	ii	iv
b)	iii	i	iv	ii
c)	iii	i	ii	iv
d)	i	iii	iv	ii

5. **Assertion :** The BOD gets removed at very fast rate immediately after sewage is discharged into a river CO4 [K₂]

Reason: The part of BOD in the sewage is due to settleable organic matter

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| a) Both A and R are Individually true, and R is the correct explanation of A | b) Both A and R are individually true, and R is the not correct explanation of A |
| c) A is true but R is false | d) A is false but R is true |

6. Stripping is widely used to remove CO4 [K₁]

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|------------------------|---------------------|
| a) Volatile components | b) Inorganic matter |
| c) Organic matter | d) Chemicals |

7. What is the correct sequenceS of treatment process in the water treatment plant. CO5 [K₁]

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|------------------|-----------------|
| 1. Coagulation | 2. Flocculation |
| 3. Sedimentation | 4. Disinfection |

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|------------|------------|
| a) 1-2-3-4 | b) 2-3-4-1 |
| c) 3-4-2-1 | d) 4-3-2-1 |

8. **Assertion (A):** Decomposition of vegetable matter into compost is an example of exothermic reactions. CO5 [K₂]

Reason (R): Exothermic reactions are those reactions in which heat is evolved.

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|---|---|
| a) Both A and R are individually true and R is the correct explanation of A | b) Both A and R are individually true and R is the not correct explanation of A |
| c) A is true but R is false | d) A is false but R is true |

9. Surface loading of a sedimentation tank varies in the range CO3 [K₁]

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|-----------------------------------|----------------------------------|
| a) 100 – 500 l/hr/m ² | b) 500 – 750l/hr/m ² |
| c) 1000- 1250 l/hr/m ² | d) 750 – 1000l/hr/m ² |

10. Which one of the following sets of processes is a part of self-purification. CO1 [K₁]

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| a) Settling, Bio degradation and Desalination | b) Settling, Bio degradation and aeration |
| c) Floating ,Ion excahnge and desalination | d) Desalination, Ion exchange and reverse osmosis |

PART B (10 x 2 = 20 Marks)

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|---|-----|-------------------|
| 11. List out the objective of screen chamber | CO1 | [K ₂] |
| 12. Distinguish between hydraulic profile and PID | CO1 | [K ₂] |
| 13. Write the working principles of RO Plant with sketch. | CO2 | [K ₂] |
| 14. State the mechanisms of the disinfection process | CO2 | [K ₁] |
| 15. Differentiate unit operation and unit process with an example. | CO3 | [K ₂] |
| 16. Label the advantages of sludge thickening. | CO4 | [K ₁] |
| 17. List the various types of the incineration process. | CO5 | [K ₂] |
| 18. How the residues from skimming tanks can be disposed off? | CO4 | [K ₁] |
| 19. Find the settling velocity of a discrete particle in water. The diameter and specific gravity of the particle is 5×10^{-3} and 2.65 respectively. Kinematic viscosity of water = 1.01×10^{-2} cm ² /sec. | CO5 | [K ₃] |
| 20. State the theory of sedimentation. | CO3 | [K ₃] |

PART C (10 x 5 = 50 Marks)

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| 21. Design a septic tank and Sock pit for the following data:
No.of people = 150 Nos
Sewage/capita/day = 120 litres per person
De-sludging period = 1 year
Assume any one data if required and mention them cleanly. | CO4 | [K ₃] |
| 22. Discuss the use of Equalization and Neutralization in Industrial wastewater treatment. | CO1 | [K ₂] |
| 23. Explain the steps involved in the preparation of activated carbon. | CO2 | [K ₂] |
| 24. Outline the features of aeration in water treatment and explain the different types of aerators employed in the water treatment units. | CO4 | [K ₂] |
| 25. List out physical and chemical characteristics of industrial waste water. | CO4 | [K ₂] |
| 26. Explain two recent trends in physio-chemical treatment system | CO5 | [K ₂] |
| 27. Design an oxidation pond for treating sewage from a hot climate with 1 lakh population. The 5days BOD of sewage is 300mg/liter. | CO5 | [K ₃] |
| 28. List and explain the various types of advanced oxidation process. | CO3 | [K ₃] |
| 29. What is meant by drying bed and explain in details. | CO3 | [K ₁] |
| 30. Explain the working principles ion exchange method to treat the waste water. | CO2 | [K ₂] |

Answer any TWO Questions

PART D (2 x 10 = 20 Marks)

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| 31. Design a rapid sand filter unit for 3.8 million liters per day of supply with all its principal components. Assume whatever data necessary and mention them cleanly. | 10 | CO3 | [K ₃] |
|--|----|-----|-------------------|

32. A rectangular grit chamber is designed to remove particles with a diameter of 0.2 mm, specific gravity 2.65. Setting velocity for these particles has been found to range from 0.016 to 0.022 m/sec .A flow velocity of 0.3m/sec will be maintained. Determine the channel dimensions for a maximum waste water flow of 10000 cu.m/day 10 CO4 [K₃]
33. Explain the self-purification of river with Oxygen Sag Curve. 10 CO2 [K₂]
