

**THE KAVERY ENGINEERING COLLEGE***(An Autonomous Institution)***M.E DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025***Third Semester**Environmental Engineering***PEVE2419 – Membrane Separation for Water and Wastewater Treatment***Regulations - 2024**Duration : 3 Hrs**Maximum : 100 Marks****PART – A (ANSWER ALL QUESTIONS) (Marks 10\*2=20)***

| <i>Q.No</i> | <i>Questions</i>                                                   | <i>BTL</i> | <i>CO</i> | <i>Marks</i> |
|-------------|--------------------------------------------------------------------|------------|-----------|--------------|
| 1.          | Define cross-flow filtration.                                      | L1         | 1         | 2            |
| 2.          | Differentiate between porous and nonporous membranes.              | L2         | 1         | 2            |
| 3.          | Define membrane module. Give one example.                          | L1         | 2         | 2            |
| 4.          | Differentiate between microfiltration and ultrafiltration.         | L2         | 2         | 2            |
| 5.          | State the principle of an MBR system.                              | L1         | 3         | 2            |
| 6.          | List any two alternative MBR configurations.                       | L1         | 3         | 2            |
| 7.          | List any two types of membrane foulants.                           | L1         | 4         | 2            |
| 8.          | Define Langlier Index (LI). What does it indicate?                 | L1         | 4         | 2            |
| 9.          | List two applications of membrane-based desalination systems.      | L1         | 5         | 2            |
| 10.         | Define reject management in membrane systems. Why is it important? | L1         | 5         | 2            |

***PART – B (ANSWER ALL QUESTIONS) (Marks 5\*16 = 80)***

| <i>Q.No</i> | <i>Questions</i>                                                                                                                                     | <i>BLT</i> | <i>CO</i> | <i>Marks</i> |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|--------------|
| 11.         | a Explain the principle and theory of membrane separation. Discuss the mass transport characteristics in detail.<br>Or                               | L2         | 1         | 16           |
|             | b Describe concentration polarization and fouling in membrane processes. How do they affect membrane flux and performance? Suggest control measures. | L2         | 1         | 16           |
| 12.         | a With neat diagrams, explain different membrane module/element designs. Discuss their advantages and limitations.<br>Or                             | L3         | 2         | 16           |
|             | b Describe the essential components in a membrane system. How are modules assembled and integrated into a plant process control system?              | L3         | 2         | 16           |
| 13.         | a i Briefly explain the historical development of Membrane Bioreactors (MBRs) and their importance in wastewater treatment.                          | L2         | 3         | 8            |
|             | ii Describe the bio treatment fundamentals that form the basis of MBR operation.                                                                     | L2         | 3         | 8            |
|             | Or                                                                                                                                                   |            |           |              |
|             | b i Explain the principles and fundamentals of MBRs with suitable diagrams.                                                                          | L2         | 3         | 8            |
|             | ii Compare different alternative MBR configurations and their applications.                                                                          | L2         | 3         | 8            |

|     |     |                                                                                                                                                   |    |   |    |
|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----|
| 14. | a   | Explain the types of membrane foulants and their combined impacts on membrane performance.                                                        | L4 | 4 | 16 |
|     |     | Or                                                                                                                                                |    |   |    |
|     | b   | Compare pretreatment methods such as sand filtration and membrane filtration. Discuss their role in reducing fouling and improving membrane life. | L4 | 4 | 16 |
| 15. | a   | Explain the concept of Zero Liquid Discharge (ZLD) in water and wastewater treatment. Discuss its advantages and challenges.                      | L5 | 5 | 16 |
|     |     | Or                                                                                                                                                |    |   |    |
|     | b i | Evaluate environmental issues associated with membrane treatment plants and suggest mitigation measures.                                          | L5 | 5 | 8  |
|     | ii  | Explain reject management strategies in desalination or wastewater treatment systems with examples.                                               | L5 | 5 | 8  |