

Course Objectives:

- To discuss the methods available for the removal of Nitrogen and Phosphorus.
- To discuss analyse and design the membrane filtration system
- To discuss the design of membrane bioreactor system

Overview of Advanced Waste Water Treatment Introduction, Need of Advanced Waste Water Treatment, Purpose of Advanced Waste Water Treatment

Nutrient Removal – Nitrogen & Phosphorus Nitrogen Removal: .Nitrification , Denitrification Simultaneous nitrification and denitrification Phosphorus Removal : Introduction, Phosphorus removal by Chemical Precipitation: Principles of process, Chemicals applied, Chemistry of phosphorus precipitation, Process configuration, Phosphorus removal by Biological Precipitation: Principles of the process, Microorganisms involved in the process, Process configurations

Membrane Filtration Membrane Process Terminology Membrane Process Classification and operation : Microfiltration, Ultrafiltration, Nano filtration, Reverse Osmosis , Electrodialysis Membrane Configurations: Plate-and-frame module , Spiral-wound module , Tubular module , Hollow-fiber module Membrane Fouling: Modes of membrane fouling , Control of membrane fouling Application of membrane processes: Microfiltration , Ultrafiltration

Membrane Bio Reactor Introduction MBR Process Description: Membrane Bioreactor with Membrane Module Submerged in the Bioreactor; Membrane Bioreactor with Membrane Module Situated Outside the Bioreactor MBR System Features Membrane Module Design Considerations Process Applications: Industrial Wastewater Treatment, Municipal Wastewater

References:

1. Waste water Engineering: Treatment and Disposal by Metcalf & Eddy , 4th Edition, 2017
2. Environmental Engineering- Peary, Rowe & Tclobaloglous, 2017
3. Membrane Systems for Wastewater Treatment –Water Environment Federation, 2005