Course Code	Course Title	Credit Hours
ENE-840	Membrane Tech for Water and Wastewater Treatment	3 (3+0)

Course Description

The objective of this course is present principles and applications of membrane processes in environmental and biotechnology applications. The emphasis of this course will be more on the engineering aspects of the membrane technology and its application for water and wastewater treatment. Membrane technologies covered in the course include microfiltration, ultrafiltration, reverse osmosis, and membrane bioreactors description and applications.

Course Outline

Introduction to Membrane Technology: Overview of the membrane technology, membrane processes, types, cost comparison, and status of membrane processes in world market, characteristics of membranes used in membrane processes, types of membrane geometries.

Membrane Processes and Applications: Membrane processes based on pore size including microfiltration, ultrafiltration, and reverse osmosis.

Membrane fouling and anti-fouling techniques: Types of fouling including physical fouling, chemical fouling, and bio-fouling

Membrane Bioreactor and its recent developments: Membrane bioreactor (MBR) Description, Types of MBRs, and Applications of MBRs in Domestic and Industrial Wastewater Treatment and Recycling.

Recommended Books

1. J. Mulder (1996). *Basic Principles of Membrane Technology (2nd Ed.).* Kluwer Academic Publishers
2. Richard W. Baker (2004). *Membrane Technology and Applications (2nd Ed.)*. John Wiley & Sons.

3. Simon Judd (2011). *The MBR Book (2nd Ed.).* Elsevier Science.
4. WEF (2012). *Membrane Bioreactors (1st Ed.)*, McGraw Hill
5. Rajindar Singh (2015). *Membrane Technology and Engineering for Water Purification (2nd Ed.)*, Elsevier
6. H.D. Park, I.S. Chang, K.J. Lee (2015). *Principles of Membrane Bioreactors for Wastewater Treatment (1st Ed.)*, CRC Press