MEMBRANE SEPARATION TECHNOLOGY

(Elective-I)

Course Code: 15CH2106	**L**	**P**	**C**
	3	**0**	**3**

Prerequisites: Basic mass transfer fundamentals.

Course outcomes: On successful completion of the course, the student should be able to

CO1: Explain the membrane processes and the preparation methods for membranes

CO2: Explain the characterization and transport mechanism in membranes.

CO3: Define the various pressure driven membrane processes and electrically driven processes.

CO4: Define the various concentration driven membrane processes and their applications.

CO5: Define the membrane polarization, fouling and various membrane modules available.

UNIT-I (10-Lectures)

Introduction: Separation process, membrane processes, definition of a membrane, classifications membrane processes.

Preparation of Synthetic membranes: Types of Membrane materials, phase inversion membranes, preparation technique for immersion precipitation, preparation technique for composite membranes.

UNIT-II (10-Lectures)

Characterization of membranes: Introduction, membrane characterization, characterization of porous membranes, characterization of non-porous membranes.

Transport in membranes: introduction, driving forces, non equilibrium thermodynamics, transport through porous, non-porous, and ion exchange membranes.

UNIT-III (10-Lectures)

Membrane Processes: Introduction, Pressure driven membrane processes: Introduction, microfiltration, membranes for microfiltration, industrial applications, ultrafiltration: membranes for ultrafiltration, industrial applications, reverse Osmosis and nanofiltration: membranes for reverse osmosis and nanofiltration, industrial applications, forward Osmosis.

Electrically Driven processes: Introduction, electrodialysis, Process parameters, membranes for electrodialysis, applications, Membrane electrolysis, Bi-polar membranes, Fuel Cells.

UNIT-IV (10-Lectures)

Concentration driven membrane processes: gas separation: gas separation in porous and non porous membranes, membranes for gas separation, applications, pervaporation, membranes for pervaporation, applications, dialysis: membranes for dialysis, applications, liquid membranes: aspects, liquid membrane development, choice of the organic solvent and carrier, applications, introduction to membrane reactors, Membrane Contactors.

UNIT-V (10-Lectures)

Polarization phenomenon and fouling: Introduction to concentration polarization, turbulence promoters, pressure drop, gel layer model, osmotic pressure model, boundary layer resistance model, concentration polarization in diffusive membrane separations and electro dialysis, membrane fouling, methods to reduce fouling, compaction.

Module and process design: Introduction, plate and frame module, spiral wound module, tubular module, hollow fiber module, comparison of module configurations

TEXT BOOKS:

1. Marcel Mulder Basic Principles of Membrane Technology, Springer Publications 2nd Ed., 2007
2. Philip C.Wankat, Rate- Controlled Separations, Springer, 1994.

REFERENCE BOOKS:

1. S.P. Nunes, K.V. Peinemann, Membrane Technology in the chemical industry, Wiley-VCH.
2. Rautanbach and R. Albrecht, Membrane Process, John Wiley & sons.
3. J.G. Crespo, K.W. Bodekes, Membrane Processes in separation and Purification, Kluwer Academic Publications.
4. Transport processes and Unit Operations by C.J. Geankoplis., 3rdEd , PHI, New Delhi, 2002.