NOVEL SEPARATION PROCESSES

(Professional Elective-IV)

Course Code: 15CH1133

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Course Outcomes :

At the end of the Course, the Student will be able to:

CO 1 Define and classify the membranes. Illustrate the synthesis and describe the different characterization procedures of membranes.

CO 2 Classify and illustrate the pressure driven and electrically driven membrane processes.

CO 3 Classify and illustrate the concentration driven membrane processes.

CO 4 Explain the separation by adsorption and select suitable adsorbent for recovery of solute and solve the related problems.

CO 5 Explain the treatment of process liquids by ion exchange process and it's applications.

UNIT-I (15 Lectures)

INTRODUCTION:

Separation processes, membrane processes, definition of a membrane, classification of membrane processes and membrane modules.

PREPARATION OF SYNTHETIC MEMBRANES:

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

CHARACTERIZATION OF MEMBRANES:

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

UNIT-II (10 Lectures)

MEMBRANE PROCESSES:

Introduction, pressure driven membrane processes: Introduction, microfiltration: Introduction, membranes for microfiltration, industrial applications, ultrafiltration: membranes for ultrafiltration, industrial applications, reverse osmosis and nanofiltration: membranes for reverse osmosis and nanofiltration, industrial applications.

ELECTRICALLY DRIVEN PROCESSES:

Introduction, electrodialysis, Process parameters, membranes for electrodialysis, applications, Membrane electrolysis, Bipolar membranes, Fuel Cells.

UNIT-III (8 Lectures)

CONCENTRATION DRIVEN MEMBRANE PROCESSES:

Gas separation: 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.

UNIT-IV (10 Lectures)

NEW SEPARATION TECHNIQUES:

Reactive Distillation, Reactive extraction, Reactive absorption , Reactive crystallization , drying (infrared, solar) Pressure swing and vacuum swing adsorption, Regeneration with purge.

UNIT-V (7 Lectures)

ION EXCHANGE:

Basics of Ion exchange, Ion exchange resins, Binary ion exchange equilibrium, Ion movement theory, Applications, Applications without exchange: Ion exclusion, Mass transfer in ion exchange systems.

TEXT BOOKS:

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

REFERENCES:

1. Nunes. S.P, Peinemann, K.V, "Membrane Technology in the chemical industry", 2nd Edition,
2. Rautanbach and Albrecht. R., "Membrane Process", John Wiley and Sons.1989.
3. Crespo. J.G., Bodekes, K.W., "Membrane Processes in separation and Purification", Kluwer Academic Publications, Netherland, 1994.
4. Geankoplis. C.J. "Transport processes and Unit Operations", 4th Edition, PHI, New Delhi, 2006.