Membrane Process Design

B.E. Sem. VIII [CHEM] (Elective − III)

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. **Introduction**
   Introduction to membrane processes, history, definition of membrane, importance, processes.
   Types of membranes, membrane processes and their applications. Porous and solid membranes, Osmosis, Micro-filtration, Ultrafiltration, nanofiltration, reverse osmosis, piezodialysis, electrodialysis, dialysis, and membranes for gas separation, pervaporation. Applications of these processes.

2. Liquid membranes supported and unsupported liquid membranes, applications and mathematical modeling.
   Materials and material properties.
   Polymers and effect of various properties of polymers such as T_g , thermal, chemical and mechanical stability, elastomers and their properties, Inorganic membranes, biological membranes.

3. **Characterization of membranes**
   Characterization of porous membranes, characterization of ionic membranes, characterization of non-ionic membranes.
   Preparation of synthetic membranes
   Preparation of phase inversion membranes. Preparation techniques for immersion precipitation, preparation technique for composite membranes, Influence of various parameters on membrane morphology, preparation of inorganic membranes.

4. Transport processes in membranes driving force, Transport through porous membranes, transport through nonporous membranes, transport in ion-exchange membranes.
   Polarization phenomenon and fouling concentration polarization, characteristic flux behavior in pressure driven membrane operation, various models, temperature polarization, membrane fouling, methods to reduce fouling.

5. **Modules and process design**
   Plate and frame, spiral wound, tubular, capillary, hollow fiber modules and their comparison, system design. Membrane reactors. Application of membrane reactors in biotechnology.

6. **Economics and feasibility of membrane technology**
   Comparison of membrane technology with other separation techniques, Scope in the future, current and existing industrial applications

Reference Books :

1. Basic Principles of Membrane Technology (*Marcel Mulder*) Kluwer Academic Publishers (1997).
2. Membrane Separation Technology (*E. J. Hoffma*) Gulf Prefession Publishing.
3. Membrane Separation Processes (*Nath*) Prentice Hall of India
4. Membrane Handbook (*W. S. Winston Ho, K. K. Sirkar*) Van Nostrand Reinhold Publication.

❑ ❑ ❑ ❑ ❑ ❑