COURSE **Post-graduate in Chemical Engineering**	DEPARTMENT **Chemical Engineering**	CENTRE **Technology**	
SUBJECT **Membrane Separation Processes**	CODE **DEQ4150**	MANDATORY ☐	ELECTIVE ☒
WORKLOAD **45 h/semester**	CREDITS **03**	VALIDITY **Since the 1st semester 2024**	
NOTE:			

PROGRAM

1. History. 2. Introduction to main membrane processes. 3. Membranes: materials; preparation techniques; characterization techniques. 4. Transport mechanisms in polymeric membranes. 5. Modules: types and main characteristics. 6. Operating modes in membrane processes. 7. Main industrial applications of separation processes with membranes. 7.1. Microfiltration. 7.2. Ultrafiltration. 7.3. Nanofiltration. 7.4. Reverse osmosis. 7.5. Dialysis. 7.6. Electrodialysis. 7.7. Gas permeation. 7.8. Pervaporation. 8. Estimation of membrane area and equipment calculations. 9. Major membrane and equipment manufacturers. 10. Membrane bioreactors. 11. Applications of membrane processes in biotechnology. 12. Applications of membrane processes in waste treatment. 13. Applications of membrane processes in the food industry.

BIBLIOGRAPHY

- R.D. Noble and S.A. Stern. *Membrane Separation Technology: Principles and Applications.* Elsevier Science, 1995.
- K. Scott. *Handbook of Industrial Membranes, 1st ed.* Elsevier Science Publishers Ltd., 1995.
- R.W. Baker; E.F. Cussler; W. Eykcamp; W.J. Koros; R.L. Riley and H. Strathmann. *Membrane Separation Process - Recent Developments and Future Directions.* Noyes Data Corporation, 1991.
- W.S. Winston Ho and K. K. Sirkar. *Membrane Handbook*. Van Nostrand Reinhold, 1992.
- M. Mulder. *Basic Principles of Membrane Technology*. Klumer Academic Publisher, 1991.
- R. Rautenbach and R. Albrecht. *Membrane Processes*. John Wiley & Sons, 1989.
- A. F. Izmail and T. Matsuura. *Membrane Separation Processes: Theories, Problems, and Solutions*. Elsevier, Amsterdam, 2022.
- E. Goldberg. *Handbook of Downstream Processing*. Springer Science and Business Media, London, 2012.

- N. Kaushik. *Membrane Separation Processes*. Second edition, PHI learning, Delhi, 2017.
- Z. F. Cui and H. S. Muralidhara. *Membrane Technology: A Practical Guide to Membrane Technology and Applications in Food and Bioprocessing*. Elsevier, Amsterdam, 2010.
- A. Basile and C. Charcosset. *Integrated Membrane Systems and Processes*. Wiley, Chichester, 2016.