GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Master of Technology	Branch/Spec.	Chemical Engineering
Semester	I	Version	1.0.0.0
Effective from Academic Year	2026-27	Effective for the batch Admitted in	July 2026
Subject code	**3CH1101**	Subject Name	**Advanced Separation Processes**

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	0	0	3	Theory	40	60	100
Hours	3	0	0	0	3	Practical	0	0	0

Pre-requisites:

Mass Transfer Operations on UG level

Course Outcomes

On successful completion of the course, the students will be able to:

CO1	Define the principle of separation processes.
CO2	Identify the separation process in the given condition.
CO3	Analyze the problems related to separation processes.
CO4	Design module for separation processes like membrane, adsorption

Theory syllabus

Unit	Content	Hrs
1	**Advanced Distillation and Absorption** Multicomponent distillation concepts, bubble point and dew point calculations, Lewis–Matheson method, Thiele–Geddes method, basics of azeotropic and extractive distillation, introduction to reactive distillation, absorption with chemical reaction, enhancement factor concept, simple film theory for gas–liquid reaction systems	9
2	**Reaction–Mass Transfer Interaction and Supercritical Extraction** Penetration and surface renewal theories for gas–liquid reactions, effect of reversible and irreversible reactions on mass transfer rate, industrial examples such as CO_2 and H_2S absorption in alkaline solutions, fundamentals of supercritical fluids, phase behavior of supercritical systems, basic industrial applications such as coffee decaffeination and oil extraction	9
3	**Membrane Separation Processes** Classification of membrane processes, membrane materials and modules, principles of dialysis and electrodialysis, fundamentals of microfiltration, ultrafiltration, nanofiltration and reverse osmosis, flux equations and operating variables, concentration polarization and fouling concepts, basic gas separation and pervaporation principles	9
4	**Sorption and Ionic Separation Processes** Adsorption principles and selection of adsorbents, pressure swing and temperature swing adsorption, basics of chromatography including separation mechanism and common techniques, fundamentals of ion exchange processes, electrodialysis principle and stack configuration, brief introduction to capacitive deionization and electrophoresis	9
5	**Non-Conventional and Emerging Separation Techniques** Micellar enhanced separation processes, cloud point extraction fundamentals, thermal diffusion principles, zone refining concept and applications, centrifugation basics and applications, membrane contactors overview, brief industrial case studies and comparison of advanced separation techniques	9

Text Books

1	Seader, J. D., Henley, E. J., and Roper, D. K., *Separation Process Principles*, 3rd Edition, Wiley India, 2016.
2	Rousseau, R. W. (Ed.), *Handbook of Separation Process Technology*, John Wiley & Sons, 1987.
3.	Geankoplis, C. J., *Transport Processes and Separation Process Principles*, 4th Edition, Prentice Hall, 2003.
4.	Purkait, M. K. and Singh, R., *Membrane Technology in Separation Science*, CRC Press, 2018.
Reference Books	
1	Humphrey, J. L. and Keller, G. E., *Separation Process Technology*, McGraw-Hill, 1997.
2	Kister, H. Z., *Distillation Design*, McGraw-Hill, 1992.
3	Li, N. N., Fane, A. G., Ho, W. S. W., and Matsuura, T., *Advanced Membrane Technology and Applications*, Wiley, 2008.
4	Taylor, R. and Krishna, R., *Multicomponent Mass Transfer*, Wiley, 1993.
ICT/MOOCs references	
1. https://nptel.ac.in/courses/103105060	

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-	2	1	-
CO3	3	3	2	1	1	-	-	-	-	-	1	3	1	-
CO4	3	2	3	1	2	1	-	-	-	1	1	3	2	2