GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Bachelor of Technology	Branch/Spec.	Chemical Engineering
Semester	V	Version	1.0.0.0
Effective from Academic Year	2026-27	Effective for the batch Admitted in	July 2024
Subject code	**2CH51PE2**	Subject Name	**Optimization of Chemical Processes**

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	2	0	0	0	2	Theory	40	60	100
Hours	2	0	0	0	2	Practical	0	0	0

Pre-requisites:

Chemical Engineering Calculations, Mathematics, Process Control

Course Outcomes

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

CO1	Students will able to explain the fundamentals of optimization and problem formulation in chemical process industries.
CO2	Students will able to apply basic optimization theory to analyze unconstrained chemical engineering problems.
CO3	Students will able to use appropriate numerical methods to solve simple optimization problems in process systems.
CO4	Students will be able to analyze optimization applications in heat transfer, separation, and reactor systems of chemical industries.

Theory syllabus

Unit	Content	Hrs
1	**Fundamentals of Optimization and Problem Formulation:** Nature and scope of optimization in process industries, hierarchy of optimization in chemical engineering systems, industrial examples of optimization, essential elements of optimization problems, general procedure for optimization, basic development and classification of mathematical models, introduction to empirical model fitting, equality and inequality constraints, formulation of objective functions, economic objective functions, and basic measures of profitability.	7
2	**Basic Concepts of Optimization Theory:** Basic optimization concepts, continuity and differentiability of functions, nonlinear programming problem formulation, convex and non-convex functions, role of convexity in optimization, quadratic approximation of objective functions, necessary and sufficient conditions for unconstrained optimization, and physical interpretation of optimality conditions in chemical engineering applications.	8
3	**Optimization of Unconstrained Functions:** One-dimensional optimization methods, scanning and bracketing techniques, Newton and quasi-Newton methods for single-variable optimization, finite-difference approximation of derivatives, polynomial interpolation methods, extension of one-dimensional methods to multivariable optimization, direct search techniques, and gradient-based methods such as steepest descent.	8
4	**Optimization Applications in Chemical Engineering Systems:** Optimization applications in heat transfer and energy conservation, waste heat recovery, basic optimization of heat exchangers and evaporators, optimization of staged distillation columns and reflux ratio, optimization of separation process flow rates, optimization of fluid flow systems, minimum work of compression, and introductory optimization of chemical reactor systems.	7

Text Books

1	**Edgar, T. F.; Himmelblau, D. M.; Lasdon, L. S.***Optimization for Chemical and Biochemical Engineering;* 2nd ed.; McGraw-Hill Education: New York, 2019.
2	**Ravindran, A.; Ragsdell, K. M.; Reklaitis, G. V.** *Engineering Optimization: Methods and Applications;* 2nd ed.; Wiley: New York, 2006.
	Reklaitis, G. V.; Ravindran, A.; Ragsdell, K. M. Engineering Optimization: Methods and Applications**; 1st ed.; Wiley: New York, 1983.**
Reference Books	
1	**Himmelblau, D. M.** *Process Analysis by Statistical Methods;* 1st ed.; Wiley: New York, 1970.
2	**Biegler, L. T.; Grossmann, I. E.; Westerberg, A. W.** *Systematic Methods of Chemical Process Design;* 1st ed.; Prentice Hall: Upper Saddle River, 1997.
3	**Marlin, T. E.** *Process Control: Designing Processes and Control Systems for Dynamic Performance;* 2nd ed.; McGraw-Hill: New York, 2000.
ICT/MOOCs references	

Mapping of CO with PO and PSO:														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	1	-	-	-	-	-	-	2	2	1	3
CO2	3	3	1	2		-	-	-	-	-	2	3	1	3
CO3	3	3	1	2	1	-	-	-	-	-	2	3	1	3
CO4	3	3	2	2	1	1	-	-	-	1	2	3	1	3