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	**2CH61PE1**	Subject Name	**Introduction to Biochemical Engineering**

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:

Material and Energy Balance; Basic Chemical Engineering Thermodynamics, Elementary Chemical Kinetics Basic Mathematics

Course Outcomes

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

CO1	Students will understand the scope and industrial relevance of biochemical engineering
CO2	Students will able to apply enzyme and microbial kinetics concepts to biochemical systems
CO3	Students will able to understand the working principles of common bioreactors
CO4	Students will be able to identify basic downstream processing steps for bioproduct recovery

Theory syllabus

Unit	Content	Hrs
1	**Fundamentals of Biochemical Engineering:** Scope of biochemical engineering, Comparison of chemical and biochemical processes, Industrial bioproducts, Types of microorganisms, Cell structure and function, Growth environments, Sterilization and contamination, Overview of industrial bioprocesses	8
2	**Enzymes and Biochemical Reaction Kinetics:** Enzyme classification and characteristics, Mechanism of enzyme action, Factors affecting enzyme activity, Michaelis–Menten kinetics, Enzyme inhibition, Immobilized enzymes, Industrial applications of enzymes	8
3	**Microbial Growth and Fermentation Kinetics:** Microbial growth phases, Growth rate parameters, Yield coefficients, Substrate utilization kinetics, Monod model, Product formation kinetics, Maintenance energy concept	7
4	**Bioreactors and Downstream Processing:** Types of bioreactors, Batch, fed-batch, and continuous systems, Stirred tank bioreactor, Aeration and agitation, Oxygen transfer fundamentals, Downstream processing overview, Cell separation and product recovery methods, Industrial applications	7

Text Books

1	**Shuler, M. L.; Kargi, F.** *Bioprocess Engineering: Basic Concepts*; 2nd ed.; Prentice Hall, 2002.
2	**Bailey, J. E.; Ollis, D. F.** *Biochemical Engineering Fundamentals*; 2nd ed.; McGraw-Hill, 1986.
3.	**Doran, P. M.** *Bioprocess Engineering Principles*; 2nd ed.; Academic Press, 2013.
4.	**Levenspiel O.**, *Chemical Reaction Engineering*, 3rd ed,; Wiley, 2012

Reference Books

1	**Stanbury, P. F.; Whitaker, A.; Hall, S. J.** *Principles of Fermentation Technology*; 3rd ed.; Elsevier, 2017.
2	**Nielsen, J.; Villadsen, J.; Lidén, G.** *Bioreaction Engineering Principles*; 3rd ed.; Springer, 2017.
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	-	1	-	-	-	-	2	3	-	3
CO2	3	3	1	2	-	-	-	-	-	-	2	3	-	3
CO3	3	3	2	2	-	-	-	-	-	-	2	3	-	3
CO4	2	2	1	1	-	1	-	-	-	-	2	3	-	2