

GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme	Bachelor of Technology				Branch/Spec.	Chemical Engineering			
Semester	VI				Version	1.0.0.0			
Effective from Academic Year	2026-27				Effective for the batch Admitted in	July 2024			
Subject code	2CH61PE2		Subject Name		Cleaner Production				
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:									
Fundamentals of Chemical Engineering (Material and Energy Balance; Unit Operations)									
Course Outcomes									
On successful completion of the course, the students will be able to:									
CO1	Students will understand the principles and objectives of Cleaner Production and pollution prevention in chemical process industries.								
CO2	Students will be able to identify sources of waste, emissions, and resource losses in chemical processes using material and energy balance approaches.								
CO3	Students will apply cleaner production tools and techniques such as source reduction, recycling, process modification, and green chemistry concepts.								
CO4	Students will be able to evaluate energy, water, and resource efficiency measures and analyze industrial Cleaner Production case studies considering technical and economic aspects.								
Theory syllabus									
Unit	Content								Hrs
1	Fundamentals of Cleaner Production: Cleaner production concept, Pollution prevention, End-of-pipe control, Sustainability principles, Environmental hierarchy, CP benefits, Global initiatives (UNEP, UNIDO), Role of chemical engineer								6
2	Waste Generation and Process Analysis: Industrial wastes, Solid waste, Liquid effluents, Gaseous emissions, Waste sources, Material balance, Energy balance, Process losses, Waste auditing, Emission inventory								8
3	Cleaner Production Tools and Techniques: Source reduction, Process modification, Raw material substitution, Equipment modification, Process optimization, Good housekeeping, Recycling techniques, Reuse strategies, Resource recovery, Green chemistry principles, Industrial CP examples								8
4	Resource Efficiency and Industrial Implementation: Energy efficiency, Energy audit, Heat integration, Waste heat recovery, Utility optimization, Water efficiency, Water audit, Water minimization, Life Cycle Assessment (LCA), Cleaner fuels, Economic evaluation, Cost–benefit analysis, Implementation barriers, Environmental regulations, ISO 14001 overview, Chemical industry case studies								8
Text Books									
1	Paul M. Randall , <i>Engineers' Guide to Cleaner Production Technologies</i> , CRC Press.								
2	Anastas, P. T. and Warner, J. C. , <i>Green Chemistry: Theory and Practice</i> , Oxford University Press.								

Reference Books	
1	Allen, D. T. and Shonnard, D. R., <i>Green Engineering: Environmentally Conscious Design of Chemical Processes</i> , Prentice Hall.
2	Baumgartner, R. J., <i>Cleaner Production and Industrial Ecology</i> , Springer
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	2	2	-	1	-	3	1	-	-	-	2	3	1	2
CO2	3	3	1	2	-	2	-	-	-	-	2	3	-	3
CO3	3	3	2	2	-	3	-	-	-	-	2	3	2	3
CO4	3	3	2	2	-	3	-	-	-	1	2	3	2	3