

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	2CH51PE1		Subject Name		<b>Nanotechnology for Chemical Engineering</b>				
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:									
Basic fundamentals of chemistry and material science.									
Course Outcomes									
On successful completion of the course, the students will be able to:									
CO1	Students will understand fundamentals of nanoscience and nanotechnology relevant to chemical engineering								
CO2	Students will understand synthesis methods and process parameters for nanomaterials.								
CO3	Students will understand characterization techniques used for nanomaterials.								
CO4	Students will be able to relate nanotechnology applications to chemical, energy, and environmental engineering systems.								
Theory syllabus									
Unit	Content								Hrs
1	<b>Fundamentals of Nanoscience for Chemical Engineers:</b> Introduction to nanotechnology and nanoscience, classification of nanomaterials, nano length scale and its significance, surface area to volume ratio, size-dependent physical, chemical and catalytic properties, comparison of bulk and nanomaterials, relevance of nanotechnology in chemical and petrochemical industries.								5
2	<b>Classification and Types of Nanomaterials:</b> Zero-, one-, two- and three-dimensional nanomaterials, metal and metal oxide nanoparticles, carbon-based nanomaterials (CNTs, graphene), polymeric nanomaterials, nanocomposites, core-shell and hybrid nanomaterials, applications in catalysis, separations, and energy systems.								5
3	<b>Synthesis of Nanomaterials:</b> Top-down and bottom-up approaches, chemical precipitation, sol-gel method, hydrothermal and solvothermal synthesis, microemulsion techniques, vapor phase synthesis, role of operating parameters (temperature, pressure, concentration, pH), reaction kinetics and transport phenomena at nanoscale, scalability and safety issues.								8
4	<b>Characterization of Nanomaterials:</b> Structural analysis using X-ray Diffraction (XRD), morphological analysis using SEM, TEM and AFM, optical and surface characterization using UV-Visible spectroscopy and BET surface area analysis, interpretation of characterization data for chemical engineering applications.								6
5	<b>Applications of Nanotechnology in Chemical Engineering:</b> Nanocatalysts in petrochemical processes, fuel cells and biodiesel production, nanomaterials for separation processes (membranes, adsorption), environmental applications (water and wastewater treatment, pollution control), energy applications (batteries, supercapacitors, solar cells), process intensification using nanotechnology.								6
Text Books									

1	Introduction to Nanotechnology by Charles P. Poole Jr and. Frank J. Owens, Wiley-Inter science, 2003.
2	Nanostructures and Nanomaterials: Synthesis, Properties and Applications by G. Cao, Imperial College Press, 2004.
<b>Reference Books</b>	
1	Nanoscale Science and technology by Robert Kelsall (editor), Ian W. Hamley (co-editor), Mark Geoghegan (co-editor), ISBN: 978-0-470-85086-2
<b>ICT/MOOCs references</b>	

<b>Mapping of CO with PO and PSO:</b>												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	-	1	1	-	-	-	-	-	2	2
CO 2	3	3	2	2	1	-	-	-	-	-	2	3
CO 3	3	2	1	2	2	-	-	-	-	-	2	3
CO 4	3	3	2	2	2	2	-	-	-	-	2	3