Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NCYD512	Functional Material and Heterogeneous Catalysis	3	0	0	3

Course Objective
● Catalysis is an interdisciplinary area which covers materials science, green chemistry and development of sustainable energy. ● The course is aimed to encourage student for understanding the correlation between different segment of chemistry along with chemical engineering as well as modern nanostructured materials.
Learning Outcomes
● At the end of the course students will be comfortable to do research in fine chemicals synthesis in gas phase as well as liquid phase ● Students will also be able to do research in hydrocarbon sector as well as in sustainable energy

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Overview of Catalysis: Homogeneous, Heterogeneous, Photocatalysis and Electrocatalysis, Role of Catalysis in Green Chemistry	7L	Primary understanding of catalysis and its application
2	Nanomaterials, Mesoporous materials, Zeolite, Core shell material, carbon based material and primary characterization by N_2 physisorption techniques, TPR/TPD/TPO techniques XPS technique	7L	Idea on and textural, morphological properties of the functional materials
3	Kinetics of Gas-solid interface reactions, L-H, L-R mechanism, several type of adsorption process, multiplet theory, understanding the morphology of surface, mass transfer limitation, batch reactor, fixed bed reactor, fluidized bed reactor	7L	Understanding the textural property of the catalyst and reaction engineering
4.	Fossil fuel, Oil refining, Hydrotreating process, Thermal and Catalytic cracking, Reforming, Isomerization, Dry reforming of methane, Fischer Trosph reaction, Petrochemical synthesis	7L	The students will have an idea about petroleum chemistry
5	CO_2 mitigation reactions, CO_2 to fine chemical, CO_2 to olefin, Biomass conversion to fine chemicals and fuels, photocatalysis,	7L	This topic will help the students to gain knowledge on environmental chemistry
6.	Selective oxidation reaction, Hydrogenation reaction, Alkylation reaction, Dehydrogenation reaction, Biofuel	7L	These are few industrially important surface catalyzed reactions
TOTAL		**42**	

Text Books:

1. Nanotechnology in Catalysis, Spinger,; ISBN-0387-34687-2; Edited by G A Somorjai Vol-1-3

Reference Books:

1. Current Trends of Surface Science and Catalysis, Jeong Young (Ed.) Park (Author), Jeong Young Park (editor), 1st Edition, Springer, 2013.
2. Handbook of Heterogenous Catalysis, G. Ertl, H. Knozinger, F. Schuth, J. Weitkamp, WILEY-VCH Verlag GmbH & Co. KGaA, ISBN 978-3-527-31241-2