Programme: M. Sc. Part-II (Inorganic Chemistry)
Course Code: ICO-502
Title of the Course: Catalysis: The Basic chemical concepts
Number of Credits: 03 **Effective from AY:** 2019-20

Prerequisites for the course:	The students with Chemistry back ground are eligible for this course.	No. of lectures
Course Objectives:	1. To understand fundamentals concepts of chemical reactions over the catalysts. 2. To understand energy saving and making green processes in chemical reactions. 3. To understand fundamentals concepts of chemical reactions for developing higher productivity, mechanisms and viability. 4. To provide knowledge on applications of heterogeneous, homogenous and other catalytic processes.	
Course Outcomes:	1. The students will be able to understand the green chemical processes. 2. They will be well equipped with the knowledge of catalytic reactions. 3. They will be in position to understand the reaction mechanism process. 4. The concepts of catalytic reactions will be cleared to them. 5. They will know the applications of catalyst compounds in chemical reactions and industries.	
Content:	**1. Origin and development of catalysis;** Difference between heterogeneous, homogeneous, auto and photocatalysis, Importance of heterogeneous and homogeneous catalysts in chemical reactions. **2. Heterogeneous Catalysis:** i. Adsorptions: Physical and chemical adsorption, dissociative adsorptions, simple adsorptions isotherm, Langmuir adsorption and the BET adsorption isotherm. ii. Types of Catalysts; Preparations of the Catalysts, nano-materials, significance of zeolites and supported catalysts. iii. Characterization of solid catalysts: Surface area, structure and surface morphology, X-ray diffraction, SEM, TEM, X-ray absorption spectroscopy, XPS and Auger spectroscopy to surface studies. iv. Activity and life of the catalysts, active centers, promoters and poisons, catalyst deactivations. v. Heterogeneous reactions: Thermodynamic consideration in surface reactions, ammonia synthesis, oxidation reduction reactions (selected examples), mechanism of catalytic reactions, method of finding rate of the reactions and the rate determining steps. vi. Theories of Catalysis: Boundary layer theory, Catalysis by semiconductors, Wolkenstein theory, Balanding's approach,	2 hr 17 hr

	electronic factors is catalysis by metals. **3. Homogeneous Catalysis:** Intermediate stages in homogenous Catalysis, energy profile diagram, general scheme for calculating kinetics of reactions, decomposition of hydrogen peroxide, acid-base catalysis, hydrogenation, Mosanto acetic acid, Carboxylation reaction and Wacker reaction. **4. Introduction to followings:** Photocatalysis, catalytic polymerizations, phase transfer catalysis and biocatalysis with suitable examples. **5. Catalysts for energy and environmental:** Catalytic gasification, steam reforming, fuel cells and auto-industrial emission control.	7 hr 6 hr 4 hr
Pedagogy	Mainly lectures / tutorials / assignments /self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	1. P. H. Emmett, *Catalysis*,Vol I, Reinhold, New York, 1955. 2. A.V. Salker, *Catalysis: Principles and Basic Concepts*, Scientific International, 2019. 3. D. K. Chakraborty, *Adsorption and Catalysis by Solids,* New Age Intl. (P) Ltd., 2008. 4. J. M. Thomas & W.J. Thomas, *Heterogeneous Catalysis*, VCH publication, 1997. 5. A. Clark, *The Theory of Adsorption and Catalysis*, Academic Press, 1970. 6. E. R. Rideal, *Concept in Catalysis*, Academic Press, 1968. 7. G. M. Panchenov & V. P. Lebedev, *Chemical Kinetics and Catalysis*, Mir publication, 1976. 8. S. J. Thomson & G. Webb, *Heterogeneous Catalysis*, Oliver and Boyd Publications, 1968. 9. R. A. Van Santen & J. W. Niemantsvedict, *Chemical Kinetics and Catalysis*, Plenum Press, New York, 1995.	