Course code	Course Name	L-T-P-Credits	Year of Introduction
CH372	CATALYST SCIENCE AND CATALYTIC PROCESSES	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To impart the principles, preparatory methods and industrial application of catalyst
- To make aware Chemistry of catalyst, Catalyst characterisation, Catalyst preparation, Industrial catalysis, Catalyst deactivation, Modern trends in catalysis.

Syllabus

Theory of Catalysis, Homogeneous catalysis, Heterogeneous catalysis, Biocatalyst, Preparatory methods, Catalyst characterization, Industrial catalysis, Catalyst activation and deactivation, Modern trends in catalysis.

Expected Outcome

The students will be able to

i. apply the basic concepts and theory for characterisation of catalysts
ii. select catalyst for various unit processes.
iii. know the various catalytic processes in industry.

Text books:

- Smith, J.M, Chemical Engineering Kinetics, McGraw Hill

Reference books:

1. B. Viswanathan, S. Sivasanker, A. V. Ramaswamy, Catalysis: Principles and Applications, Academic Press
2. Diazo Kunii, and Octave Levenspiel, Fluidization Engineering, Butterworth-Heinemann
3. Emmett, P.H , Catalysis Vol I and II, Reinhold Corp, New York, 1954
4. Fogler H.S., Elements of Chemical Reaction Engineering, Prentice Hall of India
5. Hill C.G., An Introduction to Chemical Engineering Kinetics & Reactor Design, John Wiley
6. Levenspiel O., Chemical Reaction Engineering, John Wiley
7. R. A. Van Santen, Piet W. N. M. Van Leeuwen, Jacob A. Moulijn, Bruce A. Averill, Catalysis: An Integrated Approach , Elsevier
8. Thomas and Thomas , Introduction to Heterogeneous Catalysis, Academic Press, London, 1967

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Catalysis. General characteristics of catalysis. Classification of Catalyst, Thermodynamics of adsorption, Physical adsorption and chemisorptions. Adsorption isotherms. Catalyst selectivity.	6	15%
II	Catalyst preparative methods – Precipitation and co precipitation, Sol gel process, Flame hydrolysis, Supported catalyst from CVD and related techniques, preparation and	8	15%

	structure of supports, Synthesis of aluminosilicate zeolites.		
FIRST INTERNAL EXAMINATION			
III	Catalyst Characterisation- surface area measurements, BET theory, Pore size distribution, Porosimetry, Chemisorption techniques, Static and dynamic methods, Crystallography and surface analysis techniques – XRD, NMR.	7	15%
IV	Industrial catalysis – Homogeneous, Heterogeneous, Biocatalysts, Transition metal catalyst, Organo metallic catalyst, Dual function catalyst, Zeolite, Powder and pellet catalyst and their typical industrial applications.	7	15%
SECOND INTERNAL EXAMINATION			
V	Deactivation of catalyst – classification of catalyst deactivation processes, poisoning of catalysts, poisoning of metallic catalysts, poisoning of non metallic catalysts, poisoning of bifunctional catalysts, coke formation on catalysts, metal deposition on catalysts ,sintering of catalysts. Regeneration of deactivated catalyst.	**8**	20%
VI	Modern trends in catalysis – Phase transfer catalysis, electro catalysis, Nano catalysis, Polymer supported catalysis, Bio catalysis, Photo catalysis (Types, uses and industrial application).	**6**	20%
END SEMESTEREXAMINATION			

Question Paper Pattern

Maximum Marks: 100 Exam Duration: 3 Hours

Part A : There shall be **Three questions** uniformly covering Modules 1 and 2, each carrying 15 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in each main question with a total of 15 marks for all the subdivisions put together. (2 x15= 30 Marks)

Part B: There shall be **Three questions** uniformly covering Modules 3 and 4, each carrying 15 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in each main question with a total of 15 marks for all the subdivisions put together. (2 x15= 30 Marks)

Part C: There shall be **Three questions** uniformly covering Modules 5 and 6, each carrying 20 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in each main question with a total of 20 marks for all the subdivisions put together. (2 x20= 40 Marks)