22PCM402T					Catalytic Reaction Engineering					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- Classification and characterization of solid catalysts.
- Develop rate expressions for solid catalysed reactions.
- To understand the influence of heat and mass transfer on reaction rates within solid catalysts.
- Understand the concepts of Thiele modulus and effectiveness factors in solid catalysed reaction.
- Design of solid catalysed reactors.

UNIT I Principles of Catalysis **10 Hr.**

Fundamental principles, components of industrial catalysts, catalyst activity, selectivity, catalyst preparation, catalyst storage etc. Catalyst Deactivation: Mechanistic approach, phenomenological approach.

UNIT II Physical properties of catalyst **9 Hr.**

Surface area, pore volume, pore size distribution, solid density, particle density, bulk density, void volume, Catalyst promoters & inhibitors, Catalyst accelerators & poisons.

UNIT III Kinetics of Solid catalyzed reactions **10 Hr.**

Development of kinetic rate expression using Langmuir Hinshelwood Hougen Watson Models, Eli – Rideal mechanism combined effect of chemical and physical kinetics, pore diffusion effects, Thiele modulus, effectiveness factors, inter phase and intra phase temperature gradient, parametric estimation and parametric sensitivity, steady state multiplicity.

UNIT-IV Reactor Design **10 Hr.**

Design of fixed bed and fluidized bed catalytic reactors. Design considerations for multiphase reactors such as Trickle bed reactors, Slurry reactors, Bubble columns, Packed beds etc.

Max. 39 Hr.

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1: Familiarize various types of solid catalysts used industrially.
CO2: Understand important characterization techniques used.
CO3: select the proper catalyst and able to accelerate its life by various techniques.
CO4: Develop rate laws for heterogeneous reactions.
CO5: Estimate the effects of diffusion, mass transfer effect on catalysis.
CO6: Design solid-catalyzed reactors.

TEXT/REFERENCE BOOKS

1. M.V. Twigg, 'Catalyst Handbook', Manson Publishing, 1996
2. Ronald W. Missen, Charles A. Mims, Bradley A. Saville. Introduction to chemical reaction engineering and kinetics ohn Wiley & Sons,, 1999
3. J.M. Smith, Chemical Reaction Kinetics, 3rd Ed. McGraw Hill, Inc, 1981.
4. J.J. Carberry, Chemical and Catalytic Reaction Engineering, McGraw Hill, Inc, 1976.
5. H. S. Fogler, Elements of Chemical Reaction Engineering, 4th Ed., PHI, 2005.
6. C.H. Bartholomew and R.J. Farrauto, 'Fundamentals of Industrial Catalytic Processes', Wiley Interscience, 2006
7. C.N. Satterfield, 'Heterogeneous Catalysis in Industrial Practice 2nd Ed, McGraw-Hill 1999

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs.**
Part A: 10 Questions each carrying 5 marks	50 Marks
Part B: 5 Questions each carrying 10 marks	50 Marks