

PCH223 CATALYTIC REACTOR ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course Objective:

To learn catalytic phenomena with extensions to reactor design and catalyst characterization.

Introduction: Current trend in applied catalysis, Evolution of important concepts and Techniques in Heterogeneous catalysis.

Adsorption: Adsorption isotherm and isobars, Kinetics of surface reactions, Rates of heterogeneous and homogeneous reactions.

Catalysis: Definition of catalyst activity, Selectivity of catalyst, Different types of catalyst and their applications, Engineering properties of catalysts, Preparation and characterization of catalysts, Method of estimating surface area, Method of estimating pore volume and diameter, Kinetics of fluid-solid, Non-catalytic and catalytic reactions and Kinetic parameters estimations.

Diffusion Effects and Deactivation of Catalysts: Effect of mass transfer on catalytic selectivity, Effect of intraparticle diffusion, Effect of interparticle transport, Bi-functional catalyst, Catalyst deactivation.

Heterogeneous Reactors: Fixed-bed reactor, Slurry reactor, Trickle bed reactor, Fluidized bed reactor and moving bed reactor.

Course learning outcomes (CLOs):

The students will be able to

1. understand and develop catalytic reaction mechanism
2. solve problems involving mass and heat transfer effects in heterogeneous catalysis
3. select catalytic materials, prepare and characterize catalysts
4. apply the concepts of heterogeneous catalytic reactions to reactor design

Recommended Books:

1. *Bowker, M., The Basis and Applications of Heterogeneous Catalysis, Oxford University Press, USA (1998).*
2. *Satterfield, C.N., Heterogeneous Catalysis in Industrial Practice, McGraw-Hill (1998).*
3. *Carberry, J.J., Chemical and Catalytic Reaction Engineering, Dover Publications(2001).*
4. *Fogler, H.S., Elements of Chemical Reaction Engineering, Prentice-Hall (2009).*
5. *Levenspiel, O., Chemical Reaction Engineering, Wiley Eastern (2006).*
6. *Bischoff, K.B., Wilde, J.D., and Froment, G.F., Chemical Reactor Analysis and Design, Wiley (2010).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessional (may include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	25