UCH701 CATALYTIC PROCESSES

L	T	P	Cr
3	1	0	3.5

Introduction: Catalysis and catalyst – homogeneous & heterogeneous, Classification of catalytic reactions and catalysts, Commercial chemical catalysts, Steps in catalytic reactions.

Preparation and Properties of Catalysts: Methods of catalyst preparation, Physical properties of catalyst – surface area, pore volume, pore size distribution, solid density, particle density, bulk density, void volume, Catalyst promoters & inhibitors, Catalyst accelerators & poisons.

Adsorption and Catalytic Reactions: Adsorption isotherms, Surface reaction, Single site and dual site mechanism, Desorption, Catalyst deactivation, Pore structure and surface area estimation and their significance.

External Transport Processes: Fluid particle mass and heat transfer, Fixed bed reactors: isothermal and non-isothermal behavior, Stable operating conditions, Effect of external transport processes on selectivity under isothermal & non-isothermal conditions, Fluidized bed reactors, Three phase reactors: Slurry reactors, Trickle bed reactors.

Diffusion and reaction in porous catalysts: Intra-pellet mass transfer and diffusion in cylindrical and spherical porous catalyst particles, Thiele modulus, Diffusion controlled and surface reaction controlled kinetics, effectiveness factor for catalysts, effects of heat transfer: Temperature gradients across fluid-solid film and across catalyst pellet.

Generalized Design: Design calculations for ideal catalytic reactors operating at non-isothermal: adiabatic and non-adiabatic conditions, Thermal stability of catalytic reactors and hot-spot formation in catalysts, Deviations from ideal reactor performance Design of industrial fixed-bed, fluidized-bed and slurry reactors.

Text Books:

1. Smith, J.M., Chemical Engineering Kinetics, McGraw-Hill (1981).
2. Fogler, H.S., Elements of Chemical Reaction Engineering, Prentice-Hall India (2003).

Reference Books:

1. Denbigh, K.G., and Turner, J.C.R., Chemical Reactor Theory: An Introduction, Cambridge University Press (1984).
2. Carberry, J.J., Chemical and Catalytic Reaction Engineering, McGraw-Hill, (1976).
3. Levenspiel, O., Chemical Reaction Engineering, John Wiley (1998).