

PCE6D001 ADVANCED CHEMICAL REACTION ENGINEERING (Major)

Module I:

Homogeneous reactor design and analysis-I: Ideal reactors. Review of isothermal design for batch, semi-batch, and flow reactors. Multiple reactions and reaction networks: Yield-selectivity concepts, Wei-Prater analysis for first order networks, reaction networks of general order. Reactor energy balance and its applications to reactor design and analysis.

Module II:

Homogeneous reactor design and analysis-II: Non-ideal reactors. Review of the basic concepts of residence time distributions, single parameter models for real reactor behavior, macromixing and micromixing, segregated flow model and Zwietering's analysis of maximum mixedness, IEM and other models for micromixing.

Module III:

Heterogeneous reactors-I: Gas-solid systems. Review of kinetics of gas-solid catalytic reactions with and without diffusion limitations. Reactor design for fixed and fluidized bed reactors. Selected case studies, Non-catalytic gas-solid reactions: review of kinetics; reactor design case studies.

Module IV:

Heterogeneous reactors-II: Gas-liquid systems. Basic theories of mass transfer with chemical reaction model systems and model reactors, Reactor design for mechanically agitated and bubble column reactors. Selected case studies.

Reference Books:

1. *Chemical Reactor Analysis and Design*, 3rd ed. by G F Froment, K B Bischoff, and J De Wilde, Wiley.
2. *Elements of Chemical Reaction Engineering*, 4th ed. by H S Fogler, PHI.
3. *Chemical Reaction Engineering*, 3rd ed. by O Levenspiel, Wiley.
4. *Chemical Reactor Analysis and Design Fundamentals* by J B Rawlings and J G Ekerdt, Nob Hill Publishing.
5. *Chemical and Catalytic Reaction Engineering* by J J Carberry, Dover Publications.
6. *Heterogeneous Reactions, Vol. I and II* by L K Doraiswamy and M M Sharma, John Wiley & Sons.