



16CH305 CHEMICAL REACTION ENGINEERING-II

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSR	CS	SA	S	BS
45	-	30	10	40	-	3	5	5

Course Description and Objectives:

This course encompasses methodologies to design chemical reactors and also to solve related problems in process industries. The objective of this course is to train the student to estimate non idealities of real reactors, and design of reactor for heterogeneous catalytic and noncatalytic reactions.

Course Outcomes:

The student will be able to :

- identify the non idealities of the reactor.
- model the non ideal reactors using experimental data.
- design fluid particle reactor.
- design catalytic reactor.

SKILLS:

- ✓ Carry out experiments for estimation of non-idealities.
- ✓ Modeling non-ideal reactors.
- ✓ Identify the rate control mechanism in non catalytic reactions.
- ✓ Identify the mechanism in catalytic reactions.

UNIT - 1 **L-9**

NON IDEAL FLOW : E curve, Age distribution of fluid, RTD studies, Conversion in non ideal flow reactors, Dispersion model, Axial dispersion.

UNIT - 2 **L-9**

TANKS IN SERIES MODEL : Pulse response experiments and the RTD, Chemical conversion, Conversion model in laminar flow reactors, Earliness of mixing.

UNIT - 3 **L-9**

FLUID - PARTICLE REACTIONS KINETICS : Rate equation: Fluid particle reactions: Kinetics - selection of a model, Shrinking core model for spherical particles of unchanging size, Rate of reaction for shrinking spherical particles.

UNIT - 4 **L-9**

HETEROGENEOUS REACTIONS : Introduction, Solid catalyzed reactions -pore diffusion resistance combined with surface kinetics, Porous catalyst particles.

UNIT - 5 **L-9**

DEACTIVATING CATALYSTS : Mechanisms of catalyst deactivation, Rate and performance equations.

ACTIVITIES:

- *Modeling of non-ideal reactors using MAT Lab.*
- *Simulation of compartment model using MAT Lab.*
- *Products and reactants concentration profiles in heterogeneous reactions.*

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS

Total Hours-30

1. R.T.D studies in C.S.T.R.
2. R T D studies in C.S.T.R's in series.
3. R.T.D studies in plug flow reactor.
4. R.T.D studies in combined reactor.
5. R.T.D studies in fluidized bed reactor.
6. R.T.D studies in packed bed reactor.
7. Kinetic studies of homogeneous catalytic reactions.
8. Kinetic studies of heterogeneous catalytic reactions.
9. Kinetic studies of deactivation of catalyst.
10. Compartment of modeling of non-ideal reactors.

TEXT BOOK:

1. O. Levenspiel, "Chemical Reaction Engineering", 3rd edition, John Wiley & Sons, 2012.

REFERENCE BOOKS:

1. Fogler H. S., "Elements of Chemical Reaction Engineering", 3rd edition, PHS Publishers, 2014.
2. Simth J. M., "Chemical Engineering Kinetics", 3rd edition, McGraw-Hill, 2014.