Chemical Reaction Engineering - 1

1.1 Course Number: CH251

1.2 Contact Hours 2-1-0 Credits: 8

1.3 Semester-offered: 2nd Year-even

1.4 Prerequisite: Fluid Mechanics, Heat Transfer Operations, Mass and Energy Balances

1.5 Syllabus Committee Member: Dr V S Sistla, Dr G K Agrahari

2. **Objective:** To develop general methodologies for analysis of reaction rate data and for designing of ideal reactors. Students will be encouraged to use programming languages learnt in first year, MATLAB, POLYMATH, MS EXCEL, or other similar tools for solving the equations out of this course for realization of reaction kinetics and behavior of reactors.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Homogeneous Reaction Kinetics	Rate equations of elementary and non-elementary reactions, Analysis of batch reactor data: Reversible and irreversible single reactions, Homogeneous catalytic reactions, Chain reactions, Series, parallel and series – parallel reactions, Enzymatic reactions	7
2	Design of Ideal, isothermal reactor	Behavior of ideal flow reactors, Design of mixed flow reactors, Plug flow reactors and their combinations for single and multiple reactions (series, parallel and series – parallel, Recycle reactors, Yield and selectivity in multiple reactions	8
3	Ideal, non-isothermal reactors	Optimum temperature progression, Adiabatic and non-adiabatic batch, Mixed and plug flow reactors, Exothermic reactions in mixed flow reactors, Multiple reactions: Yield and selectivity	7
4	Non-ideal Reactor	Residence time distribution, Dispersion and tank in series models, Multi-parameter models, Mixing of fluids, Degree of segregation, Laminar flow reactor, Conversion in segregated flow, Early and late mixing, Mixing of two fluids - Product distribution in multiple reactions	6
		Total	**28**

4. **Readings**

4.1 Textbooks:

1. H.S. Fogler, *Elements of Chemical Reaction Engineering*, 5th Ed., Prentice Hall, 2016.
2. O. Levenspiel, *Chemical Reaction Engineering*, 3rd Ed., Wiley, 2004.

4.2 Reference books:

1. J.M. Smith, *Chemical Engineering Kinetics*, 3rd Ed., McGraw-Hill, New York, 2014.
2. C.G. Hill and T.W. Root, *Introduction to Chemical Engineering Kinetics and Reactor Design*, 2nd Ed., Wiley, 2014.

5. **Outcome of the Course:** After the completion of this course the students will get a background in chemical reaction kinetics with the foundation necessary for the design of chemical reactors. The students will also acquire knowledge and skills required to design optimum reactor systems, and operating conditions, by applying the laws of conservation of mass and energy, reaction kinetics and flow rates. The application of computation tools will enhance the learning of students.