BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE- PILANI,
K. K BIRLA GOA CAMPUS
INSTRUCTION DIVISION
FIRST SEMESTER 2019-2020
Course Handout for Kinetics and Reactor Design

Course No.	**: CHE F311**
Course Title	**: Kinetics & Reactor Design**
Instructor-in-charge	**: Dr. Srinivas Krishnaswamy**
Instructor (Lectures/Tutorial)	**: Dr. Srinivas Krishnaswamy**

1. COURSE DESCRIPTION

Kinetics of homogeneous, heterogeneous reactions; ideal reactors, non-ideal flow; selectivity; analysis and design of chemical reactors.

2. SCOPE AND OBJECTIVE OF THE COURSE

This course is an introduction to the study of chemical reaction kinetics, design and performance of various types of chemical reactors for chemically reacting systems which yield industrially important products. The emphasis in this course will be to understand the fundamentals of kinetics of homogeneous reactions, design and analysis of ideal reactors; and non-ideal flow.

3. TEXT BOOK

H. Scott Fogler "Elements of Chemical Reaction Engineering", PHI, 4th Ed, 2007 or later edition

4. REFERENCE BOOKS

a. O. Levenspiel, "Chemical Reaction Engineering", John Wiley, 3rd Ed., 1999

5. COURSE PLAN

Lecture No.	Learning Objectives	Topics to be covered	Ref./Ch./Sec
1	Introduction	Scope and objectives of the course, methodology, concept of mole balances	1.1-1.2
2-3	Mole balances	Different types of reactors, mole balances	1.3-1.5
4	Design equations	Conversion and reactor sizing	2.1-2.2
5-6	Applications of design equations	Reactor sizing for batch and flow systems	2.3-2.5

7-8	Rate laws and stoichiometry	Basic definitions and stoichiometric tables	3.1-3.6
9-10	Isothermal reactor design	Design structure, design of batch and flow reactors	4.1-4.4
11	Effect of pressure	Pressure drop in reactors	4.5
12	Additional topics in reactor design	Membrane , micro reactors	4.6-4.7
13-14	Collection and analysis of rate data	Differential and integral methods of analysis, examples	5.1-5.4
15	Evaluation of laboratory reactors	Differential reactors, comparison of experimental reactors	5.5-5.7
16-18	Multiple reactions	Maximizing desired product in parallel and series reactions	6.1-6.2
19	Complex reactions	Stoichiometric tables	6.3
20-22	Non-elementary homogeneous reactions	Applications of PSSH and specific examples	7.1-7.4
23	Non isothermal reactor design	Energy balance	8.1-8.2
24	Flow reactors	Steady state reactor design of CSTR and PER	8.3
25-27	Additional topics	Equilibrium conversion, non-adiabatic operation, multiple study states, multiple reactions	8.4-8.7
28	Unsteady state reactor design	Batch reactors	9.1-9.2
29	Catalysis	Catalysts and mechanism of catalytic reactions	10.1-10.2
30	Finding the rate law	Mechanism, rate-limiting step and rate law	10.3
31	Reactor design	Design of reactors for Gas-solid reactions	10.4
32	Analysis of rate data for heterogeneous reactions	Deducing the rate law from experimental data; **External Diffusion effects on heterogeneous reactions*****	10.5-10.6
33-34	Reactions in porous catalysts	Diffusion and reaction in porous catalysts	11.1-11.5
35-36	Diffusion and reaction	Spherical catalyst pellets	12.1 – 12.5
37-38	Non ideal reactors	RTD, measurement and characteristics, RTD in ideal reactors	13.1-13.5
39-40	Reactor modelling with RTD	Zero-parameter models	13.6-13.9

*** Will be treated as a separate topic during the course (Time permitting)

6. **EVALUATION SCHEME**

EC No.	Evaluation Component	Duration	Weightage %	Date & Time	Remarks
1.	Test I	90 minutes	20	29.09.19, Saturday 9.00 AM – 10:30 AM	Open / Closed Book
3.	Tutorial Quiz/ Assignments / Quiz / Attendance	-	30	To be announced in class	-
4.	Comprehensive Exam	3 hours	40	07.12.19 (AN)	Open / Closed Book

The nature of exam will be announced in class

- Chamber consultation hours will be announced in the class.
- The notices will be displayed on the Chemical Engineering Notice Board – Wing A only.
- Make-up will be granted for genuine cases only. Prior permission of IC is compulsory.

Instructor-in-charge
CHE F311

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