Strategic Plan for Learning and Teaching
Department of Chemical Engineering

Branch Name:	Chemical Engineering (CHE)	**Session :**	2018-2019
Subject Name:	Chemical Reaction Engineering	**Year:**	3rd
Subject Code:	CHE 502	**Semester :**	5th

Course Objective:	• To apply knowledge from calculus, differential equations, thermodynamics, general chemistry, and material and energy balances to solve reactor design problems, • Examine reaction rate data to determine rate laws, and to use them to design chemical reactors
Course Outcome:	• Will be able to develop rate laws for homogeneous reactions and heterogeneous reactions • Develop skills to choose the right reactor among single, multiple, recycle reactor, etc. schemes • Ability to distinguish between various RTD curves and predict the conversion from a non-ideal reactor using tracer information. • Will acquaint the students to design of ideal reactors for single and complex reactions, reactors for non-catalytic and catalytic reactions and non-isothermal reactors and the heat exchange equipment required

Teaching-Learning Plan:

Lecture Class No.	Reference to the WBUT Syllabus	Subject Topics to be discussed/ covered/ delivered	Text book / Referred book Sl.No.
1	Mod-I	Introduction; Definition of reaction rate	1,2
2		Concentration-dependent term of a rate equation, single and multiple reactions, rate equation from given mechanisms.	
3		Elementary & Nonelementary reactions, Molecularity and order of reaction, Representation of reaction rate, Kinetics for non-elementary reactions, related problems	
4		Temperature dependent term of a rate equation: Arrhenius law, Collision theory, Transitionstate Theory, related problems; Interpretation of batch reactor data: Constant-volume batch reactor	
5		Integral method of analysis of data: General Procedure, Irreversible unimolecular-type first-order reaction, Irreversible bimolecular-type second-order reactions	
6		rate equation for enzymatic reaction, Zero-order reactions, Over-all order of irreversible reactions from the Half-life method, Initial rate method of analysis	
7		Irreversible Reactions in parallel, Autocatalytic reactions, Irreversible reactions in series, First-order Reversible Reactions	
8		Differential method of Analysis of data: Analysis of the Complete Rate Equation, Partial analysis of rate equation	
9		Variable-Volume reaction system: Its Integral method of analysis for Zero-order reactions, First order reaction, Second-order reactions;	

10	Mod-II	Introduction; Basic division of ideal reactors, Ideal Batch Reactor	1,2
11		Concept of flow reactors, Space-time and Space-velocity, Steady-state Mixed Flow Reactor: Design equation	
12		Graphical Representation of Design Equation, related problem; Steady-state Plug Flow Reactor: Design equation, graphical representation, related problem	
13		Design for Single Reactions: Size and comparison of single reactors: Batch Reactor, PFR, MFR	
14		General Graphical Comparison; Multiple-Reactor Systems: PFRs in Series and/or in Parallel, Equal-size MFRs in Series, MFRs of different sizes in Series	
15		Determining the best size combination of reactor size for a given combination, Reactors of Different Types in Series	
16		Recycle Reactor: Definition of Recycle Ratio, Design Equation, and Optimum Recycle ratio	
17	Mod-III	Introduction, Reactions in Parallel, Qualitative aspects of Product Distribution	1,2
18		Quantitative Treatment of Product Distribution and of Reactor Size: Definition of Instantaneous and Overall fractional yield,	
19		graphical representation; Reactions in Series: Successive First-Order Reactions, Product Distribution	
20		Quantitative Treatment of PFR, MFR and Batch Reactor.	
21		Introduction	1,2
22		Basic idea of catalysis, Catalyst properties, Steps in catalytic reaction	
23		Qualitative discussion on Pore Diffusion, Adsorption, Surface reaction and Desorption, Concept of Rate limiting step	
24		Design of reactors for gas-solid reactions: Design equation and data analysis of heterogeneous system	
25		diffusion controlled reactions (single cylindrical pore, first-order reaction): Material balance for the elementary slice of catalyst pore, Definition of Thiele Modulus and Effectiveness Factor	
26		Fluid-Particle Reactions: Introduction; Different behavior of reacting solid particles; Selection of a Model; Qualitative discussion on Progressive Conversion Model & Unreacted Core Model	
27		Introduction to non isothermal reactions: adiabatic and temperature programmed reactions	
28	Mod-IV	General Characteristics; Residence-Time Distribution (RTD) Function	1,2
29		Measurement of the RTD: Pulse Input; Related problems	
30		Characteristics of RTD: Integral Relationships, Mean Residence Time, Different Moments of RTD	
31		RTD in Ideal Reactor: RTD in Batch and PFR, Single CSTR, PFR/CSTR series RTD	
32		Concept of Macromixing & Micromixing,	
33		Zero Parameter Model: Segregation Model & Maximum Mixedness Model	
34		Models for Nonideal Reactors: Introduction; One-Parameter Models: Tanks in Series Model	
35		Dispersion Model: Basic Formulation,	
36		Definition of Peclet Number & Vessel Dispersion Coefficient	
37		Boundary Conditions (Closed-Closed & Open-Open)	
38		Correction for Sloppy Tracer Input	
39		Relation between Flow	
40		Reaction and Dispersion	

Recommended Text/ Reference Books:

Sl.No.	Name of Text/ Reference Book	Name of Author	Publisher & edition
1	Elements of Chemical Reaction Engineering, 2.	H. Scott Fogler	4th. Edition, , Prentice Hall
2	Chemical Reaction Engineering,	O Levenspiel.	Wiley Eastern Ltd.2nd. & 3rd. editions,

Course Co-ordinator / Faculty

Sl. No.	Name of the Course Co-ordinator / Faculty	Signature of Course coordinator / Faculty		Signature of HOD	
1	Dr.Debasis Ghosh				
2	Dr. Ardhendu Sekhar Giri				