SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

DEPARTMENT OF CHEMICAL ENGINEERING			LP: CH18602
~~B.E~~/B.Tech/~~M.E/M.Tech~~	: Chemical Engineering	Regulation: 2018A	Rev. No: 00
PG Specialisation	: NA		Date: 28.12.2023
Sub. Code / Sub. Name	: CH18602 Chemical Reaction Engineering II		
Unit	: I		

Unit Syllabus: Catalysts

Nature of catalysts, adsorption isotherms, surface area and pore-volume distribution, catalyst preparation.

Objective: To study about the characteristics and types of various industrial catalysts based on their preparation methods.

Session No *	Topics to be covered	Ref	Teaching Aids
1	Introduction		PPT/BB
2	Nature of catalysts	T2: Pg 646-651	PPT/BB
3	Adsorption Isotherms – Langmuir, Freundlich, BET	R1:Pg 314 - 320	PPT/BB
4	Other Adsorption Isotherms – Temkin, Toth etc., Problems – Isotherm fitting	R1:Pg 322 - 326	PPT/BB
5	Surface area determination of catalysts	R1: Pg 329 - 333	PPT/BB
6	Pore volume distribution of catalysts	R1: Pg 338 - 348	PPT/BB
7	Problems on surface area and pore volume	R1: Pg 328, 333 - 338	PPT/BB
8	Catalyst preparation methods	R1: Pg 351 - 356	PPT/BB
9	Review - Unit I		PPT/BB

Content beyond syllabus covered (if any):

* Session duration: 50 minutes

Sub. Code / Sub. Name: CH18602 Chemical Reaction Engineering II

Unit : II

Unit Syllabus: Heterogeneous Reactions

Rate equations for heterogeneous reactions, rates of adsorption and desorption, surface reaction, analysis of rate equation and rate controlling steps.

Objective: To derive rate equations for heterogeneous reactions.

Session No *	Topics to be covered	Ref	Teaching Aids
10	Introduction to Heterogeneous Catalyzed Reactions	T1: Pg 369 – 375 T2:Pg 652 - 657	PPT/BB
11	Rate equations for Heterogeneous Reactions	R1: Pg 359 - 360	PPT/BB
12	Rate of Adsorption, Desorption and Surface Reaction	R1: Pg 359 - 363	PPT/BB
13	Single site and Dual site adsorption	T2: Pg 666 - 667	PPT/BB
14	LHHW, Eley- Rideal mechanism	T2: Pg 668 - 669	PPT/BB
15	Rate controlling Steps - Adsorption	T2:Pg 669 - 677	PPT/BB
16	Rate controlling Steps - Surface Reaction	T2:Pg 677 - 678	PPT/BB
17	Rate Controlling Steps – Desorption	T2:Pg 678 - 681	PPT/BB
18	Review – Unit II		PPT/BB

Content beyond syllabus covered (if any): Pseudo Steady State Hypothesis

* Session duration: 50 mins

SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name: CH18602 Chemical Reaction Engineering II

Unit : III

Unit Syllabus: Gas-Solid Catalytic Reactions
Diffusion within catalyst particle, effective thermal conductivity, mass and heat transfer within catalyst pellets, effectiveness factor, Thiele Modulus, fixed bed reactors.

Objective: To discuss the additional effects of diffusion, mass and heat transfer in catalyst pellet in reaction rates and the significance of Thiele modulus.

Session No *	Topics to be covered	Ref	Teaching Aids
19	Introduction to Gas-Solid Catalytic Reactions	R1: Pg 450 - 452	PPT/BB
20	Gaseous Diffusion within single catalyst pores and in porous catalysts	R1: Pg 452 - 461	PPT/BB
21	Concept of Effective Thermal Conductivity	R1: Pg 473 - 477	PPT/BB
22	Effectiveness factors	R1: Pg 477 - 483	PPT/BB
23	Thiele Modulus and its significance	T2: Pg 827 - 839	PPT/BB
24	Effectiveness factor as a function of Thiele modulus for various shape of catalysts	T2: Pg 827 - 839	PPT/BB
25	Problems - Effectiveness factors, Thiele modulus	T2: Pg 839 - 841	PPT/BB
26	Performance equation for reactors containing porous catalysts	T1: Pg 393 - 396	PPT/BB
27	Problems – Using performance equation	T1: Pg 407 - 417	PPT/BB
28	Heat transfer in Catalyst pellets	R1: Pg 500 - 507	PPT/BB
29	Mass Transfer with reaction in Catalyst pellets	T2: Pg 814 - 823	PPT/BB
30	Mass and Heat Transfer with reaction	R1: Pg 500 - 506	PPT/BB
31	Design of fixed bed reactors	R1: Pg 549 - 552	PPT/BB
32	Mass Transfer limited reactions in packed beds	T2: Pg 780 - 783	PPT/BB
33	Review – Unit III		PPT/BB

Content beyond syllabus covered (if any): Design of Fluidized bed reactors

* Session duration: 50 mins

SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name: CH18602 Chemical Reaction Engineering II

Unit : IV

Unit Syllabus: Gas-Solid Non-Catalytic Reactions
Models for explaining kinetics; volume and surface models; controlling resistances and rate controlling steps; time for complete conversion for single and mixed sizes, fluidized and static reactors.

Objective: To Develop of rate equations for diffusion controlled Gas-Solid Non-catalytic reactions and calculate the time required for complete conversion of reactants.

Session No *	Topics to be covered	Ref	Teaching Aids
34	Introduction to Gas-Solid non-catalytic reactions	T1: Pg 566 -568	PPT/BB
35	Models for explaining kinetics	T1: Pg 568	PPT/BB
36	Progressive Conversion model (PCM) and Shrinking core model (SCM) Comparison	T1: Pg 569	PPT/BB
37	Shrinking Core model with Gas film control (Particle size unchanging)	T1: Pg 570 - 573	PPT/BB
38	Shrinking Core Model with Ash layer control (Particle size unchanging)	T1: Pg 573 - 575	PPT/BB
39	Shrinking Core Model with Chemical Reaction control (Particle size unchanging)	T1: 575 - 576	PPT/BB
40	Shrinking Core model for spherical particle with changing size	T1: Pg 577 - 579	PPT/BB
41	Limitations of Shrinking core model	T1: Pg 581 - 582	PPT/BB
42	Determination of Controlling resistances and Rate controlling steps	T1: Pg 582 - 586	PPT/BB
43	Conversion of Mixture of particles of different but unchanging size (Plug flow)	T1: Pg 591 - 594	PPT/BB
44	Conversion of Mixture of particles of single unchanging size (Mixed Flow)	T1: Pg 594 - 598	PPT/BB
45	Mixed flow of a size mixture of particles of unchanging size	T1: Pg 598 - 602	PPT/BB
46	Fluidized reactors	T1: Pg 447 - 451	PPT/BB
47	Static reactors	T2: Pg 780 - 783	PPT/BB
48	Review - Unit IV		PPT/BB
Content beyond syllabus covered (if any):			

* Session duration: 50 mins

SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name: CH18602 Chemical Reaction Engineering II

Unit : V

Unit Syllabus: Gas-Liquid Reactions

Absorption combined with chemical reactions; mass transfer coefficients and kinetic constants; application of film, penetration and surface renewal theories; Hatta number and enhancement factor for first order reaction, tower reactor design.

Objective: To discuss the application of mass transfer principles in Gas-Liquid Reactors.

Session No *	Topics to be covered	Ref	Teaching Aids
49	Introduction to Gas-Liquid Reactions, Types	T1 - Pg 540 - 543	PPT/BB
50	Rate Equation for straight mass transfer (absorption)	T1 - Pg 524 - 527	PPT/BB
51	Rate Equation for mass transfer and reaction	T1- Pg 527 - 537	PPT/BB
52	Mass transfer coefficients and kinetic constants	T1 - pg 527 - 533	PPT/BB
53	Theories of mass transfer – Film, Penetration Theory and Surface renewal theory	T1 – Pg 531	PPT/BB
54	Application of film, penetration and surface renewal theories	T1 – Pg 531	PPT/BB
55	Hatta number - Significance	T1 – Pg 529	PPT/BB
56	Enhancement factor - Significance	T1 – Pg 529	PPT/BB
57	Reactor design for different categories of reactions	T1 -Pg 546 -551	PPT/BB
58	Tower reactor design	T1 – Pg 540 - 546	PPT/BB
59	Problems – Reactor design	T1 – Pg 551 - 562	PPT/BB
60	Problems	T1 – Pg 551- 562	PPT/BB
	Review – Unit V		PPT/BB

Content beyond syllabus covered (if any):

* Session duration: 50 mins

SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Sub Code / Sub Name: CH18602 Chemical Reaction Engineering II

TEXTBOOKS:

1. Levenspiel, O., "Chemical Reaction Engineering ", Third Edition, John Wiley, 2014.
2. Fogler. H. S. "Elements of Chemical Reaction Engineering ", Fourth Edition., Prentice Hall of India, 2010.

REFERENCES:

1. Smith J.M., "Chemical Engineering Kinetics ", Third Edition, McGraw-Hill, New York, 2014
2. Froment G.F & K.B. Bischoff, "Chemical Reaction Analysis and Design", Third Edition, John Wiley and Sons,

	Prepared by	Approved by
Signature	A.C.Vijayalakshmi	N. Meyyappan 28/12/23
Name	Mrs. A.C. Vijayalakshmi	Dr. N. Meyyappan
Designation	Assistant Professor	Professor and Head
Date	28.12.23	28.12.23
Remarks *:		
Remarks *:		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD