SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

DEPARTMENT OF CHEMICAL ENGINEERING		LP: CH22402 Rev. No: 00 Date: 24/01/2024
~~B.E~~/B.Tech/~~M.E/M.Tech~~ : CHEMICAL ENGINEERING	Regulation: 2022	
Sub. Code / Sub. Name : **CH22402 - MASS TRANSFER I**		
Unit : I		

Unit Syllabus: Molecular diffusion in gases and liquids, measurement and calculation of diffusivities, steady state diffusion in multicomponent mixtures.
Diffusion in solids, molecular and Knudsen diffusion in porous solids, unsteady state diffusion in solids.

Objective: To understand the concept of diffusion through fluids and solids.

Session No *	Topics to be covered	Ref	Teaching Aids
1	Introduction to mass transfer operations - About diffusion, Mass transfer coefficient, humidification, drying and crystallization operations	T1-Ch.1; pg. 1-7	PPT/ BB
2	Molecular diffusion in gases – Fick's law, diffusion of A through non-diffusing B, equimolar counter diffusion	T1-Ch.2; pg.21-34	PPT / BB
3	Diffusion in liquids - diffusion of A through non-diffusing B, equimolar counter diffusion-unsteady state diffusion	T1-Ch.2; pg.34 - 41	PPT / BB
4	Diffusion in solids – diffusion in special type of solids - Knudsen diffusion	T2-Ch.6; pg.440-446	PPT/ BB
5	Problems on diffusion of liquids, gases and solids	T2-Ch.6; pg.452-457	PPT/ BB
6	Problems on diffusion of liquids, gases and solids (continuation)	T2-Ch.6; pg.452-457	PPT/ BB
7	Problems on diffusivity measurements	T2-Ch.6; pg.452-457	PPT/ BB
8	Multi-component diffusion – diffusion of A through non diffusing B&C, Stefan Maxwell method	T2-Ch.7; pg.498-499	PPT/ BB
9	Problems on Multicomponent diffusion	T1-Ch.2, pg 29	PPT/ BB
Content beyond syllabus covered (if any): Molecular diffusion in biological solutions and gels			

* Session duration: 50 minutes

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Sub. Code / Sub. Name: **CH22402 - MASS TRANSFER I**

Unit : II

Unit Syllabus: Eddy diffusion, concept of mass transfer coefficients, theories of mass transfer, different transport analogies, application of correlations for mass transfer coefficients, inter phase mass transfer, relationship between individual and overall mass transfer coefficients. NTU and NTP concepts, Stage-wise and differential contractors.

Objective: To understand the concept of Mass transfer coefficients and its application

Session No *	Topics to be covered	Ref	Teaching Aids
10	Eddy diffusion – Introduction, rate equations	T1-Ch.3; pg.54-59	PPT/ BB
11	Concept of mass transfer coefficients – types of mass transfer coefficient (MTC), MTC in laminar flow	T1-Ch.3; pg.47-50	PPT/ BB
12	Theories of mass transfer – film theory, penetration theory, surface renewal theory	T1-Ch.3; pg.59-64	PPT/ BB
13	Different transport analogies – Reynold's analogy, Chilton colburn analogy, Prandtl analogy, Von Karman analogy	T1-Ch.3; pg.66-70	PPT/ BB
14	Application of correlations for mass transfer coefficients – application in packed towers, fluidized bed	T2-Ch.7; pg.473-474	PPT/ BB
15	Inter phase mass transfer – mass transfer between gas and liquids surface	T1-Ch.5; pg.104-108	PPT/ BB
16	Relationship between individual and overall mass transfer coefficients	T1-Ch.5; pg.109-111	PPT/ BB
17	NTU and NTP concepts – concepts & calculation on NTU and NTP	T2-Ch.10; pg.676-678	PPT/ BB
18	Stage-wise and differential contractors – design of contactors	T1-Ch.5; pg.123-	PPT/ BB
Content beyond syllabus covered (if any):			

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Unit : III

Unit Syllabus: Humidification – Equilibrium, humidification operations; theory and types of cooling tower, dehumidifiers and humidifiers using enthalpy transfer unit concept.

Objective: To understand the concept of humidification and usage of psychometric chart and design of cooling tower

Session No *	Topics to be covered	Ref	Teaching Aids
19	Humidification – Equilibrium – vapour – liquid equilibria, enthalpy for pure substances	T1-Ch.7; pg.220-226	PPT/ BB
20	Humidity chart – properties of humidification	T1-Ch.7; pg.228-234	PPT/ BB
21	Problems using psychometric chart for finding properties of air – water system	T1-Ch.7; pg.272-274	PPT/ BB
22	Adiabatic and wet bulb temperatures- adiabatic saturation curve	T1-Ch.7; pg.236-237	PPT/ BB
23	Theory of wet bulb thermometry	T1-Ch.7; pg.237-240	PPT/ BB
24	Humidification operations – adiabatic and non-adiabatic operations	T1-Ch.7; pg.242-263	PPT/ BB
25	Theory and design of cooling towers – calculation of NTU and height of cooling tower	T1-Ch.7; pg.245-247	PPT/ BB
26	Types of cooling towers and problems	T1-Ch.7; pg.259-262, pg.272-274	PPT/ BB
27	Dehumidifiers and humidifiers using enthalpy transfer unit concept.	T1-Ch.7; pg.256	PPT/ BB

Content beyond syllabus covered (if any): Humidification and dehumidification operations in industries.

* Session duration: 50 mins

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Sub. Code / Sub. Name: **CH22402 - MASS TRANSFER I**

Unit : IV

Unit Syllabus: Drying Theory and Mechanism, Drying Characteristics, Estimation of Drying time, drying rate curve, Classification of Driers, Through circulation driers design, Design of driers, Description and Application of Driers, Analysis of continuous driers.

Objective: To understand the concept of drying and different types of industrial driers

Session No *	Topics to be covered	Ref	Teaching Aids
28	Drying– Equilibrium – Basic definitions in drying	T1-Ch.12; pg.655-662	PPT/ BB
29	Classification of dryers – batch and continuous dryers	R3-Ch.18; pg.662-667	PPT/ BB
30	Batch drying – total time of drying (constant rate and falling rate period)	T1-Ch.12; pg.670-671	PPT/ BB
31	Problems on total time of drying	T1-Ch.12; pg.670-671	PPT/ BB
32	Parameters affecting drying rate	T1-Ch.12; pg.675-676	PPT/ BB
33	Mechanism and time of cross through circulation drying	T1-Ch.12; pg.688-689	PPT/ BB
34	Continuous dryers - Material and energy balance – at high and low temperature	R3-Ch.18; pg.734-735	PPT/ BB
35	Problems on continuous drying	T1-Ch.12; pg.713-716	PPT/ BB
36	Design of driers and applications	NPTEL material	PPT/ BB

Content beyond syllabus covered (if any): Modern drying techniques like dielectric, infrared and freeze drying

* Session duration: 50 mins

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Unit : V

Unit Syllabus: Crystallization - Equilibrium, classification of crystallizers, mass and energy balance; kinetics of crystallization – nucleation and growth; design of batch crystallizers; population balance model and design of continuous crystallizers.

Objective: To understand the concept of crystallization and its industrial significance

Session No *	Topics to be covered	Ref	Teaching Aids
37	Crystallization – Equilibrium – crystal geometry and its principle	R1-Ch.15; pg.827-836	PPT/ BB
38	Classification of crystallizers – batch and continuous crystallizers	R1-Ch.15; pg.853-860	PPT/ BB
39	Mass and energy balance	R1-Ch.15; pg.862	PPT/ BB
40	Kinetics of crystallization – nucleation and growth - ΔL of Crystal growth	R1-Ch.15; pg.840-844	PPT/ BB
41	Problems on Crystal yield	R1-Ch.15; pg.851-852	PPT/ BB
42	Design of batch crystallizers	R1-Ch.15; pg.862	PPT/ BB
43	Problems on batch crystallization	R1-Ch.15; pg.865	PPT/ BB
44	Population balance model and design of continuous crystallizers	R1-Ch.15; pg.863-868	PPT/ BB
45	Problems on population balance model	R1-Ch.15; pg.865	PPT/ BB

Content beyond syllabus covered (if any): New techniques applied in industries for crystallization

* Session duration: 50 mins

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TEXTBOOKS:

1. Treybal, R.E., "Mass Transfer Operations", 3rd Edition, McGraw-Hill, 1981.
2. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edition., McGraw-Hill, 2005.
3. Geankoplis, C.J., "Transport Processes and Separation Process Principles Includes Unit Operations", 4th Edition, Prentice Hall Inc., New Jersey, 2003

REFERENCES:

1. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I and II,4th Edition, Asian Books Pvt. Ltd., India, 1998
2. Foust A.S, "Principles of Unit Operations", 2nd Edition, John Wiley, 2008
3. Seader J.D & Henley E.J, "Separation Process Principles", 2nd Edition, John Wiley, 2006.
4. E.L. Cussler, "Diffusion, Mass Transfer in Fluid Systems", Second Edition, Cambridge University Press, 1997

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Date	24.01.2024	24.01.24
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