UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA

LESSON PLAN

DEPARTMENT OF CHEMICAL ENGINEERING

LESSON PLAN

SUBJECT CODE : TH-3

NAME :Mass Transfer-I

BRANCH : CH

SEMESTER :Diploma-IV

CREDIT POINTS : 4

NUMBER OF MODULES : 4

CLASSES REQUIRED : 60

PRE-REQUISITE : TO UNDERSTAND MASS TRANSFER OPERATIONS SUCH AS DISTILLATION, ABSORPTION, ADSORPTION OPERATIONS IN CHEMICAL ENGINEERING PRACTICES INVOLVE TRANSFER OF MASS OF A MATERIAL FROM ONE PHASE (E.G. LIQUID) TO THE OTHER PHASE (E.G. GASEOUS) ASSOCIATED WITH OR WITHOUT CHEMICAL REACTIONS.

MODULE-I

Fundamental of Mass Transfer: 1. Importance of mass transfer operations, 2. General principle of mass transfer operations, 3. Classify mass transfer operations, 4. Molecular diffusion and inter phase diffusion, 5. Diffusion in gases and liquids, 6. Explain Fick's law & mass transfer coefficient

Objectives:

To understand the definitions & basic concepts of Diffusion**,** principle of mass transfer operations and also to determine diffusivity and mass transfer coefficient by Fick's Law.

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)
1	Importance of mass transfer operations	T1, R1, R2
2	General principle of mass transfer operations	T1, R2
3	Classify mass transfer operations	T1, R2
4	Molecular diffusion and inter phase diffusion	T1, R1, R2
5	Two film theory, Penetration theory for diffusion	R1, R2
6	Diffusion in gases and liquids	R1,R2
7	Mathematical formula for diffusivity for diffusion in gas and liquid	R1,R2
8	Explain Fick's law & mass transfer coefficient	T1, R1, R2
9	Problem solving on Fick's Law	T1, R1, R2
10	Correlation between overall mass transfer coefficient and gas/liquid film mass transfer coefficient	R1, R2

MODULE-II

Distillation: 1. Types of boiling point diagrams and enthalpy concentration diagrams, 2. Vapour liquid equilibrium, 3. Relative volatility and derive an expression between $\propto$ & x-y, 4. Draw XY data (equilibrium curve) for different system in graph paper, 5. Simple distillation & Derivation of Rayleigh's equation (solve simple problems), 6. Flash distillation and material balance in flash distillation, 7. Continuous rectification of binary system, 8.Construction of rectification column, 9. Types of trays & re-boiler, 10. Channeling, weeping, entrainment and flooding, 11. Analyze fractionating column by McCabe and Thiele Method and find out feed plate location (solve simple problems), 12. Reflux ratio and concept of minimum, optimum and total reflux ratio, 13.Plate efficiency, Murphee's efficiency, 14.Steam distillation and its application, 15.Azeotropic distillation and extractive distillation.

Objectives:

To understand various terms involved in distillation and types of distillation and can plot equilibrium curve for different system. To study the Construction of rectification column, Types of trays & re-boiler and also have a clear idea about McCabe and Thiele Method.

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)
11	Definition and terminologies of Distillation	T1, R1, R2
12	Types of boiling point diagrams	T1, R2
13	Enthalpy concentration diagrams	T1, R2
14	Vapour liquid equilibrium	T2, R1, R2
15	Relative volatility and derive an expression between $\propto$ & x-y	R1, R2
16	Draw XY data (equilibrium curve) for different system in graph paper	R1,R2
17	Simple distillation & Derivation of Rayleigh's equation	R1,R2
18	Solve problems based on Rayleigh's equation	T2, R1, R2

19	Flash distillation and material balance in flash distillation	T2, R1, R2
20	Continuous rectification of binary system	R1, R2
21	Construction of rectification column	T1, R1, R2
22	Types of trays	T2, R1
23	Types of re-boiler	T1, R1,
24	Channeling, weeping, entrainment and flooding	T2, R1, R2
25	Analysis of fractionating column by McCabe and Thiele Method	T1, R1, R2
26	Material balance equations of fractionating column	T1, R2
27	Problem based on feed plate location	T1, R2
28	Problem based on McCabe and Thiele Method	T2, R1, R2
29	Reflux ratio and concept of minimum reflux ratio	R1, R2
30	Optimum and total reflux ratio	R1,R2
31	Plate efficiency, Murphee's efficiency	R1,R2
32	Steam distillation and its application	T2, R1, R2
33	Azeotropic distillation	T2, R1, R2
34	Extractive distillation	R1, R2
35	Revision and MCQ discussion	T1, R1, R2

MODULE-III

Absorption: 1. Principles of absorption and factors affecting rates of absorption, 2. Different equipments used for absorption, 3. Types of packing materials used in absorption, explain regular and random packing, 4. Loading, flooding and its effect on pressure drop, minimum gas-liquid ratio, HETP, 5. Elementary ideas about spray tower and wetted wall column

Objectives:

To study the Fundamental concepts, terminologies of absorption, know different equipments used for absorption and understand the concepts of effect on pressure drop, minimum gas-liquid ratio, HETP

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)
36	Principles of absorption , types of absorption	T1, R1, R2
37	Factors affecting rates of absorption	T1, R2
38	Comparison between absorption and distillation	T2, R2
39	Material balance on absorption	T1, R1, R2
40	Effect on pressure drop, minimum gas-liquid ratio	R1, R2
41	Types of packing materials used in absorption	R1,R2
42	regular and random packing	R1,R2
43	Loading, flooding, HETP	T2, R1, R2
44	Elementary ideas about wetted wall column	T1, R1, R2
45	Elementary ideas about spray tower	R1, R2
46	Different equipments used for absorption	T1, R1, R2
47	Comparison of equipments used for absorption	T2, R1
48	Types of packing materials used in absorption	T1, R1,
49	Regular and Random packing	T1, R1,
50	Revision of the chapter	T1, R1,

MODULE-IV

Adsorption: 1. The principles of adsorption and types of adsorption and factors affecting adsorption, 2.The different types of adsorbents and nature of adsorbents, 3.Elutriation, percolation and industrial application of adsorption, 4. Construction and operation of Industrial adsorption equipment

Objectives:

To study the Fundamental concepts, terminologies of adsorption, know different equipments used for absorption and understand types of adsorbents and nature of adsorbents

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)
51	The principles of adsorption	T1, R1, R2
52	Comparison between absorption and adsorption	T2, R2
53	Types of adsorption	T1, R2
54	Factors affecting adsorption	T2, R1, R2
55	Different types of adsorbents	R1, R2
56	Nature of adsorbents	R1,R2
57	Elutriation, percolation	R1,R2
58	Industrial application of adsorption	T1, R1, R2
59	Construction of Industrial adsorption equipment	T2, R1, R2
60	Operation of Industrial adsorption equipment	R1, R2

Course Delivery Plan

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
MODULE	1	1	1&2	2	2	2	2	2	2&3	3	3	3	3&4	4	4

BOOKS FOR REFERENCE:

TEXT BOOKS

T1: Separation Operation by Binay Dutt, PHI Publication

T2: Unit Operation-II by K.A Gavane, Nirali Publications

REFERENCE

R1: Unit operation of Chemical Engineering by Mc Cabe & J M Smith, Tata Mc Grawhill Publication.

R2: Mass Transfer by Treybel, Tata Mc Grawhill Publication.

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