GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering Syllabus

Subject Code : 3164401

Subject Name : Mass Transfer - II

WEF Academic Year :	2021 - 22
Semester :	6
Category of the Course :	Professional Core

Prerequisite :	Mass Transfer - I
Rationale :	The purpose of this course is to utilize mass transfer principles to conduct an in-depth examination and address challenges related to standard unit operations like humidification, adsorption, drying, etc., with a focus on separation.

Course Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Course Content :

Sr. No.	Course Content	No. of Hours	% of Weightage
1	**Humidification Operations :** VLE and Enthalpy for a pure substance, Saturated and unsaturated vapour-gas mixtures and related terminologies such as absolute humidity, dry bulb temperature, dew point, wet bulb temperature, percentage & relative saturation, adiabatic saturation temperature, humid heat, humid volume etc. Psychometric chart & Psychometric relations for air-water system, adiabatic saturation curves, wet bulb temperature theory, Lewis relation, Adiabatic operations, cooling towers.	10	20
2	**Drying operations :** Mechanism of drying and drying equilibria, drying rate curve, Drying: rate of drying for batch dryers, Drying: rate of drying for continuous dryers, Drying time calculation from drying rate curve, Batch & continuous drying equipments-Tray dryer, Tunnel dryer, Rotary dryers, Spray dryers, Fluidized bed dryer, etc.	8	16

3	**Adsorption and Ion-exchange :** Adsorption: types and nature, isotherm, Stage wise and continuous adsorption, Fluidized bed and teeter bed, Unsteady state fixed bed adsorbers, concepts of adsorption wave, break-through curve, Pressure swing adsorber Ion-Exchange: Principles, Techniques, Applications, Equilibria and Rate of ion exchange.	10	18
4	**Liquid-liquid extraction :** Ternary liquid- liquid equilibrium and tie line data, system of three liquids-one pair partially soluble, two partially soluble, two partially soluble liquids and one solid, multi- component system, stage wise contact, Single stage & multistage extraction, Co-current and cross current extraction, Continuous counter current multistage extraction with and without reflux, Theory & performance of continuous contact equipments, Single stage & multistage equipments, Applications of liquid-liquid extraction.	10	20
5	**Crystallization :** Saturation, Nucleation, Principle of crystallization, Crystallization rate, Equilibria and yields, Nucleation, Crystal growth, Caking of crystals, Application of crystallization, Crystallization equipments.	4	12
6	**Leaching :** Steady state and unsteady state leaching operations, Single stage leaching, Multistage cross current and counter current leaching, Rate of leaching, Recovery of solvent vapors, Application of leaching, Leaching equipments.	6	14
	Total	**48**	**100**

Reference Books :

1. Principles of Mass Transfer and Separation Processes by Dutta B.K
2. Mass Transfer Principles and Operations by A.P. Sinha and P. De
3. Mass Transfer Operations by R. Treybal

Course Outcome :

After Completion of the Course, Student will able to :

No.	Course Outcomes	RBT Level*
CO-1	Explain concepts and applications of humidification, adsorption, and drying.	20
CO-2	Describe theories, derivations and equipments of humidification, adsorption, extraction, leaching, and drying.	35
CO-3	Solve problems of frequently encountered separation systems using conventional mass transfer operations.	30
CO-4	Compare among various mass transfer operations for desired separation.	15

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List :

1. To study Surface evaporation – Free convection mass transfer.
2. To prepare ternary diagram for a system of three liquid –one pair partially soluble.
3. To study multistage (cross current) liquid-liquid extraction for extracting acetic acid from benzene using water as solvent.
4. To find out the critical moisture content of a given material using rate of drying curve.
5. To study the characteristics of adsorption of moisture on Silica gel.
6. To find out crystal yield with & without seeding.
7. To determine Langmuir and Freundlich adsorption isotherm of a solid-liquid system.
8. To plot the Breakthrough curve of adsorption for a given system.

List of Laboratory/Learning Resources Required :

1. Students can refer to video lectures available on the websites including NPTEL.
2. Students can perform experiments on Virtual lab by IITs.

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