SRM Institute of Science and Technology

Faculty of Engineering and Technology

Department of Chemical Engineering

Course Code & Title: **15CH209 PRINCIPLES OF MASS TRANSFER**

Course Strategy Description

Course description:

This course deals with the fundamentals of mass transfer, theories, principles and calculations related to absorption, humidification and drying.

Compulsory/Elective course: Compulsory for B.Tech. Chemical Engineering

Credit hours: 3 Credits

Course coordinator(s): Ms.E.Kavitha, Assistant Professor, Department of Chemical Engineering

Instructor(s):

Name of the instructor	Room number	Email (@ktr.srmuniv.ac.in)	Consultations (day order/periods)
Ms.E.Kavitha	PGA 205	kavitha.e	Day – 2: 4 and 5
Ms.E.Poonguzhali	PGA 205	poonguzhali.e	Day – 2: 4 and 5
Ms.K.Sofiya	PGA 205	sofiya.k	Day – 2: 4 and 5

Relationship to other courses

Course category: Professional core

Prerequisite: 15CH202, 15CH204 Co-requisite: Nil

Following courses: 15CH303

Text book(s) and/or required materials:

1. Robert E. Treybal, Mass-Transfer Operations, 3rd Edn., McGraw Hill Education (India) Edition, 2012 .
2. Warren L. McCabe, Julian C. Smith and Peter Harriott, Unit Operations of Chemical Engineering, 7th Edn., McGraw Hill Education (India) Edition, 2014 .

Reference book(s):

1. Christie John Geankoplis, Transport Processes and Separation Process Principles (Includes Unit Operations), 4thEdn., Pearson India Education Services Pvt. Ltd., 2015.
2. Binay K. Dutta, Principles of Mass transfer and Separation Processes, Prentice- Hall of India, New Delhi, 2007.

Class schedule: E Slot; Three 50 minutes lecture sessions per week, for 15 – 16 weeks

DAY ORDER: HOUR	TIMING (BATCH 2)	TIMING (BATCH 1)
DAY - 3: 8 & 3	2.20 PM – 3.15 PM	9.45 AM – 10.35 AM
DAY - 5: 6,7 & 1,2	12.30 PM – 2.15 PM	8.00 AM – 9.40 AM

Instructional Objectives (IOs) and Student Outcomes (SOs)

S.No.	Instructional Objectives	Student Outcomes				
1	The students will be able to understand basic principles of mass transfer and calculate mass transfer rates.	a	e			
2	The students will be able to understand various theories of mass transfer, dimensionless numbers and calculate rates of mass transfer across fluid – fluid interfaces.	a				
3	The students will be able to understand principles of gas absorption and design an ideal tray/packed tower.	a	c	e		
4	The students will be able to understand humidification and dehumidification operations and design the cooling tower.	a	c	e		
5	The students will be able to understand the principles of drying, different types of driers and calculate drying time for different periods.	a	b	e		

Teaching plan

Section	Topics	L/T	Text book/chapter	IOs	SOs	Problem solving (Y/N)
UNIT I: MASS TRANSFER AND DIFFUSION		**9**				
1.	Introduction to Mass Transfer operations.	1	1	1	a,e	N
2.	Diffusion, Types, Ficks law of Diffusion.	1	1	1	a,e	N
3.	Steady – state molecular diffusion in fluids at rest and in laminar flow, molecular diffusion in gases-steady state diffusion: of A through non diffusing B, equimolal counter diffusion in multicomponent mixtures.	3	1	1	a,e	Y
4.	Molecular diffusion in liquids-steady state diffusion: of A through nondiffusing B, equimolal counter diffusion.	2	1	1	a,e	Y
5.	Pseudo – steady state Diffusion.	1	3	1	a,e	Y
6.	Effect of temperature and pressure on diffusivity.	1	1	1	a,e	Y
UNIT II: MASS TRANSFER COEFFICIENTS AND INTERPHASE MASS TRANSFER		9				
7.	Mass transfer coefficients, Types, Relations between mass transfer coefficients.	2	1	2	a	N
8.	Dimensionless groups in mass transfer, Simultaneous momentum, heat and mass transfer	1	4	2	a	N
9.	Theories of mass transfer: film theory, penetration theory, surface-renewal Theory, Boundary layer theory.	2	1	2	a	N
10.	Interphase Mass Transfer:equilibrium between phases, concentration profile in interphase mass transfer, Two film theory.	2	1,3	2	a	N
11.	Mass transfer using Film Mass transfer Coefficients and Interface Concentrations.	1	1,3	2	a	N

12.	Overall Mass transfer Coefficients and Driving Forces. Relation between individual and overall mass transfer coefficient.	1	1,3	2	a	Y
UNIT III: GAS ABSORPTION		**9**				
13.	Introduction, Packing Characteristics and types of tower packings. Characteristics of solvent.	2	2	3	a,c,e	N
14.	Contact between liquid and gas, pressure drop and limiting flow rates.	1	1	3	a,c,e	N
15.	Material balances, limiting gas-liquid ratio.	1	1	3	a,c,e	Y
16.	Rate of absorption, calculation of tower height, number of transfer units, height of transfer unit, alternate forms of transfer coefficients	3	3	3	a,c,e	Y
17.	Absorption in plate columns: Determination of number of plates, Tray efficiencies. Height equivalent to a theoretical plate (HETP).	2	2	3	a,c,e	Y
UNIT IV: HUMIDIFICATION		**9**				
18.	Definitions	2	1, 2	4	a,c,e	N
19.	Adiabatic saturator	1	2	4	a,c,e	Y
20.	Wet-bulb temperature, theory of wet-bulb temperature, psychrometric line and Lewis relation	2	2	4	a,c,e	Y
21.	Humidity chart, use of humidity chart	2	2	4	a,c,e	Y
22.	Cooling towers	2	1,2,4	4	a,c,e	Y
UNIT V: DRYING		**9**				
23.	Introduction, Importance of drying in processes, principles of drying, Basis, moisture contents	2	1,2	5	a,e	N
24.	Mechanism of drying and Rate of drying curve	2	1	5	a,e	N
25.	Calculation of drying time under constant drying conditions	2	1,2	5	a,e	Y
26.	Classification of dryers, solids handling in dryers, equipments for batch and continuous drying processes	1	1,2	5	a,e	N
27.	Working principle of tray driers, rotary driers, spray driers, fluidized bed drier. Concept of freeze drying.	2	1,2	5	a,e	N

Evaluation methods

S.NO.	Test	Topics covered	Marks	Test/Exam duration (min)
1.	Cycle test – I	Unit I and II	15	90
2.	Cycle test – II	Unit III, IV and V	25	180
3.	Surprise test	Questions from any units	5	20
4.	Assignment	Questions from any units	5	-
5.	Final exam	All the units	50	180

Surprise test

The surprise test will not be announced. The questions for this test will be covered until the previous class.

Home assignments

A few units will have home assignment. All the assignments should be submitted on or before the last date of submission.

Teaching Methodology

Chalk and talk for the entire course

Prepared by: E.Poonguzhali , Assistant Professor, Department of Chemical Engineering

Dated: 2/01/2017

Revision no.: 1 **Date of revision: 2/01/2018** **Revised by:**

Course Coordinator Academic Coordinator HoD/Chemical