SRM Institute of Science and Technology

Faculty of Engineering and Technology

Department of Chemical Engineering

Course Code & Title: **15CH303 Mass Transfer Applications**

Course Strategy Description

Course description:

This course deals with mass transfer principles, applications and calculations related to design of mass transfer equipments. This course deals with the (i) basic principles of distillation, methods and types of distillation. (ii) McCabe Thiele method for determination of number of stages in a distillation column (iii) calculation of percentage recovery of solute and number of stages for liquid – liquid extraction operation. (iv) major types of adsorbents and crystallization equipments. (v) Principles of other separation processes.

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

Credit hours: 3 credits

Course coordinator(s): E.Poonguzhali, Assistant Professor (O.G), 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 – 1: 2 and 3
Ms.E.Poonguzhali	PGA 205	poonguzhali.e	Day – 2: 4 and 5
Dr.P.Muthamilselvi	PGA 205	muthamilselvi.p	Day – 5: 3 and 4

Relationship to other courses

Course category: Professional core

Prerequisite: 15CH209 Principles of Mass transfer Co-requisite: Nil

Following courses: Nil

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):

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

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

DAY ORDER: HOUR	**TIMING**
DAY - 3: 5	2.20 PM – 3.10 PM
DAY - 5: 6&7	12.30 AM – 2.15 PM

Instructional Objectives (IOs) and Student Outcomes (SOs)

S.No.	Instructional Objectives	Student Outcomes				
1.	The students will be able to understand basic principles of distillation, methods and types of distillation.	a	c	e		
2.	The students will be able to apply McCabe Thiele method for determination of number of stages in a distillation column.	a	c	e		
3.	The students will be able to calculate percentage recovery of solute and number of stages for liquid – liquid extraction operation.	a	c	e		
4.	The students will be able to list major types of adsorbents and crystallization equipments.	a	e			
5.	The students will be able to understand the principles of other separation processes.	a				

Teaching plan

Section	Topics	L / T	Text book/chapter	IOs	SOs	Problem solving (Y/N)
UNIT I: DISTILLATION		8				
1 - 3	Introduction to Distillation, principle , relative volatility	1	1,2	1	a,c,e	N
1 -3	Methods of distillation: flash ,batch	4	1,2,3	1	a,c,e	Y
1 -3	Steam , vacuum distillation	2	1,2	1	a,c,e	N
1 -3	Continuous distillation	1	1,2	1	a,c,e	N
UNIT II: DESIGN OF DISTILLATION COLUMNS		10				
1 -3	Design of distillation column - McCabe-Thiele method	5	1,2	2	a,c,e	Y
1 -3	Reflux ratio, total reflux, minimum reflux, optimum reflux, Fenske's equation,	2	1,2	2	a,c,e	Y
1 -3	Introduction to Ponchon-Savarit method	1	1,2	2	a,c,e	Y
1 -3	Azeotropic and extractive distillation , comparison	2	1,2	2	a,c,e	Y

UNIT III: EXTRACTION & LEACHING		10				
1 -3	Introduction to liquid extraction , General principles of extraction, Choice of solvent	1	1	3	a,c,e	Y
1 -3	Working principle of extraction equipments: mixer-settlers, packed tower, agitated tower and pulsed column extractors.	2	1	3	a,c,e	Y
1 -3	Percentage extraction calculation for single stage operations when liquids are insoluble.	1	1	3	a,c,e	Y
1 -3	Percentage extraction calculation for multistage crosscurrent operations when liquids are insoluble.	2	1	3	a,c,e	Y
1 -3	Minimum solvent rate and number of theoretical stages for continuous countercurrent, multistage extraction operation when liquids are insoluble.	3	1	3	a,c,e	Y
1 -3	Introduction to Leaching, factors affecting leaching, Bollman extractor	1	1,2	3	a,c,e	Y
UNIT IV: ADSORPTION & CRYSTALLIZATION		9				
1 -3	Introduction to adsorption, Characteristics of adsorbents, Commercial adsorbents and their application.	1	1,4	4	a,e	N
1 -3	Adsorption isotherms, Langmuir, Freundlich.	1	1,2	4	a,e	N
1 -3	Fixed bed adsorbers.	2	1,2	4	a,e	N
1 -3	Introduction to crystallization, Yield concept, methods of super saturation.	1	2,4	4	a,e	N
1 -3	Nucleation and Crystal growth.	1	2,4	4	a,e	N
1 -3	Crystallization equipment: Continuous vacuum crystallizer, Draft tube-baffle crystallizer & Swenson-walker crystallizer.	1	2,4	4	a,e	N

1 -3	Material and Energy balance calculations in crystallizers	2	2,4	4	a,e	N
UNIT V: MISCELLANEOUS SEPARATION PROCESSES		8				
1 -3	Membrane separation processes, Classification, Membrane modules	1	2,4	5	a	N
1 -3	Osmosis – Reverse Osmosis and its applications	2	2,4	5	a	N
1 -3	Dialysis - Electro Dialysis and its applications	1	2,4	5	a	N
1 -3	Ion Exchange principles, types and its applications	2	1,2	5	a	N
1 -3	Chromatography principles , types and its applications	2	1,2	5	a	N

Evaluation methods

S.NO.	Test	Topics covered	Marks	Test/Exam duration (min)
1.	Cycle test – I	Unit I and II	15	100
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: Ms. E. Kavitha, Assistant Professor (Sr.G.), Department of Chemical Engineering

Dated:

Revision no.: Nil **Date of revision:** **Revised by:**

Course Coordinator Academic Coordinator HoD/Chemical