Multicomponent Mass Transfer - Video course

COURSE OUTLINE

After successfully completing the course the student should be able to

1. Appreciate the difference between multicomponent and binary mass transfer.
2. Develop mass transfer relations from Fickian, Maxwell-Stefan, irreversible thermodynamics and lattice approach for gases, liquids and solids.
3. Understand various models of interphase mass transfer and estimate multicomponent mass transfer coefficients.
4. Understand and be able to handle the physical and mathematical complexities involved in multicomponent mass transfer.

Contents

The course can be subdivided in two subheadings viz., Diffusion and Interphase mass transfer.

1. **Diffusion:**

   Maxwell-Stefan's, Fickian, Maxwell-Stefan, Irreversible Thermodynamics and Lattice theory approaches to multicomponent diffusion.

   Stoke's-Einstein approach to diffusion in liquids. Estimation of multicomponent Diffusion Coefficients.

2. **Interphase mass transfer:**

   Mass transfer coefficients, bootstrap matrix, Film Theory, Surface renewal models, Mass transfer in drops and bubbles, mass transfer in turbulent flows.

COURSE DETAIL

S.No	Topics	No. of Hours
1	Review of Preliminary Concepts, Definitions.	2
2	Maxwell-Stefan approach for ideal Gases.	8
3	Maxwell-Stefan approach to real gases and liquids.	4
4	Irreversible Thermodynamics approach to diffusion.	2
5	Lattice Theory approach to diffusion	2

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Chemical Engineering

Pre-requisites:

Basics of Mass Transfer, Matrix Algebra and Calculus.

Coordinators:

Dr. Rajesh Khanna
Department of Chemical EngineeringIIT Delhi

Mass Transfer Operations I Video Course Nptel

Lei Huang

Mass Transfer Operations I Video Course Nptel:

Principles and Modern Applications of Mass Transfer Operations Jaime Benitez,2016-12-27 A staple in any chemical engineering curriculum New edition has a stronger emphasis on membrane separations chromatography and other adsorptive processes ion exchange Discusses many developing topics in more depth in mass transfer operations especially in the biological engineering area Covers in more detail phase equilibrium since distillation calculations are completely dependent on this principle Integrates computational software and problems using Mathcad Features 25 30 problems per chapter *A laboratory course in chemical engineering mass transfer operations* ,1982 **MASS TRANSFER** N. Anantharaman,K. M. Meera Sheriffa Begum,2011-05 Mass transfer operations are of great importance in a process industry as it has a direct impact on the cost of the final product A chemical process engineer therefore should have sound knowledge of the basics of mass transfer and its applications This book is designed to equip the reader with sufficient knowledge of mass transfer operations and face the challenges ahead The objective of this textbook is to teach a budding chemical engineer the principles involved in analyzing a process and apply the desired mass transfer operation to separate the components involved It deals with operations involving diffusion interphase mass transfer humidification drying crystallization absorption distillation extraction leaching and adsorption The principles and equipment used for different mass transfer operations have been lucidly explained Designed for a two semester course this text is primarily intended for the undergraduate students of chemical pharmaceutical petrochemical engineering as well as biotechnology and industrial biotechnology It will also be useful to plant engineers and design professionals KEY FEATURES 1 Explains the theoretical concepts with full derivation of equations 2 Illustrates the application of theory through worked out numerical examples 3 Provides exercise problems with answers at the end of each chapter for practice Principles and Applications of Mass Transfer Jaime Benitez,2022-12-13 Principles and Applications of Mass Transfer Core textbook teaching mass transfer fundamentals and applications for the design of separation processes in chemical biochemical and environmental engineering Principles and Applications of Mass Transfer teaches the subject of mass transfer fundamentals and their applications to the design of separation processes with enough depth of coverage to guarantee that students using the book will at the end of the course be able to specify preliminary designs of the most common separation process equipment Reflecting the growth of biochemical applications in the field of chemical engineering the fourth edition expands biochemical coverage including transient diffusion environmental applications electrophoresis and bioseparations Also new to the fourth edition is the integration of Python programs which complement the Mathcad programs of the previous edition On the accompanying instructor s website the online appendices contain a downloadable library of Python and Mathcad programs for the example problems in each chapter A complete solution manual for all end of chapter problems both in Mathcad and Python is also provided Some of the topics covered in Principles and Applications of Mass Transfer include Molecular mass transfer covering concentrations velocities

and fluxes the Maxwell Stefan relations and Fick s first law for binary mixtures The diffusion coefficient covering diffusion coefficients for binary ideal gas systems dilute liquids and concentrated liquids Convective mass transfer covering mass transfer coefficients dimensional analysis boundary layer theory and mass and heat transfer analogies Interphase mass transfer covering diffusion between phases material balances and equilibrium stage operations Gas dispersed gas liquid operations covering sparged vessels tray towers diameter and gas pressure drop and weeping and entrainment Principles and Applications of Mass Transfer is an essential textbook for undergraduate chemical biochemical mechanical and environmental engineering students taking a core course on Separation Processes or Mass Transfer Operations along with mechanical engineers and mechanical engineering students starting to get involved in combined heat and mass transfer applications *Mass Transfer Operations for the Practicing Engineer* Louis Theodore,Francesco Ricci,2011-12-06 An invaluable guide for problem solving in mass transfer operations This book takes a highly pragmatic approach to providing the principles and applications of mass transfer operations by offering a valuable easily accessible guide to solving engineering problems Both traditional and novel mass transfer processes receive treatment As with all of the books in this series emphasis is placed on an example based approach to illustrating key engineering concepts The book is divided into two major parts It starts with the principles underlying engineering problems showing readers how to apply general engineering principles to the topic of mass transfer operations It then goes on to provide step by step guidance for traditional mass transfer operations including distillation absorption and stripping and adsorption plus novel mass transfer processes Essential topics for professional engineering exams are also covered Geared towards chemical environmental civil and mechanical engineers working on real world industrial applications Mass Transfer Operations for the Practicing Engineer features Numerous sample problems and solutions with real world applications Clear precise explanations on how to carry out the basic calculations associated with mass transfer operations Coverage of topics from the ground up for readers without prior knowledge of the subject Overview of topics relevant to the ABET Accreditation Board for Engineering and Technology for those taking the Professional Engineering PE exams Appendix containing relevant mass transfer operation charts and tables *Mass-transfer Operations* Robert Ewald Treybal,1967 Author s purpose is to provide a vehicle for teaching either through a formal course or through self study the techniques of and principles of equipment design for the mass transfer operations of chemical engineering As before these operations are largely the responsibility of the chemical engineer but increasingly practitioners of other engineering disciplines are finding them necessary for their work This is especially true for those engaged in pollution control and environment protection where separation processes predominate and in for example extractive metallurgy where more sophisticated and diverse methods of separation are increasingly relied upon **Mass Transfer Operations** Alapati Suryanarayana,2002 In A Simple And Systematic Manner This Book Presents An Exhaustive Account Of Various Mass Transfer Operations Involved In Chemical Engineering Emphasising The Basic

Concepts And Techniques The Book Discusses In Detail Material And Energy Balances Distillation Absorption And Stripping And Extraction The Book Also Explains The Relevant Aspects Of Equipment Design Recent Developments Like Permeation Ion Exchange And Froth Floatation Have Also Been Discussed A Large Number Of Digital Computer Programs Are Included To Illustrate Computer Aided Techniques Several Solved Examples And Practice Problems Are Presented In Each Chapter To Illustrate The Theory With All These Features This Is An Ideal Text For Undergraduate Chemical Engineering Students Practising Engineers And Students Of Pharmacy And Metallurgy Would Also Find The Book A Useful Reference Source

Mass-transfer Operations Robert Ewald Treybal,1967 **Mass Transfer** A. P. SINHA,PARAMESWAR DE,2012-05-09 This book introduces the fundamental principles of the mass transfer phenomenon and its diverse applications in process industry It covers the full spectrum of techniques for chemical separations and extraction Beginning with molecular diffusion in gases liquids and solids within a single phase the mechanism of inter phase mass transfer is explained with the help of several theories The separation operations are explained comprehensively in two distinct ways stage wise contact and continuous differential contact The primary design requirements of gas liquid equipment are discussed The book provides a detailed discussion on all individual gas liquid liquid liquid solid gas and solid liquid separation processes The students are also exposed to the underlying principles of the membrane based separation processes The book is replete with real applications of separation processes and equipment Problems are worked out in each chapter Besides problems with answers short questions multiple choice questions with answers are given at the end of each chapter The text is intended for a course on mass transfer transport and separation processes prescribed for the undergraduate and postgraduate students of chemical engineering Mass Transfer Operations-I D.C. Sikdar,2022-11-11 Mass Transfer is the net movement of mass of a chemical species from the region of higher concentration to a region of lower concentration It occurs in many industrial and non industrial processes Mass transfer is used by different scientific communities for different processes and mechanisms Mass Transfer Operation is one of the core courses at the undergraduate level of Chemical Engineering curriculum The chapters are organized in a way that enables the students to acquire an in depth understanding of the subject The emphasis is given to the basic concepts of mass transfer operating molecular diffusion inter phase mass transfer humidification operations drying evaporation crystallization adsorption novel separations and Mass transfer analogy all coming under the realm of mass transfer operations Apart from the numerous illustrations the book includes review questions exercises and aptitude test in chemical engineering which bridge the gap between theory and practical implementation All numerical problems are solved in a systematic manner to reinforce the understanding of the concepts This book demonstrates how to solve the industry related problems in chemical Engineering practice This book is primarily intended as a textbook for the undergraduate students of Chemical Engineering It will also be useful for other allied branches such as Mechanical Engineering Petroleum Engineering Polymer Science and Engineering Bio technology as well as Diploma in Chemical

Engineering PRINCIPLES OF MASS TRANSFER KAL RENGANATHAN SHARMA,2007-01-21 This book addresses the specific needs of undergraduate chemical engineering students for the two courses in Mass Transfer I and Mass Transfer II It is also suitable for a course in Downstream Processing for biotechnology students This self contained textbook is designed to provide single volume coverage of the full spectrum of techniques for chemical separations The operations covered include vapour distillation fluid adsorption gas absorption liquid extraction solid leaching gas humidification solid drying foam separation solution crystallization metal alloying reverse osmosis molecular sieves electrodialysis and ion exchange The text also discusses emerging applications such as drug delivery gel electrophoresis bleaching membrane separations polymer devolatilization solution crystallization and gas chromatography Equipment selection is discussed for different operations A table of industrial applications for each and every mass transfer unit operation is provided The worked examples illustrate problems from chemical process and biotechnology industries Review questions encourage critical thinking and end of chapter problems emphasize grasping of the fundamentals as well as illustrate applications of theory to a wide variety of scenarios KEY FEATURES Includes several case studies ranging from manufacture of vitamin C prilling tower to granulate urea to vanaspati discolouration and wilting of the lettuce Introduces generalized Fick s law of diffusion Discusses hollow fibre mass exchangers Introduces new concepts such as cosolvent factor Z step procedure for multistage cross current extraction *Mass-transfer Operations* Robert E. Treybal,1988 **WORKED EXAMPLES IN MASS TRANSFER** B. N. Nnolim,2010 Book presents mass transfer fundamentals in easily understandable form using worked examples to illustrate basic concepts and calculations *Simultaneous Mass Transfer and Chemical Reactions in Engineering Science* Bertram K. C. Chan,2023-01-30 Simultaneous Mass Transfer and Chemical Reactions in Engineering Science A comprehensive look at the basic science of diffusional process and mass transfer Mass transfer as a principle is an essential part of numerous unit operations in biomolecular chemical and process engineering crystallization distillation and membrane separation processes for example use this important method Given this significance particularly in engineering design where these processes occur understanding the design and analysis of such unit operations must begin with a basic understanding of how simultaneous mass transfer and the chemical reactions that influence these occurrences It is also vital to be aware of the most up to date technologies for analyzing and predicting the phenomena Given the significance of this process Simultaneous Mass Transfer and Chemical Reactions in Engineering Science is an important resource as it introduces the reader to the complex subject of simultaneous mass transfer with biochemical and chemical reactions and gives them the tools to develop an applicable design Analyzing the systems of simultaneous mass transfer and reactions is at the core of this book as all known design approaches are carefully examined and compared The volume also provides the reader with a working knowledge of the latest technologies with a special focus on the open sourced computer programming language R and how these tools are an essential resource in quantitative assessment in analysis models Simultaneous Mass Transfer and

Chemical Reactions in Engineering Science provides a working knowledge of the latest information on simultaneous mass transfer and reactions by focusing on the analysis of this process as well as discussing the existence and distinctive quality of the solutions to the Simultaneous Mass Transfer and Chemical Reactions in Engineering Science readers will also find A theoretical basis of each design model that is carefully stated compared and assessed Carefully developed and established Existence and Uniqueness Theorems for a general design model Comprehensive coverage of how the programming language R may be used to analyze models Numerous examples and case studies that provide a working knowledge of simultaneous mass transfer and reactions Simultaneous Mass Transfer and Chemical Reactions in Engineering Science is a useful reference for students in chemical engineering biotechnology or chemistry as well as professional process and chemical engineers *Mass-transfer Operations* R.E. Treybal,1986 Mass Transfer Conference 1962 Oklahoma State University. School of Chemical Engineering,Oklahoma State University. Engineering and Industrial Extension,1962 Advanced Topics in Mass Transfer Mohamed El-Amin,2011-02-21 This book introduces a number of selected advanced topics in mass transfer phenomenon and covers its theoretical numerical modeling and experimental aspects The 26 chapters of this book are divided into five parts The first is devoted to the study of some problems of mass transfer in microchannels turbulence waves and plasma while chapters regarding mass transfer with hydro magnetohydro and electro dynamics are collected in the second part The third part deals with mass transfer in food such as rice cheese fruits and vegetables and the fourth focuses on mass transfer in some large scale applications such as geomorphologic studies The last part introduces several issues of combined heat and mass transfer phenomena The book can be considered as a rich reference for researchers and engineers working in the field of mass transfer and its related topics Transfer Operations Robert Albert Greenkorn,D. P. Kessler,1972 Macroscopic balances Dimensional analysis Application of the macroscopic balances to flow measurement Momentum transfer in fluid flow Momentum transfer coefficients Momentun transfer applications Heat trnasfer coefficients and applications Mass transfer Design equations for mass transfer Mass transfer applications Mass Transfer Diran Basmadjian,2003-12-15 In recent years the subject of mass transfer has been treated as a minor player in the larger field of transport phenomena and taken a back seat to its more mature brother heat transfer Yet mass transfer is sufficiently mature as a discipline and sufficiently distinct from other transport processes to merit a separate treatment particularly one that does not overwhelm readers with an abundance of high level mathematics Mass Transfer Principles and Applications takes an integrated approach that uses a wealth of real world examples organizes the material according to mode of operation and highlights the importance of modeling The author begins by introducing diffusion rates Fick s Law film theory and mass transfer coefficients then develops these concepts in complementary stages The treatment of phase equilibria covers topics generally not addressed in thermodynamics courses and these concepts are then used to analyze compartmental models and staged processes as well as continuous contact operations The final chapter offers a concise survey of simultaneous mass and

heat transfer Throughout the book discussions transition smoothly between theory and practice and clearly reflect the author s many years of engineering experience and the breadth of mass transfer applications Mass Transfer Principles and Applications is a unique and accessible treatment of this relatively complicated topic that will fill a significant gap as both a textbook and professional reference **Mass Transfer Operations** Louis Theodore,1995

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About Quantum Vision System Created by Dr. William Kemp, an eye doctor from Lexington, VA, the Quantum Vision System is declared to be a scientific development that is guaranteed to assist ... Swindles, cons and scams: Don't let your eyes deceive you Oct 18, 2016 — Quantum Vision System bills itself as a tell-all book series that purportedly lifts the veil on how to achieve perfect, 20/20 vision in one ... Ophthalmologist Dr. Kemp Launches 'Quantum Vision' to ... Mar 10, 2015 — Aimed at freeing people from glasses, lenses, and expensive surgeries, this unique system seeks to help those to improve their vision and ... Quantum vision system-20/20 vision in seven days kindly any body can explain in detail what is this quantum vision system and whether it is true to get 20/20 vision in 7 days. Dr Kemp's Quantum Vision System is a scam While I have no doubt that what they're selling is total BS, this article you linked to doesn't actually prove that it is a scam. Quantum Vision - Documentation Portal Dec 21, 2016 — Quantum Vision. Quantum Vision is a data protection solution that allows you to monitor, analyze, and report on your Quantum backup ... Quantum vision in three dimensions by Y Roth · 2017 · Cited by 4 — In stereoscopic vision, each eye sees a similar but slightly different image. The brain integrates these two images to generate

a 3-D image[1]. The ... Quantum Vision System - WordPress.com Quantum Vision System program is concentrate on not only the eye restoration, it provides the solution of eye protection also. This program is very safe and ... Eye Exercises to Improve Vision: Do They Really Work? Jun 16, 2021 — Quantum Health Can Help with Your Eye Health. More than eye training, getting the right nutrients that support eye health is one of the key ways ... Quantum Vision Quantum Vision is a premier provider of business-aligned IT modernization solutions that partners with clients to accelerate and transform mission outcomes. Student Solutions Manual for Pagano/Gauvreau's ... Featuring worked out-solutions to the problems in PRINCIPLES OF BIOSTATISTICS, 2nd Edition, this manual shows you how to approach and solve problems using the ... Student Solutions Manual for Pagano/Gauvreau's ... Student Solutions Manual for Pagano/Gauvreau's Principles of Biostatistics by Marcello Pagano (2001-04-12) on Amazon.com. *FREE* shipping on qualifying ... Student solutions manual for Pagano and Gauvreau's ... Student solutions manual for Pagano and Gauvreau's Principles of biostatistics ; Genre: Problems and Excercises ; Physical Description: 94 pages : illustrations ; ... Student Solutions Manual for Pagano/Gauvreau's ... Student Solutions Manual for Pagano/Gauvreau's Principles of Biostatistics. Edition: 2nd edition. ISBN-13: 978-0534373986. Format: Paperback/softback. Publisher ... Student Solutions Manual for Pagano/Gauvreau's ... Featuring worked out-solutions to the problems in PRINCIPLES OF BIOSTATISTICS, 2nd Edition, this manual shows you how to approach and solve problems using the ... Students Solution Manual PDF Student Solutions Manual. for. Principles of Biostatistics Second Edition. Kimberlee Gauvreau Harvard Medical School. Marcello Pagano Student Solutions Manual for Pagano/Gauvreau's ... Student Solutions Manual for Pagano/Gauvreau's Principles of Biostatistics Paperback - 2001 - 2nd Edition ; Pages 112 ; Volumes 1 ; Language ENG ; Publisher Duxbury ... Student Solutions Manual for Pagano/Gauvreau's ... Featuring worked out-solutions to the problems in PRINCIPLES OF BIOSTATISTICS, 2nd Edition, this manual shows you how to approach and solve problems using the ... Student Solutions Manual for Pagano/Gauvreau's ... Read reviews from the world's largest community for readers. Book by Pagano, Marcello, Gauvreau, Kimberlee. Student Solutions Manual for Pagano/Gauvreau's ... Prepare for exams and succeed in your biostatistics course with this comprehensive solutions manual Featuring worked out-solutions to the problems in ... pptacher/probabilistic_robotics: solution of exercises ... I am working on detailed solutions of exercises of the book "probabilistic robotics". This is a work in progress, any helpful feedback is welcomed. I also ... solution of exercises of the book "probabilistic robotics" I am working on detailed solutions of exercises of the book "probabilistic robotics". This is a work in progress, any helpful feedback is welcomed. alt text ... PROBABILISTIC ROBOTICS ... manually removing clutter from the map—and instead letting the filter manage ... solution to the online SLAM problem. Just like the EKF, the. SEIF integrates ... Probabilistic Robotics 2 Recursive State Estimation. 13. 2.1. Introduction. 13. 2.2. Basic Concepts in Probability. 14. 2.3. Robot Environment Interaction. Probabilistic Robotics Solution Manual Get instant access to our step-by-step Probabilistic Robotics solutions manual. Our solution manuals are written by Chegg experts

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