

ChE 3084 Mass Transfer
Required course for ChE program

Catalog Description: Diffusion, convective and interfacial mass transfer, and its application to continuous contact operations. Design of equilibrium-stage separation processes including distillation, gas-liquid absorption and stripping, liquid-liquid extraction, and humidification. Introduction to process simulation (HYSYS).

Co-requisites: none

Prerequisites: ChE 3063 (Equilibrium Thermodynamics), ChE 2003 (Stoichiometry).

Prerequisites by Topic: Equilibrium Thermodynamics: vapor-liquid equilibrium for ideal systems (e.g., Raoult's and Henry's laws) and non-ideal systems, calculation of vapor pressure, enthalpy changes, and enthalpy of vaporization. Stoichiometry: Mass and energy balances, lever principles, psychrometric chart use.

Recent Textbook: C. J. Geankoplis, "Transport Processes and Separation Process Principles", Prentice-Hall, 4th Edition, 2003, ISBN 0-13-101367-X

Other Required Material: None

Course Objectives: By the end of the course, students will be able to:

1. Apply the basic principles of diffusion and convective mass transfer.
2. Rate and design equilibrium-stage gas-liquid separation processes (including stripping and absorption columns, binary and multi-component distillation columns) and equipment (including trays and random and structured packing) using modern computing tools as appropriate.
3. Rate other mass transfer processes such as liquid-liquid extraction and humidification using modern computing tools as appropriate."

Major Topics Covered in the Course : Fick's law, use of diffusivity functions mass transfer coefficients, principles of stage processes, gas absorption and stripping, humidification, distillation using McCabe-Thiele methods, extraction, overview of other mass transfer and separation operations

Class/Laboratory Schedule: Lecture meets for four 50-minute sessions each week for 14 weeks. HYSYS computer laboratory sessions are held to assist the student's in learning about absorption and distillation column performance.

Professional Component Contribution: This course applies stoichiometry, thermodynamics, and transport phenomena to engineering applications of mass transfer and staged operations. Computer skills are extended in this course to numerical solution of separation problems, including graphical representation of equilibrium and operating curves, and ideal stages. A minimum of one design problem is assigned in this course. Throughout the course, safety and ethics are briefly emphasized.

Relationship to Student Outcomes	
outcome:	Description of related course content:
(a) an ability to apply knowledge of mathematics, science and engineering	The course requires use of introductory linear algebra to solve separation problems. Excel and HYSYS programming are extended to separation problems. Problems in this course build on a background of stoichiometry, thermodynamics, and transport phenomena
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	Students execute a separations strategy [using both distillation and absorption processes] to satisfying a specific set of constraints based on desired compositional products
(d) an ability to function on multi-disciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	
(f) an understanding of professional and ethical responsibility	
(g) an ability to communicate effectively	
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i) a recognition of the need for, and an ability to engage in life-long learning	
(j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills and modern engineering tools necessary for engineering practice	Students are required to use computers to solve homework problems throughout the course, particularly in Excel and HYSYS. Hand calculations are strongly discouraged by the instructor

Prepared by: Kraemer Luks (July 8, 2005)

Modified by: Christi L. Patton (April 28, 2008)

New course objectives from Spring 2009 added by G. L. Price

Modified 3/20/2012 to remove old ChE criteria - GLP