

CH EN 3603 - Mass Transfer and Separations

Class Description	This course will introduce the basics and quantitative analysis methods for designing industrial separation process.
Course Topics	<ul style="list-style-type: none"> • Introduction • Thermo Review • Mass transfer and diffusion • Single Stage Equilibrium • Absorption & Stripping • Binary Distillation • Batch Distillation
Learning Objectives	Learn and understand (1) important concepts and ideas in separation, which includes thermodynamics, mole balance, and mass transfer, (2) the principle of various unit separation operations, and (3) quantitative methods for analyzing and designing separation operations
Reference books	Separation Process Principles, 4th edition, by Seader, Henley & Roper.

Schedule

Week	Date	Topics	HW due	Exam	Reading
1	01/05	Introduction			SHR Ch.1
		Types of separation techniques			
		Mass balance, split ratio/fraction, recovery and purity			
2	01/12	Separation factors, sequence, and selection			
		Thermo review. Phase equilibrium condition, K value.			SHR Ch.2
		Mass transfer. Fick's first law			SHR Ch.3
3	01/19	No class, Martin Luther King Jr. Day holiday	HW1.		
		Equimolar counter diffusion			
		Unimolecular diffusion			
4	01/26	Diffusivity	HW2.		
		Fick's 2 nd law			
		Mass transfer in lamina flow			
5	02/02	Exam 1		Exam 1	
		Exam 1 review, mass transfer in turbulent flow			
		Mass transfer across fluid interface			

6	02/09	Single Stage Equilibrium (8). Gibbs Phase Rule. Txy diagram. inverse lever arm rule	HW3.		SHR Ch.4
		yx diagram, q-line, Px diagram, azeotropic system			
		Multi-component flash, Rachford–Rice Equation			
7	02/16	No class, Presidents Day holiday			
		Bubble/dew point calculation. Example problems for flash calculation	HW4.		
		Liquid-liquid extraction, perfect immiscible case			
8	02/23	Exam 2		Exam 2	
		Liquid-liquid extraction, partially immiscible case, ternary phase diagram, inverse lever arm rule			
		Solid-liquid system, gas-liquid system, gas-solid system			
9	03/02	Exam review. Liquid-liquid system example problems	HW5.		
		Absorption & Stripping (6). Introduction			SHR Ch.5, 6
10	03/09	No Class, Spring break			
11	03/16	Exam 3 coverage. Trayed tower graph method and example.			
		Trayed tower graph method and example.			SHR Ch.7
		Packed tower			
12	03/23	Exam 3		Exam 3	
		Binary Distillation (5). distillation intro.			
		Graphical method of distillation			
13	03/30	Exam 3 review	HW6.		
		Rectifying section of distillation			
		Stripping section, q-line			
14	04/06	Feed stage, number of stages, limiting case	HW7		SHR Ch.13

		Partial reboilers & condensers, stage efficiency. Exam 4 coverage.			
		Examples.			
15	04/13	Exam 4		Exam 4	
		Exam 4 review, grading method, differential batch distillation			
	04/17	Aspen tutorial	Dave		
16	04/20	Final Review, Q&A	No due		
		Class ends			
	04/24	Final exam	Course evaluation		