

CHEE 3120
MASS TRANSFER
Fall 2015

Course description: Understanding the concept of mass transfer and its application to chemical processes: The quantitative description of mass transport (convection and diffusion). Application of mass transfer principles to model and quantify the chemical systems such as adsorption, absorption, humidification, and drying. Understand the analogies between momentum, heat and mass transfer.

Instructor: Dr. Dong-Shik Kim
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Lecture: MWF 9:00-9:50 am, PL 2470
Office Hours: Mon 1 – 3 pm, Wed 10 am – noon, and by appointment.

TA: George Amobi Ozioko
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Office Hours: At Case Center
Tue 1:00pm - 3:00pm
Wed 2:00pm- 3:00pm
Thur 1:00pm - 3:00pm

Required Text: **Unit Operations of Chemical Engineering (Julian Smith and Peter Harriott, 7th ed., McGraw-Hill, 2005)**

Recommended Text: **Fundamentals of Momentum, Heat and Mass Transfer (James Welty, Charles Wicks and Robert Wilson, 3rd ed., John Wiley and Sons, 1984)**

Transport Phenomena (R.B. Bird, W.E. Stewart, and E.N. Lightfoot, John Wiley & Sons, 1960)

Course Objectives:

After taking this class, students should be able to:

- formulate and solve mass balance equations related to mass transfer systems in chemical engineering.
- apply diffusion/mass transfer and mass balance equations to calculate the design and operating conditions of absorption tower, humidification and drying systems, membrane, and adsorption column.
- use computational tools (EXCEL) as necessary to solve problems.
- synthesize what they have learned and apply their knowledge to unfamiliar systems.

Grading: Homework: 15%
Midterm I: 25%
Midterm II: 25%
Final Exam (10:15 am -12:15 pm, Dec 15, 2015): 35%

Homework policy: Homework is due one week after assignment. No late homework will be accepted without prior approval by the instructor.

Week	Date	Topic	Reading Assignment
1	Aug 24, 2015	Introduction	McCabe: Ch. 17
	Aug 26, 2015	Mass transfer – Overview I	

	Aug 28, 2015	Mass transfer – Overview II	
2	Aug 31, 2015	Definitions for diffusion and mass transfer	McCabe: Ch. 17
	Sep 2, 2015	Mass and molar fluxes Fick's law	McCabe: Ch. 17
	Sep 4, 2015	Diffusion coefficient - Diffusivity	McCabe: Ch.17
3	Sep 7, 2015	Labor Day - No Class	
	Sep 9, 2015	Examples	McCabe: Ch.17
	Sep 11, 2015	Mass transfer theories –Film Theory	McCabe: Ch.17
4	Sep 14, 2015	Mass transfer coefficients	McCabe: Ch.17
	Sep 16, 2015	Mass transfer coefficients - Examples	McCabe: Ch.17
	Sep 18, 2015	Examples	McCabe: Ch.17
5	Sep 21, 2015	Gas Absorption	McCabe: Ch.17
	Sep 23, 2015	Pressure drop and limiting flow rates	
	Sep 25, 2015	Examples	McCabe: Ch. 18
6	Sep 28, 2015	Absorption equations	McCabe: Ch. 18
	Sep 30, 2015	Calculating tower height	McCabe: Ch. 18
	Oct 2, 2015	Midterm I	McCabe: Ch. 18
7	Oct 5, 2015	Fall Break – No Class	
	Oct 7, 2015	Absorption from rich gas	McCabe: Ch. 18
	Oct 9, 2015	Examples	McCabe: Ch. 18
8	Oct 12, 2015	Mass-transfer correlations	McCabe: Ch. 18
	Oct 14, 2015	Humidification Operations - Definitions	McCabe: Ch. 19
	Oct 16, 2015	Humidity chart	McCabe: Ch. 19
9	Oct 19, 2015	Wet bulb temperature	McCabe: Ch. 19
	Oct 21, 2015	Examples	McCabe: Ch. 19
	Oct 23, 2015	Cooling tower - Theory	McCabe: Ch. 19
10	Oct 26, 2015	Cooling tower - Examples	McCabe: Ch. 19
	Oct 28, 2015	Drying of solids – Principles of drying	McCabe: Ch. 24
	Oct 30, 2015	Midterm II	McCabe: Ch. 24
11	Nov 2, 2015	Cross-circulation drying	McCabe: Ch. 24
	Nov 4, 2015	Examples Midterm II	McCabe: Ch. 24
	Nov 6, 2015	Fixed-bed separations - Adsorption	McCabe: Ch. 25
12	Nov 9, 2015	Adsorption isotherms	McCabe: Ch. 25
	Nov 11, 2015	Veterans Day – No Class	
	Nov 13, 2015	Principles of Adsorption	McCabe: Ch. 25
13	Nov 16, 2015	Adsorber design Midterm II?	McCabe: Ch. 25
	Nov 18, 2015	Separation of gases Midterm II?	McCabe: Ch. 26
	Nov 20, 2015	Product purity and yield	McCabe: Ch. 26
14	Nov 23, 2015	Example	
	Nov 25, 2015	Thanksgiving – No Class	
	Nov 27, 2015		
15	Nov 30, 2015	Separation of liquids - dialysis	McCabe: Ch. 26
	Dec 2, 2015	Membrane separation	McCabe: Ch. 26
	Dec 4, 2015	Reverse osmosis	
16	Dec 7, 2015	Analogies of transport phenomena - I	
	Dec 9, 2015	Analogies of transport phenomena - I	
	Dec 11, 2015	Examples	
17	Dec 15, 2015	Final Exam (10:15 am - 12:15 pm, Tuesday)	