

## **CH351: MASS TRANSFER AND STAGewise OPERATIONS**

### **Fall 2007**

**Catalog Data:** CH351 Mass Transfer and Stagewise Operations

A study of mass transfer theory, equipment and design procedures which are based upon the contacting of phases in staged and continuous systems.

**Pre-requisites:** CH250: Chemical Process Calculations

CH272: Applied phase and chemical reaction equilibria

CH301: Fluid mechanics (co-requisite)

**Course Type:** Required for Chemical Engineers

**Textbook:** Separation Process Engineering. P.C. Wankat, Prentice-Hall, 2<sup>nd</sup> Ed.

**Instructors:** Ross Taylor (CAMP 244, 268-6652, [taylor@clarkson.edu](mailto:taylor@clarkson.edu))

**Office hours:** Open door policy or by appointment

### **Learning Objectives:**

1. Explain the principles of mass transfer, including diffusion, convective mass transfer coefficients, and related concepts.
2. Explain the theory, equipment and design procedures of separation processes, including distillation, extraction, absorption, ion exchange, and membrane separations.
3. Solve multicomponent separation process problems.
4. Use the computer to solve mass transfer problems, including the use of process simulation packages.
5. Apply mass transfer theory to the design of continuous contact mass transfer equipment including packed bed columns.

### **Learning Outcomes:**

1. Students will be able to carry out equilibrium stage based design of distillation, absorption, and extraction columns.
2. Students will be able to size conventional separation process equipment.
3. Students will be able to use computer software for separation process simulation.
4. Students will be able to estimate diffusion and mass transfer coefficients and to use them in chemical process modeling and design.

### **Evaluation Methods:**

1. Design project (30%)
2. Two hourly tests (10% each)
3. Final Exam (25%)
4. Pepsi Challenges – In class simulation and design exercises (15%)
5. Homework (10%)

**Course Outline:**

Separation Processes	Mass Transfer
Overview	Basic Concepts
Equilibrium staged separations	Fick's Law
Mathematical model building	The Maxwell Stefan Equations
Distillation	Diffusion Coefficients
Absorption	Mass transfer coefficients
Extraction	Models of mass transfer
Column design	Use of mass transfer theory in design
Other separation processes	

**Project Policy:**

Project reports will be due by 12 noon on specified dates. Reports received up to 24 hours after the due date and time will be accepted but subjected to a penalty as outlined below. Reports received up to 2 hours late will suffer a 10% penalty. Those received more than 2 hours late but less than 14 hours late will suffer a 25% penalty. Those received more than 14 hours but less than 24 hours late will receive a 50% penalty. Reports received more than 24 hours late will not receive a grade. I will entertain questions pertaining to any project until 48 hours before the report is due. If you leave everything to the last minute you are unlikely to produce an acceptable report. Reports will be graded on both technical merit and artistic impression (the latter covers appearance, writing quality, and anything else that goes into making an acceptable written document). You will be required to rewrite reports that are unacceptable for any reason.

**Pepsi Challenge:**

On most Fridays we will repair to CAMP 163 and carry out the Pepsi Challenge where, in 2's or 3's you solve small-scale design type problems under time constraints. Assignments that are not completed within the time allowed will be completed as homework exercises due the first class period on the following Monday. You may not repeat partners for the first five challenges and may not work with the same people more than 3 times during the semester.

Class Time: Monday, Wednesday & Friday 1:00 PM, C175; Friday 8:00 AM, C163  
Prepared by: Ross Taylor, August 21, 2007