Mass Transfer Operations
ENGG 3470
Winter 2009

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Lecture schedule:	T., Th.	1:00 – 2:20 (MACK 315)
Tutorials:	T.	8:30 – 10:20 (MACK 307)

Prerequisites: As stated in the U of G Calendar

Textbook:

Reading materials and lecture notes will be provided via WebCT.
Your Heat and Mass Transfer Text (Incropera and DeWitt) provides some excellent complementary material. Specific mass transfer material is given in Chapters 14 and 6 and Sections 7.4, 7.7, 7.8, 7.9; however, the analogous character of momentum, heat and mass transfer make the entire book useful.

Calendar Description

Application of mass transfer principles in natural and engineered systems; mass transport in the multi-media fate of contaminants in and between air, water and land; design and analysis of separation processes for emission control and pollution prevention.

Grading

Final Exam	30%
Quizzes (2)	20% (Dates TBD)
Design/research project/logbooks	35%
Labs (4)	15%

In order to pass the course the students must receive a passing mark (>50%) in either the two quizzes (combined) or the final exam.

Tutorials & Assignments

Tutorials will be used for two purposes: to strengthen students' understanding of mass transfer operations through reviewing examples, and to discuss the assigned projects. A number of review problems with solutions will be made available to the students. These review problems provide an opportunity for the students to better understand the course materials. All students are strongly encouraged to complete some of these problems either individually or in groups. Additional examples will be provided by the teaching assistants during some of the tutorials.

Design/Research Project

The students will be divided in groups of five and each group will be designing, building and testing a small mass transfer unit. These units are to be built with simple materials found in a hardware store or the machine shop. Each group will prepare a short report consisting of two sections; a laboratory manual and a laboratory report. The objective of the

laboratory manual is to provide sufficient information to another group so they can conduct the experiment without difficulty. The laboratory report will outline the materials and methods, results and discussion (a typical laboratory report). In addition, each group will prepare a one-page lab sheet to enable other students to perform the lab, collect sufficient data and answer the questions that are posed on the lab sheet. These lab sheets will then be returned to the group and marked by each group member (i.e. one lab report per group member). The marks will then be emailed by the individual group member to the TA. More details will be provided in the class.

Each student will also utilize a **logbook** to keep track of meetings, decisions, ideas, thought process, calculations, etc. The logbooks should be presented during each quiz.

Labs

Each student will be choosing 4 labs out of the available labs and will be performing these labs between March 20 and April 3. Each student will complete the lab sheet provided by the group that has designed the lab and will return these lab sheets to group for marking. The marked labs together with an answer key will be then submitted to the TA. The labs will be scheduled by early March.

Topic Outline

1. Introduction
2. diffusive mass transfer
3. convective mass transfer and dispersion
4. Film theory
5. Interphase mass transfer
6. Mass transfer in porous media
7. Mass transfer applications
    a. Absorption
    b. Adsorption
    c. Aeration
    d. Air stripping
    e. Biofiltration
    f. Membrane separation
8. Mass transfer in the natural environment
9. Fugacity

Recommended Readings

Middleman, S. 1998. An Introduction to Mass and Heat Transfer – Principles of Analysis and Design. John Wiley & Sons, Inc.

Nazaroff, W.W., and Alvarez-Cohen, L. 2001. Environmental Engineering Science (Chapter 4). John Wiley & Sons, Inc.

Brodkey, R.S., and Hershey, H.C. 1996. Transport Phenomena – A Unified Approach. McGraw-Hill Book Company.

McCabe, W.L., Smith, J.C., and Harriott, P. 1998. Unit Operations of Chemical Engineering. McGraw-Hill Book Company.

Materials posted on the course WebCT and electronic reserve.

Disclaimer

The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to University of Guelph Academic Regulations.