ENGG3470: Mass Transfer Operations
Winter, 2013

INSTRUCTOR: Dr. Sheng Chang
Office**:** THRN Room 1409, Extension: 56619,
Email: schang01@uoguelph.ca
Office hrs: Monday: 2:45 PM -4:00 PM or by appointment.

LAB INSTRUCTORS:
Joanne Ryks: Room 1199, extension: 54087, email: jryks@uoguelph.ca
Ryan Smith: Room 3403, extension: 53278, email: rsmith17@uoguelph.ca

TEACHING ASSISTANTS:
David Hufnagel: dhufnage@uoguelph.ca;
Ka Lam: klam@uoguelph.ca
Office hour: TBD

RECOMMENDED TEXT BOOKS:
Christie John Geankoplis, Transport processes and separation process principles, (Fourth Edition), Prentice Hall, Professional Technical Reference, ISBN 0-13-101367-X, 2009
Nazaroff, W.W. and Alvarez-Cohen, L., "Environmental Engineering Science", John Wiley & Sons, Inc, ISBN 0-471-14494-0, 2001.
McCabe, W.L., Smith, J.C. and Harriott, P., "Unit operations of Chemical Engineering" 7th edition, McGraw-Hill Higher education, 2005

PREREQUISITES:
ENGG*2230, ENGG*3260, MATH*2270
CO-REQUISITE (S): ENGG*3430

Note: if you do not meet these requirements, see the instructor immediately

SCHEDULE:
Lectures: MACK 029
Monday, Wednesday, Friday: 1:30 PM - 2:20 PM

Labs:
Mon. 8:30 AM – 10:20 AM
Wed, 8:30 AM - 010:20 AM
Wed, 03:30 PM - 05:20 PM,
Thur. 03:30 PM - 05:20 PM,

Tutorials (MACK 238):
Tuesday: 11:30 AM - 12:20 PM, MACK 238
Thursday: 11:30 AM - 12:20 PM, MACK 238

The Tutorials will start from the week of January 14

Midterm and final exam
Midterm will be conducted during the week of Feb 11, 2013 (Day and location: TBD)
Final EXAM: Tues, 08:30 AM - 10:30 AM, April 9, 2013, location (TBD)

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.

COURSE CONTENTS
This course introduces students with basic theories of mass transfer; principles of mass transfer operations; and contaminants transport in natural environment. The mass transfer theories will focus on the Fick's law, transport equation, and one-dimension steady-state mass transport processes. The mass transfer operations will focus on the process principles, equipment, and design of the absorption/stripping, adsorption, and membrane filtration operations. The transport phenomena in natural environment will focus on the phase partitioning principles, inter-phase mass transfer, and introduction to environmental transport modeling.

The main course contents include:

1 Molecular diffusion and transport (1.5 weeks)
- Course outline and introduction
- Binary mixture system
- Fick's law of diffusion
- The transport equation
- Equal mole diffusion
- Diffusion through a stagnant film

2 Inter-face mass transfer (2.5 weeks)
- Interface partitioning equilibrium
- Mass transfer equation
- Oxygen transfer in water
- Transport processes across solid-fluid boundary

3 Absorption/stripping operation (2 weeks)
- Gas-liquid mass transfer model
- Absorption/stripping operation principles
- Absorption/stripping equipment: packed tower
- Absorption/stripping packed tower design

4 Adsorption (1.5 weeks)
- Adsorption isotherm
- Batch adsorption

- fixed bed adsorption column design

5 Membrane filtration (1.5 weeks)
- Filtration equation
- Constant pressure filtrations
- Membrane filtration operation & design
- RO/NF processes

5 Environmental transport phenomena (3 weeks)
- Air-water interface exchange
- Sediment-water exchange
- Transport in soil
- Environmental reactor models
- General approach to solve environmental transport problem

TUTORIAL & ASSIGNMENTS:
The main purposes of the tutorial and assignments are to help students to enhance their understanding of the lecture materials through additional examples, answering questions, group discussion, and conducting labs. All students are strongly encouraged to complete the given problems individually or in groups.

COURSE DESIGN PROJECT: The students are required to work in groups to complete a course project on the absorption/stripping tower design, which involves the process design calculations, excel design sheet development, and project report writing.

LABS: Two laboratory assignments are required to complement the lecture materials. Students are required to attend the labs, conduct the experiments, analyze the results, and write a report. The specific requirements will be outlined in advance of each lab.

Safety in the laboratory is a prime concern. University policy forbids working alone in a lab; this will be strictly enforced.

GRADE EVALUATION:

Evaluation:	**Value**
Midterm (1)	25 %
Course design assignment (1)	15 %
Labs (2)	20 % total
Final Exam	40 %

Note: You are allowed to bring the course reader, lecture notes, and non-communicating calculator for the quiz, midterm, and final exam.

IMPORTANT NOTES
Student responsibilities
- Attend lectures, tutorial, and group meeting in order to obtain all the course materials that you are responsible for.

- Submit assignments and lab reports on time.
- Submission of reports for re-marking must be done within a week of being returned.
- Communications regarding this course will frequently involve the course web page and email. Students are responsible for checking the course website and the university email account for all instructions and announcements.

Late assignment/project report policy:

- Generally, when you find yourself unable to meet a course requirement such as the lab, lab report, or a test as a result of compassionate, illness or physiological reasons, a formal explanation must be made in writing to the instructor and (where possible) proper documentation must be provided. This should be done prior to an exam or assignment (if possible) or as soon as possible but definitely within a week after the exam or assignment due date.
- If no explanations are provided, exams receive a grade of zero and project reports are subject to the following deductions:
  - 25% will be deducted if the assignment is up to 24 hours late,
  - 50% will be deducted if the assignment is 24 to 48 hours late,
  - No assignments will be accepted after that.

University policy on academic misconduct:

Academic misconduct, such as plagiarism, is a serious offence at the University of Guelph. Please consult the Undergraduate Calendar and School of Engineering programs guide, for offences, penalties and procedures relating to academic misconduct.
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/

Disclaimer:

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