ENGG*3470 Mass Transfer Operations
Winter 2017

School of Engineering

1 INSTRUCTIONAL SUPPORT

1.0 Instructor

Instructor: Cameron Farrow, PhD
Office: THRN 2361, ext. 53385
Email: cfarrow@uoguelph.ca
Office hours: Open door policy and by appointment

1.1 Lab Technicians

Joanne Ryks	Ryan Smith
THRN1114	THRN1114
jryks@uoguelph.ca	rsmyth17@uoguelph.ca

1.2 Teaching Assistants

GTA	Email	Office Hours
Precious Arku	parku@uoguelph.ca	TBA

2 LEARNING RESOURCES

2.0 Course Contact Hours (Lectures, Labs, & Tutorials)

The lectures, labs and tutorials are the primary means used to support your learning in this course. Lectures will be the primary means for course news and announcements in addition to provision of course materials. Lecture attendance is expected. Tutorials will be the primary means for the instructional team to coach you. Tutorial attendance is expected. Labs will be the primary means for hands-on experience. Lab attendance is required.

2.1 Course Website

ENGG*3470 Courselink site will provide copies of lecture slides, project/laboratory descriptions and assignments.

2.2 Required Resources

None

2.3 Recommended Resources

1) Jaime Benítez, *Principles and Modern Applications of Mass Transfer Operations*, 3rd Edition, Wiley, 2016.
2) Louis Theodore and Francesco Ricci, *Mass Transfer Operations for the Practicing Engineer*, Wiley AIChE, 2010.

2.4 Additional Resources

Lecture Information: All lecture slides will be posted on Courselink.

Lab Information: Posted on Courselink.

Assignments: Posted on Courselink.

2.5 Communication & Email Policy

Communication associated with course material is delivered by a combination of the lectures, lab/tutorials and the Courselink site. It is your responsibility to receive communication from ALL of these sources – there will be some mutual reinforcement between these sources but they are not completely redundant. As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

3 ASSESSMENT

3.0 Dates and Distribution

Final Exam	40%	Friday April 21st 7:00-9:00 PM
Midterms (2)	30%	Midterm 1 - Wednesday, February 8th (In-Class) Midterm 2 – Wednesday, March 22nd (In-Class)
Laboratory	10% 10%	Aeration and Oxygen Transfer – Due: Fri, Feb 17th 6:00PM Ion Exchange/Column Adsorption – Due: Fri, Mar 17th 6:00PM
Project	10%	Due: Fri, Mar. 31st 6:00 PM

3.1 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor **within two weeks of the start** of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: To pass the course students must obtain a grade of 50% or higher.

Missed midterm: If you miss a midterm due to grounds for granting academic consideration or religious accommodation, the weight of the missed midterm will be added to the final exam.

Lab Work: You must attend and complete the hands on laboratory in order to be eligible to complete the required written laboratory report.

Late Lab Reports: Late submissions (without instructor permission based on suitable grounds and documentation) will be penalized. The penalty will depend on how late: 10% for 1-12 hours; 25% for 12-48 hours; 50% for 48-96 hours and 100% after 96 hours.

Teamwork: Teamwork is required for the completion of the laboratory component of this course. It is expected that you are an active member of the team and provided an approximately equal contribution to the submitted work. If it becomes apparent that this is not the case then the instructor may assign a substantially different (lower) grade for a member of the team.

4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.0 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 and pollutant prevention.

Prerequisite(s): ENGG*2230, ENGG*3260, MATH*2270
Co-requisite(s): ENGG*3430

4.1 Course Aims

This course introduces students to the theories of the mass transfer and operations. The main goals of this course are to: (1) teach students the approaches to solving environmental engineering related mass transfer problems; and (2) introduce the methods for process analysis and design of mass transfer operations.

4.2 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. Apply mass transfer theory to analyze interface mass transfer mechanisms and solve one-dimensional steady state mass transfer problems.
2. Utilize adsorption theory to analyze adsorption equilibrium and kinetic problems, and design fixed bed adsorption columns for water or air purification.
3. Apply absorption theory to analyze and design packed absorption/stripping equipment for environmental pollutant removal.
4. Apply membrane filtration theory to analyze and design membrane filtration process for water purification.
5. Use box models to solve environmental mass transfer problems.

4.3 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1-5	Assignments, Exams
2. Problem Analysis	1-5	Assignments, Exams
3. Investigation	1-5	Labs, Assignments
4. Design	2-4	Project
5. Use of Engineering Tools	2, 3	Labs, Project
6. Communication	1-3	Labs, Project
7. Individual and Teamwork	-	Labs
8. Professionalism	-	
9. Impact of Engineering on Society and the Environment	1-5	Project
10. Ethics and Equity	-	
11. Business & Project Management	-	
12. Life-Long Learning	-	

4.4 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.5 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.6 Relationships with other Courses & Labs

Previous Courses:

ENGG*2230: Fluid Mechanics: mass and energy conservation of fluid systems and the concept of boundary layers.

ENGG*3260: Thermodynamics: thermodynamic principles of the chemical equilibrium and kinetics.

MATH*2270: Applied Differential Equations: Mathematics employed to solve mass transfer problems.

Co-current Courses:

ENGG*3430: Heat and Mass Transfer: Heat and mass transfer analogies.

Follow-on Courses:

ENGG*4260: Water and Wastewater Treatment Design: mass transfer mechanisms and design principles of unit operations used for water and wastewater treatment.

ENGG*4330: Air Pollution Control: Mass transfer and design methods of air purification.

5 TEACHING AND LEARNING ACTIVITIES

5.0 Timetable

Lectures:			
Monday & Wednesday		5:30 – 6:50	THRN 1307
Tutorials			
Wednesday	Sec 1011 Sec 1021 Sec 1031 Sec 1041	7:00 - 7:50 PM	ALEX 218
Thursday	Sec 1012 Sec 1022 Sec 1032 Sec 1042	7:00 - 7:50 PM	
Laboratory			
Monday	Sec 1011 Sec 1012	8:30-10:20	THRN 1116
Tuesday	Sec 1021 Sec 1022	2:30 - 4:20	
Friday	Sec 1031 Sec 1032	8:30 – 10:20	
Wednesday	Sec 1041 Sec 1042	9:30 -11:20	

* you may only attend an alternate tutorial or lab time with prior permission of the instructor

5.1 Lecture Schedule

Lectures (Approx.)	**Lecture Topics**	**Learning Objectives**
1-3	Molecular Diffusion and Transport	1
4-8	Interface Mass Transfer	1
9-11	Adsorption	2
12-15	Absorption/Stripping	3
16-18	Membrane Filtration	4
19-23	Environmental Transport Phenomena	5
24	Course Wrap-Up/Course Evaluations	-

5.2 Project & Lab Schedule

Week	Topics	Due
4 & 5	Aeration and Oxygen Transfer	Fri, Feb. 17th 6:00 PM
7 & 8	Ion Exchange/Column Adsorption	Fri, Mar. 17th 6:00 PM
7 - 10	Design Project	Fri, Mar. 31st 6:00 PM

Laboratory reports and final projects are required to be submitted electronically through the Courselink drop box.

5.3 Other Important Dates

Monday, January 9: First day of class
Monday, February 20 – Friday, February 24: Reading Week
Friday, March 10: 40th class: Last day to drop single semester courses
Friday, April 7: Final Class

6 LAB SAFETY

6.0 School of Engineering Policy

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

If the laboratory rules are not followed, consequences will include removing student's access to the lab. If this results in lab work not being completed, the student will receive a grade of 0.

6.1 ENGG*3470 Specific

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.0 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

8 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Student Accessibility Services as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208, email csd@uoguelph.ca or see the website: http://www.uoguelph.ca/csd/

9 RECORDING OF MATERIALS

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, GTA, technician, classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

10 RESOURCES

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: http://www.uoguelph.ca/registrar/calendars/index.cfm?index