

University of Guelph
School of Engineering
ENGG*3160 Biological Engineering Systems II
Fall 2012

Faculty: Dr. Suresh Neethirajan, PhD., P.Eng

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Office Hours: Tuesdays: 11:30 to 12:30 pm or by appointment

Lab Co-Ordinator: Ms. Carly Genn, B.Sc (*Biological Engineering*)

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Room 3403, Thornbrough Building

Textbook:

Lecture materials and notes will be posted in the course outline.

Fournier, Ronald AL: Basic Transport Phenomena in Biomedical Engineering, CRC Press 2012.

Cussler EL: *Diffusion: Mass transfer in fluid systems*. Cambridge University Press 2009 (3rd Edition)

Transport Phenomena in Biological Systems (Second Edition) George A. Truskey, Fan Yuan, David Katz.
Pearson Prentice Hall, ISBN 0-13-156988-0.

Schedule:

Lectures: MACK 223

Mondays: 4:30 pm to 5:20 pm

Wednesdays: 4:30 pm to 5:20 pm

Fridays: 4:30 pm to 5:20 pm

Labs/Tutorials: MACK 236/SCIE 2101

Tuesdays: 2:00 PM to 3:50 PM

Course Objective:

The objective of this course is to introduce mass transfer processes of biological and medical importance and the methods used to model them.

Learning Objectives:

- Understand the process of diffusion and diffusive mass transport across biological membranes
- Understand the basic mass transfer models in applications such as hemodialysis, capillaries, lungs and relevant biological systems

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Learning Outcomes:

- Demonstrate the ability to apply the engineering fundamentals of energy and mass transfer to biological systems.
- Develop an understanding of the transport phenomena occurring in biological systems, especially the human body.

Graduate Attributes:

- Knowledge of fundamental principles governing transport phenomena and numerical skills for problem solving in engineering
- Information literacy and writing communication

Course Pre-requisites:

It is expected that you can solve a first order differential equation and that you understand boundary conditions.

Laboratory:

The laboratory component will consist of three mass transfer experiments. Please refer the lab manual and the handouts posted in course outline website.

Industrial Tours, Videos and Guest Lectures:

Movie I - Sep 25, 2012 Tuesday 2:00 to 3:50 PM
GFTC Industrial Tour - Oct 16 Tuesday 2:00 to 3:50 PM
Sleeman Brewery Tour - TBA (Some Tuesday evening at 7 pm in October)

There will be a guest lecture from industry personnel during the lecture hours.

Grade Evaluation:

Assignments	30%
Lab Reports	30%
Presentation	10%
Final Exam	30%

Final Exam is scheduled for December 3, 2012 at 8:30 am to 10:30 am. Location: TBA

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Course Syllabus

Week	Topic
1 & 2	Transport Phenomena - Hemoperfusion Example - Units and Dimensions - Review of significant digits, Example problems
2	Principles of diffusion. Fick's law. Steady state diffusion in one dimension
3	Mass balances for the ideal type reactors - mass balance equations for a continuously stirred tank reactor, batch, flow or tubular reactors
4	Phase equilibrium in mixtures, physical properties of the body fluids and cell membrane
5	Solute transport, capillary properties, solute diffusion, Fick's law, Solute diffusion through heterogeneous media
6	Diffusion in blood and tissue, solute permeability, transport of solute across capillary wall
7	Thermodynamics, Fundamental relationships, phase equilibrium in mixture introduction
8 & 9	Mass transfer in haemodialysis (Artificial kidney)
10	Oxygen transport in biological systems, Pharmacokinetic analysis
11	Mass transfer across the skin. Drug Delivery problems. Transfer of drugs or toxins across the skin
12	Slow release devices, implants, Review, Student Presentations

Exam Dates:

Final Exam is scheduled for December 3, 2012, Monday. Time: 8:30 Am to 10:30 Am, Location: TBA

Student Responsibilities:

- Attend lectures and labs in order to obtain all the course material that you are responsible for.
- Check announcements page (courselink website) on a regular basis.
- Submit assignments on time.
- Regularly, check your marks on the course web page and make sure they are up to date.
- Submission of assignments for re-marking must be done within a week of being returned.

Important Notes:

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. This must be done at least once every week.

Late Assignment/Missed Test Policy:

Generally, when you find yourself unable to meet a course requirement such as an assignment 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 assignments/lab 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 the School of Engineering programs guide, for offences, penalties and procedures relating to academic misconduct.

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08amisconduct.shtml>

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.