BIOM9311

Mass Transfer in Medicine

Term 3, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
By appoi Socrates Dokos ‰	s.dokos@unsw.edu.au	By appointment (via‰ ‰ ‴		‰

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Course Details

Units of Credit 6

Summary of the Course

This course is an introduction to mass transfer processes in medicine and biology, including the computational modelling of these. Topics covered include transfer of solutes across capillaries, mass transfer in haemodialysis, gas exchange in the lungs and in membrane oxygenators, transfer of drugs and toxins across the skin, slow release of drugs from implants, as well as mass transfer considerations in biosensors and in tissue engineering.

Course Aims

The aim of this course is to introduce various mass transfer processes of medical or physiological importance, and the methods used to computationally model these.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Explain the principles of diffusion and diffusive mass transport across synthetic and biological membranes.	PE1.1, PE3.2
2. Solve biomedical problems in mass transport by analytical and/or numerical means.	PE1.2
3. Analyse the relative importance of convection and diffusion in a given system.	PE1.3
4. Formulate and use mathematical models of mass transfer in medical applications such as haemodialysis, drug release and biosensors.	PE2.1, PE2.2
5. Explain the concepts of flow limitation and membrane limitation, distinguishing whether one or the other, or neither, is limiting in a particular medical application.	PE1.3

Teaching Strategies

This course will be taught via weekly online lectures (pre-recorded) and weekly computer laboratories (face-face and fully online classes are available). Students will be expected to apply theory covered in the lectures to the weekly team-based learning activities in class. You will need to come to each class prepared by watching the lecture and revising material from the previous week's laboratory.

During the computer laboratory class itself, you will be given an individual test under exam conditions (30 minutes), followed by an opportunity to confer with members of your allotted class group and post a revised answer to the same exercises (another 15 minutes). Some of these problems will involve computational simulations using Cb ‰ eOLthematical mods essfu sed le

Assessment

The assessment tasks for BIOM9311 Mass Transfer in Medicine have been designed to measure your achievement of the learning outcomes. The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks.

Quizzes will consist of online multiple choice questions and are designed to encourage learning throughout the semester and prepare students for the types of questions in the final exam. Quizzes must be attempted during the laboratory class, and will consist of an individual-based test (known as an individual readiness assurance test, or IRAT) and a team-based test (referred to as a team readiness assurance test, or TRAT). Both quizzes are worth 7.5% each, comprising 15% of the course assessment.

The major assignment is worth 20% of the total course assessment. A substantial problem of some complexity will be defined. The conceptual material required to solve it will have been covered in lectures but applying that material to this problem will not be trivial. It will not be a matter of simply finding the right equation. Clear thinking and working up from the basics will be required. In addition, values of some required material properties will have to be found from the literature. This will not be trivial either. It is expected that the report will clearly detail the method of solution, including all simplifying assumptions.

The laboratory report will be an opportunity for students to analyse experimental data and present findings in the form of a laboratory report. The laboratory report is worth 20% of the total course assessment.

The final exam will be held during the formal exam period and is worth 45% of the total course assessment.

Start date: 17/10/2022 05:00 PM
Due date: 21/11/2022 05:00 PM

Students are required to simulate a mass transfer system in medicine or biology, submitting a detailed report describing methods, assumptions, results and significance of findings.

Assessment 4: Final Examination

Start date: TBA
Due date: TBA

This assessment constitutes the final exam for the course. It will be an online exam consisting of multiple-choice and calculation-type questions.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

Online lectures will be released every week in Moodle by Monday 11 am. These will be pre-recorded and can be viewed at any time, but please ensure you have done so prior to the computer laboratory class each week.

For the weekly computer laboratory class, please come to the class you have been enrolled in (i.e. face-face or online class), otherwise you will not be able to access the in-class online materials required. The face-face class will be held in the Computer Laboratory, Samuels building room 518. The online class can be accessed in Moodle near the top of the course page under Online Lab Sessions --> Weekly Tutorial Sessions). In each weekly lab class, we will be working together through a set of tutorial problems (online quizzes), for which you are required to submit answers by the end of each class session. There will be eight such quizzes in total, forming 7.5% of the overall course assessment.

Each week after the lab class, you will be required to complete an online quiz, due 5 pm the following Monday. There will be eight such quizzes in total, forming another 7.5% go the overall course assessment.

View class timetable

Timetable

Date	Type	Content
Week 1: 12 September - 16 September	Lecture	Fundamentals of Mass Transfer & Introduction to COMSOL
	Assessment	In-Class Quiz 1 (IRAT & TRAT)

November	Assessment	In-Class Quiz 6 (IRAT & TRAT)
Week 9: 7 November - 11 November	Lecture	Tissue Engineering and Bioreactors
	Assessment	In-Class Quiz 7 (IRAT & TRAT)
	Assessment	Laboratory Report (due Monday Week 9)
	Assessment	Laboratory Report
Week 10: 14 November - 18 November	Lecture	Artificial Lung and Blood Gas Exchange
	Assessment	In-Class Quiz 8 (IRAT & TRAT)
Study Week: 21 November - 24 November	Assessment	Major Assignment (due Monday Week 11)
	Assessment	Major Assignment

Resources

Prescribed Resources

- Basic Transport Phenomena in Biomedical Engineering (3rd Edition) by Fournier, Ronald A. L. CRC Press 2012. (Available from the Library: 571.64/3A, 571.64/3B, plus one copy of an earlier edition).

Recommended Resources

The lecture notes given along with information posted on Moodle will be the primary source of information. Additional optional resources are given below:

A text which provides useful case studies in biomedical engineering mass transfer phenomena, as well as a useful resource in COMSOL modelling is:

Submission of Assessment Tasks

Laboratory reports and major assignments will require a Non Plagiarism Declaration Cover Sheet.

Assignments should be submitted on time. A daily penalty of 5% of the marks available for that assignment will apply for work received after the due date. Any assignment more than 5 days late will not be accepted. The only exemption will be when prior permission for late submission has been granted by the Course coordinator. Extensions will be granted only on medical or compassionate grounds under extreme circumstances.

Academic Honesty and Plagiarism

PLAGIARISM
Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise will have their names entered on a plagiarism register and will be liable to disciplinary action, including exclusion from enrolment.
It is expected that all students must at all times submit their own work for assessment. Submitting the work or ideas of someone else without clearly acknowledging the source of borrowed material or ideas is plagiarism.
All assessments which you hand in must have a Non Plagiarism Declaration Cover Sheet. This is for both individual and group work. Attach it to your assignment before submitting it to the Course Coordinator or at the School Office.
Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:
https://student.unsw.edu.au/plagiarism

Academic Information

COURSE EVALUATION AND DEVELOPMENT
Student feedback has helped to shape and develop this course, including feedback obtained from on-line evaluations as part of UNSW's as part of UNSW's myExperience process. You are highly encouraged to complete such an on-line evaluation toward the end of Term. Feedback and suggestions provided will be important in improving the course for future students.

DATES TO NOTE
Refer to MyUNSW for Important Dates, available at:
https://my.unsw.edu.au/student/resources/KeyDates.html

ACADEMIC ADVICE
For information about:

- Notes on assessments and plagiarism,
- Special Considerations,
- School Student Ethics Officer, and
- BESS

refer to the School website available at
http://www.engineering.unsw.edu.au/biomedical-engineering/

Supplementary Examinations:

Supplementary Examinations for Term 1 2022 will be held on (TBC) should you be required to sit one.

This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up to date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

Hollow fibre dialyser simulation using COMSOL Multiphysics

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW

Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	