



Department of Medical Biophysics MEDBIO 3507G - ANALYSIS OF OXYGEN TRANSPORT

Course Syllabus for Winter 2024 (DRAFT)



Western University is committed to a **thriving campus**; therefore, your health and wellness matter to us! The following link provides information about the resources available on and off campus to support students: <u>https://www.uwo.ca/health/</u> Your course coordinator can also **guide you** to resources and/or services should you need them.

1. Technical Requirements:



Stable internet connection



Laptop or computer



Working microphone



Working webcam

2. Important Dates:



Classes BeginReading WeekClasses EndStudy day(s)Exam PeriodJanuary 8February 17-25April 8April 9-10April 11–30*March 7, 2024: Last day to drop a second term half course without academic penalty

3. Contact Information

Course Coordinator	Contact Information
Instructor(s) or Teaching Assistant(s)	Contact Information

4. Course Description and Design

Delivery Mode: blended (in-person/online)

The application of physics and mathematics for modeling oxygen transport. Emphasis on problem solving and simple MATLAB computer models for enhancing the students' interpretation of analytical solutions. Topics include the Krogh-Erlang capillary model, oxygen diffusion in thin tissues and tumors, finite difference models in unsteady-state systems, and blood flow.

REQUISITES: Prerequisite(s): One of Calculus 1000A/B, Calculus 1500A/B, Numerical and Mathematical Methods 1412A/B or the former Applied Mathematics 1412A/B, plus one of Calculus 1301A/B, Calculus 1501A/B, Numerical and Mathematical Methods 1414A/B or the former Applied Mathematics 1414A/B, or the former Applied Mathematics 1413; one of Physics 1201A/B, Physics 1401A/B, Physics 1501A/B, the former Physics 1028A/B, the former Physics 1301A/B; and one of Physics 1202A/B, Physics 1402A/B, Physics 1502A/B, the former Physics 1029A/B, the former Physics 1302A/B. Integrated Science 1001X can be used as a prerequisite in place of Calculus 1301A/B and Physics 1202A/B. Although typically taken in third year, this course is available to second-year students with an overall average of at least 70% in first year.

Senate regulation regarding the student's responsibility regarding prerequisites:

Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Timetabled Sessions



Component	Date(s)	Time
Asynchronous Lecture (videos posted)		1hr
Synchronous Online Lecture		1hr
In-Person Tutorial (Online Quiz)		2hrs

- Attendance at synchronous/in-person sessions is required
- Missed work should be completed within 24 hours
- A recording will be NOT provided of synchronous/in-person sessions

All course material will be posted to OWL: http://owl.uwo.ca. Any changes will be indicated on the OWL site and discussed with the class.

If students need assistance, they can seek support on the <u>OWL Help page</u>. Alternatively, they can contact the <u>Western Technology Services Helpdesk</u>. They can be contacted by phone at 519-661-3800 or ext. 83800.

<u>Google Chrome</u> or <u>Mozilla Firefox</u> are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click <u>here.</u>

5. Learning Outcomes

Knowledge

In this course we will draw upon skills you have already acquired in the disciplines of biology, mathematics and physics in order to guide you towards solving problems involving oxygen convection, diffusion and consumption, as well as blood flow, in a variety of novel biological situations. These will include problems such as the challenge of supplying oxygen to the cornea when you wear contact lenses, how far oxygen can diffuse from capillaries into the surrounding tissue, and how oxygen diffusion limits tumour growth. With this knowledge of how to apply fundamental biophysical principles to model and understand complex biological problems, graduates of this course will be prepared to imagine and generate novel solutions to new unanswered questions in the future.

• Literacies and Interdisciplinarity

By design, this is an interdisciplinary course that applies appropriate analytical and modelling techniques (mainly, solving linear differential equations and graphical analysis of solutions) to solve problems in biology. *Graduates of this course will be able to apply appropriate terminology from these diverse disciplines*.



Resilience and Life-long Learning

Graduates of this course will have a deep appreciation of how to apply problem-solving skills in a real world setting which will contribute to their life-long learning in both academic and non-academic settings.

• Critical Inquiry and Creative Thinking

Graduates of this course will know how to extract and define solvable problems from a mass of poorly structured information, and how to develop an organized strategy for exploring, planning and solving a problem while looking back to review whether the solution achieves the original goals.

Communication

Graduates of the course will recognize the importance of effective communication and be able to communicate to others in an effective way the step-by-step processes they used in reaching a solution and demonstrate how they evaluate their solutions realistically in light of their practical knowledge of biology.

• Professionalism and Ethical Conduct

Graduates of the course will be able to identify underlying assumptions and how those assumptions may impact the resulting solution to a problem. Through the team problem solving assignments, graduates will develop critical aspects of professionalism and ethical conduct of shared responsibility and respective group interactions.

6. Course Content and Schedule

Week	Dates	Торіс	Assignments
1	Jan 8–14	Introduction to Course and Problem Solving/ Solver-Listener PS of Simple Visual Problem	HONOUR PLEDGE (Due Jan 22)
2	Jan 15-21	Problem Solving Analysis of Challenger Disaster/ Introduction to Oxygen Diffusion in Biology/ Qualitative Introduction to Mass Balance and Geometry	ASST 1a: PS Part I (Due Feb 9)
3	Jan 22-28	Boundary Conditions/ Interface Boundary Conditions	
4	Jan 29–Feb 4	Diffusion through Multiple Layers/ Maximum Diffusion Distances in Different Geometries/ Other Boundary Conditions	
5	Feb 5-11	Cornea-Contact Lens Model Development, Solution and Interpretation	ASST 2: GEOMETRY (Due Feb 16)
6	Feb 12–16	Multicellular Spheroid Tumor Model Development, Solution and Interpretation/ Mid-Term (P)Review	ASST 3: CORNEA (Due Mar 1)
7	Feb 17-25	Reading Week	
8	Feb 26-Mar 3	Oxygen Carriers and Convective Transport of Oxygen/ <i>Mid-Term</i> <i>Test</i> (through Week 5)	ASST 1b: PS Part II - REPORT AND PRESENTATION
9	Mar 4-10	Krogh Tissue Cylinder Model Development, Solution and Interpretation / Intro to Blood Flow Physics	ASST 4a: TUMORS <u>or</u> ASST 4b: KROGH (Due Mar 15)
10	Mar 11–17	Steady Flow in Large Vessels/ Flow in Vascular Networks	ASST 5: CAROTID STENOSIS (Due Mar 22)
11	Mar 18–24	Murray's Law/ Microvascular Rheology in Single Vessels/ Oxygen Transport in Arterioles	ASST 6: ARTERIOLAR FLOW/TRANSPORT (Due Mar 29)
12	Mar 25–31	MV Rheology in Branching Networks/ Conservation Laws for Two-Phase MV Blood Flow	
13	Apr 1-7	Unsteady Oxygen Diffusion Problems: Analytical Solutions and Application to Measuring Diffusion Coefficients/ Computational Modeling of Unsteady Problems: Finite-Difference Approach	
14	Apr 8		

7. **Participation and Engagement**

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Students are expected to participate and engage with content as much as possible \square Students can participate during tutorial sessions and synchronous lectures

 \mathbf{N} Students can also participate by interacting in the forums with their peers and instructors

8. Evaluation

Below is the evaluation breakdown for the course. Any deviations will be communicated.

Assessment	Format	Weighting (%)
Assignments	There will be 5 individual assignments (Assignments 2-6), each worth 3.4%. They will be posted online during the week noted, and will usually be due the following Friday. There will also be a two-part, group problem-solving assignment (Assignment 1a-b) worth a total of 8%.	25
Online Quizzes	There will be a total of 5 quizzes, with the lowest one dropped. They will take 60 minutes to complete and be given via OWL during the first hour of the weekly Tutorial session. Quizzes will be announced approximately one week before they are given.	
Mid-Term Test	Covering material through Week 5 (45min writing time)	25
Final Exam	In Person, cumulative but weighted to material after Reading Week. Date and time TBD by the Registrar (2hr writing time)	40

- All assignments are due at 11:59 PM EST unless otherwise specified
- Students are responsible for ensuring that the correct file version is uploaded; incorrect submissions including corrupt files could be subject to late penalties (see below) or a 0
- A student might not receive the same grade as their group members if it is determined that the distribution of work was not equal
- Any grade appeals on assignments, quizzes, or midterm must be received within 3 weeks of the grade being posted.

Click here for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.

-	90-100	One could scarcely expect better from a student at this level
	80-89	Superior work which is clearly above average
	70-79	Good work, meeting all requirements, and eminently satisfactory
	60-69	Competent work, meeting requirements
	50-59	Fair work, minimally acceptable
	below 50	Fail

Information about late or missed evaluations:

- Late assignments will receive a 10% penalty for each of first two days, and 15% penalty for each subsequent day
- Accommodation for missed assignments totaling more than 10% requires documentation
- \square Missed guizzes cannot be made up, but their weight will be distributed to the guizzes taken. If all guizzes are missed, documentation is required to receive accommodation

- A missed Mid-Term Test cannot be made up, but <u>with a documented absence</u> its weight will be transferred to the Final Exam
- A missed Final Exam must be made up, but this must be approved by the Dean's office
- All students in a group might not receive the same grade on the group project if it is determined that the distribution of work was not equal

INC (Incomplete Standing): If a student has been approved by the Academic Counselling Office (in consultation with the instructor/department) to complete term work at a later date, an INC will be assigned. Students with INC will have their course load in subsequent terms reduced to allow them to complete outstanding course work. Students may request permission from Academic Counselling to carry a full course load for the term the incomplete course work is scheduled.

SPC (**Special examination**): If a student has been approved by the Academic Counselling Office to write a Special Examination and the final exam is the only outstanding course component, an SPC will be assigned. If the class has a makeup exam, the student is expected to write the makeup exam. If the class doesn't have a makeup exam or the student misses the makeup exam for reasons approved by the Academic Counselling Office, the student will write the exam the next time the course is offered. Outstanding SPCs will reduce the course load for the term the exam is deferred as outlined in Types of Examinations policy.

9. Communication:

- Students should check the OWL site every 24–48 hours
- Students should email their instructor(s) and teaching assistant(s) using email
- Emails will be monitored daily; students will receive a response in 24–48 hours



Students should post all course-related queries on the discussion forum so that everyone can access the questions and responses

10. Office Hours:



- Office hours will be held remotely using Zoom (date and time TBA)
- ✓ Office hours will be group
- Office hours individual appointments can be arranged via email

11. Resources



All resources will be posted in OWL

12. Professionalism & Privacy:

Western students are expected to follow the <u>Student Code of Conduct</u>. Additionally, the following expectations and professional conduct apply to this course:



- All course materials created by the instructor(s) are copyrighted and cannot be sold/shared (e.g., Must Knows Facebook group, Course Hero, Chegg, etc.)
- Recordings are not permitted (audio or video) without explicit permission
- Permitted recordings are not to be distributed
- Students will be expected to take an academic integrity pledge before some assessments

Western is committed to providing a learning and working environment that is free of harassment and discrimination. All **students**, staff, and faculty have a role in this commitment and have a responsibility to ensure and promote a safe and respectful learning and working environment. Relevant policies include Western's <u>Non-Discrimination/Harassment Policy</u> (M.A.P.P. 1.35) and <u>Non-Discrimination/Harassment Policy</u> – Administrative Procedures (M.A.P.P. 1.35).

Any **student**, staff, or faculty member who experiences or witnesses' behaviour that may be harassment or discrimination **must report the behaviour** to the Western's <u>Human Rights Office</u>. Harassment and discrimination can be human rights-based, which is also known as EDI-based, (sexism, racism, transphobia, homophobia, islamophobia, xenophobia, antisemitism, and ableism) or non-human rights-based (personal harassment or workplace harassment).

13. How to Be Successful in this Class:

Students enrolled in this class should understand the level of autonomy and self-discipline required to be successful.

- 1. Invest in a planner or application to keep track of your courses. Populate all your deadlines at the start of the term and schedule your time throughout the course.
- 2. Make it a daily habit to log onto OWL to ensure you have seen everything posted to help you succeed in this class.
- 3. Take notes as you go through the lesson material. Keeping handwritten notes or even notes on a regular Word document will help you learn more effectively than just reading or watching the videos.
- 4. Connect with others. Try forming an online study group and try meeting on a weekly basis for study and peer support.
- 5. Do not be afraid to ask questions. If you are struggling with a topic, check the online discussion boards or contact your instructor(s) and or teaching assistant(s).

14. Western Academic Policies and Statements

Absence from Course Commitments

A. Absence for medical illness:

Students must familiarize themselves with the Accommodation for Illness Policy.

A student seeking academic accommodation for any **work worth less than 10%** must contact the instructor or follow the appropriate Department or course specific instructions provided on the course outline. Instructors will use good judgment and ensure fair treatment for all students when considering these requests. You are not required to disclose details about your situation to your instructor; documentation is not required in this situation, and you should not send any pictures to your instructor.

If you are unable to meet a course requirement for any **work worth 10% or greater** due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Academic Counseling as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. Please note that the format of a make-up test, exam, or assignment is at the discretion of the course coordinator.

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Record's Release Form (located in the Dean's



Office) for visits to Student Health Services. The form can be found at: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

B. Absence for non-medical reasons:

Student absences might also be approved for non-medical reasons such as religious holidays and compassionate situations. Please review the policy on <u>Accommodation for Religious Holidays</u>. All non-medical requests must be processed by Academic Counselling. Not all absences will be approved; pay attention to the academic calendar and final exam period when booking any trips.

C. Special Examinations

A Special Examination is any examination other than the regular examination, and it may be offered only with the permission of the Dean of the Faculty in which the student is registered, in consultation with the instructor and Department Chair. Permission to write a Special Examination may be given on the basis of compassionate or medical grounds with appropriate supporting documents. To provide an opportunity for students to recover from the circumstances resulting in a Special Examination, the University has implemented Special Examinations dates. These dates as well as other important information about examinations and academic standing can be found here.

Academic Offenses

Scholastic offences are taken seriously, and students are directed <u>here</u> to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence.

Accessibility Statement

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Accessible Education (AE) at 661-2111 x 82147 for any specific question regarding an accommodation or review The policy on Accommodation for Students with Disabilities

Correspondence Statement

The centrally administered **e-mail account** provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner. You can read about the privacy and security of the UWO email accounts <u>here</u>.

Discovery Credit Statement

Students are permitted to designate up to 1.0 Discovery Credit course (or equivalent) for pass/fail grading that can be counted toward the overall course credits required for their degree program. The details of this policy and the deadlines can be found <u>here</u>.

Essay Course Guidelines

The guidelines for the minimum written assignments refer to the cumulative amount of written work in a course but excludes written work in examinations. You can read about essay course guidelines <u>here</u>.

An essay course must normally involve total written assignments (essays or other appropriate prose composition, excluding examinations) as follows:

- Full course (1000 to 1999): at least 3000 words
- Half course (1000 to 1999): at least 1500 words

- Full course (2000 and above): at least 5000 words
- Half course (2000 and above): at least 2500 words

The structure of the essay course must be such that in order to pass the course, the student must exhibit some minimal level of competence in essay writing and the appropriate level of knowledge of the content of the course.

Turnitin and other similarity review software

All assignments will be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between Western University and <u>Turnitin.com</u>.

15. BMSUE Academic Policies and Statements

Cell Phone and Electronic Device Policy (for in-person tests and exams)

The Schulich School of Medicine & Dentistry is committed to ensuring that testing and evaluation are undertaken fairly across all our departments and programs. For all tests and exams, it is the policy of the School that any electronic devices, e.g., cell phones, tablets, cameras, smart glasses, smart watch or iPod are strictly prohibited. These devices MUST be left either at home or with the student's bag/jacket at the front of the room and MUST NOT be at the test/exam desk or in the individual's pocket. Any student found with one of these prohibited devices will receive a grade of zero on the test or exam. Non-programmable calculators are only allowed when indicated by the instructor. The program is not responsible for stolen/lost or broken devices.

Copyright and Audio/Video Recording Statement

Course material produced by faculty is copyrighted and to reproduce this material for any purposes other than your own educational use contravenes Canadian Copyright Laws. You must always ask permission to record another individual and you should never share or distribute recordings.

Rounding of Marks Statement

Across the Basic Medical Sciences Undergraduate Education programs, we strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. *Final grades* on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.45 becomes 74, and 74.50 becomes 75. Marks WILL NOT be bumped to the next grade or GPA, e.g., a 79 will NOT be bumped up to an 80, an 84 WILL NOT be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark "bumping" will be denied.

Statement on the use of ChatGPT and other Artificial Intelligence (AI) Platforms

Students are advised that all writing required in the course, including on the group problem solving assignment, should be done their own.

16. Support Services

The following links provide information about support services at Western University.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Academic Counselling (Science and Basic Medical Sciences)

Appeal Procedures

Registrarial Services

Student Development Services

Student Health Services