Medical Biophysics

Schulich MEDICINE & DENTISTRY

3501F

Biophysics of Transport Systems

Course Instructor: Graham Fraser, Ph.D.

Department of Medical Biophysics
Schulich School of Medicine and Dentistry

2015

Medical Biophysics 3501F

BIOPHYSICS OF TRANSPORT SYSTEMS

COURSE OUTLINE

This course describes the physiology and biophysics of the cardiovascular system (in health and disease); blood flow control and red blood cell distribution; and vascular mechanics in the microcirculation and large vessels; surface energy and interactions at biological interfaces such as the lung; diffusive and convective transport and exchange.

Lecture time will consist of presentation of material supported by class discussion and demonstrations. Assignments are provided to apply and advance knowledge and to help students and lecturers assess progress. Assignments are based on selected journal articles and class material, will be posted online approximately every 3 weeks, and will be due in class two weeks following posting. Marks will be deducted (20% per day) for assignments submitted late and those handed in after the marked assignments have been returned will not be marked. Students are encouraged to work together, but the assignment ***must be written up independently***.

In addition to assignments, there will be several routine assessments (quizzes) during the course consisting of multiple-choice, true/false, fill in the blank, diagrammatic, short, and long answer questions completed by each student during in-class time. The routine assessments are designed to encourage regular review and should be used as a way to keep up with the material. The course has one midterm and a final cumulative examination. Tutorial time will be available to help students understand course material and answer questions about content.

Lectures
Tuesday and Thursday: 1:30 -2:30 SH-3317 117
Tutorial
Tuesday Group: 12:30 - 1:30 pm NCB 293
Wednesday Group: 11:30 am – 12:30 pm NCB-296

Antirequisite(s): Medical Biophysics 3302E.
Prerequisite(s): one of Calculus 1000A/B, 1100A/B, Mathematics 1225A/B, Applied Mathematics 1413 or the former Mathematics 030; 1.0 course from Physics 1020, 1024, 1028A/B and 1029A/B, or the former Physics 022 or 025. Typically taken in third or fourth year, this course is also open to second-year students with an overall average of at least 70% in first year.

Senate regulation regarding the student's responsibility regarding requisites:
(from: http://www.uwo.ca/univsec/pdf/academic_policies/exam/courseoutlines.pdf)
"Unless you have either the requisites 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."

COURSE LEARING OUTCOMES

By the end of the course students will be able to:

(i) Use the concepts of vascular pressure, geometry and elasticity along with blood viscosity and velocity to assess energy storage and convective transport throughout the body. Use the concepts of partial pressure, diffusion, and microvascular geometry and blood flow to assess diffusive transport in tissues. Analyze series and parallel circuits to determine the effects of the control of vascular resistance on blood pressure and flow under normal and pathological conditions.

(ii) Use problem solving to integrate concepts from each lecture in an effort to understand and describe the biophysics of the circulation in healthy and diseased states.

iii) Critically evaluate current research using biophysical concepts learned in class.

COURSE ADMINISTRATION

OFFICE HOURS AND LOCATION
Medical Sciences Building, room 412
Ext. 86476
Office Hours: Monday 9:00 – 11:00; by appointment

Due to the nature of the professoriate, there are times when unforeseen circumstances may prevent me from being present during scheduled office hours. I am always interested in hearing from students so feel free to contact me with some potential meetings times and I will respond with a mutually suitable date and time.

COURSE CONTACT
Course E-mail address: use the web site mail for course related questions. Anything of a sensitive nature may be addressed to the instructor's personal e-mail (gmfraser@uwo.ca). Responses to inquiries via the web site email are sent to a mailbox on the web site and NOT to your personal account. Some external email services may encounter SPAM blocking or filtering. Important and timely information may not get to you if you are using another email service. Emails will only be answered when they come from your official UWO email account. Please keep all correspondence professional and concise.

In order to reduce the volume of email being directed to the principle instructor please contact your laboratory teaching assistant first before emailing the course lecturer or coordinator.

Web site address: https://owl.uwo.ca/portal Log onto OWL using your user name and password. You must be registered in this course to have access to the site and you must have an account established with UWO. All course-related materials are delivered through OWL.

TENTATIVE COURSE SCHEDULE

Medical Biophysics 3501F		
DATE	**LECTURE TOPICS**	**ASSIGNMENTS & TUTORIALS**
SEPTEMBER 8 10	- Introduction to transport systems - Cardiac function and biophysics of the cardiac cycle and systemic circulation	
15 17	- Cardiac function and biophysics of the cardiac cycle and systemic circulation - Blood and the distribution of blood to tissues	
22 24	- Distribution of blood to tissues - Resistance to flow in series and parallel circuits	 QUIZ #1
29 **OCTOBER** 1	 - Angiogenesis and microvascular geometry	 ASSIGNMENT #1 DUE
6 8	- Behavior of blood in the microcirculation	
13 15	- Blood Rheology: Viscosity and red blood cell distribution in the microcirculation	 QUIZ #2
20 22	- Veins and venous return - Midterm Review Q&A	 ASSIGNMENT #2 DUE
27 29	**- MIDTERM EXAM (In-class)** - FALL STUDY BREAK	
NOVEMBER 3 5	- Introduction to the pulmonary circulation and lungs - Gas exchange in the lungs - Surfactants	
10 12	- Biophysical measurement techniques in microcirculatory research	
17 19	- Diffusion and mathematical modeling in microcirculatory research	 QUIZ #3
24 26	- Disease and alterations in cardiovascular biophysics	 ASSIGNMENT #3 DUE
DECEMBER 1 3	- Cardiac pulse, pressure and blood velocity waves	
8	- Final Review Q&A	
FINAL EXAM (time set by Registrar) - 2 hours (covers all topics)		

ASSESSMENTS

The course has one final examination that will take place during the University scheduled final examination period. There will be three in-class quizzes, three assignments and a midterm exam. Please be aware that completion of the teaching material and the examination may be close together so it is important to keep up with the lectures.

MAKE-UP EXAMINATIONS

Only under exceptional circumstances will permission be granted for writing an exam on an alternate date (legitimate medical, religious or academic reasons (e.g. varsity sport athlete)). If the exam was missed due to illness, **proper documentation** must be provided to the School office (academic counselor) as soon as physically possible (see university policies below for further instruction). You must contact me, your course instructor that you have missed the exam. ***If approved, written makeup examinations will consist of short and long answer questions, case studies and image-based questions based on material from lectures and assignments.***

Assignments and in-class, OWL quizzes or **cannot be made up**. Quizzes or assignments that are **missed for legitimate reasons** will have their weight redistributed to the final exam.

GRADING:	Quizzes	**15%**	Three in-class quizzes will take place at regular intervals (approximately every 3 weeks) during the term. Each quiz is valued at 5% for a total of 15% of the course grade. These quizzes are not cumulative and cover material between quizzes. The each quiz consists of ~15 questions and will be delivered at the beginning of class.
	Assignments	**15%**	Three short assignments based on current research in the area and incorporating concepts from the course will be distributed about once every 3 weeks. Each assignment will be worth 5%. Assignment submissions should be a maximum of 1 page (front and back); work in excess of the page limit **will not** be marked.
	Midterm	**30%**	The midterm will cover all course material covered prior to the exam. The exam will consist of various styles of multiple choice, true/false, fill in the blank, diagrammatic, short, and long answer questions.
	Final Examination	**40%**	The final will cover all course material. The exam will consist of various styles of multiple choice, true/false, fill in the blank, diagrammatic, short, and long answer questions.

ROUNDING OF GRADES

This is a practice (for example, bumping a 79 to 80%) some students request. The practice will not occur in this course. The mark attained is the mark you achieved and the mark assigned; there is no rounding to the next grade level. Such requests degrade my experience as your professor and your experience as a student. We both have an appreciation of high standards

EXPECTATIONS

You can expect me to be on time, answer your questions to the best of my ability, start class on time, and end class on time. Class will begin promptly and end with sufficient time to exit the classroom and make your way to your next class. I will be available for 10 minutes following each class to field questions after the lecture. I may not know the answer to every one of your questions. I will however do my best to obtain an answer and discuss it at the next lecture.

I expect you to be on time for class, respect the instructor and your classmates when sharing an idea in class, and listen without disturbing others in class. In this course, I welcome you to use your laptop or tablet computers to take notes. However, disruption caused by your technology is frustrating everyone in the classroom so please set your phones to work in quiet mode. I do not condone surfing the web, social media or other non-academic use while in class. It is disrespectful to your peers sitting around you who may be distracted by your actions.

Students are not permitted to record lectures using any form electronic recording devices. Lectures are the intellectual property of the professor and the use of any type of recording device during lecture must only be done under the explicit written permission of the professor.

For security reasons, emails will only be answered when they come from your official UWO email account. Please keep all correspondence professional and concise.

COURSE MATERIALS

There is no formal text for the course. Instructional material will be provided electronically on OWL and students may be directed to on-line references.

UNIVERSITY POLICIES

STUDENT CODE OF CONDUCT
The purpose of the Code of Student Conduct is to define the general standard of conduct expected of students registered at The University of Western Ontario, provide examples of behaviour that constitutes a breach of this standard of conduct, provide examples of sanctions that may be imposed, and set out the disciplinary procedures that the University will follow. For more information, visit http://www.uwo.ca/univsec/board/code.pdf

ENGLISH PROFICENCY FOR THE ASSIGNMENT OF GRADES
Visit the website http://www.uwo.ca/univsec/pdf/academic_policies/exam/english.pdf

ACCOMMODATION FOR MEDICAL ILLNESS OR NON-MEDICAL ABSENCES
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

The University recognizes that a student's ability to meet his/her academic responsibilities may, on occasion, be impaired by medical illness. Illness may be acute (short term), or it may be chronic (long term), or chronic with acute episodes. The University further recognizes that medical situations are deeply personal and respects the need for privacy and confidentiality in these matters. However, in order to ensure fairness and consistency for all students, academic accommodation for work representing 10% or more of the student's overall grade in the course shall be granted only in those cases where there is documentation indicating that the student was seriously affected by illness and could not reasonably be expected to meet his/her academic responsibilities.

A UWO Student Medical Certificate (SMC) is required where a student is seeking academic accommodation. This documentation should be obtained at the time of the initial consultation with the physician or walk-in clinic. An SMC can be downloaded under the Medical Documentation heading of the following website: https://studentservices.uwo.ca/secure/index.cfm.

Documentation is required for non-medical absences where the course work missed is more than 10% of the overall grade. Students may contact their Faculty Academic Counselling Office for what documentation is needed. Whenever possible, students who require academic accommodation should provide notification and documentation in advance of due dates, examinations, etc. Students must follow up with their professors and their Academic Counselling office in a timely manner. Documentation for any request for accommodation shall be submitted, as soon as possible, to the appropriate Academic Counselling Office of the student's Faculty of registration. For BHSc students, you may go to the School of Health Studies Office in HSB room 222.

SCHOLASTIC OFFENCES
Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following website: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

"Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar)."

Additionally,

1. All required papers may 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 The University of Western Ontario and Turnitin.com (http://www.turnitin.com).
2. Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

SUPPORT SERVICES

There are various support services around campus and these include, but are not limited to:

1. Student Development Centre -- http://www.sdc.uwo.ca/ssd/
2. Student Health -- http://www.shs.uwo.ca/student/studenthealthservices.html
3. Registrar's Office -- http://www.registrar.uwo.ca/
4. Ombuds Office -- http://www.uwo.ca/ombuds/