

Medical Biophysics
Med Bio 3505F Mathematical Transform Applications in Medical Biophysics
Course Syllabus for Fall 2022



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: <https://www.uwo.ca/health/> 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 & speaker

2. **Important Dates:**



Classes Begin	Classes End	
Thursday, September 8, 2022	Thursday, December 8, 2022	
* November 12, 2022: Last day to drop a first-term half course without academic penalty		
Reading Week	Study day(s)	Exam Period
October 31–November 6	December 9	December 10–22

3. **Contact Information**



Course Coordinator	Contact Information
Dr. Neil Gelman	ngelman@lawsonimaging.ca
Instructors	Contact Information
Dr. Neil Gelman	ngelman@lawsonimaging.ca
Dr. Keith St. Lawrence	kstlaw@lawsonimaging.ca
Teaching Assistants	Contact Information
Paul Dubovan	pdubovan@uwo.ca
Mathew Joshy	mjoshy@uwo.ca

4. Course Description and Design

Delivery Mode: In-Person. (For the first half of the course lecture material will be presented asynchronously. In-person classes will involve problem solving related to the material.)

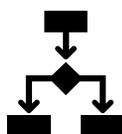
The role of mathematical transforms in biomedical research. Application of Fourier Transforms for magnetic resonance spectroscopy. Applications of systems analysis and Laplace Transforms to model complex systems, and of linear time-invariant systems and kinetic models to analyze physiological processes.

Prerequisite(s): One of [Calculus 1000A/B](#), [Calculus 1500A/B](#) plus one of [Calculus 1301A/B](#) or [Calculus 1501A/B](#), or [Applied Mathematics 1413](#); one of [Physics 1028A/B](#), [Physics 1301A/B](#), [Physics 1401A/B](#) or [Physics 1501A/B](#), and one of [Physics 1029A/B](#), [Physics 1302A/B](#), [Physics 1402A/B](#) or [Physics 1502A/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.

Extra Information: 2 lecture hours, 2 laboratory/tutorial hours.

This course will cover two different topics involving the application of mathematical and physical concepts to biology and medicine:

[Copy course description from the academic calendar; could include pre-reqs, co-reqs, anti-reqs]



Timetabled Sessions

Component	Date(s)	Time
Lecture/problem solving	T/Th	9:30 – 10:20 am
Tutorial 002	W	2:30- 4:30 pm
Tutorial 003	Th	2:30-4:30 pm

- Asynchronous pre-work should be completed prior to sessions
- Attendance at sessions is required

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 [OWL Help page](#). Alternatively, they can contact the [Western Technology Services Helpdesk](#). They can be contacted by phone at 519-661-3800 or ext. 83800.

[Google Chrome](#) or [Mozilla Firefox](#) are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click [here](#).

3505F Part 1: Fourier Transform Nuclear Magnetic Resonance

Instructor: Dr. Neil Gelman

Lecture Dates: Thursday Sept 8 to Thurs Oct 20

The Fourier Transform is a powerful mathematical tool that has extensive applications in biophysics and medical physics. In particular, it forms the foundation for creating medical images and for analyzing the biomedical information provided by these images. In this section of the course, we will introduce the one-dimensional Fourier Transform operation and its application in Magnetic Resonance Spectroscopy, a technique that is used to provide biochemical information in-vivo from humans and animals. We will also briefly consider how the one-dimensional Fourier Transform is applied to create a one-dimensional Magnetic Resonance Image. This section will provide a solid background for further courses involving medical imaging which often involve the application of two-dimensional and three-dimensional Fourier Transform operations.

3505F Part 2: Introduction to mathematical modeling in physiology and medicine

Instructor: Dr. Keith St. Lawrence

Lecture Dates: Tues Oct 25 to Thursday Dec 8

The objective is to understand linear system analysis and its application to modelling physiological processes. Topics will include predicting drug distribution and clearance from the body, measuring tissue blood flow, and applications of simple feedback systems to physiology. This section will include an introduction to linear systems, Laplace Transforms and the convolution operator. We look forward to having you with us in 3305F.

Further Course Information

The course consists of 25 lecture hours and 6 problem assignments.

To assist you in grasping the course material we have formal tutorial sessions, during which you can consult with the tutorial leader and with each other while working on the assignments or exercises. One section (002 LAB) is Wednesdays 2:30 to 4:30 pm, and the other (003 LAB) is Thursdays 2:30 to 4:30. This means you have protected time for consulting and doing much of the work, and you can count Biophysics 3305F as a laboratory course.

We have always encouraged students to work together, but you take total responsibility for what you submit to be marked. Note on 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).

There is no single text which suits us for most of the course. There is one computer software package that you may wish to purchase: MATLAB student version. MATLAB can be used online <http://myvlab.uwo.ca/>.

We wish to encourage you to contact us and discuss any problems arising from the course, whether general or specific. We are always pleased to help. If you have any concerns about the tutorial, please contact Paul Dubovan (pdubovan@uwo.ca) for part 1 or Mathew Joshy (mjoshy@uwo.ca) for part 2.

5. Learning Outcomes

Upon successful completion of this course, students will be able to:

Knowledge

- Students will develop an understanding of Fourier and Laplace Transforms along with related properties, which provide powerful mathematical tools in biomedical research
- Students will develop an understanding of the role of the Fourier transform in magnetic resonance spectroscopy and magnetic resonance imaging
- Students will learn Laplace Transforms, systems analysis and their application to physiology and medicine
- Students will develop an appreciation for the way in which magnetic resonance spectroscopy can provide information about pathological changes in-vivo within clinical and research area
- Students will develop an appreciation for the way in which mathematical modeling can enhance our understanding of measuring how physiological processes are regulated

Literacies and Interdisciplinarity

- Students will become comfortable with terminology utilized in signal analysis, particularly Fourier and Laplace analysis
- Students will develop skill in applying the basic properties of the Fourier Transform to solving problems, such as related to extracting information from magnetic resonance spectroscopy signals
- Students will develop the skills to apply linear systems analysis to physiological problems.
- Students will become familiar with utilizing symmetry properties to simplify problem solving. This will provide encouragement for use of symmetry properties in other mathematic scientific endeavors.
- Students will further develop written problem-solving skills with special attention to solution organization and visualization (also relating to communication)

Communication

- Students will further develop their writing communication skills especially those pertain to communication of mathematical ideas in problem solving. This will occur through assignments, tutorials and in class problem solving sessions

Critical Inquiring and Creative Thinking

- Students will have the opportunity to apply creative thinking in solving problems, especially those in which there are multiple pathways to solutions.



6. Course Content and Schedule

A schedule of topics for each lecture will be provided during the first class of each of the two parts of the course.

7. Participation and Engagement



- Students are expected to participate and engage with content as much as possible
- Students can participate during lecture and tutorial sessions
- 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.

Each student will receive a mark using either scheme A or scheme B (below), whichever gives the higher mark. In other words, the mid-term test (part 1 of the course) will only count if it helps the student's final mark.

	Scheme A	Scheme B
Assignments	40%	40%
Midterm test	15%	0%
Final Exam	45%	60%

Midterm Test: Tues Oct 18:

Assignment Schedule



	Assignment Posted	Completed Assignments Submission Date
Assignment 1	Sept 13	Sept 29
Assignment 2	Sept 27	Oct 11
Assignment 3	Oct 11	Oct 24
Assignment 4	Oct 27	Nov 8
Assignment 5	Nov 10	Nov 24
Assignment 6	Nov 24	Dec 1

- All assignments are due at 11:55 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.
- Written assignments will be submitted to Turnitin (statement in policies below)
- Students will have unlimited submissions to Turnitin
- After an assessment is returned, students should wait 24 hours to digest feedback before contacting their evaluator; to ensure a timely response, reach out within 7 days
- Any grade appeals on assignments, quizzes, or midterms 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 assessments without accommodation will be subject to a late penalty 2 %/day for the first two days and 5%/day thereafter.
- The assignment mark for each student will be based on the best 5 out of 6 assignments. However, students are responsible for the content of all assignments regarding the midterm test and exam.

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



10. Office Hours:

- Office hours will be held in-person or remotely using zoom
- Office hours can be arranged with instructor.



11. Resources



- All resources will be posted in OWL

12. Professionalism & Privacy:



Western students are expected to follow the [Student Code of Conduct](#). 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

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 [Non-Discrimination/Harassment Policy](#) (M.A.P.P. 1.35) and [Non-Discrimination/Harassment Policy – 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 [Human Rights Office](#). 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. Follow weekly checklists created on OWL or create your own to help you stay on track.
4. 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.
5. Connect with others. Try forming an online study group and try meeting on a weekly basis for study and peer support.
6. 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).
7. Reward yourself for successes. It seems easier to motivate ourselves knowing that there is something waiting for us at the end of the task.

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 [Accommodation for Religious Holidays](#). 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 [here](#) 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 [here](#).

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 [here](#).

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 [here](#).

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. Students will be able to view their results before the final submission. 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 Turnitin.com.

15% Rule

According to the [Evaluation of Academic Performance](#) policy, at least three days prior to the deadline for withdrawal from a 1000- or 2000-level course without academic penalty, students will receive assessment of work accounting for at least 15% of their final grade. Generally, students can expect some form of feedback on their performance in a course before the drop date. In rare instances, at the Dean's discretion, an exemption can be issued, which also must be noted in the course syllabus. Deans should review exemptions on a course-by-course basis each time an exempted course is offered.

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, i.e., cell phones, tablets, cameras, 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., 74.4 becomes 74, and 74.5 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.

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](#)