

# APPLIED MATHEMATICS 4817B

## METHODS OF APPLIED MATHEMATICS

### Course Outline: Winter 2021

Version 1.0

***Important Notice:***

*This course outline is a living document that may be updated throughout the course. Such updates will be announced and the latest version will be posted on <http://owl.uwo.ca>. The version number can be found at the bottom of each page. It is your responsibility to ensure that you have the most recent version of this document. All students registered in AM4817B are expected to have read this course outline carefully.*

## 1 General Course Information

**Course Information: (0.5 course:)** Fourier, Laplace and Hankel transforms with applications to partial differential equations; integral equations; and signal processing and imaging; asymptotic methods with application to integrals and differential equations.

**Prerequisite(s):** Applied Mathematics 3815A/B. **Pre-or Corequisite(s):** Applied Mathematics 3811A/B.

## 2 Timetable

All course content and evaluations will be done online, i.e. there is no face to face (in person) component to this course. The course material will be delivered using a combinations of methods involving both synchronous lectures over Zoom which will be recorded with links to the session posted on OWL, as well as asynchronous materials such as notes, videos and supplemental readings posted on OWL.

This is an outline of when the class meets:

LECTURES ON ZOOM	Tuesday 5:30 p.m. - 6:30 p.m.
	Thursday 4:30 p.m. - 6:30 p.m.
OFFICE HOURS ON ZOOM	Tuesday 4:30 p.m. - 5:30 p.m. (or by appointment)

**Note: First class is on Tuesday, January 12th.**

### 3 Instructor Information

**Instructor:** Prof. Trichtchenko

**email:** otrichtc@uwo.ca

The simplest way to reach me is by email. Students must use their Western (@uwo.ca) email addresses when contacting their instructors.

### 4 Resources

**Lectures:** The instructor will hold live lectures (synchronous) on Zoom which will be recorded. These will have accompanying notes in pdf format and the recordings will be posted.

**Textbook:** There is no required textbook for this class. Notes will be posted on OWL and additional select references from textbooks will be posted as course readings through the Western library services on OWL.

**Homework:** These will be posted on Gradescope roughly every other week for a total of 4 homework assignments.

#### 4.1 Online Tools:

Aside from built in OWL tools, we will use the following tools with links available from the OWL sites:

1. **VoiceThread:** Instructional videos with course content will be posted on VoiceThread to facilitate comments and questions.
2. **Gradescope:** Homework assignments will be submitted and returned using Gradescope.
3. **Zoom:** Lectures will take place on Zoom synchronously and will be recorded.

Students should check OWL (<http://owl.uwo.ca>) on a regular basis for news, updates, as well as a calendar and weekly checklist. This is the primary method by which information will be disseminated to all students in the class.

**Note:** 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.

## 5 Methods of Evaluation

Your final grade in this course will be computed using the following scheme:

<b>Assignments (4)</b>	30%
<b>Project</b>	10%
<b>Midterm Exam</b>	25%
<b>Final Exam</b>	30%
<b>Participation</b>	5%

**Assignments:** These will be posted online approximately every other week, for a total of 4 assignments. Assignments not submitted by the due date will be lose 15% for every 24 hours after the due date and time it is due, unless the instructor is provided with a valid excuse. **Please submit individual answers and do not plagiarise.**

**Note:** If the answers that are uploaded cannot be read or the right answer is not marked and easily found, these answers will not be assigned points. Please make sure your assignment is complete and legible before finishing your upload to Gradescope.

**Project:** Students will complete an individual project illustrating how one of the methods discussed in class is used in current research/literature, elaborating on needed extensions of the method or the unique applications.

**Midterm exam:** The midterm exam will be a timed 2 hour exam. It will take place during one of the two hour classes, proctored over Zoom.

**Special Accommodations for timed tests:** Please contact me if you require special accommodations for exams and tests.

**Final exam:** The final exam will be a 3 hour online exam, proctored over Zoom.

**Participation:** Students are encouraged to attend live lectures and ask questions in class as well as post comments and answers on OWL Forums and VoiceThread. These will be moderated by the instructor.

The schedule of evaluations is as follows

Type	Date
Assignment 1	TBA
Assignment 2	TBA
Midterm	To be approved centrally
Assignment 3	TBA
Assignment 4	TBA
Project	April 12, 2021
Final	To be scheduled centrally

Where TBA will be decided the first week of classes.

## 6 Course Content

Here are some of the topics we will cover in this class (not necessarily in this order). Whenever needed, supplementary readings will be provided as required.

1. Review
  - Complex variables
  - ODEs
  - PDEs
2. Special functions
  - Green's functions in ODEs and PDEs
  - Bessel, Hermite, etc\*
3. Integral Transforms
  - Laplace transforms
  - Fourier transforms
  - Hankle transforms
  - Unified transform method\*
4. Optional Content
  - Dimensional analysis\*
  - Perturbation theory\*
  - Asymptotic analysis\*

Whenever possible, we will discuss the application in physics, engineering, medicine or other fields.

Based on student backgrounds and interest, the timing for the topics will be adjusted (for example, review can be faster or slower depending on student comfort level). Topics with a \* are optional and will be covered based on time constraints and student interest.

We may also illustrate some methods using software such as Maple (can be used for free through a virtual license) or Python which is freely available.

## 7 Learning Outcomes

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

1. Review and recognise where previously learned theory works and where it fails
2. Contextualise how mathematical methods introduced in this class can add to analysis of mathematical equations
3. Understand where different methods covered in this class are applicable and where they can fail
4. Understand the application and importance of the methods discussed in class to fields outside of mathematics
5. Understand how differential and integral equations are related through different transforms
6. Recognise that in certain applications, the only available methods for analysis of differential equations are approximate methods and what their limitations are
7. Learn about how some of these methods are implemented in computational software
8. Relate the course material to current research in applied mathematics

## 8 Accommodation and Accessibility

### 8.1 Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/AcademicAccommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/AcademicAccommodation_disabilities.pdf)

### 8.2 Academic Consideration for Student Absence

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30 % or less of the students final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30 % of the students final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are not met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see: [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic\\_Consideration\\_for\\_absences.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf) and for the Student Medical Certificate (SMC), see: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

### 8.3 Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar.

## 9 Academic Policies

### 9.1 Scholastic Offenses

are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

## 9.2 Academic Integrity

When completing online exams, please abide by the rules and regulations outlined by the instructor, i.e. complete the exam on your own only using the resources allowed for the exam or test.

## 9.3 Online Etiquette

Some components of this course will involve online interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

- arrive to class on time
- use your computer and/or laptop if possible (as opposed to a cell phone or tablet)
- ensure that you are in a private location to protect the confidentiality of discussions in the event that a class discussion deals with sensitive or personal material
- to minimize background noise, mute your microphone for the entire class until you are invited to speak, unless directed otherwise
- When in a larger course, in order to give us optimum bandwidth and web quality, turn off your video camera for the entire class unless you are invited to speak
- please be prepared to turn your video camera off at the instructors request if the internet connection becomes unstable
- unless invited by your instructor, do not share your screen in the meeting

The course instructor will act as moderator for the class and will deal with any questions from participants. To participate please consider the following:

- If you wish to speak, use the raise hand function and wait for the instructor to acknowledge you before beginning your comment or question.
- Please remember to unmute your microphone and turn on your video camera before speaking.
- Self-identify when speaking.
- Please remember to mute your mic and turn off your video camera after speaking (unless directed otherwise).

General considerations of netiquette:

- Keep in mind the different cultural and linguistic backgrounds of the students in the course.

- Be courteous toward the instructor, your colleagues, and authors whose work you are discussing.
- Be respectful of the diversity of viewpoints that you will encounter in the class and in your readings. The exchange of diverse ideas and opinions is part of the scholarly environment. Flaming is never appropriate.
- Be professional and scholarly in all online postings. Use proper grammar and spelling. Cite the ideas of others appropriately.

Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct.

## 9.4 Internet

Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Zoom. Information about the system requirements are available at the following link: <https://support.zoom.us/hc/en-us>

Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.

## 9.5 Recordings

All of the remote learning sessions for this course may be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

# 10 Zoom Proctoring of Exams

Examinations in this course will be conducted using Zoom. You will be required to keep your camera on for the entire session, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session will not be recorded.

More information about the use of Zoom for exam invigilation is available in the Online Proctoring Guidelines at the following link: <https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf>.



Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Zoom. Information about the system requirements are available at the following link: <https://support.zoom.us/hc/en-us>.

Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please discuss this with your instructor in advance of the test or examination.

## 11 Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to [Mental Health@Western](mailto:Mental_Health@Western) [http://www.health.uwo.ca/mental\\_health](http://www.health.uwo.ca/mental_health) for a complete list of options about how to obtain help.