COURSE OUTLINE
Complex functions and PDEs
Winter 2024

Course Information

Lectures: Mondays and Wednesdays from 11AM to 12:30PM

Lecture Room: M339

Labs: Tuesdays from 5PM to 6PM

Lab Room: A248

Instructor information

Instructor: Dr. Lorena Aguirre-Salazar

E-mail: lorena.aguirresalazar@lakeheadu.ca

Office hours: Tuesdays and Wednesdays from 3.30PM to 4.30PM, or by appointment

Office: Unit T3, located in the E/H parking lot, office B

Course materials

Website: this course uses a D2L (courselink, `https://mycourselink.lakeheadu.ca/`) site, on which grades and important course information will be posted. You are expected to check this website regularly for announcement and course materials.

Recommended textbook: Advanced Engineering Mathematics, D.G. Zill, Sixth Edition. You might find the following relevant: `https://elasticbeanstalk-us-east-2-344375731421.s3.us-east-2.amazonaws.com/StudyChat/Dennis-G.-Zill-Advanced-Engineering-Mathematics-2016-Jones-Bartlett.pdf`

Evaluation Policy

Your final grade is comprised of the following components, weighed as indicated:

Component	Weight
Quizzes	5%
Term Test 1	15%
Term Test 2	15%
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Component	**Weight**
Term Test 3	15%
Project	10%
Final exam	40%

On quizzes

There will be a low-stakes quiz every week.

On term tests

There are three term tests. Each term test is scheduled for roughly one week after we finish covering corresponding topics. If a term test is missed for a legitimate reason (e.g. illness), the weight of the test will be added to the final exam.

On project

We have an individual project in this course. There are multiple steps you need to take to complete the project. The final outcome of the project consists of two things you submit through the course website: a presentation that includes a video of you presenting your project, and a form I provide filled out. There cannot be two people with projects that overlap.

You will present one and only one of the following:

- A mini-lecture on a section from the textbook that we do not cover in class. The mini lecture includes the name of the topic, background information (who discovered it, what was their motivation, where would the topic fit in our course), the actual topic (which formulas are applied), a substantial example (how formulas are applied and what they give), conclusions, and references.

- A mini-lecture on an application of material(s) covered in class to your field. The mini lecture includes a specific research question, background information (who discovered the application, what was their motivation), a detailed answer to the question (how formulas are applied numerically and what they give when you simulate everything), conclusions, and references.

- A mini-lecture on how you apply material(s) covered in class to a problem you are interested in. The mini lecture includes a specific research question, background information (what your motivation was, what has been done in the past), a detailed answer to the question (how formulas are applied numerically and what they give), conclusions, and references.

Here are the steps you need to take to complete the project:

Step 1: Think of the name of the method you intend to present, or the research question you would like to answer. Submit a form I provide to the corresponding folder on the course website. I will ask you to change your project choice if somebody else is already doing something similar, or if your research question is not specific enough (if applicable).

Step 2: Once I approve your project, think of what you need to do in order to complete your project. Submit a form I provide filled out to the corresponding folder on the course website. The form contains questions on your project plan.

Step 3: Participate in a group activity in class to share your project plan with classmates. There will be an exchange of feedback.

Step 4: Submit a form filled out to the corresponding folder on the course website. The form contains questions on your project plan.

Step 5: Submit a power point presentation and a form I provide filled out to the corresponding folder on the course website. The form contains questions on your presentation.

Step 6: Present your project to classmates. There will be an exchange of feedback.

Step 7: Create a video of you presenting your project and fill out a form I provide. Submit a link to the video and the form to the corresponding folder on the course website.

Here is the breakdown of the grade for the project:

Component	Weight
Step 1 and getting your project approved by me	15%
Step 2	5%
Step 3	10%
Contents of the form in step 4	15%
Step 5	5%
Step 6	10%
Contents of your submission in step 7	40%

I do not accept late submissions under any circumstances. If you do not meet the deadline corresponding to step 1, 4, or 7, you get zero on that component and all subsequent steps.

On final exam

There will be a cumulative final exam, the date and time of which will be announced as soon as it is scheduled. Missing the final exam results in automatic failure of the course.

Schedule of Activities

We will adhere to the following schedule of topics to the best of our abilities. It may be subject to minor changes due to unforeseen delays and/or expedition.

Week	Topic(s) covered	Evaluation
1 (Jan 8th- Jan 12th)	Series solutions of linear ODEs about ordinary points. Series solutions of linear ODEs about singular points.	
2 (Jan 15th- Jan 19th)	Orthogonal Functions. Fourier Series. Half-range expansions. Complex Fourier Series. Regular Sturm–Liouville Problems.	
3 (Jan 22nd- Jan 26th)	Separable Partial Differential Equations. Classical PDEs and Boundary-Value Problems. Heat equation.	Step 1 of the project is due
4 (Jan 29th- Feb 2nd)	Wave equation. Laplace's equation.	
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Week	Topic(s) covered	Evaluation
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5 (Feb 5th- Feb 9th)	Non-homogeneous Boundary-Value Problems.	Step 2 of the project is due. Term test 1
6 (Feb 12th- Feb 16th)	Heat equation in two dimensions. Sine series in two variables. Cosine series in two variables.	Step 3 of the project in class
7 (Feb 19th- Feb 23rd)	Boundary-Value Problems in polar coordinates. Fourier transform. Fourier sine transform. Fourier cosine transform. Fourier transform pairs.	Step 4 of the project is due
8 (Feb 26th- Mar 1st)	STUDY WEEK ENJOY THE BREAK!	
9 (Mar 4th- Mar 8th)	Solving PDEs problems using Fourier transforms. Complex numbers. Powers and roots. Function of a complex variable.	
10(Mar 11th- Mar 15th)	Cauchy-Riemann equations. Contour integrals.	Term test 2
11(Mar 18th- Mar 22th)	Sequences and series. Taylor series. Laurent series. Zeros and poles.	Step 5 of the project is due
12(Mar 25th- Mar 29th)	Residues and Residue Theorem. Evaluation of Real Integrals.	Step 6 of the project in class
13 (Apr 1st- Apr 5th)	Evaluation of Real Integrals. Complex functions as mappings. Conformal mappings.	
14 (Apr 8th- Apr 12th)		Step 7 of the project is due. Term test 3

How to do well in this course

We cover a lot of material fairly quickly.

I upload handouts consisting of partially complete notes for classes. You are expected to bring these notes to class, and we fill them in together. Skim through the corresponding handout before class.

During class, take notes on the handouts, add pages as needed, and try to pay attention and understand at least a quarter of what we cover. You might find yourself connecting what we discuss with what you read before the session. Be gentle with yourself if you feel lost. If there is something you do not understand, please do not hesitate to ask about it. There is a good chance someone else has the same question. If you still do not understand it, then let it go so that you can focus on trying to understand what comes next. You are always welcome to come to office hours and get all the help you need. Also, I strongly suggest you try studying with peers, and that you access resources for success the University offers.

It is important to keep clear lecture notes. If you miss a lecture, please catch up on activities as soon as possible.

After class, read over your notes and redo examples. Those examples are usually simple but interesting enough as for setting a good start. Then, come to the lab. While the purpose of the lectures is to introduce new material and discuss mathematical theory, it is in the lab that we apply the lecture material to solve problems. Notes from lab sessions should prove invaluable to you as you work through suggested problems and study for tests and the final exam.

After the lab, read over your notes and redo examples. Then, read corresponding sections from the textbook and try examples from there. Then, give suggested problems a try and check answers at the back of the textbook. Bring questions to the lab or office hours.

You should study for this course at least 6 hours per week on top of class time. Please plan for reaching that minimum, and keep in mind that sometimes you will need to invest more time, depending on how strong your foundational understanding of the material is.

To study for a test or for the final the exam, go over your notes, write a summary of what is going to be tested, redo examples from class, examples from the lab, and suggested problems, in that order. If you have extra time, explain what you know to another person.

Lakehead-Georgian Policies

Academic and Student Code of Conduct Policies

- Academic and student policies and procedures for those enrolled in the Lakehead- Georgian programs can be found on the Lakehead-Georgian Student Portal

- All Lakehead-Georgian programs will follow the Lakehead Regulations as list in the Lakehead University Academic Calendar (`http://csdc.lakeheadu.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&loaduseredits=False`).The University Regulations include but are not limited to Registration, Examinations, Reappraisals and Academic Appeals, Special Examinations, Academic Misconduct, Withdrawal, and Timely Feedback. Additional Faculty Regulations may also apply. Please review the Academic Calendar.

- The Lakehead University Student Code of Conduct - Academic Integrity (`https://www.lakeheadu.ca/students/student-life/student-conduct`) will apply to all Lakehead-Georgian students regardless of campus of study.

- The Lakehead University Student Code of Conduct - Appeals (`https://www.lakeheadu.ca/students/student-life/student-conduct`) will apply to all Lakehead-Georgian students regardless of campus of study

- The Georgian College Student Code of Conduct (`http://www.georgiancollege.ca/student-code-of-conduct/`) will apply to the Lakehead- Georgian students studying at the Barrie campus. Additional campus policies of Sexual Violence Procedure and Protocol (`https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/sexual-violence`), Alcohol, Drugs and Tobacco (`https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/alcohol-drugs-and-tobacco`), and Information Technology Acceptable Use Procedure (`http://www.georgiancollege.ca/wp-content/uploads/2-117IT-acceptable-use.pdf`) also apply.

- The Lakehead University Student Code of Conduct – Non-Academic (`https://www.lakeheadu.ca/students/student-life/student-conduct`) will apply to the Lakehead-Georgian students studying at the Orillia campus.

Plagiarism and academic dishonesty

A breach of Academic Integrity is a serious offence. The principle of Academic Integrity, particularly of doing one's own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle in university study. Students should view the Student Code of Conduct -Academic Integrity (`https://www.lakeheadu.ca/students/student-life/student-conduct`) for a full description of academic offences, procedures when Academic Integrity breaches are suspected and sanctions for breaches of Academic Integrity.

Student services and support

Student advisors

- Help students build both academic and personal resilience so that they can flourish at Georgian and beyond

- Provide individual, group and web-based advising sessions

- Are housed within the academic areas

- To book an appointment with your advisor go to the Student Portal (preferred, `https://georgiancollege.sharepoint.com/sites/student/Student-Services/StudentAdvisors/SitePages/Home.aspx`) or call 705-728-1968 Ext. 1307.

Library (`http://library.georgiancollege.ca/main`)

Customer Service

- Off campus access

Research help

- Help finding books, articles and credible sources.

- Using specialty databases.

- Creating a search strategy.

Academic Success (`https://library.georgiancollege.ca/help/contact-academic-success`)

Writing centre (`http://library.georgiancollege.ca/writing_centre`)

- Improve your writing.

- Help with citing sources and laying out your paper.

Math Centre (`http://library.georgiancollege.ca/math_centre`)

- Make sense of Math questions.

- Understand concepts and develop skills.

Tutors (`http://library.georgiancollege.ca/tutoring)`)

- Further understand course content.

- Build your study practices.

Accessibility services (`https://www.georgiancollege.ca/student-life/student-services/accessibility-services/`)

If you are a student experiencing a disability who may require academic accommodations and have not yet registered with Accessibility Services, please contact their office at 705-722-1523, email `studentsuccess@georgiancollege.ca`, or visit their offices in B110. You must be registered with Accessibility Services to access academic accommodations. Support for those students whose success at college may be affected by a disability include:

- Ongoing support from our Accessibility Advisors including arranging a confidential psychoeducational assessment where required

- Training in the use of specialized computer technology

- Classroom and test accommodations

Test Services (`http://www.georgiancollege.ca/student-life/student-services/testing/`)

- Accommodated testing

- Missed/Makeup testing

- Proctoring services are also available for external and Ontario Learn exams

Counselling (`http://www.georgiancollege.ca/student-life/student-services/counselling/`)

- Free, confidential counselling is available to all students

- Walk in counselling is available on a daily basis Monday to Friday

Career Success (`http://www.georgiancollege.ca/student-life/student-services/co-op-and-career-services/`)

Career assessments and exploring options

- Job search workshops

- Labour market information

- Resume/cover letter help

- Interview practice

- Graduate employment information

- Links to job postings and online resources

Campus Safety and Security Syllabus Addendum

Emergency Evacuation (`https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/fire`)

- Evacuate buildings when a fire alarm is activated or an official announcement is given. Review evacuation guidelines. (https://www.georgiancollege.ca/about- georgian/campus-safety-services/tab/fire)

- Students requiring assistance in emergency situations must inform their faculty during the first week of class.

- Familiarize yourself with all fire exit doors of classrooms and buildings you may occupy.

- Do not re-enter a building until instructions are given by the Fire Department or college personnel.

Lockdown (`https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/lockdown`)

- Lockdown is initiated when there is a potential or actual violent incident on campus that could result in a serious injury or threat to life.

- Students can download the new Safe@Georgian app to stay updated on Campus Safety and Security information including lockdown.

- Familiarize yourself with the College Lockdown procedure (`https://www.georgiancollege.ca/wp-content/uploads/Lockdown.pdf`)

- Lockdown tests occur each semester.

Resources:

- Get Out, Hide, Fight Lockdown Video (`http://youtu.be/JA8cckMbVDk`)

- Lockdown quick reference sheet (`http://www.georgiancollege.ca/wp-content/uploads/COM-15-416_LockdownProcedure_Signage_FVR3_print.pdf`)

- Lockdown Model – Get Out, Hide, Fight: Lockdown Tools and Tactics and FAQs.

Unscheduled Campus Closure (`https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/campus-closures`)

Resources:

- How to find out if your campus is closed (`http://www.georgiancollege.ca/about-georgian/campus-safety-services/#how-to-find-out-if-your-campus-is-closed`)

- Unscheduled Campus Closure Procedure (`https://www.georgiancollege.ca/wp-content/uploads/2-102Unscheduled-college-closure-2018.02.10.pdf`)

Timing of Closures/Notification:

Closure	Decision	Notification	Notes
College has made the decision to close a campus or location in the morning:	6:00 a.m.	By 6:30 a.m.	If re-opening for noon or evening classes is being considered, this will be mentioned in the message
College closes a campus(s) in the morning and expects to re- open by 12:00 noon	9:30 a.m.	By 10:00 a.m.	Only affects classes beginning at 12 noon or later
Closure expected to continue past 12:00 noon	9:30 a.m.	By 10:00 a.m.	
College intends to re-open for evening classes which commence at 5 p.m. or later	2:30 p.m.	By 3:00 p.m.	
College intends to NOT re-open for evening classes:	2:30 p.m.	By 3:00 p.m.	

*Notification will be made via:

- Georgian social media (Facebook, Twitter)

- Safe@Georgian app

- Georgian website (homepage)

- Recorded message when you call into Barrie campus at 705-728-1968

- Student or employee portal

- Georgian email account

- Radio and television announcements through local and regional media

Note: We only announce the names of campuses that are closed. If your campus is not named in a closure, it's open.