DALHOUSIE UNIVERSITY

Topics in Mathematical Physics

Department of Mathematics and Statistics

MATH4165/MATH5165/PHYC4160/PHYC5160 Fall 2024

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.
Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Roman Smirnov	Roman.Smirnov@dal.ca	WF 3:30pm-4:30pm

Course Description

The material is aimed to discuss in detail some techniques that can be applied to the problems of solving partial differential equations arising in physics and other sciences. It includes the following topics: Complex variables (complex numbers, analytic functions, singularity structure, contour integration, method of residue, conformal mappings), integral transforms (Fourier, Laplace), special functions (Gamma function, Bessel function, Legendre polynomials), partial differential equations (separation of variables, conformal transformations).

Course Prerequisites

MATH 3120.03 or MATH 3260.03 or permission of instructor.

Course Exclusions

PHYC 5160.03, MATH 5165.03

Student Resources

The MATH/STAT Learning Centre is located in Chase 119 and will be operating in-person and remotely. It opens on Sept. 5 and support is available Monday through Friday from 11:30am - 4:30pm and Monday through Friday evenings from 6:30-7:30pm, until Dec. 19. Register for the Brightspace ``course'' at https://www.dal.ca/faculty/science/math-stats/about/learning-centre.html to access the online support and see the latest schedule.

Course Structure

Course Delivery - In-person (MWF).

Lectures - Monday, Wednesdays, Fridays, 13:35PM-14:25PM, HENRY HICKS ACADEMIC ADMIN 217

Course Materials

Recommended textbook: K. F. Riley, M. P. Hobson, S. J. Bence, Mathematical Methods for Physics and Engineering, Cambridge, 3rd edition, 2006.

One copy of the textbook will be put on reserves at the Killam library (2 hours loan).

The course notes. I'll post online course notes in the end of each week.

Assessment

Assignments

Assignments (bi-weekly)	20%
Midterm Test (in class)	30%
Final exam (3 hours), scheduled by registrar	50%

Graduate students will be required to do a project and present it in class.
Graduate students will be assessed according to the following scheme:

Assignments (bi-weekly)	20%
Midterm Test (in class)	20%
Project	10%
Final exam (3 hours), scheduled by registrar	50%

Conversion of numerical grades to final letter grades follows the Dalhousie Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

- Be sure to plan your term to include the dates and times of the tests and the examination. Conflicts with travel arrangements, jobs, etc. cannot be accommodated.
- Calculators, textbooks, and notes are not allowed in midterm and final exam
- Accommodation for late and missed assignments require contact before posted due date
- The Student of Absence form for late or missed requirements during the term may be used once during the term. More extensive accommodations have to be arranged through the Student Accessibility Centre.

Course Policies related to Academic Integrity

All tests must be a strictly individual effort. Violations will be reported to the faculty integrity officer. You can discuss assignment problems with your classmates but the problems must be solved individually. Don't try to solve the assignment problems with the aid of ChatGPT or other AI programs. At this point, you are very likely to get a wrong answer, using AI.

Learning Objectives

Complex variables (Chapter 3)

Integral transforms (Chapter 13)

Special functions (Chapter 18)

Partial differential equations (Chapters 20-21)

Course Content

1. September: Complex variables
2. October: Integral transforms/Special functions
3. November: Special functions/Partial differential equations
4. December: Partial differential equations

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: https://www.dal.ca/about-dal/internationalization.html

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: http://www.dal.ca/cultureofrespect.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: https://www.dal.ca/about/leadership-governance/academic-integrity/faculty-resources/ouriginal-plagiarism-detection.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.