Mathematical Methods of Physics I

Course Information

Instructor: Roman Grigoriev (roman.grigoriev@physics.gatech.edu)
Course Prefix and Number: PHYS 6124 A
Term: Fall 2026

Teaching Assistant(s)

TBD
Office hours: TBD

Course Description

This graduate-level course provides an overview of the essential mathematical methods illustrated by applications to problems from various branches of physics. The focus is on the topics that are not covered (or not covered in substantial depth) in typical undergraduate physics curricula.

Textbook

The recommended, but not required, textbook that includes most of the topics that will be covered in the class is Arfken, Weber, and Harris, Mathematical Methods for Physicists, Seventh Edition: A Comprehensive Guide (Academic Press, 2012). An earlier (5th or 6th) edition of the book will also work, if you already have one. We will rely on lecture notes for subjects that are not adequately covered in the textbook.

Grading

Your performance will be assessed based on the homework (67%) and final exam (33%). There will be one homework assignment per week. Completed assignments should be submitted online. All students are expected to comply with the academic honor code.

Grading scale: A = 80-100%, B = 70-80%, C = 60-70%, D = 50-60%, F = 0-50%

For those taking the course pass/fail, a passing grade is C or better.

Attendance

Each student should be aware of the regulations that are listed in the student handbook. The class attendance policy, which the Georgia Tech regulations say shall be at the discretion of the instructor, will be as follows: There will be no prescribed maximum

number of unexcused absences for this class. However, if it is apparent that lack of attendance at class may be impairing a student's performance in the course, the instructor may require that the student not miss more classes, under the penalty of failing the course. Please consult http://catalog.gatech.edu/rules/4/ (Links to an external site.) for details on what constitutes an excused absence and other aspects of the Georgia Tech Attendance Policy.

Statement of Intent for Inclusivity

As a member of the Georgia Tech community, I am committed to creating a learning environment in which all of my students feel safe and included. Because we are individuals with varying needs, I am reliant on your feedback to achieve this goal. To that end, I invite you to enter into dialogue with me about the things I can stop, start, and continue doing to make my classroom an environment in which every student feels valued and can engage actively in our learning community.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit either of these links (one (Links to an external site.), two (Links to an external site.)). Any student suspected of cheating or plagiarizing on an assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Individuals with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404) 894-2563 or this link (Links to an external site.), as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations

At Georgia Tech we believe that it is important to continually strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See this link (Links to an external site.) for an articulation of some basic expectations – that you can have of me, and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech, while in this class.

Course Outline

- Complex analysis
  - Functions of complex variables
  - Conformal maps and their applications
  - Calculus of residues
- Integral and discrete transforms
  - Fourier series and Fourier transform
  - Laplace transform
  - Hilbert transform
- Linear vector spaces
  - Vectors and matrices
  - Eigenvalue problem
  - Normal modes
  - Tensors
- Differential equations
  - Separation of variables in PDEs
  - Boundary value problem
  - Sturm-Liouville theory
- Variational calculus
  - Euler equation
  - Constrained minimization
  - Rayleigh-Ritz method