PHYSICS 434 / 534 METHODS OF MATHEMATICAL PHYSICS: Winter 2026

Instructor: Dr. Andy Martwick, martwick@pdx.edu, text & voice 503 333 8285

Office Hours: After class and by arrangement.
Class: MW VSC-B1-21 11:00-12:40

Recommended Textbook: Physical Mathematics, Kevin Cahill
Additional Reference: Mathematical Methods for Physicists, Arfken and Webber. Youtube, and other math method books can be found online. Homework assignments are complete assignments, no book required.

Course Description –This class is a survey of methods of applied mathematics used in physics partially following Cahill chapters 1-5 in first edition, chapters 1-6 in the second edition. Outside reference material may be required. Use all resources available to you.

Outline subject to change:

1. Ch1-Linear Algebra topics includes Sets, Vector Spaces, Dirac Notation, Operators, Eigenvectors, matrices, basis transformations. Spin vector space.
2. Ch2- Vector calculus review, Levi-Civita, and vector identities derived with Levi-Civita. Some electromagnetics problems.
3. Ch5- Infinite series, Laurent series, power series
4. Ch6- Complex analysis and complex integrals, real integrals in the complex plane
5. Ch3- Fourier series solutions to differential equations, Dirac delta functions
6. Ch4- Fourier and Laplace transforms with circuit examples, inverse transforms using complex analysis

Homework: There will about five homework assignments. Assignments will be sent by email. I will correct the homework if you turn it in on the due date. I will not correct homework that is turned in after the due date. Homework does not count for grade.

The second hour of Wednesday's class will be for working together on the homework.

534 students will have additional work and exam problems.

Quizzes: There will be 5 quizzes that will account for 40% of your grade. The lowest quiz score will be dropped. If you have not done the homework it is unlikely that you will do well on the quiz. Quizzes are closed book and closed notes.

Exams: Exams will be open book, open notes. If you have not done the homework, open book will not help you. One page of (8 ½ x 11) notes is allowed. Exams will be based on the homework.

Grading
Quiz 40% Midterm 30% Final 30%

Suggested Pre-requisites:
Physics 201–203/211–213: General physics
Physics 311-312: Modern physics
Mathematics 251–253: Calculus I-III
Mathematics 256: Differential equations and multivariate calculus

Absence due to sickness –You will not be penalized for illness-related absences or unforeseen emergencies. If this occurs contact me and let me know.

Attendance and Participation:
Attendance will be taken and can be used to improve your final grade by up to ½ a grade.

Course Schedule (tentative)

Week	Topics, Readings, Assignments, Deadlines
1	**Day 1**: Introductions, the role of AI, sets, Complex numbers 1.1 and vector spaces 1.4 **Day 2**: Arrays 1.2, Matrices 1.3, Linear Operators 1.5, Inner Products 1.6, Inequality 1.7
2	**Day 3**: Linear Independence, Dimensions, Orthonormal, Outer products, Dirac notation, Operators 1.8-16 **Day 4:** Determinants 1.20, Eigenvector / value 1.25, basis transforms
3	**Day 5**: MLK Holiday **Day 6**: Ch2. Vector Calculus review 2.1-2.3, line integrals, Stokes theorem, curl and levi civita proofs **- Homework 1 due: Chapter 1**
4	**Day 7**: More levi civita proofs. Summary of Linear algebra, linear vector spaces, HW questions **Day 8**: Convergence, 5.1-5.3. Taylor series 5.7, Binomial series 5.9, analytic functions 6.1
5	**Day 9**: CR tests, 6.2, integral thm and integral formula 6.2-6.4 **Day 10:** Taylor series 6.6, Fundamental thm, Laurent series, Singularities, 6.9-6.11 **Homework 2 due Chapter 2, 5**
6	**Day 11:** Calculus of residues 6.13, real integrals in complex plane **Day 12**: **Midterm Ch 1, 2, 5**
7	**Day 13**: Real Integrals **Day 14**: Fourier series, 3.1 – 3.4
8	**Day 15**: Intervals 3.5, First order diffy q and Fourier series solutions **Day 16**: Dirac Delta 3.11, Fourier xforms of functions 4.1 & 4.2 **Homework 3 due: Chapter 6 & 3**
9	**Day 17**: Laplace 4.6-4.8 **Day 18**: More Laplace
10	**Day 19**: Graduate topics **Day 20**: Review **Homework 4 due, Ch 4**
Final Exam	**Chapters 6, 3, 4**

Access and Inclusion for Students with Disabilities

PSU values diversity and inclusion; we are committed to fostering mutual respect and full participation for all students. My goal is to create a learning environment that is equitable, useable, inclusive, and welcoming. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me. The Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment.

If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu,https://www.pdx.edu/drc.

If you already have accommodations, please contact me to make sure that I have received a faculty notification letter and discuss your accommodations.

Students who need accommodations for tests and quizzes are expected to schedule their tests to overlap with the time the class is taking the test.

Title IX Reporting Obligations

As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. Please be aware that as a faculty member, I have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment, sexual violence or discrimination to a confidential employee who does not have this reporting responsibility, you can find a list of those individuals or contact a confidential advocate at 503-725-5672. For more information about Title IX please complete the required student module Creating a Safe Campus in your D2L.