

PHYSICS 434 & 534 METHODS OF MATHEMATICAL PHYSICS – *Winter 2011*

<http://web.pdx.edu/~arice/mathmethods/434534.htm>

Instructor: Andrew Rice, 472 Science Building 2, arice@pdx.edu, 503-725-3095

Office Hours: Monday 2-3PM, Wednesday 2-3PM, Thursday 3-4, and by appointment.

Course Description – A survey of methods of applied mathematics used in modern physics, to include: vectors, matrices, operators, and eigenvalues; tensors; complex variables and complex analysis; Delta function and Green's function; Fourier series; and Fourier transform.

Lectures: Monday, Wednesday, Friday 12:45-1:50

Location: Stephen Epler Hall, room 107

Required Textbook: *Mathematics for Physicists*, Susan M. Lea, 1st Edition (Brooks, Cole)

Text on reserve: *Mathematical Methods in the Physical Sciences* Mary L. Boas

Homework: There will be 6 homework assignments. Assignments are passed out during class time and are due one to two weeks after they are assigned at the beginning of class. Most problems will be directly out of the book. Some problems may require outside physics reference material. Assignments and solutions will also be posted on the website. Lowest homework set will be dropped from the final grade. Late homework will be marked off at 25% per day.

Exams: Exams will be open book, closed note. There will be no make-up exams. No calculators allowed.

Midterm: Wednesday Feb 9, 12:45-1:50

Final: Monday, March 14, 12:30-2:20

Grading

Homework 40% (lowest homework will be dropped)

Midterm 25%

Final 35%

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

Mathematics 261: Linear Algebra

Academic Honesty: ‘Academic honesty is a cornerstone of any meaningful education and a reflection of each student’s maturity and integrity. The Student Conduct Code, which applies to all students, prohibits all forms of academic cheating, fraud, and dishonesty. These acts include, but are not limited to, plagiarism, buying and selling of course assignments for other persons, unauthorized disclosure and receipt of academic information, and other practices commonly understood to be academically dishonest’ – Portland State University Bulletin, General Catalog Issue, Vol. 40, No. 4, 2006-2007.

Absence due to sickness – Due to concern about this year’s flu season, if you are ill with flu-like symptoms please stay home for at least 24 hours after your fever is gone except to receive medical care. You will not be penalized for illness-related absences. If you will not be able to turn in an assignment or take an exam due to illness, please contact me via email or phone.

Ordinary language is totally unsuited for expressing what physics really asserts, since the words of everyday life are not sufficiently abstract. Only mathematics and mathematical logic can say as little as the physicist means to say - Bertrand Russell

Tentative Schedule (subject to change)

Week 1

Jan 3 – Introduction to course. **Chapter 1.** Review of linear algebra (1.6)

Jan 5 – Matrices, linear equations, and eigenvalues (1.6)

Jan 7 – Coordinate systems and vectors (1.1) Vector spaces (1.5)

Week 2

Jan 10 – Properties of vectors and notation (1.1)

Jan 12 – Vector calculus and fields (1.2)

Jan 14 – Curvilinear coordinates (1.3)

Week 3

Jan 17 – **Martin Luther King Day. PSU Closed**

Jan 19 – **Optional Topic A.** Introduction to tensors (A.1) (*hw 1 due*)

Jan 21 – Tensor notation and tensor products (A.2-A.3)

Week 4

Jan 24 – Tensor calculus (A.4)

Jan 26 – Tensor applications

Jan 28 – **Chapter 2.** Complex numbers: elementary operation and representation (2.1) (*hw 2 due*)

Week 5

Jan 31 – Mapping and branch cuts (2.1)

Feb 2 – Functions of complex variables (2.2)

Feb 4 – Complex series (2.3)

Week 6

Feb 7 – Poles & zeros (2.5) (*hw 3 due*)

Feb 9 – **MIDTERM: 12:45-1:50**

Feb 11 – Residue theorem (2.6)

Week 7

Feb 14 – Using the residue theorem (2.7)

Feb 16 – **Chapter 4.** Real and complex Fourier series (4.1-4.2)

Feb 18 – Fourier Sine & Cosine series (4.3) (*hw 4 due*)

Week 8

Feb 21 – Fourier series & differential equations (4.4)

Feb 23 – Applications of Fourier series

Feb 25 – **Chapter 6.** The Delta function (6.1) Green's Function (6.7)

Week 9

Feb 28 – **Chapter 7.** Fourier transform (7.1) (*hw 5 due*)

Mar 2 – Using Fourier transform (7.1-7.2)

Mar 4 – Fourier Transform properties (7.3)

Week 10

Mar 7 – Solving differential equations using FT (7.5)

Mar 9 – Fourier Transforms and Power Spectra (7.6)

Mar 11 – Review Chapters 1-7 (*hw 6 due*)

Week 11

Mar 14 – **FINAL EXAM** 12:30-2:20

Important deadlines

Last day to drop without a W January 16

Last day to withdraw from class February 20

Last day to change grade option February 20