Intermediate Mathematical Physics I  
Physics/Math 5030  
Fall 2010

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Email: michael.ritzwoller@colorado.edu  
Text: Mathematical Methods for Physics and Engineering (Riley, Hobson, Bence), 3rd edition  
Time: MWF 3:00-3:50, G125  
Web Site: http://ciei.colorado.edu/physics5030

Note on the Textbook: The text is not available at the CU bookstore. You can order it on-line at barnesandnoble.com or amazon.com by typing in the ISBN number of the book, which is: 978-0-521-67971-8

There is a student solution manual for the book containing solutions to odd numbered problems. Sometimes I will assign some of these problems, so please do not order the solutions manual.

Grading Policy: There will be weekly homework assignments, two of which probably will be called the mid-term and final exams. Thirteen assignments are expected. Late homework will not be accepted. Students are to do their own work on all assignments, but may ask other students and the professor for help on particular problems. Each homework will be weighted equally in determining the final score. Achievement of 90% or above will be rewarded with an A- or A, 80%-90% will be some flavor of B, and so forth.

Recommended Syllabus Content Concerning Disabilities, Religious Observances, Behavior, Discrimination and Harassment, and the CU Honor Code:

(1) If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and www.Colorado.EDU/disabilityservices.

(2) Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with
scheduled exams, assignments or required attendance. See full details at
http://www.colorado.edu/policies/fac_relig.html

A comprehensive calendar of the religious holidays most commonly observed by CU-Boulder
students is at http://www.interfaithcalendar.org/

(3) Students and faculty each have responsibility for maintaining an appropriate learning
environment. Those who fail to adhere to such behavioral standards may be subject to discipline.
Professional courtesy and sensitivity are especially important with respect to individuals and
topics dealing with differences of race, culture, religion, politics, sexual orientation, gender,
gender variance, and nationalities. Class rosters are provided to the instructor with the student's
legal name. I will gladly honor your request to address you by an alternate name or gender
pronoun. Please advise me of this preference early in the semester so that I may make appropriate
changes to my records. See policies at http://www.colorado.edu/policies/classbehavior.html and
at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code

(4) The University of Colorado at Boulder policy on Discrimination and Harassment, the
University of Colorado policy on Sexual Harassment and the University of Colorado policy on
Amorous Relationships apply to all students, staff and faculty. Any student, staff or faculty
member who believes s/he has been the subject of discrimination or harassment based upon race,
color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should
contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of
Judicial Affairs at 303-492-5550. Information about the ODH, the above referenced policies and
the campus resources available to assist individuals regarding discrimination or harassment can
be obtained at http://www.colorado.edu/odh

(5) All students of the University of Colorado at Boulder are responsible for knowing and
adhering to the academic integrity policy of this institution. Violations of this policy may include:
cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening
behavior. All incidents of academic misconduct shall be reported to the Honor Code Council
(honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic
integrity policy will be subject to both academic sanctions from the faculty member and non-
academic sanctions (including but not limited to university probation, suspension, or expulsion).
Other information on the Honor Code can be found at
http://www.colorado.edu/policies/honor.html and at
http://www.colorado.edu/academics/honorcode/

Tentative Outline of PHYS/MATH 5030

I. Complex Variables (Ch. 24)
   A. Differentiability and the Cauchy-Riemann conditions.
   B. Elementary functions of a complex variable.
   C. Multi-valued functions and Branch Cuts.
   D. Singularities and zeroes of complex functions.
   E. Complex integrals and Cauchy’s theorem.
   F. Cauchy’s integral formula.
   G. Taylor and Laurent series.
   H. Residue theorem.
   I. Definite integrals with contour integration: Types 1-5.
II. ODEs: Part 1
   A. First order ODEs. (Ch. 14)
   B. Higher order linear ODEs. (Ch. 15)
      B.1 Linear equations with constant coefficients:
         Method of undetermined coefficients.
      B. 2 Linear equations with variable coefficients:
         Legendre & Euler equations.
         Variation of parameters.
   C. Laplace transforms. (Ch. 13.2, 15.1.5, 25.5)
   D. Green’s functions. (Ch. 15.2.5)
   E. Series solutions of ODEs. (Ch. 16)
      E.1 Series solutions about an ordinary point.
      E.2 Series solutions about a regular singular point: Fuch’s theorem, Frobenius
         series, and the indicial equation.
      E.3 Obtaining a second solution: Wronskian method.
   F. Eigenfunction methods. (Ch. 17)
      F.1 Function spaces and Hilbert space.
      F.2 Properties of Hermitian operators.
      F.3 Sturm-Liouville equations and their Hermiticity.
      F.4 Transforming to S-L form.
      F.5 Green’s functions and eigenfunction expansion.
   G. Stokes equation, Airy functions, and the WKB method. (Ch. 25.6-25.7)

III. PDEs: Part 1 (Ch. 21.1-21.3)
   A. Separation of variables: converting a PDE into a set of ODEs.
   B. Application in Cartesian, polar, cylindrical, and spherical coordinates.

IV. Special Functions (Ch. 18)
   A. Legendre/Associated Legendre equation and functions, spherical harmonics. (Ch. 18.1-
      18.3)
   B. Bessel/Spherical Bessel equation, Bessel/Hankel functions, spherical Bessel functions.
      (Ch. 18.5-18.6)
   C. Hypergeometric and confluent hypergeometric equations and functions. (Ch. 18.10-18.11)

V. PDEs: Part 2 (Ch. 21)
   A. Solving the PDEs derived from separation of variables. (Ch. 21.1-21.4)
   B. Integral transform methods. (Ch. 21.4)
   C. Green’s function and Boundary Value problems. (Ch. 21.5)

VI. Calculus of Variations (Ch. 22)
   A. Application to variational principles in physics: Euler-Lagrange equation.
   B. Constrained variation.
   C. General eigenvalue problems.
   D. Transforming a S-L equation into a variational problem to find the eigenvalues.
   E. Rayleigh-Ritz method to approximate eigenvalues.