TOPICS in MATHEMATICAL PHYSICS
PHYS 324
Winter Quarter, 2014

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Course Schedule: TTh, 12:30-1:50 in Rush 213.

Objective: To provide all the mathematical background required for the undergraduate courses:

Classical Mechanics
Classical Electrodynamics
Quantum Mechanics
Thermodynamics

Goals: To master a basic working knowledge of the standard tools of elementary mathematical physics required to progress effectively through the courses listed above.

Prerequisites: Calculus 1-4, Linear Algebra.

Corequisite: Differential equations.

Specific Expectations at End of Course: Working knowledge of: differentiation including partial derivatives, single and multiple integrals, integration by parts, lookup tables of integrals, jacobians, unit vectors **i, j, k**, div, grad, curl, solutions of sets of linear equations, matrix inversion, vectors, eigenvalues and eigenvectors, trigonometric functions, complex numbers, exponential function.

Course Texts: Most of the material to be covered is summarized in the required text:

Mathematical Handbook, Murray R. Spiegel & John Liu, Schaum's Outlines NY: McGraw Hill, 1968;

There are many texts that cover this material. They all have more or less isomorphic names. There are many books that are suitable for this course. The committee appointed to discuss this course had "exciting

discussions" about the choice of text. Ultimately, I decided that since any of these texts is very expensive (new), and that a text that appeals to one student might repel another, I would leave it to each student to choose his/her own, in the event (s)he prefers to have a text with more words than the basic compilation chosen for this course. All suitable texts have the words *Mathematical Physics* somewhere in their title. Such books can be found in the Hagerty library hovering around call numbers QC20 and QC401. Some are available for inspection in my office.

My favorite (unfortunately, not currently available) is

Mathematics of Physics and Modern Engineering, I. S. Sokolnikoff and R. M. Redheffer, NY: McGraw Hill, 1966.

Grading: The course grade will based on homework assignments, two in-class midterm exams, and one final exam.

Homeworks: Homework assignments will involve a mixture of analytic and computational problems. They are due on the date stated at the top of the assignment. Late assignments will receive 50% of the possible maximum grade during the first late week, 40% during the second late week, etc. For the computational problems, you can use any platform you desire, program in any language you like, and use any package that suites you (Matlab, Mathematica, Maple, etc.) Some of the problems will be labeled **Narrative**. For these problems you are required to provide a written statement to accompany your solution. Full sentences. Clear and lucid. The written solution must provide enough information for one of your peers (another student) to reproduce your results. No narration = no credit.

Topics	Weeks
Complex numbers	0.5
Solutions of Ordinary Differential Equations	1
(Esp. linear differential equations to at least 2nd order)	
Div, Grad, Curl, Laplacian, line integrals	1
Simple PDE's, separation of variables	1
Fourier Series & Transforms	1
Overview of other special functions	1
(Spherical harmonics, Legendre, Bessel Functions, etc.)	
Eigenvalues, Eigenvectors, & Linear Algebra	1
Complex Analysis	1
(Analytic functions, Cauchy-Riemann, Contour Integral)	
χ^2 Minimization/Maximum Likeihood	1
(Alt. Probability and Statistics: PDFs, CDFs, tests)	1
Lagrange Multipliers	0.5