

Mathematical Principles in Science III

Time: 10:30-11:20a.m. MWF

Prerequisites: *By the second week:* know how to solve (a) a second order ordinary differential equation with constant coefficients, (b) Euler's homogeneous differential equation.

By the third week: know (a) the CAUCHY-GOURSAT theorem, (b) the RESIDUE of a complex analytic function, and (c) CAUCHY'S INTEGRAL FORMULA. Look them up in a text on complex variables; R.V. Churchill's "Complex Analysis and Applications" is a good possibility.

By the fifth week: know the "Basic Properties of a Sturm-Liouville Eigenvalue Problem" (Section 3.3.3 in "Linear Mathematics in Infinite Dimensions"), in particular, know how to use Exercise 3.3.4 ("how to normalize an eigenfunction").

Primary Text: *Linear Mathematics in Infinite Dimensions*, Beta edition, by U.H. Gerlach (Typeset lecture notes)

Auxiliary Texts: 1.) *Mathematics of Classical and Quantum Physics* by F.W. Byron & R.W. Fuller (Dover paperback should be at Long's Bookstore)
2.) *Mathematical Methods in Physics and Engineering* by J.W. Dettman (Dover paperback)

Syllabus (in essence): Fourier theory.
Wave packets and wavelets.
Green's function theory.
Integral equations.
Theory of cylinder harmonics and Bessel functions.
Applications: Waves, scattering, vibrating systems, and Helmholtz's equation
Potential theory via spherical harmonics.
Partial differential equations: elliptic, parabolic, and hyperbolic (time permitting).

Website: If you haven't done so already, visit

<http://www.math.ohio-state.edu/~gerlach/math>

and also

<http://www.math.ohio-state.edu/~gerlach/math/math603>

for other useful and *mandatory* information about this course.

Homeworks: One homework set every week, generally handed out each Friday and due the following Friday AT THE START OF CLASS.

Exams: One take-home final (counts about 2 or 3 homework sets). It will be handed out on Friday, the last day of classes. It will be due the subsequent Monday at 4pm. (**OVER**)

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Grading Guidelines: Each assignment paper will be graded for mathematical correctness AND PRESENTATION.

Important: Points will be DEDUCTED for sloppiness, incoherent or insufficient explanation, or for lack of supporting rationale. The solutions should be presented so that your fellow students, or a client, could read them and follow both the CALCULATIONS and LOGIC.

Each assignment (8 or 9 total) will consist of approximately 70 possible points, and the Final Exam will be worth about 200 points. There is a total of about 800 points.

Late papers will not be accepted except in extreme situations with documented excuse.

It is the student's responsibility to be aware of all instructions that are delivered during class, including departures from general assignments.