

PHYS 7110, Mathematical Physics, Fall 2016

Instructor: Dr. Abhijit Majumder, 316 Physics, Ph: 313-577-4569
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1 Learning Outcomes

As part of the work associated with this course, the student will be expected to (in no particular order):

- 1) Become familiar with a wide range of methods of solution of ordinary and partial differential equations, including but not limited to power series solutions, separation of variables, Green's functions etc.
- 2) Have a good working knowledge of the solutions of standard PDEs such Legendre's and Bessel's equations
- 3) Achieve a deep understanding of complex analysis, including but not limited to harmonic functions, poles, residue theorems, Taylor and Laurent expansions, analytic continuation etc.
- 4) Be able to solve a variety of physical problems using methods of complex analysis. In particular should be able to integrate over a range of functions using residue theorems.

2 Hours and location:

Mon-Wed-Fri, 9:35am - 10:30pm, 0177 Physics.

Office Hours: Monday 1:00 pm - 3:00 pm or by appointment.

3 Textbooks:

Mathematical Methods for Physicists, Arfken and Weber.

Other books of interest:

Mathematics for physics, M. Stone and P. Goldbart.

Mathematical Physics, S. Hassani.

Introduction to Mathematical Physics, M. Vaughn.

Physical Mathematics , K. Cahill

Mathematical Methods for Physics and Engineering, Riley, Hobson and Bence.

Methods of Theoretical Physics, Morse and Feshbach.

4 Grading (total 500)

Homework: Assigned Bi-weekly, and due every 2 weeks: 40 points each.
(total 5 assignments=200 points)

Midterm: 1 during class (end of October), “**closed**” book, 100 points.
(total from midterm=100 points)

Final Exam: 2 and 1/2 hours, closed book. 200 points.

5 Course Outline:

- 1) Ordinary differential equations
- 2) Partial differential equations
- 3) Laplace and Fourier transforms
- 4) Method of Green’s functions
- 5) Complex analysis

6 Homework

About 5 assignments will be handed out during the semester. Each assignment will consist of about 4 to 6 problems. Some of these will be quite difficult. You will have 2 weeks for each homework. Please do not leave these for the last minute. No solutions will be provided. You will be expected to complete as much of the homework as possible. **While consultation with your fellow students and with the instructor is encouraged, copying another student’s work is not acceptable. More than one student with similar solutions**

will be penalized.

7 Intended Audience (grading for graduate students)

This course is meant for graduate students only.