# PHYS 502
# Mathematical Physics II
*Winter 2014*

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| **Instructor:** | Prof. S. McMillan (12-816/610, x2709/2723) |
| **Time and place:** | MWF 10:00–10:50, Disque 919 |
| **e-mail:** | `steve (at) physics.drexel.edu` |
| **URL:** | `http://www.physics.drexel.edu/courses/Comp-Phys/Physics-502` |

## Course Outline

This course is a continuation of PHYS 501. Its goal is to integrate classical analytical methods with modern computational techniques. Emphasis will be placed on application of the methods studied to problems in physics and elsewhere. Topics covered will include:

1. Fourier Series and Transforms
2. Discrete and Fast Fourier Transforms
3. Partial Differential Equations
4. Bessel and Legendre Functions
5. Fluid flow: equations of motion and selected solutions
6. Numerical Solutions of PDEs
7. Monte-Carlo Methods
8. Calculus of Variations
9. Integral Equations (if time)
10. Fitting and Modeling Data (if time)

Topics may change or be rearranged at short notice, depending on circumstances.

## Texts

*Essential Mathematical Methods for the Physical Sciences* (K. F. Riley & M. P. Hobson, Cambridge University Press, 2011). Discussion of computational material will be based on *Numerical Recipes in C* (W. Press, S. Teukolsky, W. Vetterling, & B. Flannery, Cambridge University Press; 2nd edition [1992] in C, or 3rd edition [2007] in C++). These books contain a lot of useful explanatory text, along with numerous practical implementations of the algorithms discussed. The C and Fortran versions of this book are available free online, and all programs can be found on newton.

The recommended programming languages for the course are C (or C++) or Python. Fortran will probably do—versions of Numerical Recipes exist for Fortran 77 and Fortran 90—see the main course web page). Java might be acceptable, but may be somewhat slow for the problems of interest here. Python benefits from the large number of high-performance modules that have been written for computationally intensive applications. You may find it more convenient to use Maple or Matlab instead for some of the assigned problems (but note that solutions will only be provided in C/C++ and Python, and using a canned routine really doesn't count as programming).

## Evaluation

The final grade for the course will be based on (1) a 1-hour mid-term examination (25% of the total), tentatively scheduled for Friday, February 14 (week 6), (2) a final examination (30%), to be held during finals week, and (3) 6–7 homework assignments completed during the quarter (45%). Assignments will be due one week after they are distributed. Late homeworks will receive reduced credit, at a rate of -15% per week late. Homeworks turned in after they are discussed in class (about 1 weeks after they are due) or after the final examination will receive zero credit.