

SPRING, 2013
Math 451, CMPSC 451. Numerical Computations

Instructor: Timothy Reluga, treluga@math.psu.edu

Office: 424 McAllister (but I'll soon be moving to 210 McAllister)

Section 1: Monday, Wednesday, and Friday, 1:25 -2:15 pm, Willard 365

Section 2: Monday, Wednesday, and Friday, 2:30 -3:20 pm, Willard 167

Course Web page: <http://www.math.psu.edu/treluga/451>

Office hours: Tuesday's, 4-5 pm, or by appointment

Course Description: Algorithms for interpolation, approximation, integration, linear equations and nonlinear systems, fast Fourier transforms, and differential equations emphasizing computational properties and implementation.

Prerequisite: MATH 230 or MATH 231. (calculus, linear algebra, elementary differential equations, and maybe a little programming)

Textbook: Numerical Methods using Matlab, by Matthews and Fink (ISBN: 9780130652485)

Laboratories: This is a hands-on class, in which you will need to learn to program. We will start off using Matlab, but will also explore other tools for numerical computation as the course goes on. The tentative schedule will be to meet in the Hammond 316 Linux Lab on the following (tentative) dates: Jan 18; Feb 15; March 1, 22; April 5, 19.

Grading: Grades will be awarded based on regular homework assignments and computer labs (45%) an in-class midterm on February 25th (25%), and a final exam (30%). Course grades will be assigned out of 100 points as follows:

A 100-95 A- 95-90 B+ 90-87 B 87-83

B- 83-80 C+ 80-77 C 77-70 D 70-60 F 0-60

Academic Integrity: All Penn State and Eberly College of Science policies regarding academic integrity apply to this course. See

<http://www.science.psu.edu/academic/Integrity/index.html> for details.

Software: As mentioned above, you will be required to do programming in this course. The languages I prefer to work with are Python and C++, but Matlab (and Octave), Mathematica, Fortran, R, and a variety of other tools may be used for specific applications (Gnuplot, graphviz). We will mostly focus make use of Matlab within the course, with maybe a few exceptions. Some assignments will need to be electronically submitted (hopefully), and specific instructions will be presented for those assignments.

Rough Course Outline:

- Introduction to numerics and Matlab
- Function evaluation
- Scalar Root-finding
- Optimization
- Matrix methods
- Gaussian Elimination
- Least-Squares approximation
- Interpolation
- Fourier transformation
- Quadrature
- Differential Equations
- Eigenvalue Approximation
- Montecarlo methods