SYLLABUS
PHZ 5156, Computational Physics
Fall 2006
Prof. Patrick Schelling

Lecture: PL 101, Tues, Thurs 4:30-5:45pm
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Office hours: Mon, Wed, Fri 2:00-3:00pm
Final Exam: Thursday Dec. 7, 4:00-6:50pm

Required Books:


Suggested Book:

Grading:

Computer Projects: 35%
Written Homework: 35%
Final Exam: 30%
I will use +/- grades, and the grading will be done on a curve.

This course is both an introduction to computational and numerical tools needed for physics, but also an opportunity to sharpen analytical skills. The class will be relatively evenly divided between numerical and analytical methods.

The numerical methods will be done using codes written in Fortran. In particular, we will develop the skills necessary to program in Fortran77. This is a somewhat outdated version of Fortran, yet it is a subset of more modern and widely used Fortran90.

In addition to written homeworks, computer projects will form a major portion of the course. You can in some sense consider these to be research projects, where some portion of the work might involve looking up references and accessing journal articles from the web. The material that is handed in from a project will include a printout of the code, results, and a write-up.
**Planned Topics:**

- Introduction to Fortran programming
- Ordinary Differential Equations
- Partial Differential Equations (PDE) in physics
- Matrix Algebra
- Fourier Transforms and Fast-Fourier Transforms
- Monte Carlo Methods
- Complex Variables

**Some planned projects include**

- Fluid dynamics
- Tight-binding model of a simple crystal
- Phonon spectra of a lattice
- Thermodynamics of Ising model
- Quantum Monte Carlo estimate of ground state of helium atom
- Possibly some others...