

## Syllabus

### Phys. 476/576 Advanced Computational Physics

Fall 2009

**Instructor** Dr. William R. Gibbs, Office Regents Row 402/526  
Office Hours 1:30-2:30 MWF

#### Course Objective

The principal objective of this course is to introduce the students to the methods of problem solving in the sciences using advanced computational techniques. It provides an introduction to these methods and is suitable for all graduate and senior science majors with an interest in the use of computers to solve, and model, modern mathematical problems. A firm understanding of calculus and differential equations is necessary. Some knowledge of Fortran is useful.

Approximately 22 homework assignments will be given. The grade will be determined by 55% homework, 15% on each of two quizzes and 15% for the final exam.

Homework assignments are graded on a binary basis. They are either acceptable or not. The student may continue to turn in assignments which have been returned as unacceptable until the end of the semester.

#### Topics

Classical Integration Techniques [trapezoidal and Simpson's rules, Gauss-Legendre and Gauss-Laguerre integration, principal-value integrals]

Monte Carlo Techniques [sampling, evaluation of multi-dimensional integrals, radiation transport]

Differential Equations [classical motion, molecular dynamics]

Introduction to Computer Architecture for Scientists [Intel 8086—80486 processor series, basic Cray architecture, Intel i860 processor and other machines of current interest]

Systems of Equations [linear algebra, elimination and eigenvalue techniques]

Finite Element Methods in one and two Dimensions

Introduction to Signal Processing

Introduction to Chaotic Systems [Feigenbaum's numbers](time permitting)

**Textbook** "Computation in Modern Physics", W. R. Gibbs

**Students with Disabilities:** If you have or believe you have a disability, you may wish to self-identify. You can do so by providing documentation to the Office for Services for Students with Disabilities, located at Garcia Annex (phone: 646-6840). Appropriate accommodations may then be provided for you. If you have a condition which may affect your ability to exit safely from the premises in an emergency or which may cause an emergency during class, you are encouraged to discuss this in confidence with the instructor and/or the director of Disabled Student Programs. If you have general questions about the Americans With Disabilities ACT (ADA), call 646-3333.