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PHYS 302
Methods of Computational Physics

Bowdoin College – Fall 2011

Meeting Times:

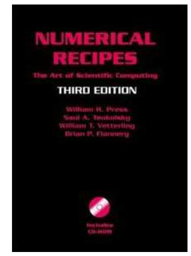
(LECTURE) **Searles 313, MW 2:30p – 3:55p**

Instructor: **Rob Salgado** **Visiting Assistant Professor of Physics** Office: **Searles 303** Voice: **(207)-725-3170**	Email (the <u>best</u> way to contact me): `rsalgado@bowdoin.edu` Instant-Messengers: AOL, WindowsLive[hotmail], Yahoo, Google, Skype: `robowphy` (IM only… do *not* email here—I won't read it)	Office hours: **-to be announced**

Departmental Coordinator: **Dominica Lord-Wood** (`dlord@bowdoin.edu`) (M-F 9:30-5:00), **Searles 319 (207)-725-3308**

Catalog Description:

PHYS 302 – Methods of Computational Physics
An introduction to the use of computers to solve problems in physics. Problems are drawn from several different branches of physics, including mechanics, hydrodynamics, electromagnetism, and astrophysics. Numerical methods discussed include the solving of linear algebra and eigenvalue problems, ordinary and partial differential equations, and Monte Carlo techniques. Basic knowledge of a programming language is expected.



Required Materials:

"Numerical Recipes in C++: The Art of Scientific Computing, 3rd"
by W. H. Press, S. A. Teukolsky, W. T. Vetterling & B. P. Flannery,
or a version of the book for a different programming language.

Electronic Materials:

I will maintain a Blackboard website (`http://blackboard.bowdoin.edu/`) that links to homework assignments, electronic-whiteboard notes, and handouts. (These materials are not a substitute for regular attendance, participation, and problem-solving.)

Course Goals:

A. To introduce computational methods than can be used to solve problems as they arise in various fields of physics.
B. To further develop physical intuition, mathematical reasoning, and problem solving skills (including scientific modeling and computational thinking).

Rough list of topics:

root-finding techniques;
vectors, matrices and linear algebra;
interpolation and extrapolation;
differentiation and integration;
random numbers and Monte Carlo techniques;
ordinary differential equations;
eigenvalue problems;
Fourier transforms; and
partial differential equations.

Homework and Projects:

Given that your grade will mostly be based on your homework and project reports, these reports should clearly represent your work. You are strongly encouraged to help each other with problems that you encounter, but all final programs and write-ups should be your work. Reports will be graded based on both the results and presentation. Include (and clearly present) derivations, results, figures and also your programs. Be creative!

You can always ask me for help after you have made an honest effort. You are always welcome to stop by my office hours, send an email, or an IM.

Course Requirements:

There will be no final and no midterms. Your grade will be based on your homework and projects (see below), as well as a presentation on one of the projects. Early in the course the homework will consist of traditional weekly homework sets; later in the course these will be replaced with projects that are a little larger in scope, and in which you will solve a computational physics problem in more depth. Projects may include the structure of relativistic stars, the two-dimensional Ising model for spin-spin interaction, two-dimensional fluid flow, heat transport, and traffic flow problems.