# Syllabus for
# Physics 220
# Introduction to Computational Physics

*Spring 2014*

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Office Hours: MW 1-2 or by appointment

Class Time: TTh 8:30-9:45
Room: Physics 201

■ **Some Important Dates This Semester**

January 27 First Day of Class
March 15-23 Spring Break
April 17 Daffy Duck's Birthday
May 13 Last meeting of this class

May 6, 8, &13 Final presentations

If any classes are cancelled, I will attempt to make them up, probably at the free hour on Wednesday.

## Course Objectives

The learning objectives for this course are threefold. (1) to learn to formulate physical problems in mathematical terms; (2) to implement the solution of the resulting mathematics with a combination of both analytical tools and numerical tools with an emphasis on the use of *Mathematica* to achieve these; (3) to be aware of the limitations of both the physical model and the computation of the results.

# Preparation

We will be using the software package *Mathematica*, version 9.0.1 This is available on all campus computers and available for free download from myUMBC. It is strongly suggested that you download and install a copy of Mathematica 9 on your computer.

# Course Outline

In this course you will learn basic Mathematica syntax and idioms and use them to solve physics problems and to produce a formal document of your work. The types of problems we will encounter fall into at least three main categories:

- Symbolic algebra and calculus
- Data analysis and the use of graphics
- Approximate numerical solutions

We will discuss each of these areas in the course. There will be a very strong emphasis on the use of graphics to give insight into the solutions of physics problems. Some of the problems we will cover are:

- Linear algebra and simultaneous equations
- Solving equations in general
- Data I/O and display
- Plotting both theory and data
- Symbolic algebra and calculus
- Curve fitting
- The ever present harmonic oscillator and its offspring
- Orbital motion
- Vector calculus and electrostatics
- Numerical approximations
- Differential equations

# Grading

There will be no formal exams in this course; however, ... there will be significant computational assignments. In addition, there will be a final project that each of you will choose about half way through the semester. In all cases, you may seek help from anyone, and I encourage you to work together, but you should be aware that if you just copy someone else's work, you will not learn this stuff. The grade will be 50% homework and 50% project.

You will make a ~10 min presentation of your final project during the last three days of class, 5/6, 5/8, and 5/13 Attendance is required all three days.

Since your grade is entirely based on the assignments and project, I will say a brief word about what I expect. I expect your assignments to be complete, legible, and "professional". By professional I mean that your work should be of high quality and not something that is thrown together the night before it is due. When appropriate, your assignments should reference other works used. I expect your English to be correct with complete sentences and well-structured paragraphs. I also expect you to make use of *Mathematica'*s paragraph formatting in your notebooks. (We will go over this in class.) In other words, you should think of each assignment as a term paper.

All assignments should be emailed to me unless there is some reason that this is not practical. The files you email me should start with your last name and then have 220 followed by a number or descriptor (I will give you these) for the particular assignment, for example: last_name-220-Harmonic Oscillator.nb, or something similar. Please make sure that your name is in **both** the name of the file and somewhere obvious within the file itself.

**Late assignments or a late project will NOT BE ACCEPTED without prior permission (no exceptions).**