PHY 322 **Computational Physics** Spring, 2010

Instuctor: Dr. Drake Mitchell
Contact: drakem@pdx.edu, 5-9876
Office Hours: Wednesday 9:00-10:00 and by appointment; B1 50 Science Building 2 (1 floor down from the ground floor)

Required text: N. Giordano and H. Nakanishi – "Computational Physics" 2nd edition
Also see: http://www.physics.purdue.edu/~hisao/book/ and material handed out as needed

Other books that might be useful:

Numerical Recipes–Press, Teukolsky, etc. Old version: http://www.nr.com/oldverswitcher.html
Similar to Giordano: A first course in computational physics – DeVries
Similar to Giordano: Computational Physics – Landau and Paez

Grader: Xiaohua Wang (xiaohuaw@pdx.edu)

Homework: Emailed: format: DCM *(that is* **YOUR** *3 initials)_(number of homework assignment).*7z, each exercise should execute after input from the grader. **Send your homework to the grader**. **No late homework accepted.** The lowest homework grade will not be counted. **Language: Python**

Plagiarism: Collaboration is encouraged; wholesale copying from someone else is not. A grade of zero for the assignment is certain; further sanctions are possible.

Pre-class Warm Ups: This means short homework assignments due before class. These assignments will consist of three questions; 2 taken from the reading assigned for that day's class and a final question about what you found difficult in the day's reading. These assignments will be graded on effort and coherence rather than correctness. These assignments will not include problems or derivations. Ideally I would like pre-class Warm Ups turned in via email as a plain email (not an attachment) by 8am on the day of class, if this is not possible they can be turned in on paper at the start of class.

Grading Component	**%**
Homework; 9 assigned; will toss the lowest 1	30
Pre-class Warm Ups (14)	10
In-class quizzes (6)	20
Project; due day of final exam	20
Final exam	20

No late pre-class reading homework will be accepted, since it will be pointless after the corresponding class is over.

Final grades will NOT be evaluated in terms of a 'curve'. This means 2 things:
1) It is possible for the entire class to earn A's & B's (I've had it happen)
2) If another person in the class is doing well it has no effect on your grade

Syllabus (subject to revision)

Week	Tuesday/Thursday - Reading	WarmUp	Assignments (due Thursday, by email)
3/30	Ch 1, Appendix A	Thur	**Quiz 0: today and Quiz 1: Thursday, Ch 1.**
4/6	Ch 2, Appendix D	Tue	**1**: 1, 4, 6, **Quiz 2: Thursday, Python**
4/13	Ap. B, Ch. 3 to 3.4	Tue	**2**: 2, 6, 9; **Quiz 3: Thursday**
4/20	Rest of Ch. 3 and Ap. C	Tue/Thur	**2**: 14, 18, and two problems below (3_3 and 3_4)
4/27	Ch. 4	Tue	4_1 and 4_2 (below), and **3**: 2, 12. **Quiz 4.**
5/4	Ch. 5	Tue/Thur	**3**: 22, 34, 37, and **4**: 4, 8
5/11	Ch. 6 and Ap. E	Tue	**4**: 10, 17, 19, and **5**: 4. **Quiz 5**.
5/18	Ap. F & G	Tue/Thur	**5**: 9, and **6**: 1, 9. **Presentation of project proposals**
5/25	Ch7	Tue/Thur	**F:** 1 & 3 and two problems below: 8_3 and 8_4. **Quiz 6.**
6/1	Ch. 8	Tue	**E:** 2, 5, 7 , and **7**: 2, 12
6/9	**Final 6/9: 1015-1205**		Project due: send to me (zipped: named *DCM_project.7z* with **YOUR** 3 initials replacing ESB!)

3_3: Find the root of $f(x) = \cos(x)-x = 0$ by the method of bisection. How many iterations are necessary to determine the root to eight significant figures?

3_4: Repeat 3_3 by using Newton-Raphson and the secant method. Compare the effort to find the roots with 3_3.

4_1: Use N-R to solve $x^{2/3}-169 = 0$.

4_2: Find an extremum of $2x^4-x^3-x^2+17$ between: –10 and 10. There might be multiple extrema, find at least one.

8_3: Evaluate the integral $\int_0^{\pi} \sin^3 x dx$ using approximations to the integrand that are piecewise linear, quadratic and quartic. With N intervals, and hence N+1 points, evaluate the integral for N= 4, 8, 16, …., 1024, and compare the accuracy of the methods.

8_4: Numerically integrate the Fresnel integrals: $C(v) = \int_0^v \cos(\pi w^2/2)dw$ and $S(v) = \int_0^v \sin(\pi w^2/2)dw$ and evaluate: $I/I_0=0.5\ \{|C(v)+0.5|^2+|S(v)+0.5|^2\}$ and plot the results. This is the pattern of diffraction at a knife-edge.

Warm Up for Thur. 4/1/10

1. What is pseudocode? Give an example.

2. What are 3 numerical methods for evaluating differential equations?

3. What did you find confusing/frustrating/counter-intuitive in this section? If nothing fits those categories, what did you find interesting?