Computational Physics – Physics 331
Westminster College

1 Pertinent Information

Instructor: Douglas Armstead
Office: 124 Hoyt (724) 946-7201
Office Hours: MWF 3-4. These are just the times I guarantee. I am available other times so feel free to drop by or to email me for an appointment.
Email: armstedn@westminster.edu
Course website: www.westminster.edu/staff/armstedn/ComputationalPhysics.html
Lecture meets: MW 2-3pm in Hoyt 116.
Texts:
Mathematical Methods in the Physical Sciences by Boas published by Wiley.
Computational Physics 2^{nd}Ed by Giordano and Nakanishi.
Prerequisites: Physics 152 is a prerequisite and Math 251 is needed at least concurrently.

2 The Point of this Class [1]

This course will stress the application of mathematics to physical processes. The course will emphasis analytical approaches to problem solving both for their application in problems of physical interest and to build the scaffolding for Computational Physics 2.

The areas in which you will gain proficiency include: series expansions, complex numbers, linear algebra, partial derivatives, multiple integrals, vector analysis, Fourier series, ordinary differential equations, partial differential equations, special functions, and probability. By the end of the course you will be expected to know how and when to apply these techniques.

3 Expectations

What you should expect from me:

- Explanations of physical concepts that include concrete examples and, where reasonable, demonstrations.

[1] If you are looking for the outcomes of this course, they are here. This course's effectiveness will be assessed by monitoring the quality of the student's work on the graded elements of this course. See Graded Elements section for their descriptions.

- In-class examples that help you to develop the level of reasoning that is necessary to do the problems you will encounter in the homework and on exams.
- Careful and respectful consideration of your questions.
- An open door policy–if my office door is open you should feel free to come in and talk about physics. This is in addition to my regularly scheduled office hours listed above.

What I expect of you:

- Your presence in class, both physical and mental, for the entire class period.
- To prepare for class. This includes doing the reading at a level that you arrive with questions in hand about the material.
- When you have a question, ask it. Your fellow classmates will thank you–if you are unclear on something, chances are the person next to you is, too.
- Submit work for grading that is your own. If you copy from another student or source and submit it for a grade, then you risk receiving an F in the course.

4 Grades

The final score for the class is found in the following way:

$$score = \frac{H + E_1 + E_2 + F}{4} \tag{1}$$

where H =homework average, $E_i = i$th midterm exam, and F =final exam.

4.1 Graded Elements

The point of the homework is to solve problems. Lots of problems. This makes you proficient at using the techniques and also shows some of the situations in which these techniques are useful.

Your goal in solving the homework is to both know when to use a given technique and to correctly apply said technique. This is the standard I will apply when evaluating the homework and the exams. Some exams will have an in-class format and others a takehome. Make-up exams will only be administered for "Excused Absences" (see pages 71-72 of Undergraduate Catalog for details). Supporting documentation to excuse your absence will be required.

The score is mapped into a grade roughly as:

Final %	Grade
90-91,92-100	A- to A
80-81,82-86,87-89	B- to B+
70-71,72-76,77-79	C- to C+ etc.

Improvement and class participation may be used raise a border line grade.

4.2 Academic Integrity

You are expected to observe the College's statements and procedures on Academic Integrity in the 2009-2010 Undergraduate Catalog, pages 72-76. Ask the instructor if you have any uncertainty about what is proper collaboration and what is not.

5 Class Schedule

All dates are tentative.

Week	week starting	Chapter(s)	Topic
1	Aug. 31		Dimensional Analysis
2	Sept. 7	Boas 1	Series–Geometric series, power series, Taylor series
3	Sept. 14	Boas 2	Complex Numbers–Algebra of, Euler's equation, powers, roots, trig
4	Sept. 21	Boas 3	Linear Algebra–Determinant, linear operators, Eigenvalues/Eigenvectors
5	Sept. 28	Boas 4	Partial Derivatives–Chain rule, extremization, Lagrange multipliers, change of variables
6	Oct. 5	Boas 5	Multiple integrals–Double, triple, and surface integrals
7	Oct. 12	Boas 5	Multiple integrals
8	Oct. 19		
			M Fall Break
			Test:Chapters 1-5 on Wednesday.
9	Oct. 26	Boas 6	Vector Analysis–Algebra, Derivatives, line integrals
9	Nov. 2	Boas 6	Vector Analysis–Divergence and Curl Theorems
10	Nov. 9	Boas 7	Fourier Series–Calculating, interpreting, and applying Fourier series
11	Nov. 16	Boas 7	Fourier Series–continued
12	Nov. 23	Boas 8	ODEs–1st and 2nd order, delta functions
13	Nov. 30	Boas 13	PDEs–Heat flow and wave equation
			Test: Chapters 6-8 on Monday.
			W Thanksgiving Break
14	Dec. 7	Boas 13	PDEs
15	Dec. 14	Boas 12	Series solutions of ODEs

Final Exam 11:30-2pm on Friday Dec. 18.