Physics 430 Class Schedule – Winter 2010

	Monday	Tuesday	Wednesday	Thursday	Friday
January	4 *Before first class:* Review Matlab	5	6	7 Lab 1 Grids and numerical derivatives	8
	11	12	13	14 Lab 2 Differential equations with boundary conditions	15 Add/drop deadline
	18 **MLK Day Holiday**	19	20	21 Lab 3 Wave equation: steady state & resonance	22
	25	26	27	28 Lab 4 Hanging chain and quantum bound states	29
February	1	2	3	4 Lab 5 **Partner switch #1 at start of lab** Animating the wave equation: Staggered Leapfrog	5
	8 Withdraw deadline	9	10	11 Lab 6 Staggered Leapfrog in 2D	12
	15 **Presidents Day Holiday**	16 Monday Instruction **Take home problem #1 due by midnight**	17	18 Lab 7 Diffusion/heat equation	19
	22	23	24	25 Lab 8 **Partner switch #2 at start of lab** Implicit methods: Crank Nicholson	26
	1	2	3	4 Lab 9 Schrödinger's equation	5
March	8	9	10	11 Lab 10 Poisson's equation 1: Successive over-relaxation	12
	15	16	17	18 Lab 11 Poisson's equation 2	19
	22	23 **Take home problem #2 due by midnight**	24	25 Lab 12 **Partner switch #3 at start of lab** Gas dynamics 1	26
	29	30	31 Discontinuance deadline	1 Lab 13 Gas dynamics 2	2
April	5	6	7	8 Lab 14 Solitons: the KdV equation	9
	12	13 last day of classes	14 Reading Day	15 Reading Day	16 Begin Final Exams
	19 **Scheduled final exam for section 2 2:30 – 5:30 pm**	20 **Scheduled final exam for section 1 7:00 – 10:00 pm**	21 End Final Exams	22 Graduation	23 Graduation

Physics 430 – Winter 2010 – Sections 1 and 2
Computational Physics Lab 3
aka "Solving Partial Differential Equations Using Matlab"
Dr. John S. Colton

Instructor: Dr. John S. Colton, john_colton@byu.edu
Office: N335 ESC Phone:422-3669
Instructor Office Hours: 3:30-5:30 pm Wed, or by appointment.
Research Lab: U130 ESC Phone: 422-5286
TAs: Daniel Jensen (danielsjensen1@gmail.com) and Quinn Norris (nurch111@juno.com)

Website: http://www.physics.byu.edu/faculty/colton/courses/phy430-winter10. You can navigate there via www.physics.byu.edu → Courses → Class Web Pages → Physics 430 (Colton).

Student Email Addresses: I may periodically send class information via email to your email address that is listed under Route-Y. If that is not a current address for you, please update it.

Course Objectives: In this course you will:

- Gain a better understanding of the physical implications of important partial differential equations by numerically solving the equations and graphically displaying the solutions.
- Improve your Matlab and general programming skills by using loops, logic commands, and other techniques as you solve these PDEs in Matlab.
- Learn to apply linear algebra to physical systems described by data on grids

Prerequisites: Everyone in this class should have had Physics 330.

Lab manuals: There are two manuals for this class:

1. *Introduction to Matlab*, which you should have from Physics 330. If not, it is available for purchase (by request) at the BYU Bookstore, and available in pdf format for downloading from the class website. This will be a useful language reference manual to help you as you program in Matlab.
2. *Computational Physics 430*, the lab manual for the course. This is available for purchase at the BYU Bookstore, and available in pdf format for downloading from the class website. There was a substantial revision at the end of summer 2009, so be sure you have the manual dated Aug 6, 2009. (The date is shown on the second page.) This manual contains the material for each laboratory period, the assignments that you will need to pass off.

Important note: If you want a paper copy of either of these it is generally cheaper to buy them from the Bookstore than it is to print your own (it is inappropriate for you to print a copy of this manual on department printers without paying for the printing costs).

Software: We will be using Matlab for all numeric problems. We will also be doing some symbolic problems, using your choice of Maple or Mathematica. However, I myself have never used Maple. Therefore, if you want my help, you will have to use Mathematica (I can't speak for the TAs). All three software programs are available on all departmental computers.

You should seriously consider buying the student editions of Matlab and Mathematica/Maple while they are still cheap because you have a student ID. These two pieces of software become much more expensive when you graduate.

Grading: If you hit these grade boundaries, you are guaranteed to get the grade shown. In past semesters most of the class has received A's, A-'s, and B+'s.

A	93%	B+	83%	C+	71%	D+	59%
A-	88%	B	79%	C	67%	D	55%
		B-	75%	C-	63%	D-	51%

Grades will be determined by the following weights:

- Warmup quizzes: 10%
- Laboratory assignments: 60%
- Take-home problems: 20%
- Final exam: 10%

Warmup quizzes: You will be expected to read each lab prior to coming to class. A brief warmup quiz on the material will be given at the start of each class (not including Lab 1). If you are late to lab, you will get a zero on the quiz for that day. To account for emergencies when you may have to miss or be late to lab, however, your lowest two warmup quizzes will be dropped.

Laboratory assignments: This class is taught as a laboratory with graduate students/advanced undergraduates as TA because finding and fixing simple programming mistakes can be challenging and frustrating for students. The instructor and TAs may occasionally present mini-lectures to explain difficult concepts or to teach good programming practice. The lab setting provides an active learning environment where you can learn the material, solve problems, and debug programs with the help of your lab partner, the TAs, and the instructor. Take advantage of this time! Attendance is not optional!

Laboratory partners. You must work in pairs and pass off the labs in pairs.* I will assign the initial lab partners. You will change partners three times during the semester, so you will get a chance to work with at least four other students altogether. As you work with your partner(s), you can teach each other and "both [be] edified and rejoice together" (D&C 50:22). You will be on your honor that both partners contributed roughly equally to the work you pass off together.

Passing off lab assignments. As you complete each section of a lab, you must get a TA to pass you off. The TA will look at your results, ask you questions about the assignment, and (if you pass) mark down that you have completed the section. If you complete all sections of a lab, you will get full credit. If you do not complete all of the sections, you will only get partial credit for that lab.

Completing assignments: If you do not complete all of the lab during the regularly-scheduled lab time, you can work with your partner on the remaining sections before the next lab period. However, all of the sections must be ready for passing off at the start of the next lab period. For example, if you don't complete Lab 3, you can pass off the last section of Lab 3 at the start of Lab 4. But only at the start of Lab 4.

Making up labs: If you have to miss a lab period, you have two options. (1) You can attend my other lab period that day. This is the best option, since the TAs and I will be present to give assistance. No prior approval is needed, although if students from the 8 am section start regularly attending the 3 pm section, I might re-think this policy. (2) You can work through the lab on your own time—possibly with help from your partner who presumably would have completed the lab in the regular section—and then arrive the next lab period ready to pass everything off.

* If we have an odd number of students in class, there may be one group of three.

Take-home problems: There will be two take-home problems which you will need to do individually. The format of these will be will similar to other take-home exams you may have had in other classes: open book, open notes, open previous work, open any reference material you can find, but closed people (including your lab partner, classmates, TAs, internet posters, etc.). After you complete the problems you will email your work to me for grading.

Final exam: There will be a final exam. I have not yet decided whether the exam will be during our scheduled final exam time or whether it will be take-home.

Extra Credit: The 430 lab manual was substantially redesigned in Aug 2009. That type of thing tends to introduce errors. You are the first class to use the new manual. Consequently I will give extra credit to students who find significant errors in the manual (serious typos, incorrect directions, etc.). Only the first student or group to find a given error gets the extra credit for that error, however. Yes, I realize that students in my earlier lab will have an advantage here, but such is life!

BYU Policies:

Prevention of Sexual Harassment: BYU's policy against sexual harassment extends to students. If you encounter sexual harassment or gender-based discrimination, please talk to your instructor, or contact the Equal Opportunity Office at 378-5895, or contact the Honor Code Office at 378-2847.

Students with Disabilities: BYU is committed to providing reasonable accommodation to qualified persons with disabilities. If you have any disability that may adversely affect your success in this course, please contact the Services for Students with Disabilities Office at 378-2767. Services deemed appropriate will be coordinated with the student and your instructor by that office.

Children in the Classroom: The serious study of physics requires uninterrupted concentration and focus in the classroom. Having small children in class is often a distraction that degrades the educational experience for the entire class. Please make other arrangements for child care rather than bringing children to class with you. If there are extenuating circumstances, please talk with your instructor in advance.