

Physics 230 – Winter 2014

Dr. John S. Colton

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Course Website: <http://www.physics.byu.edu/faculty/colton/courses/phy230-Winter14/>

You can navigate there via www.physics.byu.edu → Courses → Class Web Pages → Physics 230 (Colton).

Learning Suite: We will not use Learning Suite at all.

Max: I will use the Physics Department online “Max” system for keeping track of grades, etc. Max is located at: <http://max.byu.edu>.

Class Schedule:

Lab	Section 1 Monday 2-5 pm	Section 2 Friday 12 -3 pm	Topics
1	Jan 6	Jan 10	Introduction (notebook basics, menus, documentation, syntax, applications and simple examples)
2	Jan 13	Jan 17	Functions and Lists (functions, arguments, list generation and processing, random numbers, statistics)
3	Jan 27	Jan 24	Plotting (plotting functions and lists)
4	Feb 3	Jan 31	Differentiation (limits, extrema, partial and higher-order derivatives, implicit differentiation, series expansions)
5	Feb 10	Feb 7	Integration (definite and indefinite integrals, multiple integrals, regional integrals, algorithms and options for numerical integration). Take home exam 1 due at midnight on Feb 13 and Feb 10, respectively.
6	Feb 18 (Tues)	Feb 14	Programming I (logic, conditional statements, piecewise functions, procedural vs functional programs, loop structures, recursive structures)
7	Feb 24	Feb 21	Programming II (scoping constructs, iterative equation solving, procedural flow control, debugging)
8	Mar 3	Feb 28	Data Processing (data import/export, text parsing and formatting, multimedia, integrated data sources)
9	Mar 10	Mar 7	Optimization (1D curve fitting, data variables vs parameters, cost functions, algorithms, uncertainties).
10	Mar 17	Mar 14	Linear Algebra (vector and matrix operations, linear systems of equations, eigenvectors and eigenvalues) Take home exam 2 due at midnight on Mar 20 and Mar 17, respectively.
11	Mar 24	Mar 21	Complex Analysis (operations, unit circle, functions, calculus) Term project proposals due at midnight on Mar 24 and Mar 21, respectively.
12	Mar 31	Mar 28	Project 1
13	Apr 7	Apr 4	Project 2
14	Apr 14	Apr 11	Project Show & Tell/Sample final exam problems. Term project final reports due at midnight on Apr 14 and Apr 11, respectively.

Prerequisites: All students should have taken Physics 121 and 123, and be at least concurrently enrolled in Physics 220.

Textbook: The course materials will consist entirely of laboratory exercises (available on the course website) and online software documentation. There are no textbooks or course packets to purchase.

Learning Outcomes: The objective of this one credit-hour class is that you develop fluency in formulating and solving physics problems using a symbolic-mathematics language called Mathematica. Mathematica is a

powerful analytical tool that can be applied to a wide variety of problems in both academic and industrial settings. You will find it useful in most of your upper-division physics and astronomy courses and in a number of our research groups on campus. Many of our students say that Physics 230 was one of their favorite classes at BYU.

The BYU Learning Outcomes website specifies that after completing this course you should be able to:

- Demonstrate the ability to apply calculus, linear algebra, and complex analysis to solve undergraduate-level physics problems.
- Demonstrate the ability to use programming constructs such as looping, conditional execution, and iteration to solve physics problems.
- Solve equations, including systems of equation, related to physical phenomena both symbolically and numerically.
- Demonstrate the ability to visualize, analyze, and interpret equations, data, and physical models.

In addition to those official Learning Outcomes, I myself see the purpose of the class as being fourfold:

- Teach the basics of Mathematica so that you and future professors will be able to use it as a tool.
- Teach some general computational principles, including the basics of programming.
- Review many physics concepts which you have learned in previous classes.
- Expose you to some new physics concepts which you'll see in greater detail in the future.

Student Email Addresses: I will 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.

Department Computer Accounts: Mathematica is found on all departmental computers. In case you do not already have a departmental computer account, you can gain access to these computers by following the instructions given here: <http://www.physics.byu.edu/ComputerSupport/ComputerAccounts.aspx>

You should seriously consider buying the student edition of Mathematica so that you can use Mathematica on your own computer. It becomes much more expensive after you graduate.

Remote server: The departmental “remote server” is a computer that you can log onto remotely and run applications. It a very useful way to use Mathematica from home so that you can work on labs you didn’t finish, take-home exams, your project, etc. To access it from a Windows computer (sorry, I don’t know Macs), run the “Remote Desktop” program and type in “remote.physics.byu.edu” as the computer you want to connect to. Use your regular departmental login.

Grading: If you hit these grade boundaries, you are guaranteed to get the grade shown. I may make the grading scale easier than this in the end, if it seems appropriate, but I will not make it harder.

A	94%	B+	88%	C+	79%	D+	70%
A-	91%	B	85%	C	76%	D	67%
		B-	82%	C-	73%	D-	64%

Grades will be determined by the following weights:

- Laboratory assignments (labs 1-11): 60%
- Exams: 18%
- Term project: 12%
- Final exam: 10%

Your current grade can be viewed through the class web page. Please check your scores regularly to make sure they are recorded correctly.

Laboratory assignments: During each 3-hour lab period, you are to complete the assigned lab. All labs, Lab 1 to Lab 11, are weighted equally. The labs are designed to be a combination of tutorial exercises along with additional assignments requiring more independent thought. If you get stuck on lab assignments, you are welcome to ask for help from the TAs or other students.

Passing off lab assignments. All assignments in a given lab are weighted equally. As you complete the assignments, you must get a TA to pass you off. If the TAs are unavailable when you complete a section, you can proceed on to the next section and pass off the previous section later in the lab. The TA will look at your results, possibly ask you questions about the lab section, and record that you have completed the section. The lab scores will be entered into the computer grading system; you can then verify we have entered the correct information by checking the computer against your own record. 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 assignments during the lab, you can work on the remaining sections on your own before the next lab period. However, all of the sections must be ready for passing off at the start of the next lab period. Assignments completed after this time will not count for course credit. For example, if you don't complete Lab 3, you can pass off the last section or sections 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 the other 230 lab section, if there is room. (2) You can work through the lab on your own time and then arrive the next lab period ready to pass everything off. If you go this route, you are welcome to get help from a friend, but are on your honor to do your own work.

Exams: There will be two take-home exams which you will need to do individually. The format of these will be similar to other take-home exams you may have had/will have in other classes: open book, open notes, open previous work, open any reference material you can find including internet searches... but closed *people* (including your friends, classmates, TAs, smart relatives, people on internet discussion boards, etc.).

Term Project: The term project is an opportunity for you to extend your Mathematica skills by proposing and carrying out an in-depth project. You must work with a partner. Term projects should be related to something taught in Phys 121, 123, 220, and/or an advanced physics principle taught in this course. Be creative! The project should be substantial enough that it will take you and your partner two full lab periods to complete, plus a few hours outside of class. There are three parts to the term project: a proposal, an oral presentation (the main report), and a brief final report. Due-dates are on the class schedule. Additional information such as a grading rubric and a list of past term project topics can be found on the class website.

Final exam: There will be a cumulative final exam. I have not yet decided whether this will be in-class (at the scheduled time) or take-home.

Advice from last year's students: I asked students from Fall 2012 if they had any general advice for future students. Here are their replies:

- Be ready to put more time into this class than expected.
- Do the lab assignments in the same notebook as the lab, it is easier and keeps things more organized.
- Don't be afraid to ask others for help. Some of the stuff is tough, and if you try to do it all on your own, you will struggle.
- Don't put anything off. Remote Desktop is your friend.

- Focus on understanding Mathematica thoroughly, and don't simply try to get the assignment done.
- Go to class and get help from TAs.
- I felt like if I got to class a little early and started working on the lab then, I always seemed to do better. So maybe try and read through them a little before class.
- It can be done! It may seem hard, but you can do it!
- Make a friend to work with on the labs with.
- Make sure you keep up on the labs, as you will use skills from each lab on the next ones.
- Mathematica will be your best friend in the entire world if you take the time to pay attention in the labs. Also get an early start on the assignments so you can finish early and appear to know what you're doing.
- Pay attention to the details and don't rush things. Rushing it makes it easier to make mistakes and get frustrated. If you work at a steady pace you'll be less likely to make mistakes that will be hard to find later on. Also, don't be afraid to ask the TAs for help.
- Prepare yourself as well as you can for each class period. Getting as much done during class is the most productive way to complete the assignments. It's hard to focus for 3 hours, so try to let go of any other distractions from other classes, etc. so that you can focus. Then you will not have to worry about this class outside of class.
- Preview the labs.
- Talk to your neighbors if you get stuck.
- Work ahead for half an hour before the class period. That way, you can figure out as much as you can on your own and ask questions as soon as the period starts.
- Work hard
- Work quickly in class!
- Work with your classmates.

BYU Policies:

Honor Code. In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

Academic Honesty. The first injunction of the Honor Code is the call to "be honest". Students come to the university not only to improve their minds, gain knowledge, and develop skills that will assist them in their life's work, but also to build character. "President David O. McKay taught that character is the highest aim of education" (The Aims of a BYU Education, p.6). It is the purpose of the BYU Academic Honesty Policy to assist in fulfilling that aim. BYU students should seek to be totally honest in their dealings with others. They should complete their own work and be evaluated based upon that work. They should avoid academic dishonesty and misconduct in all its forms, including but not limited to plagiarism, fabrication or falsification, cheating, and other academic misconduct.

Sexual Harassment. Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education and pertains to admissions, academic and athletic programs, and university-sponsored activities. Title IX also prohibits sexual harassment of students by university employees, other students, and visitors to campus. If you encounter sexual harassment or gender-based discrimination, please talk to your professor or contact one of the following: the Title IX Coordinator at 801-422-2130; the Honor

Code Office at 801-422-2847; the Equal Employment Office at 801-422-5895; or Ethics Point at <http://www.ethicspoint.com>, or 1-888-238-1062 (24-hours).

Student Disability. Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 422-2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.