

Physics 230 – Winter 2015

Dr. John S. Colton

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Instructor Office Hours: Mainly just during class; other times available by appointment

Research Lab: U130 ESC, Phone: 422-5286

TAs: TA Information is posted to the course website.

Course Website: <http://www.physics.byu.edu/faculty/colton/courses/phy230-Winter15/>

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 system for keeping track of grades: <http://max.byu.edu>.

Class Schedule:

Lab	Section 1 Monday 2-5 pm	Section 2 Friday 12 -3 pm	Topics
1	Jan 5	Jan 9	Introduction (notebook basics, menus, documentation, syntax, applications and simple examples)
2	Jan 12	Jan 16	Functions and Lists (functions, arguments, list generation and processing, random numbers, statistics)
3	Jan 26	Jan 23	Plotting (plotting functions and lists)
4	Feb 2	Jan 30	Linear Algebra (vector and matrix operations, linear systems of equations, eigenvectors and eigenvalues)
5	Feb 9	Feb 6	Differentiation (limits, extrema, partial and higher-order derivatives, implicit differentiation, series expansions)
6	Feb 17 (Tues)	Feb 13	Integration (definite and indefinite integrals, multiple integrals, regional integrals, algorithms and options for numerical integration). Take home exam 1 due at midnight on Feb 20 and Feb 16, respectively.
7	Feb 23	Feb 20	Programming I (logic, conditional statements, piecewise functions, procedural vs functional programs, loop structures, recursive structures)
8	Mar 2	Feb 27	Programming II (scoping constructs, iterative equation solving, procedural flow control, debugging)
9	Mar 9	Mar 6	Data Processing (data import/export, text parsing and formatting, multimedia, integrated data sources)
10	Mar 16	Mar 13	Optimization (1D curve fitting, data variables vs parameters, cost functions, algorithms, uncertainties).
11	Mar 23	Mar 20	Complex Analysis (operations, unit circle, functions, calculus) Term project proposals due at midnight on Mar 23 and Mar 20, respectively. Take home exam 2 due at midnight on Mar 26 and Mar 23, respectively.
12	Mar 30	Mar 27	Project 1
13	Apr 6	Apr 3	Project 2
14	Apr 13	Apr 10	Project Show & Tell/Sample final exam problems Term project final reports due at midnight on Apr 13 and Apr 10, respectively.

Prerequisites: All students should have taken Physics 121 and 123, and be at least concurrently enrolled in Physics 220. All students should also have take Math 112 and 113, and be at least concurrently enrolled in Math 302 or 313.

Textbook: There are no textbooks or course packets to purchase. The course materials are all available online.

Learning Outcomes: This class will help you learn to formulate and solve physics problems analytically and numerically. We will use a computational software program called Mathematica, which is a powerful tool

that can be applied to a wide variety of problems.

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 computer 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 myBYU. 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/accounts>. You will also need to get the door codes for the computer labs, see that same website for how that is done.

Mathematica is also available for free download from BYU's software website, <http://software.byu.edu/>. The license is probably only good for a year, but can be renewed as long as you are a student. You may also be able to purchase a student edition of Mathematica with no expiration date that you can use after you graduate (this has been the case in the past), but I don't have the details on that.

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 if you don't have it installed on your personal computer. There are also some other useful programs installed that you can run this way. To access the remote server 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%

Laboratory assignments: All labs during the semester are weighted equally. They are designed to be a combination of tutorial exercises along with additional assignments requiring more independent thought. If you get stuck, 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. You must get a TA to pass off your lab assignments. The TA will look at your results, ask you questions about the material, and record that you have completed the assignment. 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: Most students will complete most labs during the regular lab period. However, if you do not finish a lab you can still get full credit by completing any remaining sections on your own before the start of the next lab period. If you need help you can talk to friends, see a TA or Dr Colton during the other lab section, or make arrangements to meet with a TA at a special time. Regardless, to receive full credit, the unfinished sections must be ready for passing off at the start of the next lab period. Assignments completed and passed off after this time will only count for 50% credit.

Making up labs: If you have to miss a lab period, you have two options. (1) You can attend the other lab section, assuming there is room. (2) You can work through the lab on your own (with help from friends, a TA, or Dr Colton) and then arrive the next lab period ready to pass everything off.

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 carrying out an in-depth project. You must work with one or two partners. 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 your group two full lab periods to complete, plus potentially 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, given in-class at the time scheduled by BYU.

Advice from previous students: I asked students from Fall 2012 if they had any general advice for future students. Here are some replies:

- 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.
- 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.
- 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.

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.