

Complex Variables Physics 101, Winter 2013

Web page: <http://www.physics.ucsb.edu/~phys101/>

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Office Hours: Tuesday 3:00-3:50pm and Thursday 4-4:50pm. If my scheduled office hours do not fit with your own schedule, you are welcome to contact me during class or by e-mail and we can attempt to arrange a more convenient meeting time. While you may also ask questions by e-mail, you should expect a sizeable delay (perhaps several days) in my response as my INBOX is often quite full.

Teaching Assistants: Jason Kaufman & Yinbo Shi.

Office Hours: W 2-4 (YS), Thurs 1:30-3:00 (JK), and F 2:30-3:30 (YS) in the PSR.

Summary: Physics 101 is a serious, upper division course in mathematical physics. This quarter, our focus will be primarily on complex variables and their applications, as well as transform methods, asymptotic series, and Green's functions. These are among the most elegant topics in mathematics. For example, using methods based on complex variables, many complicated problems are seen to have surprisingly simple solutions. These tools are useful for a wide range of courses as well as research in science and engineering, and we will approach these tools in a formal, mathematically rigorous manner. The biggest mistake you can make is to start the homework late and/or to not take it seriously. If you work hard on the homework and stay on top of the material, you will do well in this class.

Textbook

Mathematical Methods in the Physical Sciences, Third Edition, by Mary Boas. Please note that we will use only certain chapters and that we will study the material in a different order than what Boas presents. The weekly assignments will guide you to the relevant reading. *Please bring your textbook to your discussion section (Tuesday or Wednesday) each week, especially the first week.*

Clickers: Yes, we will be using i>Clickers in this class. Please bring them every day. Responding to i>Clicker questions will generate participation points that count toward your final grade in this class. To get the participation point for a given day, you must respond (not necessarily correctly!) to almost all of the i>Clicker questions from that day. These participation points will begin the 2nd day of class. They will be worth 3% of your final grade. The other participation points will come from homework participation (see below).

To receive clicker points, you will need to register your i>Clicker at <http://www.iclicker.com/support/registeryourclicker/> (Answer no to the Learning Management System.)

Also, be sure to set your frequency to AC each day. Hold down the power button until you see blinking. Then hit A, followed by C. If you are using an original i>Clicker (not i>Clicker2), you must do this again if you turn the clicker off during class.

Books on Reserve in the Reserve Book Room

Mathematical Methods in the Physical Sciences, Third Edition, by Mary Boas.

Mathematical Methods for Physicists, by Arfken (this book is similar to Boas, written at a slightly higher level – somewhere between an undergraduate and graduate level treatment of the material).

Complex Variables and Applications, Churchill and Brown (this book is very thorough in its treatment of complex variables, including conformal mapping).

Visual Complex Analysis, by Needham (this book includes many helpful visualizations of the spatial transformations which are an integral part of complex variables).

Handouts: Will be posted on the course website at <http://www.physics.ucsb.edu/~phys101/>. These include all homework assignments (one of which is due Friday 1/11!!). Only rarely will I actually hand out paper copies in class.

Course Work

Class Meetings: 9-9:50am MWF Broida 1640. You should also be signed up for a discussion section that meets once per week, either on Tuesday morning or Wednesday afternoon. You should attend the section for which you are enrolled. We simply do not have room to accommodate students from other sections.

Grading:

Graded Homework (see below): 10%

Participation 10% = 3% i>Clicker + 7% HW

Midterm #1 (Monday February 11, in class): 20%

Midterm #2 (Monday, March 4 in class): 20%

Final (Wed, March 20, 8-11 am): 40%

The final will cover the entire course. **Stay tuned for info on where the final will be held. Because this class is over capacity, some of you may take these exams in an alternate room.**

For each exam you will be allowed to use one (single-sided) page of notes that you bring with you (and which you must turn in with the exam). The use of books, calculators, additional notes beyond those mentioned above, or other aids will not be allowed on any exam.

Homework: Weekly homework will be assigned. It will be due at 5pm each Friday. HW is to be turned in to the Phys 101 HW box. Unless you have received a special exception from Prof. Marolf in advance, late HW will be given no more than 50% credit.

I view homework as a *learning* tool and not an *evaluation* tool. As students, your focus should be on using the homework as a guide to gaining the best possible grasp on the material and not on simply achieving a high grade. This means that you *are* encouraged to get help on any homework you find difficult, either from the professor, the TA, or your fellow students. Working in groups is a good idea and can make doing homework much more fun. However, after you have received the help you need, be sure that you work through each problem on your own in order to best understand the material. **Merely copying someone else's work constitutes plagiarism and will not be tolerated. Do not mess with me on this.** Remember also that you will be on your own during the exams.

We do not have the resources to fully grade all of the HW each week. Instead, only a selection of the HW problems will be fully graded. However, full solutions for all problems

will be posted each week on the web. I encourage you to carefully read through each solution and to ask your TA in your section meeting or in office hours if you have any question.

The HW grade will be divided into two parts, graded homework and homework participation. The first is for problems we grade fully. The other problems will contribute to your participation grade. The ungraded problems will be assigned either zero or one HW participation points each based on whether a reasonable-looking attempt was made. The particular problems to be graded will not be decided until after each HW due date.

Please note: The HW will be graded by Yinbo Shi. Please contact him directly if you have issues with the HW grading.

Course Contents

- Analytic functions, contour integration, branch cuts and contour integrals with branch cuts
- Conformal mapping
- Asymptotic Series and the Gamma Function
- Fourier Transforms
- Laplace transforms
- Green's functions