

Physics 116 Laboratory Online: Introduction to Experimental Methods II

Instructor: Jeff Steele (jsteele@randolphcollege.edu)

Course URL: <http://physics.randolphcollege.edu/online11/online116/>

The course Moodle site (available via <https://inside.randolphcollege.edu>) is the most current and up-to-date source of information for labs and any changes to the schedule. All assignments will be submitted via Moodle.

Office hours/Oral Labs/Lab meetings: <https://zoom.us/j/4122028428>

Lab section: Mondays and Thursdays 2:00-4:30 pm EDT

Office hours: Sundays and Wednesdays 7:00-8:00 pm EDT (and by appointment if necessary)

Registration Add/Drop Information

Online registration and payment **MUST** occur prior to the first class meeting. The drop period is 3 days to have the course not become a part of your student record and the withdrawal period ends on the 7th day. After this you cannot withdraw unless under medical or mitigating circumstances, which must be documented. **To drop or withdraw, email the course instructor who will forward your email to the Registrar. The date of your email will be the date used for the course drop/withdrawal.**

Payment: Once you register, you will be billed by Randolph College – the first billing may be as late as May even if you register earlier. Summer tuition for online course is \$450/credit hour and is due prior to the first day of the course. Each lecture course is 3 credit hours, and each lab is 1 credit hour. There is a \$30 lab fee per lab course. If you drop the course before the first day of either class, you get a 100% refund for that class. If you drop the course during the first week, you will be reimbursed 90% of your payment. If you drop the course sometime in the second week, you will be reimbursed 50% of your payment. Beyond the second week of a given course, you will not be reimbursed for that course if you drop it.

Lab	Topic	Meeting Date	Due Date	Lab Format
1	Introduction, Fluids & Pressure	M Week 1	Th Week 1	Informal
2	Buoyancy	Th Week 1	M Week 2	Oral
3	Harmonic Motion	M Week 2	Th Week 2	Informal
4	Waves & Sound	Th Week 2	M Week 3	Formal
5	Refraction Laser Lab	M Week 3	Th Week 3	Formal
6	Optics	Th Week 3	M Week 4	Informal

7	Ohm's Law	M Week 4	Th Week 4	Oral
8	DC Circuits	Th Week 4	M Week 5	Formal
9	Capacitors	M Week 5	Th Week 5	Informal
10	Magnetism	Th Week 5	F Week 5	Informal

Structure of the Laboratory:

This physics laboratory class will consist of pre-laboratory assignments, hands-on experiments, computer simulations, post-lab assignments, and lab reports. The website will be updated frequently throughout the class, so pay attention to any announcements that change or update specific parts of the laboratory activities. I will try to finalize most of them very early in the class so that you can work ahead if you would like.

A laboratory class supports the theory you learn in lecture. Lab experiments give you the opportunity to explore the physical concepts in greater detail, connect abstract concepts with physical phenomena, and verify the physical laws for yourself. Although most of the labs have known results, we are using real objects and not frictionless planes and point particles, so your answers may slightly differ from the expected theoretical answer. You will be expected to recognize when this happens, and make intelligent observations about why this is the case. You will also be expected to comment on how you would improve the experiment and/or the theory to find a closer match between them. Even if your answer is “correct” you should still be able to think of ways that the experiment can be improved.

Laboratory class also gives you the opportunity to practice skills that are very important to the working scientist. You will practice designing experiments, using experimental equipment, keeping a laboratory notebook, analyzing data, and presenting your work in both an oral and written form.

We will use computers extensively in this class, and as this is an online class all of our communication will be via the computer (either email or Zoom). Zoom has a lot of great features such as screen and application sharing and the ability to let someone else control your mouse and keyboard, so I will be able to help you learn how to use the software and help with your data analysis remotely.

Pre-Laboratory Assignments:

Pre-lab assignments will be due one week after the official lab session starts, the same date of the lab due date (with the exception of the compressed due dates at the end of the term). Since this is an online class it is especially important that you **read the theory section and lab procedure** before attempting the lab. The pre-lab assignments will be available on the lab website and will be submitted via Moodle. You will type your answer and a short description of your work. This has the added benefit of giving you practice at clearly and succinctly explaining scientific ideas.

Experiments and Laboratory Equipment:

You will receive laboratory kits before the beginning of class. Your kits will include most of the necessary supplies. Please email Dr. Sheldon (psheldon@randolphcollege.edu) if you have not received your lab equipment by July 4.

Some of the labs will ask you to supplement the equipment with some household objects. Examples include a camera or smartphone for taking video, coins, a ball or similar object. Everything should be readily available, and you will get your own opportunity to be an experimental physicist. Many research scientists must craft their own experimental apparatus!

Due to the online nature of this lab, some of your “experiments” will use simulations rather than physical experiments. These should be treated as seriously as the physical experiments.

Reports:

Lab reports will consist of 5 informal reports, 3 formal reports, and 2 oral presentation (via Zoom). Oral presentations will need to be scheduled in advance and completed by the due date for the lab. Each presentation will take no more than 15 minutes, and will be a dialogue between you and I. For your convenience, if you are prepared you may do multiple Oral lab presentations at the same time. With the exception of the last two labs you will have one week to submit your lab reports to Moodle. The due dates are on the lab schedule. The formal reports are noted on the schedule of labs for the semester. Formal lab reports will be written up in Word (or equivalent word processing program) using write up details found here. These reports do not need to be extensive, but should be all-inclusive and concise.

Your informal lab reports will consist of pictures or scans of the relevant pages of your lab notebook and a document with any relevant charts or graphs that you made on the computer and any pictures that you wish to include. The informal lab reports consist of a purpose, any data and analysis, results, and conclusion all written in your lab notebook. Your informal lab reports can be completed during the lab session, but I am giving you extra time to be able to scan or photograph the relevant information and upload it to Moodle. Scanners are often available in public libraries or as a feature of your household printer, but if you do not have access to a scanner, there are many free phone apps that will take pictures of documents and convert them into PDF files for you (I use one called Tiny Scanner). Because of the schedule you will often be working on two labs at once, and it is your responsibility to make sure that you do not get behind with the labs.

The oral reports are not meant to be a scary or intimidating event but a way for you to practice speaking about science. You will present to me your experiment, what you did, and what you found, and I will ask you some questions about your experiment and what you learned from it. Remember that you must schedule these meetings in advance.

Please pay attention to the due dates for the last three labs. To give you as much time as possible to work on the lab reports, these final three lab due dates are on the final weekend of class. I strongly encourage you to work diligently and even ahead for the last few reports.

The grading rubric for both informal and formal lab reports is found here. Oral reports will be graded as if they are formal labs.

Notebook:

The laboratory notebook is the scientist’s most important tool. You must have a dedicated lab notebook (do NOT also take class notes in it) that you can use to keep lab information and record data. The lab notebook must include **a bound paper notebook, from which you will not tear any pages.** This is unchanged from the lab notebook requirement for 115. There will be some

tasks that are more easily completed electronically, or even required to complete with certain software programs. In these instances you will also print out any charts or graphs that you make on the computer and tape them into your lab notebook. Your informal reports will be written *legibly* in these notebooks. While it is important that I can read what you have written, you are encouraged to write extra ideas that you think of and explore extra experiments that you do in your lab notebook. Your lab notebook can get a little bit messy, just not so much that I can't read it well enough to grade it. This is meant to be a real scientific lab notebook, so you should write anything related to the lab in it: notes, data, analysis, ideas for extensions, questions, etc. It is very important that you keep everything in chronological order and write the date and experiment on each page. Do not erase text or tear out pages. You will use this information to write your formal lab reports. I will not be physically checking your lab notebooks, but if we are meeting in office hours or in lab section I will expect you to have it and be able to show me what you have done.

Policy:

You must complete and turn in all labs. You have the option of attending Zoom lab sections and office hours, but none of them are required. If something happens that makes it impossible for you to complete the labs on time, please email me so we can discuss what can be done. How you use the live sessions is entirely up to you. You may want to attempt labs on your own first, and if you have difficulty then attend the live session to work the lab with me or attend office hours/email questions if a simple clarification is all that is needed.

Each lab will be on the web ahead of time, so you should have ample time to read, complete the pre-lab, do the experiment, complete the post-lab, and hand in the report. Formal write-ups are graded on a ten-point scale. Pre-lab and Post-Lab problems are graded on a three-point scale. Late labs will be penalized ten percent per day.

- Lab Notebooks/Informal Labs: 30%
- Formal and Oral Reports (5 @10% each): 50%
- Pre-Labs and Post-Labs: 20%

Honor Code and Responsibility

Take responsibility for your work and yourself. You are expected to complete all work by the policies outlined for the assignments, on time. Honor is of utmost importance in the academic atmosphere and is taken very seriously by me. I encourage people to work together on homework and labs, but the finished product must be your own work. I would encourage anyone to come to me with a problem that has kept you from doing your work, so that we can work something out, rather than just taking a zero, or worse yet, cheating and possibly failing the class. I will feel free to give you freedom, but then the conduct of the Honor System instituted at Randolph College is in the hands of the students.

Accommodations for Students with Disabilities

Students with disabilities needing accommodation in summer online classes at Randolph College may send any requests for accommodations and accompanying documentation to droy@randolphcollege.edu.

Students enrolled at other colleges or universities may submit current letters of accommodation from their home school. Students who are not currently receiving accommodations and would like to inquire about receiving them in summer online classes at Randolph College can send any pertinent documentation or inquiries to the Coordinator of Disability Services at the email address listed above.

List of Labs

1. Pressure
2. Buoyancy
3. Simple Harmonic Motion
4. Waves and Sound
5. Refraction
6. Geometric Optics
7. Ohm's Law
8. Circuits
9. Capacitors
10. Magnetism

Communication

I plan on using Moodle to communicate. Homework assignments and solutions, exam hints and solutions, schedule changes and guidelines (such as those listed here) will all be on the web so that you can access them anytime, and even print them out if you would like.

Link to Zoom (Office Hours): <https://zoom.us/j/4122028428>

Text: 540-425-4533