

# Physics 2225 - Physics Lab II for Scientists & Engineers

## Syllabus – Spring 2018

**Instructor/Lab Director:**

Gernot Laicher

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<http://www.physics.utah.edu/~gernot/gernot.html>

Office hours: M, W, F 11am-12pm (check Canvas and Website to verify)

**Section Teaching Assistants:**

The lab sections will be taught by assigned teaching assistants. The name, contact information and the TA office hours will be published on Canvas. The lab TA also grades the homework and lab reports.

**Office Hours During First Week of Semester:**

During the first week of the semester this class does not meet (no lab activity is performed). The office hours of the section teaching assistants are held in this first week during the first hour of the regularly scheduled lab section time in the lab room. For example, a section that normally meets from 2pm-5pm in the Physics building (building 10) room 405 will have the lab section TA present in the lab room from 2pm-3pm to answer questions about the course and assist with the first homework assignment which is due at the beginning of the first lab activity. **Exception:** Sections that normally meet from 7:30am-10:30am will have the TA present from 9:30am-10:30am.

The instructor/lab director will have office hours in the first week of the semester on M, T, W, H, F from 11am-12pm to answer questions about the course or assist with the first homework assignment.

Starting with the second week of the semester the office hours of the Instructor/Lab director will revert to those listed above. TA office hours for the remainder of the semester will be posted on Canvas. Please check the course website and/or Canvas for updated information that may still be missing in this syllabus

**Important Information for People with Disabilities**

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.

**Textbooks and Online Access:**

Students are required to purchase a laboratory manual named “Physics 2225 Physics Lab II for Scientists & Engineers Spring 2018” at the University of Utah bookstore. It is typically available in the week before the semester starts. Should the bookstore run out of lab manuals for this course, please ask a bookstore employee to order an extra copy for you. It is produced at the University Print and Copy Center and should be available within 2 days after ordering. Please get this lab manual as soon as possible. Pdf files of Introduction, Homework 1, and Lab 1 are available online (course website and on Canvas) in case manuals are temporarily unavailable. Other homework assignments and lab activities will not be provided as pdf files.

This class uses Canvas to provide online learning material relevant to the homework assignments and lab activities. Canvas also provides a convenient venue to ask questions and get answers and to look up your homework and lab report scores. Please regularly check your scores to make sure that the TA has recorded them correctly and completely. The Canvas site can be accessed through login at:

<https://go.utah.edu/cas/login?service=https%3A%2F%2Futah.instructure.com%2Flogin%2Fcas>

**Introduction :**

Physics 2225 is the second part of a two part Physics Lab for Scientists & Engineers. This class is an introductory laboratory course with topics from standing waves, sound, electricity and magnetism, as well as optics. The main topics in this course are closely related to those treated in Physics 2220. Many students take Physics 2225 in the same semester as Physics 2220 to complement the experience. Other students take it in a semester following their Physics 2220 class. Physics 2225 is a calculus based course. In this course each student has to complete several homework assignments which are intended to prepare him/her for an upcoming lab activity. While each student has to prepare this homework individually (no group homework accepted), the Lab activities (“Mini-labs”) themselves are performed in groups of 2 or 3 students. One activity (called “e/m experiment”) in this course is more self-guided and requires a special lab report in the form of a scientific paper.

In this course students will be able to measure physical quantities in a variety of experiments and compare their measurements with the laws of Newtonian mechanics thus enhancing and fortifying their understanding of Physics. In addition this course will let the student develop basic practical laboratory skills and it will foster critical thinking as well as team work, discussion, and cooperation.

The grade earned in this class is based on the scores received in the homework assignments, the mini-lab reports, and the experiment lab report written in the form of a scientific paper.

**Learning Objectives:**

In Physics 2225 the students will practically explore and verify physical relationships from topics of waves, sound, electricity and magnetism, as well as optics in three-hour lab activities done in groups of two to three students. The main learning objective is to deepen the understanding of the laws of physics, but also many practical laboratory skills are practiced in this course such as the use of basic measuring devices, estimation and propagation of uncertainty, statistical and graphical analysis, as well as basic troubleshooting of equipment should the apparatus not function as planned. In addition, the laboratory group experience allows students to exercise soft skills such as critical thinking, team work, discussion, and cooperation. The student will also plan an experimental activity and present the results in the form of a scientific paper.

The objective of the homework assignments is to refresh memory of the basic principles learned in Physics 2220 in as far as they are needed in the upcoming lab activity and to introduce the student to and have the student practice data processing techniques that will be used in the lab activities.

**Prerequisites:**

PHYS 2220 or an equivalent calculus-based introductory Physics course is required. Physics 2215 is also a pre-requisite. The Physics Lab II for Scientists & Engineers can either be taken in the same semester as Physics 2220, or it can be taken in a semester following Physics 2220. Calculus is a prerequisite for this course.

**Registering for a Lab Section:**

The number of students for each lab section is generally limited to 26 students. Many sections fill up quickly and remain full in the weeks preceding the start of the semester. Students who wish to enroll in a section that is currently full are encouraged to frequently check the enrollment numbers in that section and add the section as enrollment allows. In general one can observe a small amount of fluctuation in the enrollment near or at the start of the semester as well as during the first week of the semester.

If a student has met the prerequisites/corequisites and there are free spots in the lab section, yet the student is still not able to register, the student needs to contact Mrs. Tamara Young ([tamara@physics.utah.edu](mailto:tamara@physics.utah.edu)). She can check and make sure that the prerequisites/corequisites are met. If they are met, she will then inform the lab director who in turn can issue a permission code if a spot is still available at that time.

Starting at the end of the first week of classes permission codes are mandatory to add a section. Students who wish to register at that time will need to have checked - by Mrs Tamara Young ([tamara@physics.utah.edu](mailto:tamara@physics.utah.edu)) - whether they have met the prerequisites/corequisites for this course. If they are met, she will then then inform the lab director who can then issue a permission code if a seat is available.

**Course Content/Lab Activities:**

Standing Waves - includes a homework assignment

Sound

Working with Electronic Equipment - includes a homework assignment

Analog Circuits / Digital Circuits - includes a homework assignment

Resistors, Capacitors, and RC Circuits - includes a homework assignment

Magnetic Fields

Faraday's Law

E/m Experiment - includes an ungraded but required homework assignment

Optics I: Activities with Light Rays

Optics II: Spherical Lenses and Optical Instruments

Optics III: Physical Optics

The Spectrometer - includes a homework assignment

**FIRST Week of Classes:**

Physics 2225 will not meet during the first week of classes. However, students need to go on Canvas and watch the introductory video for this class. In this video, course policies and objectives are discussed. It is also important that students familiarize themselves with the lab webpage and with the features of Canvas. Students will also need to do homework 1 (it is due at the beginning of the first lab activity). In the first week of classes, the lab TA (if already assigned at that time) will be available during the first hour of the regularly scheduled lab time in the elementary lab area (for any 7:30am class the TA will be there from 9:30am-10:30am). In addition, the lab director will have office hours.

**Canvas Course Material:**

Most course material on the Canvas site can be found by clicking on “Modules”. There is an organizational module listing contact information etc., a course introduction module containing an initial video and other material that summarizes and clarifies how the course is conducted and what to expect from it. Finally, there is a module for each homework and for each lab activity. Each lab activity module contains at least an introductory video that summarizes the lab activity. Students are expected to watch these videos before coming to the lab activity. Other material or additional videos are provided as needed by each lab activity. The homework modules may contain links to internet based resources, they may also contain hints regarding the homework or instructional videos that provide homework help.

The Canvas serves several purposes:

1. Provides an introductory video and supplemental guidance for each lab activity.
2. Provides homework help material.
3. Contains student scores which are accessible for each student, allowing the student to double check recorded scores.
4. Allows one-on-one communication between students and teachers.
5. Allows discussions among all students and teachers in an online format.

**LAB STRUCTURE:**

In preparation for an upcoming lab activity, you are expected to do the following at home:

1. Do any homework that is due for this lab.
2. Watch any introductory videos provided for this lab on Canvas.
3. Familiarize yourself with the scope of the Physics subjects by reading through the upcoming lab activity.
4. If necessary, refresh your knowledge of the relevant Physics topics by reading/studying a suitable Physics textbook.
5. Contact your TA (or any other TA teaching another section of the same course) by e-mail or during office hours regarding questions on how to do the homework or about

questions regarding the Physics subject matter.

The lab activities are structured as follows:

1. At the beginning of the lab session any homework associated with the current lab must be submitted. Each student must submit his/her own homework.
2. There will be a short discussion at the start of every lab session. Be sure to be on time, because this discussion will be vital to your ability to complete the lab.
3. The lab work will follow the initial discussion and will be performed in groups of two or three students. All group members are expected to participate in performing the lab activity, recording data, evaluating data, discussing findings, and writing of the lab report.
4. The lab TA will be available to answer questions and help you during equipment trouble or if a lab instruction is unclear. Please note that TAs are instructed to not simply provide direct answers to all of your questions in which your critical thinking skills are demanded. Instead they are instructed to try to guide your thought process into the right direction. You will ultimately still have to find the answer yourself.
5. At the end of the mini-lab session a lab write-up must be submitted by each group. The names of the participating students must be written on this lab write-up. The lab write-up for the most part consists of the relevant pages in the lab manual with the grey shaded answer fields filled out during the course of the activity. Additional material should be included as requested in the lab instructions (plots, screenshots of computer etc.).
6. In the later part of the semester there is one “Experiment” which is more self-guided than the so-called “Minilabs” and requires that the students design the “Experiment”. This “Experiments” will still be performed in groups. However, the lab reports will be produced individually and in the form of a scientific paper. These papers are due 1 week after the completion of the experiment.

#### **ATTENDING OTHER SECTIONS:**

You must do your lab in the section for which you are registered. In general, you may not attend other sections. Exceptions are only granted by the lab director in severe circumstances (see also the section on “MISSING A LAB...” below).

#### **MISSING A LAB OR HOMEWORK / MAKING UP A MISSED LAB OR MISSED HOMEWORK**

Due to the large number of students and sections, we usually address missed lab issues as follows:

1. At the end of the semester, there will be a lab session for which we have not scheduled any regular lab activity. If you have missed lab activities during the preceding weeks, you will be allowed to **make up one of these missed lab activities**.

2. We **drop the lowest score of the mini-lab write-ups**. This may be a mini-lab score that happens to be zero because the mini-lab was missed, or a mini-lab score that was done but produced the lowest score. If the lowest score of the mini-labs is higher than the experiment lab report, then all minilabs are counted and the score from the experiment lab report is disregarded instead. **IMPORTANT:** The maximum possible score in this class is 290 points - based on 5 homework assignments (=50pts total), the 10 best of the 11 minilabs (=200 pts total) and 1 experiment (=40 points). In cases in which the experiment score is disregarded because it is lower than the lowest minilab score it is still assumed that the maximum of possible points is 290 points. This means that a student who had 5 perfect homework and 11 perfect minilab scores but missed the experiment can only get  $50+220=270$  points, which is 93.1% of the possible points. Thus, it is very important not to miss the experiment.
3. Labs which were missed due to participation in **University-sponsored activities** (e.g., if you are a member of a University athletic team and had to be at a competition during your lab time) can all be made up. Please contact the lab director in such circumstances and provide him with advance notice (at least 1 week in advance) of your absence so that proper arrangements for making up the missed lab can be made.
4. **Severe circumstances:** If you feel that severe circumstances are causing you to miss more than two lab activities, you may contact the lab director. He will hear your case, discuss your options, and may grant permission to make up more than one missed lab.
5. **Homework cannot be made up at the end of the semester.**
6. If you participate in a lab activity, the homework is due at the beginning of that lab activity. You will not be able to submit it at a later point.
7. If you miss a lab, you have **two options on how to deal with the missed homework:**
  - a) Submit the homework early to your TA if you know in advance that you will miss the lab.
  - b) Submit the homework as quickly as possible, but no later than 1 week late to your TA if you miss a lab but didn't know in advance about it (e.g., you overslept or your car broke down on the way to the University).

In either case, please make sure you e-mail to your TA that you want to submit this homework to his/her mailbox. Then drop it into the TA's mailbox, after having it dated and signed by the Physics Department Secretary. **Do not submit your homework/lab reports to the Lab Director's mailbox. Get it to your TA.** All TA's maintain mailboxes in the vicinity of room 201 JFB (North Physics). If you cannot find a mailbox, please ask the secretary for help.

**DUE DATES:**

- Homework: If a homework is due for a particular lab activity, it is due before that lab activity is started. Each individual must turn in their own homework.
- Mini-Labs: Due at the end of the lab period. Each group only turns in one lab write-up. Make sure both names are written on the lab write-up.
- Experiment: Due one week after completion of the experiment. Each individual must write his/her own lab report in the form of a scientific paper.

**GRADING:**

Physics 2225 is a graded one credit hour course. Grades of A, B, C, D, and E will be assigned on the basis of your performance in the course.

Homework is graded on a scale of 0-10 points by the TA.

Mini-Lab write-ups are graded on a scale of 0-20 points by the TA.

The experiment lab report is graded on a scale of 0-40 points by the TA. Note that for each day the experimental lab report is late, there is a 5% deduction from the achieved score. For example, a lab report which is 3 days late and would have received 34 points will score only 85% of 34 points (28.9 points).

There are no quizzes, midterm exams, or final exams. Therefore, your grade will depend solely on your homework, mini-lab write-up, and experiment lab report grades.

Each homework counts towards the final grade. As far as the mini-lab reports are concerned, the lowest score of them will be dropped and do not count (alternatively, the lowest of the two experiment lab reports is dropped if it is lower than the sum of the two lowest mini-lab grades).

The final grade you receive is determined by the lab director at the end of the semester. The lab director determines your final grade using a method that takes into account the average score in all the sections taught by your TA. This method ensures that you are not favored or punished by an excessively lenient or harsh TA.

**PROCEDURE FOR DISPUTING A RECEIVED GRADE:**

Any grievances about received grades in homework or lab write-ups should initially be addressed to your TA. Please explain to the TA in detail where and why you disagree with his/her grading and submit the assignment in question to your TA for a re-grade. In cases in which you and the TA are not able to resolve the dispute about the grading, you may contact the lab director for further advice. The lab director will make a final decision on the case after consulting both the TA and the student about the matter. The lab director may request that both the TA and the student meet with him in his office to discuss the issue.

Complaints about the final grade received in the class should be addressed directly to the lab director.

**IMPROPER CONDUCT:**

Improper conduct may result in zero or reduced credit for a homework or lab write-up and may result in a failing grade for the class.

Improper conduct includes, but is not limited to:

1. Copying results of lab activities from other groups and submitting them as your own.
2. Copying results of homework from others and submitting it as your own.
3. Fabricating data.
4. Deliberate destruction of laboratory equipment.
5. Stealing laboratory equipment.
6. Deliberate activities that impair the operation of the computers (e.g., deliberate installation of computer viruses/worms, etc.).
7. Not following safety advice.

To clarify, the following behavior is **not considered improper**:

1. Working on homework together with another student - as long as both students are gaining a full understanding of the results and are both contributing to the results. Nevertheless, each student must still submit a separate homework to the TA.
2. Asking another group in the lab: "How did you do that?" However, after you have gained such knowledge from another group, please return to your lab setup and do this activity yourself.
3. Accidental destruction of equipment. Please notify your TA immediately so that we can replace the destroyed or malfunctioning equipment for you and those in the following groups.

**Laboratory Safety:**

Eating and drinking in the laboratory is not allowed. While we generally do not use severely toxic chemicals in this lab, it is always good practice to refrain from consuming food and beverages in a laboratory environment. You never know what materials have been handled in a lab prior to your use. This is for your own health and safety as well as for the protection of equipment that can be damaged by spilled fluid and such. If you need to eat or drink something, please go to the bathroom, wash your hands thoroughly, and then consume your beverage outside of the lab room in an appropriate venue.

Follow all safety instructions provided in the manual and/or on Canvas. Closed shoes are recommended.

**Final Lab Grade:**

Initially, the lab director will determine two grades for each student, based on two methods:

**a) An “absolute scale”.**

The “absolute %” is determined by dividing your final score by the maximum possible score.

**b) A relative scale (“curve”).**

The “relative %” is determined by dividing your final score by the class average of your TAs sections. All equivalent sections taught by your TA will be averaged together.

Equivalent sections are, for example two 2225 sections. Not equivalent sections would be a 2225 section and a 2215 section. The class averages will not include people that achieve less than 50% of the maximum possible number of points because these are typically students who have dropped out during the semester.

Your final grade will be **the better one of these two grades.**

<b>Absolute Scale</b>		<b>Relative Scale</b>	
<b>93% or more</b>	<b>A</b>	<b>101% or more</b>	<b>A</b>
<b>90 - 92%</b>	<b>A-</b>	<b>96 - 100%</b>	<b>A-</b>
<b>85 - 89%</b>	<b>B+</b>	<b>91 - 95%</b>	<b>B+</b>
<b>80 - 84%</b>	<b>B</b>	<b>86 - 90%</b>	<b>B</b>
<b>75 - 79%</b>	<b>B-</b>	<b>81 - 85%</b>	<b>B-</b>
<b>70 - 74%</b>	<b>C+</b>	<b>76 - 80%</b>	<b>C+</b>
<b>65 - 69%</b>	<b>C</b>	<b>71 - 75%</b>	<b>C</b>
<b>60 - 64%</b>	<b>C-</b>	<b>66 - 70%</b>	<b>C-</b>
<b>55 - 59%</b>	<b>D+</b>	<b>61 - 65%</b>	<b>D+</b>
<b>50 - 54%</b>	<b>D</b>	<b>56 - 60%</b>	<b>D</b>
<b>45 - 49%</b>	<b>D-</b>	<b>51 - 55%</b>	<b>D-</b>
<b>0 - 44%</b>	<b>E</b>	<b>0 - 50%</b>	<b>E</b>

**All numbers are rounded up or down to the nearest integer**

(example: 69.5% --> 70% ..... 69.4% --> 69%)

**Example:**

A student achieves 247 of a possible 330 points. This is equivalent to (absolute)  $247/330 = 74.8\%$ , which rounds to 75%. The absolute scale will result in a **B-** for this student.

However, the class average of the TA was 265 points. Therefore, the relative % of the same student is  $247/265 = 93.2\%$ , which rounds to 93%. The relative scale will result in a **B+** for that student.

The student will receive a final grade of **B+**.