Physics & Astronomy 224 – Fundamentals of Physics II Lab – S
Spring Semester 2022 – 1 Credit Hour
Online Learning

Instructor

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Video Conference: by Zoom or Blackboard Collaborate on request

This class is entirely online. Your work will be at your own pace whenever you want to do it since there are no scheduled class times. However the course has weekly assignments which are required. See the sections below about how to begin your class.

University email is preferable to a phone call or a message through Blackboard, and will provide you with a written response you can save. Please identify the course you are taking in the subject line with "224-50" if the mail is about this class. Video conferences in my "virtual office" are available too, through the Zoom or Blackboard's Collaborate conferencing systems if you have a microphone and webcam on your desktop computer, an Android cellphone or an iPhone. Please send an email first to set up an appointment and for connection instructions. There is a discussion forum on class website where questions that others may have could be asked.

The physics lab class has a teaching assistant who helps me with grading and who will also will help you if you need assistance with the activities. When the contact information for your assistant is available it will be added to the Blackboard site as well.

Objectives

Physics is the foundation of the sciences that enable us to understand the universe on the largest and smallest scales, from the beginning of time to its uncertain future. It is also the practical basis of contemporary technology, engineering, medicine, and biology.

In this lab, the second of a two-semester sequence on the fundamental concepts and methods of physics, we will explore how physics works, learn the necessary math concepts to use it, and apply it to electricity, magnetism, light, quantum mechanics and relativity through laboratory experiments, simulations, and analysis of real data.

The objective of this course is to provide experience with how physics determines what we can observe, provides the tools to enable improving our understanding of nature, and in turn limits what is observable, measurable, and possibly even knowable. The lab activities, even while virtual and online, will incorporate physics into your critical thinking skills, and develop your ability to understand and solve problems using the fundamental concepts of physics and a reasoned approach that seeks simplification leading to quantitative and intuitive understanding of how nature behaves. This is a pre-professional course and is one of two semesters that together cover much of "classical physics" experiments. We will not

ignore the really interesting new developments though, where it is possible with our resources we will engage the most current aspects of scientific exploration. Our goals are to

- Help you understand (and cope with) physics encountered in everyday life: LED light bulbs, microwave ovens, and car parts.
- Provide a basis for understanding the latest developments about science you will hear in the news: colliding blackholes, global warming.
- Apply physics principles to astronomy, geology, biology, chemistry, medicine, engineering, music, and yes, to cats.
- Recognize that while physics does not explain everything, it does predict observable effects through sometimes intangible, invisible, and not fully understood processes.
- Present you with mysteries not yet solved, perhaps so that you may solve them in the future and win a Nobel Prize giving due credit to your physics class.
- Teach physics that you may apply to make life better for yourself and others now, and in the future.
- Open your mind to new discovery by knowing that the world should be understandable.

Cardinal Core Outcomes and Assessments

Natural Sciences are concerned with understanding the laws of nature and the physical world. Students who satisfy the Cardinal Core requirement for Natural Sciences will be able to do all of the following:

1. Demonstrate an understanding of the nature and methods of science inquiry.
2. Apply scientific principles: to interpret evidence, to make predictions, and/or to explain cross-cutting concepts in one or more of the sciences.
3. Explain how scientific principles relate to issues of personal and/or societal importance.
4. Communicate effectively an understanding of scientific concepts and experimental outcomes in speech or writing, using sound scientific terminology and citation appropriate to the discipline.

In this course these outcomes will be assessed through weekly assigned activities or experiments. A monitored online forum for class discussion of topics posed both by students and by the instructor will encourage students to develop their knowledge, deeper understanding of the science, and the skills to communicate effectively with others.

Outcome 1

Demonstrate an understanding of the nature and methods of science inquiry.

The course covers how we have come to understand the entire universe through physics and emphasized in the first semester the physics of motion, energy, gravity, heat, thermodynamics and sound. This embodied many of the elements that begin even before written history but continue to this day especially in applications as a basis for atmospheric science, energy generation and Earth's energy balance, space exploration, mechanical and civil engineering, bio-mechanics, and bio-medical devices. This second semester continues with electricity, magnetism, optics, relativity and quantum phenomena. Understanding the roles of individual scientists and their contemporaries, the methods enabling their discoveries, how their knowledge was communicated, and the current process of scientific enterprise, is incorporated into the classes weekly assignments. Additionally, communication skills are refined by the thoughtful questions posed to others in the class that encourage and engage one another in collaborative decisions on how the experiments are done and how data are analyzed.

Outcome 2

Apply scientific principles: to interpret evidence, to make predictions, and/or to explain cross-cutting concepts in one or more of the sciences.

While physics is based on observation and measurement, the analysis of the observations leads to a broader understanding of the fundamental natural laws that simplify the apparent complexity of the natural world. This is the essence of experimental science and the the basis for having a laboratory class such as this one. The emphasis in this course is on understanding what those facts tell us about the universe, how we come to those conclusions, and what the uncertainties are in that process. These fundamental ideas of physics unify our understanding of the current state of the universe, and allow us to predict or model its future. Examples will span from our everyday experiences to those we can only imagine.

Outcome 3

Explain how scientific principles relate to issues of personal and/or societal importance.

The role of science in modern society is a topic that recurs throughout this class, especially in the context of technology that depends on physics. Contemporary physics uses all the tools at its disposal, including those developed by physics itself. We look at how things work with their dependence on the principles of mechanics, electricity, magnetism, thermodynamics, quantum mechanics and relativity. We may also explore topics of immediate pressing concern as experiments themselves. Examples could be drawn from the measurement and modeling of pandemics, the Earth's global temperature rise, near Earth objects in our solar system, or the Sun's ultimate aging and demise.

Outcome 4

Communicate effectively an understanding of scientific concepts and experimental outcomes in speech or writing, using sound scientific terminology and citation appropriate to the discipline.

There are required written responses to your work with the lab activities. The topics for these questions are explored in a discussion forum for the class that invites participation by

everyone, so that skills to communicate scientific concepts develop during the course when students explain those concepts to one another, and pose questions to their peers. The forum is mentored, and the written responses through submitted reports become part of the class grade.

Requirements

The class website will guide you through experiments or observations on different weekly topics over the semester, and will pose specific questions to answer. While you may work on these on- or off-line, your responses will be entered online interactively on Blackboard and will be graded. We reserve the right not to accept work that is late, but please let us know when you need extra time.

While you study, you are expected to use the discussion forum Blackboard with other students in the same way that you would work with one another for any class. This is a very important part of the class and we monitor the forum to see where you are having difficulty. We encourage collaboration and peer instruction because our goal is to have you participate in the activities to gain an understanding of the science, and learn by whatever means you find most helpful, but of course you must do your own work. We will try to resolve questions you may have for the class as a whole through the discussion forum whenever we can, and to respond to email individually as needed.

Use the discussion forum, take your time to understand, ask questions when you need help, and remember the objective is to learn how to observe, reason, and use your growing knowledge and skill to solve problems. Individual and group assistance through email, video conferencing, or telephone is available on request.

Blackboard

The University's Blackboard system is the University's gateway to Distance Education programs:

https://blackboard.louisville.edu/

Use your University *User ID* and *Password* to log into Blackboard.

Start Here provides guidance the first time and will help if you are new to online classes.

Announcements are updated at least weekly with the topic and any new instructions. These are also sent to you by email.

Assignments is where you submit your work for the week by answering the questions asked there. It is due before Monday midnight of the following week.

Content has the link to our class web server. It is different from Blackboard and requires its own password (see below).

Tools is a link provided by the University to many different features of Blackboard and its commercial partners. If we need these (for example Collaborate Ultra) we will also link to them from Content. This tab is overflowing with options, most of which you do not need.

My Grades will be updated with recent work when it is evaluated. Your course grade is the average all labs. You must participate in the class content before answering the questions that determine your score, and also contribute to discussions about the work. Be sure to stay active in the class by participating in the class website and submitting your work on time for assessment weekly.

Help will take you to Blackboard support. Please note that this does not provide help with our class website which we run ourselves. If you need help with it, send an email and we will work with you individually.

Class website

Content for this course is provided through our server at

https://prancer.physics.louisville.edu/moodle

which you may bookmark for direct access during the week, or click on the link in Blackboard for the course under Content.

This resource requires a login with a user ID and password. We create these accounts for you using your U of L ID (something like "ablast01") which you use for access to university online resources. The list we use is based on Blackboard enrollment and it may lag your enrollment in the class by a day after Friday, January 7. You may send an email to remind us if the following does not work.

When you go to the class site the first time you will be asked to enter a user name and password. For the name use your U of L ID (in the form "ablast01") For the password use the one we will provide on the Announcements page, and also on the Content link, of your Blackboard class. Once you do this the first time, the server will request that you enter a new password. You may then select your own. You may also edit your personal information on the server if you want to share it with others in the class. The next time you connect you will need to use the password you created. We advise not to use the same password you have on other university accounts for your own protection. Should you forget or need to change your password we will provide another one for you if you request one by email. This server does not store grades, but it provides records for us of your participation in the class, and we use it for the discussion forum for the course too.

If you are also taking another online Physics & Astronomy class this semester you will only need to create a new password once. Once you log in, our site will offer the classes to you that we know you are taking.

Textbook

While the content you need will be provided online through Blackboard, for additional help the recommended reference for the course is the same one used for our online sections of Physics & Astronomy 221-222.

College Physics, Open College, 2016

It is made available under the auspices of Rice University and other donors **for free** online at

https://openstax.org/details/books/college-physics

Click "Download a PDF" or links on the class website or Blackboard. It is also available in a high quality paper copy through Amazon. This is a comprehensive general college physics textbook that uses algebra.

In many cases, simply by using Google and looking for an appropriate entry in the Wikipedia you can find an answer to basic physics questions, and links to examples and videos that will add to what we offer in selected links on the class website.

Information on useful software and other materials will be provided online. No matter what kind of computer you use, there will be tools available for you. Because the class is entirely online, you will need Internet access and would benefit from a laptop or desktop computer for working with the content, developing answer to questions raised in the labs, and responding to the assignments on Blackboard.

Evaluation and Grading

While you will receive email reminders, the course is self-paced. You should plan to complete one experiment each week, and to respond to the weekly lab assignment about that experiment on Blackboard. You may do the work at any time during the week, and you may return to Blackboard's Assignment section to modify your answers until it is finally submitted for our review. Weekly work is always due by Monday midnight of the following week.

Although the initial scoring of most questions is done in part automatically, there are some that require you to write an answer which we will read and evaluate. Consequently, there will be a delay after you submit your work before we can provide an assessment. If we see an issue about what you have submitted, we may advise changes that would improve your score. Our purpose is to help you learn and understand by observation and reason, not to hear an echo of a precisely "correct" textbook answer. You will have an opportunity during the week after the score is posted to submit a revision. Current assignments and those which remain open for followup work will appear on Blackboard under "Assignments".

This is very important – to complete the course and receive a passing grade, you must participate in the online course content weekly, participate in the discussion forum, and submit your work on Blackboard's Assignments for our assessment. Given that, we will average all of your work and final course letter grades are approximately A (90 to 100); B (80 to 89); C (70 to 79); and D (60 to 69). We use +/- grades within 2 points of the cuts for the letter grades. For example, 85 would be "B", while 82 would be "B-" and 88 would be "B+".

Caveats

We reserve the right to make changes in the syllabus when necessary to meet learning objectives, when new physics related discoveries occur, or when there is a technical or software issue that requires a change in content or methodology. Any changes will be announced by email and posted in the current online syllabus and schedule.

Title IX/Clery Act Notification

Sexual misconduct (including sexual harassment, sexual assault, and any other non-consensual behavior of a sexual nature) and sex discrimination violate University policies. Students experiencing such behavior may obtain confidential support from the PEACC Program (502.852.2663), Counseling Center (502.852.6585), and Campus Health Services (502.852.6479). To report sexual misconduct or sex discrimination, contact the Dean of Students (502-852-5787) or University of Louisville Police (502.852.6111).

Disclosure to University faculty or instructors of sexual misconduct, domestic violence, dating violence, or sex discrimination occurring on campus, in a University-sponsored program, or involving a campus visitor or University student or employee (whether current or former) is not confidential under Title IX. Faculty and instructors must forward such reports, including names and circumstances, to the University's Title IX officer.

For more information, see the Sexual Misconduct Guide.

https://louisville.edu/hr/employeerelations/sexual-misconduct-brochure

Syllabus version of January 4, 2022

What to do Weekly

- Each Monday begins a new activity for that week with content on the class website.
- Connect to Blackboard and follow the content link to the weekly activity.
- Read the instructions and content on line, work through it at your own pace.
- Ask and answer questions on the discussion forum.
- Before end of day the following Sunday, complete the "Assignment" by responding to the item on Blackboard for that week.

Schedule and Content

The primary content is on-line, linked from Blackboard entries. Follow the "What to do weekly" guide above, and check there first for the new material. The topical list here is our current plan for the semester.

10 January - 16 January Newton's physics and gravitational fields and potentials

17 January - 23 January Coulomb's law

24 January - 30 January Electrostatic fields and potentials

31 January - 6 February Ohm's law

7 February - 13 February Ampere's force law

14 February - 20 February Earth's magnetic field

21 February - 27 February Charge to mass ratio of the electron

28 February - 6 March Light, lenses and vision

7 March - 13 March Interference and diffraction of waves and light

14 March - 20 March Spring break

21 March - 27 March Telescopes and light detection

28 March - 3 April Optical spectra from atoms, molecules, and blackbodies

4 April - 10 April Radioactive decay

11 April - 17 April Relativity through time dilation and cosmic rays

18 April - 24 April Photoelecric effect

25 April Last day of classes
All course work is due today
The course does not have a comprehensive final