PHYSICS 0111: Introduction to Physics 2

Fall 2021

Lecture: Mon/Wed/Fri 1:00-1:50PM, 343 Alumni Hall

Recitation: As scheduled, with TA

Instructor and Office Hour Information:

Instructor: Dr. Melanie L. Good
Office Hour: Thursdays 11:00AM-12:00PM, 321 Allen Hall (Conference Room)
Virtual Office Hour: Wednesdays 8:30-9:30PM, `https://pitt.zoom.us/j/99273627245`, or by appointment

Prerequisites: PHYS 0110 or 0174 or 0475; MIN GRAD: 'C' for all listed Courses

Textbook: *College Physics* OpenStax `https://openstax.org/details/college-physics`

Other materials: Scientific calculator, face mask

COVID-19 Information: By University policy, during the first two weeks of classes, a remote option must be made available, after which time, all classes are to be held in person. Students are also given the option to attend in person or remotely, so while all classes will meet in person, as per University guidance, during the first two weeks, you are welcome to attend remotely via Zoom `https://pitt.zoom.us/j/91030110960`. As of the time of this writing, starting on Monday, September 13, you will be expected to attend class in person. However, certain safeguards against COVID-19 are also mandated during all in-person classes. **Face masks must be worn at all times during class, regardless of vaccination status. You will be asked to leave if you are not wearing a well-fitting mask properly, covering your mouth and your nose.** Your professor is vaccinated against COVID-19 and will be wearing a mask, but she has small children who are too young to be vaccinated at the time of this writing, and, so she will have zero tolerance for anyone endangering her children indirectly through a lack of compliance with any of the health and safety policies of the University. Refusal to properly wear a mask or to leave the room if you refuse to properly wear a mask will result in a University Health and Safety Conduct Referral. **Class will not be conducted if anyone present refuses to properly wear a mask.**

If you have any symptoms of COVID-19, please do not come to class. Your absence will be excused. In the meantime, promptly contact Student Health Service (SHS) at 412-383-1800 for further advice. If you have had any exposure to someone with COVID-19, you may need to isolate. Please inform your instructor if this is the case.

If you have not been vaccinated for COVID-19, your professor urges you to please consider getting vaccinated. For further information on COVID-19, vaccinations, University policy, and to learn about any important COVID-19 updates, please visit `https://www.coronavirus.pitt.edu`. You are responsible for knowing about any updates or revisions to University policy regarding COVID-19.

Should the University change its policy regarding in-person instruction, a revised syllabus will be created and shared as promptly as possible. Most aspects of the course were designed with this contingency in mind, so it is unlikely that there will be major changes to the material or assessments. However, the method of delivery and other class policy changes may be revised, if necessary, should we be required to move away from in-person instruction.

Email and Canvas Announcements and Messaging: The main means of communication from your professor will be through Canvas Announcements. You are responsible for assuring that you receive all pertinent Announcements given through Canvas. Please be sure your Canvas notifications are set in such a way to alert you to the fact that an Announcement has been made. Questions that have already been answered in an Announcement may not receive a response. ***Please follow this order of communication***: If you have questions for your professor that are not covered in the Syllabus, FAQ, or recent Announcements, you should ask them in class and/or during office hours. If this cannot be done, you should direct your question to the TA, either during recitation, TA office hours, or via email with your TA. If this fails to resolve the question, then you can reach our to your professor via email at **mlgood@pitt.edu**, including the response you received from your TA in your email. Following this order of communication helps you most efficiently receive an answer to your question and avoids email backlogs which can slow down response time. Only email that includes a previous TA response or reference to an earlier conversation with the professor or TA about the matter can be expected to elicit a response.

Videos and Social Media: Video recordings of past and/or current lectures may be made accessible to you to enhance the learning process, and allow you to review previous material. Please discuss any concerns you may have regarding privacy and the sharing of recorded lectures with your professor. Recordings should not be edited, shared, taken out of context, or otherwise misused on social media or other outlets.

In an ever-connected world, it is important to maintain boundaries between personal social media and academic/professional life. Unfortunately, this has not always been the experience of your professor, and you may come across a satirical social media post from a personal account that was made years ago. At the time, this post was shared with less than 5 people, and meant purely as self-depricating satire to amuse close family and friends; however, it was discovered and misinterpreted by some students. The post was immediately deleted and student concerns were promptly addressed. Yet, each semester, this post resurfaces and is misinterpreted once more. To avoid misinterpretation that could lead to unpleasant feelings, please let this serve as pre-emptive clarification that, should you find this long-deleted post, it was meant as satire and that, in all seriousness, your professor considers herself an ally in your learning. No priority is higher to your professor than the education of her students.

Course Description: This is the second term in a two-term lecture-demonstration sequence that presents the elements of both classical and modern physics. The emphasis of the course is on a clear understanding of the underlying principles rather than on mathematical formalism and problem-solving (although some attention is given to these aspects of physics). This course is appropriate for non-science majors, and for those majoring in the social, psychological and life sciences that do not need the more mathematically oriented course required of engineering and physical science students (Physics 0174,0175). The introductory laboratory course to be associated with this sequence is Physics 0212 (see below). Credit will not be given for both this sequence and the Physics 0174, 0175 sequence. Subjects covered in the course include: thermodynamics; electricity and magnetism (electrostatics to electromagnetic waves); geometrical and physical optics; relativity; and quantum physics.

Honor Code:

Students are expected to uphold the University's standard of conduct relating to academic honesty. Students assume full responsibility for the content and integrity of the academic work they submit.

Students shall be guilty of violating the honor code if they:

1. represent the work of others as their own
2. use or obtain unauthorized assistance in any academic work
3. give unauthorized assistance to other students
4. modify, without instructor approval, an examination, paper, record, or report for the purpose of obtaining additional credit

5. misrepresent the content of submitted work

Any student violating the honor code is subject to receive a failing grade for the course and will be reported to the Vice President of Academic Affairs.

Course Objectives:

The department has clearly-defined Learning Objectives for the course, listed at the end of the syllabus, and also available online: https://www.physicsandastronomy.pitt.edu/sites/default/files/PHYS_0111_LearningObjectives_2017.pdf :

PHYS 0111 Learning Objectives

Module 1. You should be able to: mathematically describe molecular diffusion; apply the ideal gas model to find pressure, temperature, volume, or number of moles; find the average molecular speed for a gas at a known temperature.

Module 2. You should be able to: identify a thermodynamic system; calculate the work done by an ideal gas during various thermal processes; understand the relation between heat and work; apply the first law of thermodynamics; calculate the efficiency of heat engines; apply the second law of thermodynamics in the context of heat engines.

Module 3. You should be able to: explain the microscopic origin of charge; distinguish conductors from insulators; apply conservation of charge; calculate the mutual force between two stationary charges; visualize an electric field from a stationary charge distribution with field lines; calculate the net electric field from multiple point charges; apply the relation between electric force and field.

Module 4. You should be able to: calculate the work needed to assemble a set of charges; apply the concept of electric potential energy; calculate the electric potential from a set of point charges; qualitatively apply the concept of capacitance; calculate the capacitance of a parallel-plate capacitor; calculate energy in an electric field.

Module 5. You should be able to: understand the microscopic origin of current; read a current-voltage characteristic; calculate the resistance of a conductor; calculate the equivalent resistance of multiple resistors either in series or in parallel; explain electromotive force; find currents in circuits of batteries and resistors; calculate electric power; calculate the equivalent capacitance of multiple capacitors either in series or in parallel; mathematically describe the charging and discharging of a capacitor.

Module 6. Upon mastering this material, you should be able to: describe the interaction between permanent magnets; visualize magnetic field with field lines; calculate the magnetic force on a moving charge; calculate the magnetic force on a wire; explain the fundamental differences between electric force and magnetic force; calculate the torque developed by an electric motor; calculate the mutual force between two long current-carrying wires.

Module 7. You should be able to: calculate the flux of a magnetic field; explain electromagnetic induction; calculate the induced electromotive force due to a changing magnetic flux; apply Lenz's law for sense of current; describe the operation of an electric generator; calculate the self-inductance of a solenoid; calculate energy in a magnetic field; predict the voltage or current at either end of a transformer.

Module 8. You should be able to: mathematically describe an oscillating voltage and derive root-mean-square power; explain electric-mechanical analogies; describe the oscillation of charges in an inductor-capacitor circuit; describe a resonance process; calculate the resonant frequency of an inductor-capacitor circuit.

Module 9. You should be able to: explain the fundamentals of Maxwell's unified theory of electromagnetism; describe the generation of an electromagnetic wave in empty space; relate the speed of an electromagnetic wave with its properties; calculate the intensity of a traveling electromagnetic wave; describe the process of polarization; calculate the effect of polarizing sheets on a traveling electromagnetic wave.

Module 10. You should be able to: explain the behavior of an electromagnetic wave at an interface between materials; correctly use basic geometric optics jargon (rays, fronts); apply the law of reflection; find the image formed by a plane mirror; find the object, distance, or focus of a spherical mirror; explain limitations of spherical mirrors.

Module 11. You should be able to: relate the index of refraction with the speed of an electromagnetic wave; qualitatively apply the concept of critical angle; explain total internal reflection; find different color paths in the case of dispersion; find the object, distance, or focus of a converging lens; find the object, distance, or focus of a diverging lens; qualitatively explain imaging by the human eye.

Module 12. Upon mastering this material, you should be able to: mathematically describe a traveling electromagnetic wave; apply the conditions for interference of two electromagnetic waves; explain the interference pattern produced by a double slit; explain the diffraction of light past an opening; calculate the size of the central bright fringe for a diffraction pattern; apply Rayleigh's criterion of resolution.

Module 13. You should be able to: explain the evidence for particle-like behavior of light; explain the evidence for wave-like behavior of particles; calculate the de Broglie wavelength of a particle; describe photoelectric effect; explain Einstein's hypothesis about quanta; find metal work function or maximum kinetic energy of emitted electrons in photoelectric effect.

Course Topics:

- Module 1: The Ideal Gas Law and Kinetic Theory
- Module 2: Thermodynamics
- Module 3: Electric Forces and Electric Fields
- Module 4: Electric Potential Energy and the Electric Potential
- Module 5: Electric Circuits
- Module 6: Magnetic Forces and Magnet Fields
- Module 7: Electromagnetic Induction
- Module 8: Alternating Current Circuits
- Module 9: Electromagnetic Waves
- Module 10: The Reflection of Light: Mirrors
- Module 11: The Refraction of Light: Lenses and Optical Instruments
- Module 12: Interference and the Wave Nature of Light
- Module 13: Particles and Waves (time permitting)

Tentative Schedule (subject to change, as needed):

Wk	Mon	Wed	Fri
1			27 (Syllabus and Module 1)
2	30 (Module 1)	Sept 1 (Module 1)	3 (Module 2)
3	6 (Labor Day)	8 (Module 2)	10 (Module 3)
4	13 (No Class)	15 (Module 3)	17 (Module 3)
5	20 (Module 4)	22 (Module 4)	24 (Module 4)
6	27 **Midterm 1**	29 (Module 5)	Oct 1 (Module 5)
7	4 (Module 5)	6 (Module 6)	8 (Module 6)
8	11 (Module 6)	13 (Module 7)	15 X
9	18 (Module 7)	20 (Module 7)	22 (Module 7)
10	25 (Module 8)	27 (Module 8)	29 (Module 9)
11	Nov 1 (Module 9)	3 (Module 9)	5 **Midterm 2**
12	8 (Module 10)	10 (Module 10)	12 (Module 10)
13	15 (Module 11)	17 (Module 11)	19 (Module 11)
14	22 (Thanksgiving Break)	24 (Thanksgiving Break)	26 (Thanksgiving Break)
14	29 (Module 12)	Dec 1 (Module 12)	3 (Module 12)
15	6 (Module 13)	8 (Module 13)	10 (Review for Final)
16	Finals week–	Date/time of Final:	TBA

Grading Scheme:

- 5% Participation
- 10% Homework
- 40% Midterm Exams
- 20% Recitation work
- 25% Final Exam

See below for description of each grading component.

Grading Scale: The default grading scale will be as follows:
98-100 % A+
94-97 % A
91-93 % A-
88-90 % B+
84-87 % B
81-83 % B-
78-80 % C+
74-77 % C
71-73 % C-
68-70 % D+
64-67 % D
61-63 % D-
60 and below F

This grading scale may decrease if a curve is warranted, but it will not increase. It is recommended that students do not count on a curve.

Particpation (worth 5% of grade): Participation will take place through TopHat. The join code is: 587054 . The question statements themselves will be asked during class, so your attendance in class will be essential in order to know how to answer these questions.

Homework (worth 10% of grade): Homework assignments will be completed through the online system called Achieve. Students will be expected to note the due dates and complete their assignments on time.

Midterm Exams (worth 30% of grade–15% / each): Midterm 1 will primarily cover material from the beginning of the semester through Module 4, and midterm 2 will primarily cover material from Module 5-9. However, this does not mean that earlier material is irrelevant or could not be included in some way. You will be expected to retain some understanding of all preceding modules AND some comprehensive understanding of Physics 1 material. For example, it is assumed that you will already have an understanding of Newton's second law, conservation of energy, etc. These concepts are still relevant in Physics 2, as we build upon this prior knowledge.

Midterm exams could include multiple choice and/or open-ended questions. There is no one-size-fits-all recipe to follow which will guarantee a good score on the exams; however, to best prepare for midterm exams, you should focus on achieving the following goals: 1). ability to solve relevant problems **independently** and efficiently, and 2). ability to identify underlying physics principles and apply them appropriately. Solving vast quantities of problems will not help you prepare, if, when solving problems, you rely on solutions to get you through and/or if you do not develop a good grasp of what physics principle(s) underlie a problem and how to identify these principles in a different problem. Two problems which use the same principle may appear superficially to be very different–identifying how they are the same is a key step in developing physics understanding. Many students have found that creating and giving themselves mock exams can help test their understanding and ability to work under pressure.

In addition, reading your textbook and going through textbook examples is an important step in building understanding. According to recent research, 80% of students do not read their textbook, but you cannot expect to perform well on exams if you skip this step. It is a necessary (though not sufficient) part of studying. Thus it is recommended that you read as you go, rather than putting off reading for when you are preparing for an exam. Because textbooks and departmental curriculum do not always evolve in sync with each other, material in the textbook may not flow in the same exact order as what is covered in class. The best way of ensuring that you have read the relevant material is to make use of the index and/or table of contents to find the topics and learning objectives that go with each module. For example, the topic of Polarization is not covered in your textbook until Chapter 27, but we discuss it in Module 9, along with other topics from Chapter 24. It is your responsibility to map the material discussed in class with the relevant sections in the textbook, and to be aware of any material that appears in the textbook but which has not been presented in class so that you know what sections do not need to be read. Anything that has been presented in some way could appear on an exam, but any material that has not been mentioned at all in class or recitation can be safely skipped when reading the textbook. For example, we will not discuss section 22.6 The Hall Effect, and so there is no need to read this section.

Finally, lecture slides, homework, and recitation problems should be reviewed when preparing for an exam, but remember that you have more resources to draw upon when solving homework and recitation problems, and that these problems are often easier to understand in retrospect. Most students will have extremely high scores on homework and recitation problems, as these can best be seen as "warm up" activities compared with exams, rather than predictors of exam performance. Recitation and homework scores are usually 95% or higher; whereas, exam averages, department-wide, are typically around 60 %. Remember, however, that your letter grade is determined by a composite of all graded components, as well as any curving needed to produce a reasonable letter grade distribution. The end result is typically that at least half of students receive As and Bs. So try to remember the big picture if you tend to find yourself feeling stressed about exams.

A helpful resource for preparing for exams is the Pitt Study Lab:`https://www.asundergrad.pitt.edu/study-lab`. In addition, the Physics Department maintains a list of free and for-hire resources and tutors: `https://www.physicsandastronomy.pitt.edu/resources-current-students`.

Once exams are graded, it is helpful to reflect upon what you missed and why, in order to avoid similar mistakes in future exams. Every effort will be made to give you the results of your exam within one week of when the exam was taken.

Recitation Work (worth 20% of grade): Recitation work will be completed during recitation and graded by your TA.

Final Exam (worth 25% of grade): Your Final Exam will be comprehensive, and the same preparation techniques listed above under Midterm Exams can serve to guide you in preparing for the Final Exam.

Code of Conduct:

Communication is key to a productive learning environment, and we can maintain productive communication by exhibiting respect for one another. The success of the course for yourself and others depends on all of our commitment to behavior that demonstrates respect for differences, understanding towards others and a willingness to listen and learn. For these reasons, it is unacceptable to harass, discriminate against, or abuse anyone because of race, ethnicity, gender, disability, religious affiliation, sexual orientation, or age. If you witness or are subject to such harassment, please report it to the instructor or to the Office of Diversity and Inclusion.

Disability Services:

If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and Disability Resources and Services no later than the second week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. To notify Disability Resources and Services, call (412) 648-7890 to schedule an appointment. The Disability Resources and Services office is located at 140 William Pitt Union, and is open Monday-Friday from 8:30AM to 5:00PM.

Title IX:

Legal text: "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance." As a professor I am a mandatory reporter, and I am required to report violations of Title IX that I observe or am made aware of to the Title IX office, Title IX violations include, but are not limited to, sexual harassment, sexual violence and verbal or sexual abuse. Within the classroom, behavior in violation might appear as: suggestive jokes or innuendos, inappropriate touching, and unwanted sexual behavior or advances, but my capacity and obligation to report does not end at the classroom.