Syllabus for Physics 0476: Honors Physics II
University of Pittsburgh, Spring 2017

Schedule and Instructors. The class will meet every day (Monday through Friday), 11 AM to 11:50 AM, Thaw Hall 104. Mondays, Wednesdays, and Fridays, the class will be led by the instructor, Professor Arthur Kosowsky (Allen Hall 315, kosowsky@pitt.edu). These classes will be devoted to a mix of lectures, demonstrations, and some interactive activities. Tuesdays and Thursdays are the recitations, led by the teaching assistant Paul ("Captain") Justice (Old Engineering Hall 108D Desk 1, paj42@pitt.edu). Recitations are required, and will be devoted primarily to developing skill in solving problems, and to answering questions about class material. Professor Kosowsky will have office hours Monday 1 PM to 2:30 PM and Thursday 1 PM to 2:30 PM. TA Justice will also have regular office hours. Other times by appointment if you have schedule conflicts with these times.

Overview. Physics is the fundamental basis for all of science. Observations of planetary motions on the sky during the 16th century led directly to an understanding of the simple laws governing motion of the planets, and the realization that these same laws applied universally. This chain of observation and reasoning during the 17th century culminated with Isaac Newton's formulation of the basic laws of force and motion, which we still use today and will learn in this class. Since then, our knowledge of the basic constituents of the world, the forces between them, and their resulting motions (which we now call "physics") has expanded immensely, but still rest on these universal ideas. Physics formed the first topic for modern science, and helped spark an intellectual revolution which changed the way that people viewed the world.

Our ability to understand physics formed the basis for the industrial revolution and the rise of our modern technological society. This class will cover the basics of electricity and magnetism, the branch of physics which perhaps has the most immediate applications in the modern world. It underlies our machines and our communications, computers and electronics, lasers, microscopes, and telescopes, energy storage and distribution. During the 19th century, the principles describing the motions of charged particles was the great question in classical physics, and its answer was the greatest advance in physics since Newton's Laws. In the 20th century, the mathematical description of electric and magnetic fields and their relation to charges led directly to Einstein's theory of special relativity. When extended to the quantum world, electrodynamics provides the most precise comparison between theory and experiment in any branch of science: the magnetic moment of the electron is predicted to 9 decimal place accuracy, and matches experiments!

Textbook. The textbook for the course is *Physics* volume 2 by Resnick, Halliday, and Krane, 5th edition, Wiley Publishing, 2002. One copy of the textbook will be available on reserve at the Benedum Engineering Library; it may be checked out for two hours to use in the library. The list price of the book is very expensive, but far cheaper used copies are available to buy or rent online.

Assignments and course materials will be posted on the class Blackboard site; sign in at http://courseweb.pitt.edu with your Pitt username and password.

Assignments. Generally you will have one assignment per week, posted on Friday due the following Friday in class. It will consist of a number of problems of varying levels of difficulty. For each assignment, some fraction of the problems chosen at random will be graded. Your solutions will be graded both on accuracy of your answers, but also on the process by which you arrive at your answers. Steps for solving problems, and accompanying grading expectations, will be provided on the Courseweb site; these will be familiar to Physics 475 students.

You are encouraged to discuss homework problems with fellow students! Even better, form a regular study group with other people in the class. Collaborative learning has been proven to be much more effective for most physics students than learning in isolation. But do your own work to figure out and write up solutions to the assignments. We have no way of knowing whether you are simply copying answers to someone else's homework, but if you do, you will surely do poorly on the exams, which count for the largest portion of your class grade.

Exams. The class will have three in-class exams during the semester, and one cumulative final exam. The dates of these are listed in the calendar below. Attendance at exams is required. The only excuses for missing an exam are university-related activities or serious illness. If you are going to miss an exam for one of these two reasons, please let me know as soon as possible. All exams will be open notes and open book,

so you do not have to memorize anything. During exams, you may not use any device which is capable of connecting to the internet, including your phone, laptop, or tablet. You may use a calculator but only if it does not connect to the internet. If you normally use your smart phone as a calculator, please invest in a cheap calculator (generally available for less than $10). A few calculators will also be available to share during exams.

Grading. 3 in-class exams, each 15% of the final class grade. 1 final exam, worth 20% of the class grade. Assignments, in total worth 30% of the final class grade, and an additional 5% for assignment completion. The two lowest assignment scores will be dropped from computing your final grade. If your class average is at least 90% you will earn an A for the course, at least 80% for a B, 70% for a C, and 60% for a D. The grade boundaries may be lower than these, depending on the overall class grades.

Prerequisites Math 230 (second-semester calculus) is a prerequisite for this course, and Math 240 (third-semester calculus) is a corequisite. You are expected to be comfortable using derivatives and integrals, vectors, and Taylor series. We will sometimes solve problems in vector calculus, but no background in vector calculus will be assumed. If you have not taken a high-school level physics class covering electricity and magnetism, please talk to the instructor about whether you should be in this class or in Physics 175.

Class Etiquette. No cell phones allowed in class – please turn them off and put them away before class starts. Asking questions about class material is strongly encouraged. If you don't understand, it is likely that many other people also do not understand: no question about the material is a "dumb" question. Please do not talk to your neighbors unless it is directly about the class material – and in that case it is probably better to raise your hand and ask a question. During class, a general questions may be asked for group discussion; at this point please DO talk to people seated near you.

Class Resources. The Physics Resource Room in 312 Thaw Hall is staffed by teaching assistants from 9 AM to 5 PM on weekdays. These TA's are available to answer questions and help with assignments as needed. The Academic Resource Center in the Gardner Steele Conference Center (across the street from Allen Hall) will sometimes have physics tutors available; times will be publicized when known.

Academic Integrity. Students in this course are expected to comply with University of Pittsburgh's Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, or obtain exam materials before the beginning of the exam.

Students with Disabilities. If you have a disability, please speak to the course instructor and to the Disabilities Resources and Services office by the second week of class to make any necessary arrangements to support a successful learning experience, and provide documentation through your disabilities coordinator. The Disabilities Resources office is located in 216 William Pitt Union, 648-7890 (voice or TTD).

Course Schedule

The following is a tentative course schedule. Adjustments to the schedule and order of the material may be made depending on the pace of the class. Read the assigned textbook sections before class: the in-class lectures and activities will assume all students have done the reading.

Week of January 4: Electric charges, Coulomb's Law of electrostatic force, definition of the electric field. Reading: Chapter 25 and 26.

Week of January 9: Electric field and Gauss' Law. Divergence and Curl. Electric potential and potential energy. Reading: Chapter 27 and 28.

Week of January 16: Conductors and Insulators. Capacitors. Reading: Chapter 29 and 30. NO CLASS Monday January 16.

Week of January 23: Electric current. Circuits with resistors and capacitors. Reading: Chapter 31. EXAM 1: FRIDAY JAN 27.

Week of January 30: Magnetic fields and the Lorentz Force. Reading: Chapter 32.

Week of February 6: Magnetic fields due to moving electrons. Ampere's Law. Reading: Chapter 33 and 34.

Week of February 13: Faraday's Law of Induction. Inductance. Circuits with inductors, alternating current circuits. Reading: Chapter 35 and 36.

Week of February 20: Maxwell's Equations. Wave solutions. Reading: Chapter 38.

Week of February 27: Catchup week. EXAM 2: WEDNESDAY MARCH 1.

Week of March 5: NO CLASS, SPRING BREAK.

Week of March 12: Basic properties of light waves: reflection and refraction. Mirrors and lenses. Reading: Chapter 39 and 40.

Week of March 19: Interference and diffraction. Reading: Chapter 41 and 42.

Week of March 26: Radiation from moving charges. Antennas. EXAM 3: FRIDAY APRIL 1.

Week of April 2: Magnetic materials. Ferromagnetism and paramagnetism. Magnetic moments.

Week of April 9: Electromagnetism and special relativity.

Week of April 16: The particle nature of light. Reading: Chapter 45.

Week of April 23: FINAL EXAM Time to be announced.