SYLLABUS

Physics 0175
(1230)

Spring Term 2016
Lecture: TTh 11:00-12:45PM @ 102 Thaw Hall

Prof. Vittorio Paolone

Note: The information in this printed syllabus can also be found on the Web site maintained for this course under the CourseWeb address **http://courseweb.pitt.edu/**. This course is listed as Physics 0175 (1230). Please consult this Web site regularly throughout the term for the weekly homework assignments, reminders, special announcements, and any future revisions of this syllabus.

COURSE DESCRIPTION

Physics 0175, Basic Physics for Science & Engineering 2, is the second semester of an intensive two-term (8-credit) introductory physics course sequence. This section is restricted to freshman engineering students; the choice of material and the order in which it is presented has been coordinated with the second-semester courses in calculus, chemistry, and engineering which these students take concurrently. Some subjects that were traditionally taught in introductory physics courses will be taught instead as part of the chemistry and engineering courses. The subjects covered in Physics 0175 are: electrostatics, electric current, magnetic fields and magnetic forces, the sources of magnetic fields, electromagnetic induction, electromagnetic waves, the nature and propagation of light, interference, and diffraction. A detailed week-by-week course outline is given below.

COURSE MATERIALS

The textbook for this course is "Fundamentals of Physics", 10th edition, authored by Halliday, Resnick, and Walker. You will need a reliable calculator with log, exponential, and trigonometric functions.

LECTURES AND RECITATIONS

The intensive character of this course is reflected in the fact that four contact hours are scheduled for each student each week: three hours are devoted to lectures for the entire class of in which new material is discussed, often with the help of illustrative demonstrations; each student will spend one hour per week in a recitation, which

provides an opportunity to ask questions about the lecture material and the homework problems in a setting of no more than 40 students. (The recitations are taught by graduate student Teaching Assistants.)

The lectures and recitations for this section of Physics 0175 are scheduled and staffed as follows:

	Day	Time	Room	Instructor	CRN
Lectures	T, Th	11:00-12:45pm	102 Thaw Hall	V. Paolone	11263
Recitations	W	12:00-12:50pm	105 Allen Hall	?	11264
	W	1:00-1:50 pm	102 Thaw	?	21015
	Th	10-10:50am	11 Thaw	?	11265

COURSE OBJECTIVES

Regardless of the engineering specialization you plan to pursue, you will be challenged to find practical solutions to real problems. In your future work you will be dealing with complex technical problems that can only be solved by methodical analysis and ultimately accurate calculations. The course objectives listed below have been established to help prepare you for a career in engineering:

(1) To understand the fundamental laws of physics that govern the behavior of the physical world in which we operate.
(2) To discover how the laws of physics explain the operation of common technical devices you use in daily life and many of the phenomena you encounter in the other natural sciences.
(3) To develop a systematic, analytical approach to solving problems.
(4) To learn to calculate accurate numerical solutions with the help of a computer.

MY APPROACH TO TEACHING THIS COURSE

In recent years research on the effectiveness of physics education has uncovered two surprising facts: (1) many students leave high school with significant misconceptions about how the physical world around them works, and (2) conventional introductory physics courses in college that rely largely on the transmission of information in the traditional lecture format are quite ineffective, regardless of the lecturer, in making the students give up these misconceptions and replace them with correct ones. This research has also shown that a better way to get students to understand the important physics concepts correctly is to involve them actively during the lectures, forcing them to test the concepts they hold against experimental evidence. And students who have learned the correct conceptual framework will also discover that there is a more reliable and satisfying way to solving physics problems correctly than the "plug and chug" approach that relies on memorizing formulas. In light of these findings my approach to teaching this course will be different from what you may experience in your other

courses: in my lectures I will NOT simply present the information that is contained in your textbook; **I expect you to have read the assigned sections in the textbook before you come to class.** (In order to make sure that you do this, I will periodically give a short quiz during lecture that is based on the textbook section(s) assigned for that day.) Instead of reciting the material that is found in the textbook I will use the lectures and the computer exercise sessions to elaborate on the important concepts, engage the students in predicting their consequences in certain situations, and test the predictions with a variety of demonstrations. (The lecture hall is equipped with an electronic Student Response System that enables the lecturer to pose questions and collect individual responses from each student in the class and display and/or record the results.) And as we go along in the course I will also show you by way of examples how to solve physics problems methodically and analytically.

If you want to succeed in this course you must not only attend all lectures and recitations, but also spend at least 10 additional hours each week reading the textbook and doing the assignments. Keep in mind that this is a 4-credit course!

COURSE OUTLINE

Caution: This outline is subject to modest adjustments as the course progresses. However exam dates are FIXED!!!

Week #1	Jan 7	Lect 1-2: organizational details, course overview and teaching philosophy; Two kinds of electric charge; electric charge and the structure of matter; conductors and insulators; superconductors and semiconductors; induced charges; Coulomb's Law; quantization of charge; conservation of charge; illustrative examples.
Week #2	Jan 12-14	Lect 3-4: The electric field concept; electric field calculations; electric field lines; the electric field due to a point charge; the electric field due to an electric dipole; the electric field due to a line of charge; the force experienced by a charge in an electric field; the Millikan oil drop experiment; illustrative examples.

Week #3	Jan 19-21	Lect 7: Definition of electric flux; calculating electric flux; Gauss' Law and its equivalence to Coulomb's Law; applications of Gauss' Law in cases of cylindrical symmetry, planar symmetry, and spherical symmetry; charges on isolated conductors; illustrative examples.
Week #4	Jan 26-28 **Jan. 28 (Th)**	Lect 8-9: The concepts of electric potential energy and electric potential; equipotential surfaces; calculating the electric potential from knowledge of the electric field; finding the electric potential for a single point charge and a collection of point charges; the electric potential energy of a collection of point charges; illustrative examples. Pre-examination review. **1st hour examination**
Week #5	Feb 2-4	Lect 10-11: Definition of capacitance; calculating the capacitance for several different geometries of conductors; combinations of capacitors, in series and in parallel;
Week #6	Feb 9-11	Lect 12: energy storage in capacitors; electric-field energy; dielectric materials; molecular model of induced charge; applying Gauss' Law in dielectric materials; illustrative examples. Charges in motion: definition of electric current; resistivity; resistance; Ohm's Law; energy and power in electric circuits; illustrative examples.
Week #7	Feb 16-18	Lect 13-14: Direct-current circuits; electromotive force; combinations of resistors, in series and in parallel; single loop and multiloop circuits; Kirchhoff's rules; electrical measuring instruments; resistance-capacitance circuits; illustrative examples.
Week #8	Feb 23-25 **Feb. 25 (Th)**	Lect 15-16: Magnetism; magnetic field lines and magnetic flux; the magnetic force on a charged particle moving in a magnetic field; applications of magnetic fields to guide the motion of charged particles; the magnetic force on a current-carrying conductor; force and torque on a current loop; the magnetic dipole moment; illustrative examples. Pre-examination review. **2nd hour examination**
Week #9	Mar 1-3	Lect 17-18: Sources of magnetic field: magnetic field of a moving charge; magnetic field of a current element; magnetic field of a straight current-carrying conductor; force between parallel conductors; magnetic field of a circular current loop; Ampere's Law and some applications; illustrative examples.
Week #10	**Mar 8-10**	**No lectures – Spring Recess**
Week #11	Mar 15-17	Lect 19-20: Electromagnetic induction; Faraday's Law; Lenz's Law; motional electromotive force; Eddy currents; induced electric fields; inductors and inductance; self-induction; R-L circuits; energy stored in a magnetic field; mutual induction; illustrative examples.
Week #12	Mar 22	Lect 21: Gauss' Law for magnetic fields; induced magnetic fields; displacement current; Maxwell's Equations; magnetism of matter: illustrative examples;
Week #13	Mar 29-31 **Mar 31 (Th)**	Lect 22-23: Electromagnetic waves; the speed of light; the electromagnetic spectrum; description of traveling electromagnetic waves; energy and momentum in electromagnetic waves; polarization; propagation of electromagnetic waves in matter: reflection and refraction; total internal reflection; dispersion; illustrative examples. Pre-examination review. **3rd hour examination**
Week #14	Apr 5-7	Lect 24-25: Formation of images; plane mirrors and spherical mirrors; thin lenses; ray tracing; optical instruments; illustrative examples; definition of interference; interference and coherent sources; two-source interference of light; intensity in interference patterns; illustrative examples.

Week #15	Apr 12-14	Lect 26-27: Diffraction; introduction to quantum physics, including photons
Week #16	Apr 19-21	Lect 27-28: Bohr atom and intro to wave mechanics, Review

Week #17	**Apr 25 – 30 (DAY/TIME TBA)**	**Final Examination (all material covered in the course)**

HOMEWORK AND QUIZZES

A weekly homework assignment consisting of conceptual questions and numerical problems will be posted on the website (details are forthcoming) and announced during lecture. The homework will automatically be graded by the computer, which will allow you instant feedback. After the due date has passed solutions to the problems will posted on the same website.

Working on the homework assignments conscientiously is the best way for you to determine whether or not you have really understood that week's material and to practice the analytical and methodical approach to problem solving that we are trying to get you to adopt. To get the most out of these assignments, you must honestly try to solve every problem before you go to your weekly recitation. Then you will know what question(s) to ask during the recitation. The recitation instructors are told to focus on those concepts that seemed to cause the most difficulties; they cannot discuss every problem on every assignment. At the end of most recitation sessions the TAs will give a short quiz that will be based on the homework assignment due that week. All of these quizzes will be graded.

WEEKLY READING ASSIGNMENTS

WEEK	READING
#1	Chapter 21
#2	Chapter 22
#3	Chapter 23
#4	Chapter 24 **Review the material covered in Ch. 21 through 24 for 1st hour exam**
#5	Chapter 25
#6	Chapter 25 Chapter 26
	Chapter 27

#7	
#8	Chapter 28 **Review the material covered in Ch. 24 through 28 for 2nd hour exam**
#9	Chapter 29
#10	**Spring break**
#11	Chapter 30
#12	Chapter 32
#13	Chapter 33 **Review the material covered in Ch. 28 through 33 for 3rd hour exam**
#14	Chapter 34 Chapter 35
#15&16	Chapters 36,38 Chapter 39

STUDY ASSISTANCE

Students who need additional help are **strongly encouraged** to see the lecturer or their recitation instructor during their regular office hours (see below) or make an individual appointment at a mutually convenient time.

The Department of Physics and Astronomy maintains a **Resource Room** and **Exploration Center** for the benefit of the students in the introductory courses. They are both accessible through Room 312 on the third floor of Thaw Hall. The times during which the Resource Room will be staffed by a Teaching Assistant will be announced as soon as the scheduling arrangements have been completed. The simple laboratory set-ups that are provided in the Exploration Center during the course resemble the lecture demonstrations and are selected to help you develop a hands-on understanding of the key concepts presented in the lectures. You are strongly encouraged to experiment with them.

All engineering students can also obtain study assistance from the **Freshmen Engineering Tutoring Program**, located in room B-80 of Benedum Hall.

EXAMINATIONS

There will be three written hour-examinations (~ 1 hour long) during the term, the best two scores (lowest is dropped) are each worth a maximum of 100 points. Both scores will be used in the calculation of your final course grade. Like the homework assignments, these examinations will consist of conceptual questions and numerical problems. The final examination will be worth a maximum of 200 points and will consist of multiple choice questions. (See the Course Outline above for the dates of and the material covered in these examinations.) **No make-up examinations will be given.**

LATE WORK AND MISSED EXAMINATIONS

As a general rule, assignments turned in after the specified deadline and missed examinations will be given zero points. Exceptions may only be made at the lecturer's discretion in documented cases of unforeseen circumstances that were clearly beyond the student's control. Such circumstances must be brought to the lecturer's attention as soon as they develop, whenever possible **before** the deadline or test.

COURSE GRADE

Your final course grade will take into account the following five elements of your performance, with the indicated weighting factors:

(1) Your attendance and participation in the recitation sessions, the points you earned for handing in homework sets (70 pts), plus the sum of your recitation quiz scores (30 pts) (renormalized to a maximum of 100 points)

(2) The sum of your scores on the two hour examinations (maximum of 200 points)

(3) Your score on the final examination (maximum of 200 points).

Your final course grade will be based on the percentage of the maximum total score of 500 points that you achieve in this course. The translation of your overall course score into a final letter grade will take into account the average and the distribution of the overall course scores achieved by the entire class. However departmental policy is the following:

Physics 0174, 0175 and 0475, 0476: The sum of the grades A+ through B- should be in the 35-45% range of all grades A through F.

SPECIAL ACCOMMODATIONS FOR DISABILITY

If you have a disability that requires special testing or other accommodations, you need to notify both the instructor and the Office of Disability Resources and Services no later than the 2nd week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. The Office of Disability Resources and Services is located in the William Pitt Union, Room 216. Call 648-7890 (Voice or TDD) to schedule an appointment.

ACADEMIC INTEGRITY

All students and instructors in these courses are expected to follow the University of Pittsburgh academic integrity guidelines. If you are not aware of the specifics, you should obtain a copy of these guidelines from the CAS Dean's Office, 140 Thackeray Hall, or look them up on page 9 of the CAS publication "*First-Year Viewpoint, 1999-2002*" or on the College of Arts and Sciences Web page. Violations of these guidelines by a student may result in a zero score for an examination or a failing grade for the entire course.

INSTRUCTIONAL STAFF

The lecturer is:

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The Teaching Assistant is:

TBA