Physics 1402 General Physics II

Instructor

David Hobbs
Office: S117D
Office Hours: MW 1:00 – 2:00 pm, TT 9:00 – 10:30 am, F 9:00 am – 12:00 pm
Phone: 806-716-2639
email: dhobbs@southplainscollege.edu

Course Description

Content

Fundamental principles of physics, using algebra and trigonometry; the principles and applications of electricity and magnetism, including circuits, electrostatics, electromagnetism, waves, sound, light, optics, and modern physics topics; with emphasis on problem solving.

Prerequisites

Completion of PHYS 1401 – General Physics I is required before taking Physics 1402.

Textbook

The textbook is *Physics, 5th edition* by Walker (Pearson, 2017). There is no lab manual for this course.

Course Overview

One major goal of this course is to help you appreciate science as a process for constructing knowledge about the physical world. This means you will be asked to do much more than just memorize a few random equations and use them to "plug-and-chug" your way through contrived textbook problems. We want to build on your existing intuition and personal experience to help you construct a solid conceptual understanding. This will require effort on your part to be *making sense* of what you are learning, to connect what you are learning in the classroom to the real world.

Approach

The course will emphasize construction of physics knowledge using a student-centered active learning environment. Class sessions will require students to be responsive, to think, and to perform hands-on tasks. Key concepts of new material will be discussed in short lectures. Lab time will be interspersed with classroom discussion. If you devote a sufficient amount of time each day to studying physics, you will be in a position to attack physics problems efficiently, based on a clear understanding of the fundamental physical principles that underlie all successful analyses.

Collaborative Work

This course encourages collaborative teamwork, a skill that is valued by most employers. As you study together, help your partners to get over confusions, ask each other questions, and critique each other's homework write-ups. Teach each other! You can learn a great deal by teaching. But remember that you are responsible for understanding all details of a problem solution.

Study requirements

Studying science can be a time intensive activity. You have probably heard the recommendation to study two hours outside of class for every hour of time in class. In physics, this is a reasonable way to estimate the needed study time. So, in addition to your time in class each week, you can expect to spend about 10 hours studying outside of class.

It is important to keep up with the class. New concepts introduced in this course build on earlier ones, so mastering key concepts is critical. If you get behind, seek help right away!

Attendance policy

Attendance and effort are vital to success in this course. Class attendance keeps you well connected to the course, so that you know at all times what's going on, what are the most important points, etc., and gives you opportunities to ask questions and clear up confusions. Therefore, students are expected to be in attendance for every class session. However, everybody gets sick, has some emergency, needs to care for a friend or family member or similar stuff now and then. Therefore, all students will be allowed two excused absences, no documentation required. The third and fourth absences will be unexcused and in-class work missed will receive a grade of zero. After a fifth absence you will be dropped from the class. If you stop attending class and wish to avoid an "F" you must obtain an official drop form, have it signed, and take the completed form to the registrar's office before your fifth absence. See the current class schedule for the last day you can drop a class.

Assignments

Readings

A key component of the course is the textbook, in which you are asked to analyze phenomena, to work out small examples, to answer review questions, etc. *Class discussion may not cover all of the assigned material; it is essential that you study the textbook carefully.*

Class sessions will be devoted to *discussion* of ideas, clarifying points of confusion, and activities of various kinds that allow you to practice using the concepts you have read about in the text. The text thus provides the *background* for these activities. *Therefore, it is essential to read the appropriate sections in the textbook BEFORE coming to class.* Your time in class will be largely ineffective if you have not studied the appropriate text sections prior to coming to class.

Short reading quizzes will be given at the start of some classes.

Homework

A weekly homework assignment will be due at the start of class each Tuesday. An important purpose of these problems is to provide practice in communicating your thinking process in a clear and precise way. Being able to write clearly is an important skill for both scientists and medical professionals. You will also find that writing good explanations of your thinking process will improve your understanding of the physics concepts you are studying. Communicating your thinking process on paper will require writing sentences and paragraphs in addition to equations and formulas. In keeping with this purpose of these problems, grading will emphasize the quality of the solution write-up as well as the correctness of the answer. A well written solution will include verbal explanation stating what physics principles are used, appropriate well-labeled diagrams, symbolic solution before numerical values are substituted, and correct numerical result with correct number of significant figures and correct units. Students whose work is excessively messy or difficult to read may be required to produce typed solutions.

Getting help with assignments

You should ask lots of questions in class to clear up any initial confusion you might have about a topic. I also encourage you to avail yourself of my help during office hours. You do not have to wait for my official office hours to get help; anytime I am in my office you are always welcome to come get help. If you fall behind for any reason, please let me know as soon as possible. The sooner I know about these situations, the better I can help you make up work. I will do what I can to help you complete the course satisfactorily.

Laboratory

Lab activities will be interspersed with short lectures. During lab activities you will typically work in groups of three students on the following kinds of activities:

- Experiments, involving measurement and analysis of data according to fundamental principles.
- Short activities designed to observe basic phenomena or test explanations.
- Group problem solving, involving work on large, complex problems. In lab you may begin work on a large problem to be completed outside class or the entire problem may be solved during class.

You must attend class during the day the lab is done in order to receive credit. If you have an excused absence, you will be excused from the lab work you missed, and your lab average will be taken from your remaining labs. If you miss a lab, you should work with your classmates to be sure you understand the missed lab activities since these will be covered on tests.

Tests

Tests

Three tests will be given as shown on the course calendar. Each test will be comprehensive, i.e., covering all material from the start of the semester up to the test date. These tests will be closed-book, but some relevant formulas and constants will be provided. The tests will consist of 50 multiple choice questions and the score on the test will be 50 + "number of correct answers" (i.e., if you get 35 of the 50 questions correct, your score would be 50 + 35 = 85). There will be no make-up tests – if you miss a test due to an excused absence, your final exam will count twice (once as the final exam and once in place of the missed exam). Tests missed due to an unexcused absence will receive a grade of zero and cannot be replaced by the final exam.

Final exam

A comprehensive final exam will cover all of the course material. The final exam will be closed-book, but some relevant formulas and constants will be provided. It will be given during the scheduled final exam time as shown on the course calendar. The format and grading of the final exam will be the same as the tests. If you score higher on the final exam than your lowest test grade, your final exam will count twice (once as the final exam and once in place of the lowest test).

Grade calculation

Your final grade will be assigned based on your overall, weighted class average using the weighting scheme shown below:

Task	Weight
Daily Work	20%
Tests	60%
Final	20%

The letter grades will be based on a fixed scale as follows:

A: 89.5 – 100 B: 79.5 – 89.5 C: 69.5 – 79.5 D: 59.5 – 69.5 F: below 59.5

If everyone in the class does well, grades are not curved downward. Everyone can get an A. There usually is a "gray area" between two letter grades for borderline cases (grades within 0.5 points of the break point). Earning the higher grade in these cases depends on your interactions in class and whether your test and homework performance shows improvement during the course of the semester.

Miscellaneous information

In this class, the teacher will establish and support an environment that values and nurtures individual and group differences and encourages engagement and interaction. Understanding and respecting multiple experiences and perspectives will serve to challenge and stimulate all of us to learn about others, about the larger world and about ourselves. By promoting diversity and intellectual exchange, we will not only mirror society as it is, but also model society as it should and can be.

Students with disabilities, including but not limited to physical, psychiatric, or learning disabilities, who wish to request accommodations in this class should notify the Disability Services Office early in the semester so that the appropriate arrangements may be made. In accordance with federal law, a student requesting accommodations must provide acceptable documentation of his/her disability to the Disability Services Office. For more information, call or visit the Disability Services Office at Levelland (Student Health & Wellness Office) 806-716-2577, Reese Center (Building 8) & Lubbock Center 806-716-4675, or Plainview Center (Main Office) 806-716-4302 or 806-296-9611.

South Plains College does not discriminate on the basis of race, color, national origin, sex, disability or age in its programs and activities. The following person has been designated to handle inquiries regarding the non-discrimination policies: Vice President for Student Affairs, South Plains College -1401 College Avenue, Box 5, Levelland, TX 79336, 806-894-9611

Note to students with disabilities: If you have a disability-related need for reasonable academic adjustments in this course, provide the instructor with a letter of accommodation from the Disability Services Office. If you need immediate accommodations or physical access, please arrange to meet with the Disability Services Office before the next class meeting.

Core Objectives Addressed in this course:

Communication skills - to include effective written, oral, and visual communication

Critical Thinking skills - to include creative thinking, innovation, inquiry and analysis, evaluation and synthesis of information

Empirical and Quantitative skills - to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions

Teamwork skills - to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

Course Objectives

Measurable learning objectives students should achieve after one year of introductory physics are listed below.

1. Students should develop a good functional understanding of physics.
   They should be able to:
   a. describe and explain physics concepts including knowing where and when they apply.
   b. apply physics concepts when solving problems and examining physical phenomena.
   c. apply concepts in new contexts (transfer).
   d. translate between multiple-representations of the same concept (for example: between words, equations, graphs, and diagrams).
   e. combine concepts when analyzing a situation.
   f. evaluate explanations of physical phenomena.

2. Students should begin developing expert-like problem solving skills.
   They should be able to:
   a. apply a small set of fundamental physical principles to a wide variety of physical situations.
   b. use these principles to satisfactorily solve standard textbook problems.
   c. model complicated physical systems by making approximations and idealizations in order to be able to apply fundamental principles.
   d. solve more challenging problems, including: context-rich ("Real World") problems, estimation problems, multi-step problems, multi-concept problems, problems requiring qualitative reasoning.
   e. evaluate other people's written solutions and solution plans.

3. Students should develop laboratory skills.
   They should be able to:
   a. interact (set up, calibrate, set zero, determine uncertainty, etc.) with an apparatus and make measurements.
   b. explain the physical principles underlying the operation of the apparatus, measurements, physical situation being studied and analysis of data.
   c. design, execute, analyze, and explain a scientific experiment to test a hypothesis.
   d. evaluate someone else's experimental design.

4. Students should develop technology skills.
   They should be able to:
   a. utilize a spreadsheet to graph and do curve fitting.
   b. find information on the web.
   c. use microcomputer, video, and web-based software and hardware for data collection and analysis.

5. Students should improve their communication, interpersonal, and questioning skills.
   They should be able to:
   a. express understanding in written and oral forms by explaining their reasoning to peers.
   b. demonstrate their knowledge and understanding of physics in written assignments.
   c. discuss experimental observations and findings.
   d. present a well-reasoned argument supported by observations and physical evidence.
   e. evaluate oral arguments, both their own and those espoused by others.
   f. function well in a group.
   g. evaluate the functioning of their group.

6. Students should retain and/or develop student cognitive attitudes and beliefs (expectations) that are favorable for learning physics with deep understanding.
   They should:
   a. believe that understanding physics means understanding the underlying concepts and principles instead of focusing on knowing and using equations.
   b. see physics as a coherent framework of ideas that can be used to understand many different physical situations.
   c. see what they are learning in the classroom as useful and strongly connected to the real world.
   d. be cognizant of the scientific process/approach and how to apply it.
   e. indicate a willingness to continue learning about physics and its applications.
   f. see themselves as part of a classroom community of learners.

Student Learning Outcomes from the common course syllabus

1. Electricity and Magnetism: Student will demonstrate an understanding of electromagnetism.

    1.1. Articulate the fundamental concepts of electricity and electromagnetism, including charge, electric field, electric potential energy, electric potential difference, magnetic field, and induction.
    1.2. Articulate the general nature of electrical forces and electrical charges, and their relationship to electrical current.
    1.3. Solve problems involving the inter-relationship of electrical charges, electrical forces, electric field, and currents.
    1.4. Apply Ohm's law and Kirchhoff's laws to the analysis of circuits with potential sources, capacitance, inductance, and resistance, including parallel and series capacitance and resistance.
    1.5. Solve problems in the electrostatic interaction of point charges through the application of Coulomb's law.
    1.6. Solve problems involving the effects of magnetic fields on moving charges or currents, and the relationship of magnetic fields to the currents which produce them.
    1.7. Calculate the force on a charged particle between the plates of a parallel-plate capacitor.
    1.8. Use Faraday's and Lenz's laws to determine electromotive forces and solve problems involving electromagnetic induction.

2. Optics: Student will demonstrate a basic understanding of the wave nature of light.

    2.1. Describe the wave nature of light and compare to the particle view of matter.
    2.2. Describe the characteristics of light and the electromagnetic spectrum.
    2.3. Articulate the principles of reflection, refraction, diffraction, interference and superposition of waves.

3. Modern Physics: Student will demonstrate a familiarity with concepts in modern physics.
    3.1. Discuss the philosophical shift and experimental evidence in Quantum Physics.
    3.2. Expand upon the relationship between chemistry and atomic and nuclear physics.
    3.3. Review recent history and modern trends in physics research.

4. Laboratory Work:

    4.1. Prepare laboratory reports that communicate experimental information compared with theoretical expectations.
    4.2. Conduct basic laboratory experiments involving the areas of electricity, magnetism, and optics detailed above.
    4.3. Relate physical observations and measurements of classical electromagnetism and optics to theoretical principles.
    4.4. Evaluate the accuracy of physical measurements and potential sources of error in measurements.
    4.5. Work effectively with others in coordinating and executing laboratory experiments.

Calendar

Phys 1402.200 Fall 2017

Week	Tuesday		Thursday	
	Readings	Topics	Readings	Topics
1	08/29	Course Introduction; Physics 1 Review	08/31 **19.1 – 19.3**	Electric Charge; Insulators and Conductors; Polarization; Coulomb's Law
2	09/05 **19.4 – 19.7**	Electric Field; Superposition; Electric Flux; Gauss's Law	09/07 **20.1 – 20.3**	Electric Potential Energy and Electric Potential; Connection between Electric Field and Electric Potential
3	09/12 **20.4 – 20.6**	Equipotential Surfaces; Capacitance; Energy Density in an Electric Field	09/14 **21.1 – 21.4**	Electric Current; Resistance; Power in Electric Circuits
4	09/19 **21.5 – 21.8**	Kirchhoff's Rules; RC Circuits; Ammeters and Voltmeters	09/21 **22.1 – 22.4**	Magnetic Field; Forces Exerted by Magnetic Fields on Moving Charges
5	09/26 **22.5 – 22.8**	Sources of Magnetic Field; Ampere's Law; Atomic Structure of Magnets	09/28 **23.1 – 23.5**	Electromagnetic Induction; Faraday's Law; Generators; Motors
6	10/03	**Test 1 – Chapters 19 through 21**	10/05 **23.6 – 23.10**	Inductance; RL Circuits; Energy Density in a Magnetic Field; Transformers
7	10/10 **24.1 – 24.6**	AC Circuits; Phasors; Capacitive and Inductive Reactance; Resonance in AC circuits	10/12 **25.1 – 25.2**	Electromagnetic Waves; Doppler Effect
8	10/17 **25.3 – 25.5**	Energy and Momentum in Electromagnetic Waves; Polarization	10/19 **26.1 – 26.4**	Reflection; Image Formation with Mirrors; Ray Tracing
9	10/24 **26.5 – 26.8**	Refraction; Image Formation with Thin Lenses; Dispersion	10/26 **27.1 – 27.6**	Optical Instruments – Human Eye, Camera, Microscope, Telescope
10	10/31	**Test 2 – Chapters 22 through 25**	11/02 **28.1 – 28.3**	Superposition and Wave Interference; Double Slit Interference; Thin Film Interference
11	11/07 **28.4 – 28.6**	Diffraction; Diffraction Gratings; Resolution of Optical Instruments	11/09 **29.1 – 29.4**	Postulates of Relativity; Time Dilation; Length Contraction; Relativistic Addition of Velocities
12	11/14 **29.5 – 29.8**	Relativistic Momentum and Energy; General Relativity and Gravitational Waves	11/16 **30.1 – 30.4**	Blackbody Radiation; Photoelectric Effect; Compton Effect
13	11/21 **30.5 – 30.7**	De Broglie Hypothesis; Wave-Particle Duality; Uncertainty Principle; Quantum Tunneling	11/23	Thanksgiving – No Class
14	11/28	**Test 3 – Chapters 26 through 29**	11/30 **31.1 – 31.7**	Bohr Model of the Hydrogen Atom; Pauli Exclusion Principle and the Periodic Table
15	12/05 **32.1 – 32.4**	Radioactivity; Half-Life and Radioactive Dating; Nuclear Binding Energy	12/07 **32.5 – 32.8**	Nuclear Fission and Fusion; Elementary Particles; Cosmology
16	12/12	**Final Exam – 6:00 to 8:00 pm**	12/14	