

PHYSICS 4C

INSTRUCTOR: Mike Read Email: read@siskiyous.edu

OFFICE: PS-1

Office hours: M-F 12-1 (Feel free to stop by at other times).

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Class Meeting Times: M,W,F 1-2; Th 2-5 in PS-1

PREREQUISITES: MATH 5A , **Advisory:** PHYS 4B

REQUIRED TEXT: Physics for Scientists and Engineers by Knight (The textbook will be supplemented with numerous in class and homework problem sets, computer exercises etc.)

GOALS OF THE COURSE: Physics 4C is the third in a sequence of three calculus based introductory physics courses for engineering and science majors. The course covers Physical & Geometrical Optics, Heat and Statistical Physics, Waves, and Intro to Modern Physics

The goal of this course is to have you engage in a process central to science: the attempt to explain in detail a broad range of electric and magnetic phenomena using a small set of powerful fundamental principles.

The course places considerable emphasis on qualitative physical reasoning as a compliment to quantitative problem solving. We want to avoid having the "physics" get lost in the equations.

Objectives:

- Understand how a wave travels through a medium
- Use the wave model and understand how it differs from the particle model
- Understand the properties of sinusoidal waves
- Understand the important characteristics of waves
- Apply the principle of superposition to interfering waves
- Understand how standing waves are created
- Calculate allowed frequencies and wavelengths of standing waves
- Calculate the interference pattern of double slits and diffraction gratings
- Understand how light diffracts through single slits
- Use the ray model for light
- Calculate angles of reflection and refraction
- Understand color and dispersion
- Use ray tracing to analyze lens systems
- Work with and convert between different temperature scales
- Use the ideal gas law
- Understand ideal gas processes and represent them on a pV diagram
- Understand the energy transfer known as heat
- Use the first law of thermodynamics
- Use specific heats and heats of transformation in the application of calorimetry
- Understand adiabatic processes

- Understand how molecular motions and collisions are responsible for macroscopic phenomena such as pressure and heat transfer
- Establish a connection between temperature, thermal energy, and translational kinetic energy of atoms
- Understand how x rays are used to study atoms and solids
- Recognize experimental evidence for the wave nature of light
- Use the photon concept
- Understand the photoelectric effect in terms of light quanta
- Recognize experimental evidence for the wave nature of matter
- Understand that energy quantization is a consequence of the wave-properties of matter
- Understand how the principle of relativity leads to time dilation and length contraction.
- Calculate relativistic energy and momentum
- Understand how mass and energy are equivalent
- Understand how the electron was discovered and its charge determined
- Understand how the nucleus was discovered and its properties identified
- Understand how atoms emit and absorb light
- Use Bohr's model of quantization in atoms
- Understand how de Broglie's matter waves lead to quantization of energy
- Connect the wave and particle descriptions of matter
- Use the wave function to calculate probabilities of detecting particles
- Recognize the limitations on knowledge imposed by the Heisenberg uncertainty principle
- Use a strategy for finding and interpreting wave functions
- Draw wave functions with appropriate shapes
- Understand the use of several important quantum mechanical models
- Calculate the probability of quantum mechanical tunneling

Student Learning Outcomes: Upon completion of PHYS 4C students will:

- Analyze how the laws of physics apply to a broad range of everyday phenomena. In addition, students will use knowledge of the laws of physics to appraise the relative influence of different variables on the physical descriptors of the phenomena.
- Demonstrate proficiency in calculating solutions to numerical problems that require identifying key data, deciding which principle of physics applies, choosing an appropriate formula and problem solving strategy, converting units as required, performing algebraic manipulations & calculations, and deciding if the answer is reasonable.
- Design and execute experiments according to the scientific method. This includes the ability to: (a) determine whether or not a question can be addressed by science, (b) define and follow the scientific method, (c) record, manipulate and evaluate the experimental data to reach conclusions
- Determine solutions to non-computational problems that require identifying key information, deciding which principle of physics applies, interpreting how the physics principle applies, and justifying the final conclusion.

ATTENDANCE: Students are expected to attend all classes and to arrive “on-time”. Class will begin promptly at 1:00. Students who do not arrive on-time may/will lose points from daily activities.

GRADING POLICY:

ASSIGNED HOMEWORK PROBLEMS : 10%

Homework is due at the start of class. Late homework will not be graded. . However, the lowest three homework grades will be dropped to account for excused absences and extenuating circumstances. Approximately two hours of homework can be expected for every class meeting. One of the primary objectives of this class is to develop the student’s problem solving abilities. Consequently, homework is considered to be a very important component of this class.

Your homework grade will be based on neatness, documentation, and methodology as well as the accuracy of your solution.

We will use a PLUS , CHECK , MINUS or ZERO grading scale

- A PLUS will be recorded as 10 points and indicates excellent work with respect to neatness, documentation, and methodology as well as the accuracy of your solution.
- A CHECK will be recorded as 8 points and indicates generally adequate work. However, either the neatness, documentation, methodology, or accuracy of the solution needs some improvement.
- A MINUS will be recorded as 5 points and indicates generally unacceptable quality of work.
- A ZERO will be recorded as 0 points and indicates little or no effort demonstrated.
- A STAR will be recorded as 15 points and indicates work that is unusually exemplary and goes far beyond my expectations for this particular assignment. This score is rarely assigned and you should be very proud of your efforts.

Due to time limitations, only selected homework problems may be graded.

READING ASSIGNMENTS: 10%

Much of the basic information/knowledge in this class will be obtained from reading the textbook. Most students find reading in the textbook interesting and enjoyable. Class time will be spent doing exercises designed to deepen your understanding of the basic principles and in developing your ability to apply the basic principles. In order for you to get the most benefit from each class, you will need to come to class prepared by doing the assigned reading. For each reading assignment, you will be given a handout on important concepts to look for in the reading. You will be quizzed on selected questions from this handout at the start of class.

Missed reading quizzes may not be made up, however the lowest three reading quizzes will be dropped to account for excused absences and extenuating circumstances.

LABS/IN-CLASS ASSIGNMENTS: 10%

Missed assignments may not be made up, however the lowest grade will be dropped to account for an excused absence and extenuating circumstances.

QUIZZES: 10% If you know that you will be absent you can schedule to take the quiz in advance with Mr. Read. Make-ups will not be given for missed quizzes without prior approval, however the lowest grade will be dropped to account for an excused absence and extenuating circumstances.

EXAMS: 40%

There will be two exams plus a final. Make-up exams will not be given unless there are extenuating circumstances discussed with the instructor in advance. If possible make-ups will be scheduled before the regular exam date.

Since my primary goal is for you to learn the material, I will offer you an opportunity to learn from your mistakes on quizzes and exams. You will have an opportunity to rework missed quiz and exam problems for 60% credit on quizzes and 30% credit on exams

Since the point of doing the make-up is to learn from your errors, I will not give credit if I believe you are just copying answers from other students. It is OK (and encouraged) to discuss your errors with the instructor or other students, but do not just copy answers without understanding and being able to work the problem on your own! There may be an oral exam on the corrections to check your understanding.

FINAL: 20%

The instructor will guarantee the following course letter grades for the following averages:

A=100-90

B=89-80

C=79-70

D=69-60

The FW grade will be given at the discretion of the instructor in cases of extreme extenuating circumstances. The usual extenuating circumstance would be cases of verified illness or accidents which cause the student to drop out of school.

STUDY GROUPS AND COLLABORATIVE WORK

Scientists and engineers normally work in groups and social interactions are critical to their work. Most good ideas grow out of discussions with colleagues. *In this course, I want you to work with others as much as possible.* Study together, ask each other questions, help each other to clear up confusion, critique each other's homework. Teach each other! Teaching is the best way to learn!

But don't let one person do all the work. You still need to do the work yourself or you will not learn. Don't kid yourself that because you understand someone else's solution, you could do it yourself on an exam.

Because I feel that collaborative work is so beneficial, I am offering the following incentive to those students who will attend the official study group: **One additional homework grade, will be dropped for every three official study group sessions attended. Alternatively (for students who would benefit more), 1 homework "extra credit" point will be earned for each study group attended.**

WITHDRAWAL: Any student withdrawing must do so through official channels (don't just stop coming to class). Otherwise you could receive an F for the course. Please see the college catalog for information on withdrawal. Also please refer to the COS academic calendar for the last day to drop without a penalty

INCOMPLETES: The COS policy for granting incomplete is in the college catalog.

EARLY FINALS: The final is scheduled for Monday 12/14 at 1:00. Early finals will be allowed only in cases of unforeseen emergency. An early final will not be granted for cases of christmas jobs, plane reservations, etc.

ACADEMIC DISHONESTY

I assume that all students will pursue their studies with integrity and honesty; however, all students should know that incidents of academic dishonesty are taken very seriously. It is vitally important to your academic success that you know what constitutes academic dishonesty.

What is Academic Dishonesty?

The two most common kinds of academic dishonesty are cheating and plagiarism. Cheating is the act of obtaining or attempting to obtain credit for academic work through the use of dishonest, deceptive or fraudulent means. Plagiarism is representing the work of someone else as your own and submitting it for any purpose.

It is your responsibility to know what constitutes academic dishonesty. If you are unclear about a specific situation, speak to your instructor. The following list identifies some of the activities defined as academic dishonesty:

Cheating

1. Copying, in part or in whole, from someone else's test.
2. Altering or interfering with grading.
3. Using or consulting, during an examination, any sources, consulting with others, use of electronics equipment including cell phones and PDAs, or use of materials not authorized by the instructor; or
4. Committing other acts which defraud or misrepresent.

Plagiarism

Incorporating the ideas, words, sentences, paragraphs or parts of another person's writings without giving appropriate credit, and representing the product as your own;

Other Specific Examples of Academic Dishonesty

1. Purposely allowing another student to copy from your paper during a test;
2. Giving your homework, term paper or other academic work to another student to plagiarize;
3. Having another person submit any work in your name;
4. Lying to an instructor or college official to improve your grade;
5. Altering a graded work after it has been returned, then submitting the work for re-grading;
6. Stealing tests;
7. Forging signatures on drop/add cards or other college documents; or
8. Collaboration without permission of instructor.

Consequences of Academic Dishonesty

Academic sanctions may be applied in cases of academic dishonesty. Depending on the seriousness of the infraction, you may:

1. Receive a failing grade on the test, paper or exam.
2. Have your course grade lowered.
3. Receive an **F** in the course.

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

The learning services Office (Eddy Hall 1) can provide resources/information to accommodate students with special needs.

SUPPORT HOUR REQUIREMENT

This course includes a support hour. The support hour provides students with professional assistance, supplemental instruction and remediation opportunities to help improve student success. Supervised support is offered for reading, writing, math, information technology, computer competency, and other skills outside of discipline specific content. During the semester, students will complete a variety of tasks related to this course that will necessitate the services available through the support hour. These tasks will include:

1. We will be using computers extensively in class for analysis, simulation, data collection & analysis, video analysis, modeling, etc. You may need to complete some of this work outside of class. You may also wish to review some of these exercises on your own to prepare for quizzes and exams.
2. You can expect some homework assignments which require the use of MS Word, Excell, and other computer simulation and analysis programs in the physics lab.
3. There are many excellent resources on the Web related to learning/topics in this course. These may serve as an excellent supplement to your text and other course materials to complete assignments and prepare for exams.
4. It is suggested you utilize email (in addition to telephone) for communication with your instructor and other students. My email is: read@siskiyous.edu
5. It is suggested that you discuss written assignments with Writing Lab staff before turning them in.