SFSU PHYS 240 Waves, Thermo, & Modern	Lecture	HSS 130	2:10–3:25 TuTh
Syllabus Fall 2016	Final Exam	HSS 130	1:30–4:00 Th 12/15
instructed by William Caudy wcaudy@sfsu.edu	Office Hours	TH 328	TBA

Syllabus Contents: Course Website, Prerequisites & Expectations, Lab Phys 242, Exams, Readings, Homework, Grades, Course Objectives, Learning Standards, Dates & Policies, Lessons Outline.

A course calendar with links to all lessons and homework assignments is found on the
PHYS 240 **Course Website:** https://ilearn.sfsu.edu/.
Please become familiar this website and check for updates often.

Passing grades in MATH 227 and PHYS 220 are **Prerequisites** for PHYS 240. Students who have not completed equivalent courses with a grade of C or higher in each will be dropped from PHYS 240. Students will be need to use all the physics concepts and basic equations from PHYS 220, and all math classes leading up to MATH 227 including algebra, geometry, trigonometry, and calculus.

Lab PHYS 242 is a separate 1 unit class taught by a different instructor who assigns you a separate grade. Your work for lab does not affect your grade in lecture, and vice versa, but enrollment in both is required for both courses (with possible exceptions for transfer credits and returning 240 students.) You cannot enroll in lab until you are enrolled in lecture. Students not enrolled in lecture will be dropped from all lab sections during the first week of class to make space for those enrolled in lecture.

Exams: There are *four* 45 minutes long Exams with, four written response questions requiring diagrams and calculation. You are allowed one page of notes, front and back, and a scientific calculator.

The **Textbook** for PHYS 240 is *Physics, The Nature of Things. volume III* by Lea, Susan M. and John Robert Burke, available in the SFSU bookstore. Older editions may be available online and are equally acceptable. All editions have the same homework numbers. If you choose to substituted another Physics textbook (Giancoli, Serway, Tipler), make sure it uses calculus level math (this should be evident from the textbook's treatment of Kinematics, usually in the second or third chapter). A science textbook is an exhaustive reference book: use the book's index and table of contexts to match lesson topics with book sections. This is a skill you should practice with any textbook. Read short segments with one or two examples relevant to each lesson. Then practice with the homework and other questions from the textbook and online. Readings from Lea & Burke, along with Homework questions and supplementary online resources, will be posted with each lesson on the **Course Website**.

There are ten **Homework** sets with 10-20 questions each. Your solutions to homework are to be hand written/drawn on paper with *no torn edges*. Legibility is your responsibility – if the grader can't read it, it's zero credit. Questions may ask for graphs, written explanations, diagrams, or calculations. Your solution to any homework calculation must *first* be in the form of an equation, derived algebraically from the basic physical principles and equations covered in class notes, *before* you plug in any given numbers to get a numerical answer. If HW brings your grade down, it is dropped.

Work with your classmates to solve homework questions! Attempt homework questions on your own

referring to your book and notes, then work with a group and come to office hours.
You are free to attend the help sessions of all lab instructors, not just your own.

Grades will be posted on the course website by the last four digits of your student ID.
The grade scale used for this course is:

letter	**F**	**D**	**C–**	**C**	**C+**	**B–**	**B**	**B+**	**A–**	**A**
%	0-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-100

Homework: 4-0% (if HW is bringing your grade down, it is dropped)
Exams: 24-25% each (four)

Course Objectives:

1. Know that light can be modeled either as a collection of particles that move along rays or as a wave that moves through empty space, that color is our perception of light-wave frequency, and that light is quantized into smallest components called photons that have fixed energy.
2. Know that the speed of light is independent of reference frame, and be able to derive results of special relativity including length contraction, time dilation, and velocity addition.
3. Know that every object has resonant frequencies that depend on its shape and composition.
4. Know that waves transmit energy, that wave speed is determined by internal forces of the wave medium, and that waves can pass through each other and overlap in elaborate patterns.
5. Know that sound is a pressure wave that travels in solids, liquids, and gasses, that pitch is our perception of sound-wave frequency, and that the energy carried by sound waves disperses spherically outward from the sound-source.
6. Know how pitch is altered by the relative speed between the sound-source and listener, how stringed instruments and organ-pipes are tuned, how higher-energy harmonics are related to fundamental frequencies and musical scales, and how two sound waves interfere.
7. Know that subatomic particles are most accurately modeled as waves, that atomic spectra can be derived from a wave model, that particles cannot have an exact position and momentum, and that a conceptual understanding of this wave model remains an open debate.
8. Know historical and conceptual connections between classical and modern physics.
9. Know the relationships between properties of water and air modeled as incompressible fluids, including pressure, volume, cross-sectional area, velocity, and flow rate.
10. Understand the total energy in the universe is conserved, energy moves from object A to B either by work or heat transfer (positive work done by A on B or heat transferred from A to B), and the total energy of a large collection of objects changes forms depending on the arrangement (relative positions and orientations) of these objects and forces acting between them.
11. Understand energy conservation follows from Newton's laws.
12. Show that the macroscopic properties temperature and pressure can be derived from microscopic properties of gasses modeled as a large collection of point-like objects that repel at short distances and do not interact across large distances (the ideal gas model).
13. Apply the ideal gas model to engines and heat pumps to calculate work, heat, and energy.
14. Understand how entropy relates to energy and the direction of time, and how absolute zero relates to the long term future of the universe.
15. Know the fundamental forces and particles of nature, the evidence for them, and their

applications in nuclear technology, and their roll in the evolution of the universe.

Student Learning Outcomes for Lower Division Physical Science (B1):

1. Explain the steps in the scientific method of inquiry, which involves gathering observable, empirical and measurable evidence subject to specific principles of reasoning, and recognizing that reproducible observation of a result is necessary for a theory to be accepted as valid by the scientific community;
2. Analyze specific examples of how the scientific method has been used in the past to collect data through observation and experimentation, and to formulate, test and reformulate hypotheses about the physical universe; evaluate scientific information from a variety of sources and use that information to articulate well-reasoned responses to scientific concerns;
3. Evaluate scientific information from a variety of sources and use that information to articulate well-reasoned responses to scientific concerns;
4. Recognize the utility of alternative scientific hypotheses in the development of scientific theories, research and applications and understand how scientific evidence is used to develop hypotheses and theories;
5. Describe ethical dilemmas arising out of contemporary scientific research and applications, which may include those related to social justice, and may have implications for local and/or global communities;
6. Use scientific theories to explain phenomena observed in laboratory or field settings; and
7. Discuss the relevance of major scientific theories and research to their lives.

Dates & Policies, SFSU 2016 Calendar: https://webapps.sfsu.edu/public/webcal/acadcalendar

Last day to add/drop without W: Monday 2/8.

Withdrawal: http://www.physics.sfsu.edu/policy/withdrawal.pdf

Plagiarism: http://www.physics.sfsu.edu/policy/plagiarism.pdf

The Disability Programs and Resource Center (DPRC): Students with disabilities who need reasonable accommodations are encouraged to contact the instructor. The Disability Programs and Resource Center (DPRC) is available to facilitate the reasonable accommodations process. DPRC is located in the Student Service Building and can be reached by telephone (voice/TTY 415-338-2472), by email dprc@sfsu.edu, or visit their website at http://www.sfsu.edu/~dprc

SF State fosters a campus free of sexual violence including sexual harassment, domestic violence, dating violence, stalking, and/or any form of sex or gender discrimination. If you disclose a personal experience as an SF State student, the course instructor is required to notify the [Dean of Students]. To disclose any such violence confidentially, contact:
[The SAFE Place - (415) 338-2208; http://www.sfsu.edu/~safe_plc/**]**
[Counseling and Psychological Services Center - (415) 338-2208;http://psyservs.sfsu.edu/**]**
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