

PHY 4C – GENERAL PHYSICS/WAVES, HEAT, LIGHT AND MODERN PHYSICS HARTNELL COLLEGE

COURSE/UNITS:	PHY 4C / 4 units	SEMESTER:	Spring 2017
INSTRUCTOR:	Laura Fatuzzo	PHONE:	(831) 770-7017
OFFICE:		OFFICE HRS:	M, W: 11:00 AM-12:00 noon F: 10:30 AM-11:30 AM
EMAIL:	lfatuzzo@hartnell.edu		

CLASSROOM MEETING TIMES & LOCATION

Mon, Wed: 8:00 AM-9:15 AM in Room S131
Fri: 8:00 AM-8:50 AM in Room S131

LAB-ROOM MEETING TIMES & LOCATION

PHY-4C-1154 Tue 08:00AM - 10:50AM in Room S208
PHY-4C-1155 Tue 11:00AM - 1:50PM in Room S208
PHY-4C-1156 Tue 02:00PM - 4:50PM in Room S208

CATALOG DESCRIPTION- Waves, sound, thermal properties of matter, kinetic theory of gases, heat transfer, laws of thermodynamics, heat engines, reflection, refraction, interference, diffraction of light, lens systems, electromagnetic waves, Special Theory of Relativity, photoelectric effect, Compton effect, Bohr Model for the hydrogen atom, elementary quantum mechanics. Required for engineering and physical science majors. Strongly recommended for math majors.

COURSE PREREQUISITE- PHY 4A: General Physics/Mechanics I with a grade of "C" or better

COURSE COREQUISITE- MAT 3B: Analytic Geometry and Calculus

INSTRUCTIONAL METHODOLOGY - Lecture, lab activity, individual assistance, audiovisual assistance (including Power Point or other multimedia), demonstrations, discussion, group activity.

The course requires a minimum of three (3) hours of work per unit including class time and homework.

REQUIRED MATERIALS

- *Physics for Scientists and Engineers with Modern Physics (w/MasteringPhys)* Edition: 4th by Knight or earlier edition (Mastering Physics MUST be 4th Edition)
- Lab Manual – to be purchased in bookstore
- Scientific calculator (Lab and lecture)
- Three or four colored pencils (Lab and exams)
- Notebook for problem-solving journal (Lecture)
- Quadrille (squares, not lines) notebook (Lab)
- 15-cm clear plastic ruler (Lab)
- Glue stick (Lab)

CONTACTING INSTRUCTOR- Students are **strongly encouraged and welcomed** to come for help during office hours and/or contact the instructor via email with any questions or concerns regarding the class. There is no such thing as silly questions, and if they do exist, they are welcomed.

COURSE CALENDAR- Please go to the Classroom Blog for the calendar: lfphysicsblog.wordpress.com

CAMPUS SAFETY

EMERGENCY NOTIFICATION: In the event of a life threatening emergency call 911. To report a non-life threatening incident, safety hazard, or a suspicious activity please contact campus security at 755-6888. To obtain campus status information, call the campus safety and facilities emergency status bulletin telephone number: 831-796-6222. From a campus line, simply dial 6222.

Please visit Hartnell's emergency reporting link here: <http://www.hartnell.edu/reporting-emergencies>

Students: If you receive an emergency notification while you are in class, please notify your instructor immediately.

During a campus emergency, you will generally be told to do one of two options, SHELTER IN PLACE or EVACUATE. When either of these are given, vehicle traffic coming onto campus will likely be turned away. Students are required to obey the directions of staff in a timely fashion.

EVACUATION: Please note the exit(s) in the room. In the event of an alarm or safety threat, uniformed Hartnell personnel equipped with two-way radios--including security, and maintenance staff--have up-to-date information; they also have the authority to order either shelter-in-place or immediate building evacuation. For evacuation, immediately heed their directions by proceeding calmly and quickly to an exterior assembly area as indicated by trained staff. Please stay back at least 200 feet from any building until the "all clear" command is issued.

SHELTER IN PLACE: In the event of a safety threat, instructors and staff will lock classroom doors and direct occupants to stay clear of windows. Occupants are requested to remain quiet. During this time, DO NOT access any exits unless directed by first responders or staff. A shelter in place order is also used for severe environmental threats like a thunderstorm.

Active Shooter Response

In the event of an Active Shooter Event, there are three things you need to know in order to survive: Run, Hide, Fight.

If you see suspicious behavior on campus, please tell someone. Our campus safety officers are trained to investigate suspicious incidents.

EMERGENCY PREPAREDNESS: The first 72 hours of a disaster are often the most difficult, but this period can be less stressful if everyone has extra supplies on hand. The college has a limited amount of emergency supplies, so students and staff should have on campus their own portable emergency kit including snacks, water, and prescription medication; this is especially important for those who may need to shelter on campus. For more information go to <http://72hours.org/>

Students: If you have knowledge of an emergency on campus, share it immediately. If you see something suspicious or potentially hazardous, let someone know.

STUDENT LEARNING OUTCOMES

- Given information about a wave disturbance, the student will characterize the wave and do quantitative calculations that predict its behavior.
- Given information about a thermodynamic system, the student will describe the energy flow into and out of the system and do quantitative calculations that predict the behavior of the system.
- Given information that characterizes an optical system, the student will describe the passage and behavior of light through that system.
- Given information about the atomic nature of a simple system, the student will use the principles of elementary quantum mechanics to do basic predictions about the behavior of that system.

IMPORTANT NOTE ON STUDENT LEARNING OUTCOMES

(1) Students may vary in their competency level on these outcomes, and (2) they can expect to achieve these outcomes *only if* they honor all course policies, attend classes regularly, complete all assigned work in good faith and on time, and meet all other course expectations of them as students.

COURSE OBJECTIVES

Upon satisfactory completion of the course, students will be able to:

1. Recognize the properties of sinusoidal traveling waves and use the wave model to solve problems of wave motion.
2. Analyze how constructive and destructive interference occurs and calculate the allowed frequencies and wavelengths of standing waves.
3. Examine the wave model of light and calculate the interference pattern of double slits and diffraction gratings.
4. Employ the wave model of light to calculate angles of reflection and refraction.
5. Analyze combinations of lenses to compare and contrast cameras, microscopes, and telescopes.
6. Use the first law of thermodynamics to calculate work and heat for ideal gas processes.
7. Use the second law of thermodynamics to assess how interacting systems come to thermal equilibrium.
8. Demonstrate how molecular motions and collisions are responsible for macroscopic phenomena such as pressure and heat transfer.
9. Characterize the performance of a heat engine in terms of its thermal efficiency and that of a refrigerator in terms of its coefficient of performance.
10. Use the principle of relativity to solve problems involving time dilation and length contraction.
11. Analyze how de Broglie's matter waves lead to the quantization of energy.
12. Evaluate the connections between the particle and wave descriptions of matter to develop a model of the wave function.
13. Construct experiments for examining predetermined scenarios of waves and thermodynamics.
14. Assemble and use equipment to investigate predetermined scenarios of waves and thermodynamics.
15. Use experimental equipment to verify qualitatively the concepts required to predict outcomes in scenarios of waves and thermodynamics.
16. Collect and interpret experimental data via graphs to display the relationships between the measured quantities to demonstrate quantitatively laws governing waves and thermodynamics.

STUDENT RESPONSIBILITIES

Students are expected to be collegial, professional and respectful at all times, and together with the instructor, create a positive learning community.

CLASS PARTICIPATION	<p>Students are expected to play an active role rather than a passive role during class. Students are strongly welcomed and encouraged to ask questions, ask that something be clarified, and contribute to the learning community at all times. Students are expected to participate actively in all activities in a professional manner.</p> <p>If a student misses all or part of a class/lab section, the student is still responsible for the material covered during that session. If you are going to miss a class, email the instructor BEFORE CLASS, and find out outside of class if the instructor has made any changes on assignments, due dates etc.</p>
CELL PHONES	<p>If you need to call or text someone, or answer a text or a phone call, please do so outside of class. Do not use non-class related gadgets in class. You may use iPads and other gadgets if they contribute in learning what is being presented in class.</p>

ATTENDANCE, TARDINESS AND BREAKS	<p>Attendance will be taken at the beginning of each class session. The standard attendance policy from the Hartnell Schedule of Classes will be adhered to: “Any lack of attendance which leads an instructor to judge that unsatisfactory progress is being made may result in the student being dropped. Absence from a full semester class in excess of two weeks (consecutive or non-consecutive) may result in the instructor dropping the student. That is, a student may be dropped after missing one more class meeting than twice the number of class meetings per week.” This amounts to 8 absences including labs, excused OR unexcused. In addition, 3 tardies can be counted as 1 absence.</p> <p>IMPORTANT NOTE: If you are going to be absent, email the instructor BEFORE CLASS . If you are going to miss class excessively, email the instructor that you will be missing many class sessions and that you will take responsibility for the consequences.</p> <p>Come to class prepared and on time. If you feel that you have an acceptable reason for <u>being consistently</u> tardy, such as having to drop off family members to school, please let me know so we can make special arrangements.</p> <p>Be respectful of others when entering and leaving the classroom.</p> <p>If you need to talk to others about non-class related topics, do so outside of the classroom.</p>
TALKING IN CLASS	<p>Talking in class when the instructor is lecturing or a student is asking a question etc. is very disruptive, disrespectful and unprofessional. If you want to discuss something that deals with the topics at hand, want to ask a question, or want to make a comment, let the instructor know by raising your hand. You may talk when the instructor is erasing the board, etc., or when working in groups. If the instructor feels a student is being disruptive, the instructor will talk to the student about how to resolve the issue. If the issue continues not to be resolved, the instructor will follow Hartnell policy to deal with the issue.</p>

ACADEMIC INTEGRITY POLICY (AIP)

As per the Hartnell policy from the Schedule of Classes:

“Dishonesty includes, but is not limited to, in-class cheating, out-of-class cheating, plagiarism, knowingly assisting another student in cheating or plagiarism, or knowingly furnishing false information to College staff, faculty, administrators or other officials. Following are definitions of in-class cheating, out-of-class cheating, plagiarism, and furnishing information. These are not all-inclusive, and the list itself is not meant to limit the definition of cheating to just those mentioned.

1. In-class cheating: during an examination or on any work for which the student will receive a grade or points, unauthorized looking at or procuring information from any unauthorized sources or from any other student's work.
2. Out-of-class cheating: unauthorized acquisition, reading or knowledge of test questions prior to the testing date and time: changing any portion of a returned graded test or report and resubmitting as original work to be regarded; or presenting the work of another as one's own for a grade of points.
3. Plagiarism: unauthorized use of expression of ideas from either published or unpublished work(s) as a student's own work for a grade in a class. This also includes the violation of copyright laws, including copying of software packages.

4. Furnishing false information: forgery, falsification, alteration, or misuse of College situations.”
5. If a student is discovered to be cheating, a zero will be immediately given on the assignment and a meeting with the instructor will be scheduled. If a second instance occurs, the prior policy will be invoked in addition to further action taken with administration and the possible result of a failing grade in the course.

STUDENT SUPPORT SERVICES

DEPARTMENT OF SUPPORTIVE PROGRAMS & SERVICES
Hartnell College offers supportive services and instruction for students with disabilities through the Department of Supportive Programs and Services (DSP&S). Students with needs are urged to contact DSP&S and the instructor as soon as possible. The DSP&S office is located in Building B, Room 107. You can also contact them at (831) 755-6760.
CRISIS COUNSELING SERVICES
Appointments may be scheduled by phoning the crisis line (770-7019). Offices are located in building "D" (D-123, -124 and -126).
THE EARLY SUCCESS PROGRAM
We are fortunate to have Hartnell’s Early Success Program (ESP) available for students in this course. The ESP allows instructors to notify a special ESP Counselor, who can provide early support and assistance to a student that the instructor feels (or the student feels) will benefit from the services of the program. This is an important source of help. If you want to hear more about the program, please see me; or if the ESP Counselor contacts you, please take advantage of the help offered.

CLASS COMPONENTS AND GRADES

LAB COMPONENT: -----20%
CLASS COMPONENT:
Four exams @ 10 % each -----40%
Homework, quizzes, class assignments, participation points ---20%
Comprehensive final -----20%

The grade breakdown is as follows:

A	90 - 100%	B	80 - < 90%	C	70 - < 80%	D	60 - < 70%	F	< 60%
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- Remember: **The instructor does not give grades; you earn them.** If you catch a mistake in the grading, such as points being added incorrectly in an exam, notify the instructor immediately, preferably by email, so that the mistake can be corrected as soon as possible.
- Your grades will be posted on Canvas. If you see a mistake, please email the instructor ASAP.
- **Final grades:** If you feel there is a mistake with your final grade for the class, please send the instructor an email showing in detail how you calculated your grade. The instructor will then check your calculation for accuracy. Make sure you weigh each category as stated in the syllabus; do not just add the points.
- **Your final exam will be kept for two years in case you want to go over it the following semester.**
- **You can make an appointment with the instructor at any time during the semester to look over your grades.**

PARTICIPATION POINTS - Participation points may be given at any time. Socratic may be used to record the participation points. Often, participation points are earned for participation in an activity assigned for the first 10 minutes of class, so make sure you come to class on time. **As a backup, write the time you came to class on the roll-sheet.**

QUIZZES - Quizzes may be given at any time, announced or unannounced. Socratic may be used during the quizzes.

HOMEWORK - For homework assignments and due dates, see Canvas. Your homework will consist of completing **Mastering Physics** assignments and completing **Reading Assignments**. Homework is due on the date and time designated.

- **Mastering Physics: No late Mastering Physics assignments will be accepted. You can have TWO replacement assignments; you cannot earn more points than the assignment you are replacing. There are two due dates for replacement assignments: those that are part of the first set of replacement assignments are due two days after Exam 2, while those that are part of the second set are due two days after Exam 4.**
- **Reading Assignments:** Two of your reading assignments will be optional. You can earn a total of 40 bonus points by doing all of the reading assignments. **No late reading assignments will be accepted.**

NOTE: IF YOU HAVE ANY QUESTIONS, ISSUES ETC. REGARDING THE HOMEWORK, IT IS YOUR RESPONSIBILITY TO EMAIL THE INSTRUCTOR IMMEDIATELY SO A TIMELY SOLUTION CAN BE FOUND. DO NOT WAIT UNTIL THE LAST MINUTE OR AFTER AN ASSIGNMENT IS DUE TO CONTACT THE INSTRUCTOR OR THE ASSIGNMENT MAY BE COUNTED LATE.

When solving problems from Mastering Physics, you are encouraged to do the problems also on paper in a notebook, showing all the steps. The notebook will not be collected, but it will help you when studying. Follow the problem-solving format shown below.

PROBLEM-SOLVING FORMAT -

1. Be neat.
2. Draw diagram(s) , labeling “knowns” and “unknowns.”
3. Organize information “knowns” and “unknowns” in a table .
4. Show the basic equations used, in symbol form , that reflect the main concepts
5. Substitute numbers into the equations
6. Solve difficult algebra only if time permits.
7. Highlight or box in the answers or final equation(s)

EXAMS- There will be **four exams** throughout the course and a comprehensive final. No missed exams can be made up unless an arrangement has been made with the instructor **before the exam**. Exam problems will be similar to but not identical to those done in class and to those assigned as homework. You may also have conceptual questions to answer in the exam. **Formulas will be provided**. For each exam problem, you will be graded on procedure, which means you are to follow the problem-solving format above. The problems must be legible and easy to follow or will not be graded.

If you have completed at least 70% of your homework and your attendance is at least 80%, you may regain up to 10 points for **TWO** of the first three exams (not the fourth one) if you earned less than 67% on that exam. The points added cannot make your exam grade be greater than 67%.

To earn back points follow this formula:

(30 minutes spent in the Panther Learning Lab within one week of getting back the exam = 1 point)

NOTE- When taking quizzes and exams, all electronic equipment except calculators needs to be put away. This includes iPads, iPhones, and earphones.

IMPORTANT, REGARDING LAB GRADE: No one will be given a passing grade in the course unless at least 3/4 of the required lab reports are satisfactorily completed by the end of the semester.

IMPORTANT STATEMENT: THE SCHEDULE, POLICIES, PROCEDURES, AND ASSIGNMENTS IN THIS COURSE ARE SUBJECT TO CHANGE IN THE EVENT OF EXTENUATING CIRCUMSTANCES, BY MUTUAL AGREEMENT, AND/OR TO ENSURE BETTER STUDENT LEARNING.

COURSE CONTENT

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| <p>I. Mathematical description of waves</p> <ul style="list-style-type: none"> A. The wave model B. One-dimensional waves C. Sinusoidal waves D. Waves in two and three dimensions E. Sound and Light F. Power, Intensity, and decibels G. The Doppler effect <p>II. Superposition</p> <ul style="list-style-type: none"> A. The principle of superposition B. Standing waves C. Transverse standing waves D. Standing sound waves and musical acoustics E. Interference in one dimension F. The mathematics of interference G. Interference in two and three dimensions H. Beats <p>III. Wave optics</p> <ul style="list-style-type: none"> A. Light and optics B. The interference of light C. The diffraction grating D. Single-slit diffraction <p>IV. Ray Optics</p> <ul style="list-style-type: none"> A. The ray model of light B. Reflection C. Refraction D. Image formation by refraction E. Thin lenses: ray tracing F. Image formation by spherical mirrors <p>V. Optical Instruments</p> <ul style="list-style-type: none"> A. Lenses in combination B. Vision C. Resolution of optical instruments <p>VI. Kinetic theory of gases</p> <ul style="list-style-type: none"> A. Molecular speeds and collisions B. Pressure in a gas C. Temperature D. Thermal energy and specific heat E. Thermal interactions and heat F. Irreversible processes and the Second Law of Thermodynamics | <p>VII. Laws of thermodynamics</p> <ul style="list-style-type: none"> A. First Law of Thermodynamics B. Work in ideal-gas processes C. Heat D. Thermal properties of matter E. Calorimetry F. Specific heats of gases G. Heat-transfer mechanisms <p>VIII. Heat engines</p> <ul style="list-style-type: none"> A. Turning heat into work B. Heat engines and refrigerators C. Ideal-gas heat engines D. Ideal-gas refrigerators E. The limits of efficiency F. The Carnot cycle <p>IX. Special Theory of Relativity</p> <ul style="list-style-type: none"> A. Galilean relativity B. Einstein's Principle of relativity C. Events and measurements D. The relativity of simultaneity E. Time dilation F. Length contraction G. The Lorentz transformations H. Relativistic momentum I. Relativistic energy <p>X. Quantization</p> <ul style="list-style-type: none"> A. Photoelectric effect B. Matter waves and quantization C. Bohr's model of atomic quantization D. The Bohr hydrogen atom E. The Hydrogen spectrum <p>XI. Elementary quantum mechanics</p> <ul style="list-style-type: none"> A. Schrodinger's Equation B. Solving the Schrodinger equation C. A particle in a rigid box D. The correspondence principle E. Finite potential wells F. Wave-function shapes G. The quantum harmonic oscillator H. Quantum-mechanical tunneling |
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LAB CONTENT (tentative)

1. Error and Measurement
2. Standing Waves on a String
3. Finding the Speed of Sound Using a Resonant Air Column
4. Electrical Equivalent of Heat
5. Specific Heat of an Unknown Metal
6. The Heat of Fusion of Water
7. Plane and cylindrical Mirrors
8. Efficiency of a Heat Engine
9. Interference and Diffraction
10. Reflection and Refraction
11. Thin Lenses
13. Compound Microscope
14. Michelson Interferometer
14. Atomic Spectra
15. Half Life