

## **Physics Heat, Sound, Light - PHY K115 - COURSE SYLLABUS**

**Instructor:** Charles Mihalko

**Room:** class / lab B-208

**Class Time:** W 5:30- 9:55 pm

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### **Course Description for Physics Heat, Sound, Light - PHY K115 (formerly PHY K120)**

4 CREDIT HOURS

HEAT SOUND LIGHT

Prerequisite: MAT\* K095, with a "C#" grade or better.

Co-requisite: MAT\* K137.

This course covers three broad areas of physics including thermal equilibrium, heat transfer, harmonic motion and wave properties of sound and light. Three hour lecture, one two-hour lab.

### **Course Topics/Content**

#### **Classroom/Lecture (45 hours total)**

##### **I. HEAT (15 hours)**

- Thermal Expansion
- Electrical equivalent of heat
- Mechanical equivalent of heat
- Specific Heat
- Calorimetry
- Latent heat
- Heat transfer

##### **II. ELASTICITY AND HOOKE'S LAW (5 hours)**

##### **III. VIBRATIONS AND WAVES (5 hours)**

- Simple harmonic motion
- Transverse and longitudinal waves
- Wave equation
- Superposition, interference, and reflection of waves

##### **IV. SOUND (5 hours)**

- Speed in different media
- Doppler effect for sound
- Decibel Scale
- Forced vibrations and resonance

##### **V. ELECTROMAGNETIC WAVES (15 hours)**

- Spectrum, frequency and wavelength
- Energy-frequency relationship
- Refraction and reflection
- Mirrors and lenses
- Optical instruments
- Wave optics

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### **Lab Experiments (30 hours total)**

1. Linear Thermal Expansion
2. Volumetric Thermal Expansion
3. Specific heat and Calorimetry
4. Latent Heat of Fusion
5. Latent Heat of Vaporization
6. Heat Equivalent of Electricity
7. Simple Harmonic Motion (Hooke's Law or Pendulum)
8. Waves on Strings
9. Speed of Sound in Air
10. Refraction
11. Lenses
12. Young's Two-Slit Experiment
13. Diffraction Grating
14. Polarization
15. Optical Instruments - Two Lens Systems
16. Additional Lab Experiments:
  - a. Reflection from Two Mirrors
  - b. Interference in Thin Films
  - c. Speed of Light

### **Measurable Objectives: (Classroom/Lecture)**

The student will be able to do the following:

1. Calculate the coefficient of linear and volume expansion for various materials.
2. Solve calorimetry problems using specific heats of various solids and liquids.
3. Solve calorimetry problems using the Heat of Fusion and the Heat of Vaporization
4. Explain and contrast methods of heat transfer
5. Calculate heat transfer by conduction, convection and radiation
6. Solve general calorimetry problems involving heat transfer processes.
7. Calculate the spring constant "k" for various mass spring systems; and calculate elastic potential energy.
8. Explain the relationships between displacement, velocity and acceleration in simple harmonic motion.
9. Explain interference and superposition of waves.
10. Calculate the speed of sound in different solids, liquids, and gases.
11. Calculate the Doppler frequency shift for moving sound sources and observers.
12. Perform calculations with the decibel scale of sound intensity and explain the need for ear protection.
13. Give examples (preferably from technology applications) of resonance and damping.
14. Describe the electromagnetic spectrum in terms of both frequency and wavelength.
15. Solve problems using the laws of reflection and refraction.
16. Explain critical angle and the principle of optical fibers.
17. Calculate the position and describe the character of images in systems involving convex and concave mirrors and converging and diverging lenses.
18. Predict the fringe patterns (max./min. locations) for two-slit and diffraction grating problems.
19. Define diffraction, and use to explain the "limits of seeing".
20. Explain the construction and operation of optical instruments including the camera, telescope, microscope and human eye.

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### Measurable Objectives: (Lab)

Students will be able to:

1. Read and follow written instruction
2. Assemble and use lab equipment peculiar to thermodynamics, acoustics and optics including (but not limited to) gas burners, steam generators, calorimeters, stroboscopes, dB meters, lasers, optical benches and their accessories.
3. Collect data in an organized fashion, noting precision of measurement and unit labels.
4. Analyze data by creating graphs (by hand and by computer, with slope and intercept, if needed) and by correctly inserting data into equations.
5. State results to the correct accuracy.
6. Calculate % error, where applicable.
7. Explain sources of error in an experiment based on the limitation of the equipment used.
8. Draw conclusions by relating their results to the appropriate physics principles.

### Required Texts/Supplies:

*College Physics, ed. 7; Wilson and Buffa; Prentice-Hall*  
*Departmental Lab Manual for HSL*

### Expectations, Attendance, Grading, Due Dates, and Academic Honesty:

**Attendance** - *I will take attendance at each class meeting. Because many of the ideas for out-of-class work will be discussed in detail during class, it is to your advantage to attend regularly. One or two missed classes will not impact your work negatively as long as you make up the work, but excessive absences (more than three) will most likely impact your work negatively.*

#### **General / Due Dates:**

1. *Come to class prepared to learn. We will have fun too!*
2. *Come to class prepared as if you will teach the class!*
3. *Work the sample problems in the book as you read & study the material. We will be doing a lot of math work in class, for homework, & assessments. Have paper, pencils & calculator.*
4. *Take notes as you study. Write down your questions. Try to find the answers via Internet search. Bring the questions to class. Chances are, that we all will learn from the questions.*
5. *All written work is due on the assigned date. Late work will automatically have ten percent deducted from the grade. Work over one week late will not be accepted and a grade of zero will be assigned. If you have any questions or concerns about getting your work in on time, please contact me before the due date.*
6. *Actively participate in class!*

#### **Methods of Evaluation:**

- *Sectional Exams (Three exams)*
- *Quizzes / Assignments (Weekly)*
- *Participation / Attendance (Weekly)*
- *Laboratory (Weekly Lab Reports & Participation)*

*The final course grade will be computed according to the following formula:*

<i>Section Exams (Three exams)</i>	<i>50%</i>
<i>Quiz / Assignments / Class Participation</i>	<i>25%</i>
<i>Lab / Participation</i>	<i>25%</i>
<i>Final Grade</i>	<i>100%</i>

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### Grading Scale:

Letter	Percent	Letter	Percent
A	94-100	C	73-76
A-	90-93	C-	70-72
B+	87-89	D+	67-69
B	83-86	D	63-66
B-	80-82	D-	60-62
C+	77-79	F	<60

### **Class/Lecture (75% of grade):**

- Weekly “Exit Tickets” will be completed after the end of class. They are due Thursday Midnight. Your responses are important to help assess the understanding of the topic and what questions you might still have. You will be asked to document 3 important things we discussed in class, 2 questions you still have, and one connection to share. The lowest score will be dropped in computing your grade. Spend no more than five minutes on this assignment. Exit Tickets will be turned in via email.
- Quizzes / Assignments will be given after every class and will be due before the beginning of the following class. The lowest score will be dropped in computing your grade. This work will be open book/open notes.
- Three Section In-class Exams will be given during the semester and will be scheduled at least one week in advance. If you must be absent from an exam, consult with me BEFORE the exam is given. These in-class exams will be open book/open notes.

### **Lab (Reports & Participation) (25% of grade)**

- Each student will turn in a lab report after each lab. The lab report will be due before the beginning of the following lab. The lowest score will be dropped in computing your grade.
- Lab reports will be neatly typed or handwritten with college level grammar and spelling. Each report should include the following sections:
  - Introduction/Objective: The purpose of the experiment, the physical phenomenon observed and the concept or numerical constant to be verified. (10%)
  - Procedure: A description of the methods and materials for the lab experiment describing the equipment and set up used to observe and investigate the objective and how the data was collected and recorded. Describe the dependent and independent variables where applicable. (20%)
  - Results: Display the data collected and the results obtained expressed as a neatly organized table of data, the mathematical models used and the calculations derived from the data, graphs of results with clearly labeled axes. Calculations used in the experiment should be included in a clear and organized manner with the proper units. (30%)
  - Discussions/Conclusions: An explanation and interpretation of the results and how they compare to the stated objective. Patterns and trends should be identified and related to supporting or refuting your hypothesis. Possible sources of errors should be discussed and the percent error from the accepted values should be indicated when appropriate. Questions related to the experiment should be included and answered as completely as possible. **This section will have the strongest determination for your grade. (40%)**

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Please remember that it is your responsibility to keep up with assignments and paper due dates as outlined by the syllabus. Contact me if you miss a class to get any handouts from the session you did not attend.

If a class is cancelled for some reason, expect to do the work and turn in any papers associated with the cancelled class in the following session.

### **Campus and Class Policies:**

**Academic Integrity** - Academic integrity is essential to a useful education. Failure to act with academic integrity severely limits a person's ability to succeed in the classroom and beyond. Furthermore, academic dishonesty erodes the legitimacy of every degree awarded by the College. In this class and in the course of your academic career, present only your own best work; clearly document the sources of the material you use from others; and act at all times with honor.

**Academic Dishonesty** - Student Discipline Policy, section 2:10, Board of Trustees of Connecticut Community Colleges. Academic Dishonesty shall in general mean conduct which has as its intent or effect the false representation of a student's academic performance, including but not limited to (a) cheating on an examination, (b) collaborating with others in work to be presented, contrary to the stated rules of the course, (c) plagiarizing, including the submission of others' ideas or papers (whether purchased, borrowed, or otherwise obtained) as one's own, (d) stealing or having unauthorized access to examination or course materials, (e) falsifying records of laboratory or other data, (f) submitting, if contrary to the rules of a course, work previously presented in another course, and (g) knowingly and intentionally assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed.

**Withdrawal policy**- A student who finds it necessary to discontinue a course once class has met must provide written notice to the registrar. Withdrawal forms are available at the Registrar's office. No punitive "W" grades are assigned to any withdrawal requested before the unrestricted withdrawal deadline for the semester. Withdrawal requests received after this deadline must bear the signature of the instructor. No withdrawals are permitted after the last class preceding the final exam. Students who do not obtain an official withdrawal, but simply stop attending classes, run the risk of receiving an "F" grade for the course.

**Students with disabilities**- Students with disabilities are guaranteed reasonable accommodations under the provisions of the Americans with Disabilities Act of 1992. Disclosure of a disability must be voluntary. If you have a hidden or visible disability that may require classroom or test-taking modifications, please contact the Student Development Services office at 860-383-5217. Please see the Three Rivers Community College Catalog for additional policies and information.

**Classroom Behavior**- This is a college course for committed students, and I expect you to maintain proper decorum in the classroom. Treat your fellow students with maturity and respect at all times. Extend the same attitude towards your instructor. **Immature behaviors will simply not be tolerated; if I am forced to address a behavior issue more than once, you will be asked to leave and not return to class.**

**Online learning portfolio** - As a student you will maintain an online learning portfolio using a college-designed template in Digication. Through this electronic tool you will have the opportunity to monitor your own growth in college-wide learning. It may even help you determine a major that is best suited to you. You will be able to keep and maintain your learning portfolio after graduation. A Three Rivers General Education Assessment Team will select and review random

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works to improve the college experience for all. If your work is selected and reviewed for assessment purposes, it will remain anonymous and private. Digication provides a “place” where you will connect your learning from the classroom, college, and life in general. Sometimes when you review all of the work you have done and think about it, you end up learning something different and perhaps unexpected. Please review your course outlines to determine what assignments to upload into the TRCC Digication template and please post your own choices, as well. Have fun in learning!

### **Revisions to Syllabus:**

The information contained in the syllabus is subject to revision at my discretion. I will inform the class of any changes that are made. If you miss a class, check with a classmate upon your return to verify that you have the most up-to-date information.