

## **PHYS 2423, PRINCIPLES OF PHYSICS II**

*Summer Semester, 2014*

Physics Department, Dr. Ernest Pyle, Department Chair

### **COURSE DESCRIPTION**

An introduction to the physical principles of thermodynamics, kinetic theory, electricity, magnetism, simple AC and DC circuits, and geometric wave optics. This course includes one semester hour credit for laboratory sessions.

### **COURSE SEQUENCE IN CURRICULUM**

Prerequisite to PHYS 2343, 3313, 3323, 4323 and 4343

### **PRE-REQUISITE INFORMATION**

PHYS 2413

### **INSTRUCTOR INFORMATION**

Name: Dr. Gardo Blado  
E-mail: gblado@hbu.edu  
Office Phone: 281-649-3187  
Office Location: S217  
Office Hours: To be announced in class  
Web Page Address, Web Board, ListServ: See Blackboard

### **LEARNING RESOURCES**

Course Text: *Principles of Physics*, 5<sup>th</sup> ed., by R.A. Serway and J. W. Jewett Jr.  
Laboratory Text: None  
Supplementary Text: None  
Other Required Materials: None

### **COURSE OBJECTIVES**

#### Purpose of the course:

Physics 2423 is a calculus-based course that is intended to provide the basic knowledge in physics needed to study advanced physics or other sciences. Both problem-solving skills and conceptual understanding are emphasized. In addition, the students acquire laboratory skills through experiments. The topics covered are thermodynamics, electricity, magnetism and optics.

#### Aims for the course:

To develop critical-thinking skills and prepare the students for courses or examinations that require a knowledge of physics.

#### On completion of this course, students should be able to:

1. understand the basic theory of thermodynamics, electricity, and magnetism
2. use mathematical techniques in solving problems in thermodynamics, electricity and magnetism
3. be aware of the type of testing used in the MCAT physics tests

### **RELATION TO DEPARTMENTAL GOALS AND PURPOSES**

The Mathematics/Physics Department "...will offer an academically rigorous, undergraduate curriculum in classical and modern mathematics. The curriculum will prepare students majoring in mathematics and mathematical studies for careers and further education in mathematics and will encourage a lifetime of learning."

"...will provide academically rigorous and modern courses in mathematics to support other programs at the University."

"...will offer courses to enable all graduates of the University to become mathematically literate and develop useful skills in mathematics."

"...will provide the appropriate administrative processes, facilities, research experiences, and faculty to achieve the goals stated above."

### **RELATION TO COLLEGE GOALS AND PURPOSES**

"...to prepare students for careers and further education in the natural sciences and mathematics in a nurturing Christian environment. The College will also serve the HBU community by providing science and mathematics classes that empower HBU students to meet the goals and requirements of their field of study and enrich their liberal arts education."

### **RELATION TO THE PURPOSE STATEMENT OF THE UNIVERSITY**

University mission and purpose statement from the Houston Baptist University Catalog, 2009-2010: "...to provide a learning experience that instills in students a passion for academic, spiritual, and professional excellence as a result of our central confession, "Jesus Christ is Lord"

"...Committed to providing a responsible and intellectually stimulating environment that:

- fosters spiritual maturity, strength of character, and moral virtue as the foundation for successful living
- develops professional behaviors and personal characteristics for life-long learning and service to God and to the community
- meets the changing needs of the community and society
- remains faithful to the '**Nature of the Institution**' statement"

"...Promotes learning, scholarship, creative endeavor, and service".

### **ATTENDANCE**

Please see the official Attendance Policy in the HBU Classroom Policy on Blackboard. Students missing more than 25% of the class will be given a failing grade.

For this class, after 5 absences, the student will get automatically a grade of "F".

### **ACADEMIC ACCOMODATIONS**

Students needing learning accommodations should inform the professor immediately and consult the Academic Accommodations section of the HBU Classroom Policy posted on Blackboard.

### **TEACHING STRATEGIES**

To make the lectures interactive, I am employing the “Peer Instruction” technique started by Professor Eric Mazur at Harvard University. The students are assigned reading assignments and warm-up questions for the next class. In class, the students are made to discuss the answers to the warm-up questions. The short lecture that follows outlines in an orderly fashion, the important concepts and emphasizes on topics that give the students the most difficulty as seen in the discussions. Problem-solving and conceptual understanding are both emphasized through the homework problems, lectures, quizzes and exams. Recent physics education research ideas, especially the works of Professor Arons of the University of Washington, are applied to improve conceptual understanding. Since the majority of the students are pre-medical students, “MCAT-type” testing is being developed and applied. In addition, commonly asked MCAT questions and problems are also discussed. The laboratory experiments are designed to coincide with the lectures to facilitate the interconnection of theory and experiment.

### **Classroom Performance System (CPS):**

See my handout, “Classroom Performance System (CPS) Instructions” in Blackboard ASAP!!! You need to have your clickers ready and you must have registered by the second meeting of this summer!!!

### **COURSE REQUIREMENTS & GRADE SCALE**

#### Course requirements:

**Note for Seniors:** If you are graduating this Summer, **PLEASE IDENTIFY YOURSELF TO ME AS SOON AS POSSIBLE!**

**Special note for the 8 am class:** If the instructor is late and a note is posted that the instructor will arrive, students are required to wait through the whole period, spending time doing homework, studying or doing advance work for the class. Students who leave will be considered absent and will be responsible for whatever material they miss during the class period.

**Calculators:** During tests, **GRAPHING CALCULATORS ARE NOT ALLOWED!** Make sure you have a scientific calculator that can calculate trigonometric functions.

**Cell Phones:** During tests, **CELL PHONES ARE NOT ALLOWED!** No Exceptions!!!

**Reading Assignments:** Reading assignments will be given to enable the students to prepare for the next lecture. These assignments will be collected and graded according to the effort made to answer the questions. We will answer the reading assignments together in class and class participation will be graded for each question as follows: 1 pt for a correct answer, ½ point for wrong answer, 0 point for no answer.

**Homework Problems:** The assigned sample multiple-choice questions will be given in class. I will place the solutions to the sample multiple-choice questions in Blackboard, which I expect you to study. We will use an online homework system. You will use Web Assign to do and submit homework. The class key will be given in class. **You need to self-enroll. For instructions to self-enroll, read the handout in Blackboard “Self Enrollment Instructions”.** **Please use your official HBU name when you enroll otherwise I will not consider your grades and you will get a zero for the HW!** **Assignments are due at midnight of the day in which it is due.** It is your responsibility to check if there are homework due everyday. I do not postpone the WebAssign for any reason except when we have not finished covering the sections included in the homework. Excuses like ‘I forgot, my computer crashed, WebAssign was unavailable, I had a family/personal emergency, etc.’ will not be considered as valid excuses. Your WebAssign grade will be normalized out of 100 pts. (like 1 exam grade).

**Quizzes:** I will give 5 quizzes (worth 20 points each) on assigned homework problems (**or similar problems**), example problems discussed in class from sections covered (**or similar problems**) and conceptual questions. These quizzes will be given at the beginning of the class. **I do not give make up quizzes.** However, you can talk to me about missed quizzes if you feel the need for it. You must talk to me about a missed quiz within three days from the time the quiz is given. Otherwise, I will not entertain any discussions on the missed quiz. If you know that you will miss the quiz beforehand, it is best to talk to me or contact me, before the quiz is given. Inability to contact me in time to talk about a missed quiz is not an excuse. You can go to me during my office hours, leave a note on my door, leave a message in my office voice mail, or e-mail me.

**Exams:** The instructor may check the students' HBU ID's before exams! Students are expected to bring their HBU ID's during every exam. NO ID NO EXAM (SO YOU GET A ZERO) NO EXCEPTIONS! I will give 4 exams (100 points each) and a final exam (worth 200 points). The **2 ½ -hour final exam** will be comprehensive. . PLEASE NOTE THAT I DO NOT RESCHEDULE FINAL EXAMS! PLAN TO TAKE THE FINALS DURING THE DESIGNATED TIME. **I do not give make up exams.** However, you can talk to me about missed exams if you feel the need for it. You must talk to me about a missed exam within three days from the time the exam is given. Otherwise, I will not entertain any discussions on the missed exam. If you know that you will miss the exam beforehand, it is best to talk to me or contact me, before the exam is given. Inability to contact me in time to talk about a missed exam is not an excuse. You can go to me during my office hours, leave a note on my door, leave a message in my office voice mail, or e-mail me.

ASSIGNMENTS:

Sections	Multiple Choice Questions
16.1-16.2	"Temperature" #1,3,5,6,7
16.3-16.5	"Temperature" #2,4 "Kinetic Theory of Gases" #5,6,8,10
17.1-17.4	"Heat and the First Law of Thermodynamics" #1,5,7,9,11,14,15,16,18
17.5-17.8	"Heat and the First Law of Thermodynamics" #4,8,10,12,13,17,19 "Kinetic Theory of Gases" #1,3,7
17.9, 17.10, 18.1	"Heat and the First Law of Thermodynamics" #2,3,6 "Kinetic Theory of Gases" #2,9,11
18.2-18.5, 18.7-18.8	"Heat Engines, Entropy and the Second Law of Thermodynamics" #1-10
19.1-19.4	"Electric Fields" #3,5,9,10,12,14,15
19.5	"Electric Fields" #1,6,7,8
19.6-19.10	"Electric Fields" #2,4,11,13 "Gauss' Law" #1-3, 6-12
19.11, 20.1-20.3	"Gauss' Law" #4,5 "Electric Potential" #2-6, 9,10
20.4-20.6	"Electric Potential" #1,7,8
20.7-20.10	"Capacitance and Dielectrics" –all (note, I sometimes use $V$ for $\Delta V$ )
21.1-21.2	"Current and Resistance" #2, 3, 8, 9, 10, 13
21.5-21.8	"Current and Resistance" #1, 4, 5, 6, 7, 11,12 "Direct Current Circuits" #1-8, 10-14
21.9	"Direct Current Circuits" #9
22.1-22.3	"Magnetic Fields" #2, 3, 5, 7, 8, 9, 10, 12, 13,14,17,18
22.5-22.8	"Magnetic Fields" #1,4,6,11,15,16 "Sources of Magnetic Fields" #2, 3, 4, 6, 8, 11
22.9, 22.10, 23.1	"Sources of Magnetic Fields" #1, 5, 7, 9, 10
23.2-23.3	"Faraday's Law" #1-5, 8, 9, 11, 12, 14, 15

23.5-23.7	“Inductance” #1,2,4,5,6,7,8,10,12,13
25.1-25.4	“Nature, Reflection and Refraction of Light” #1,2,3,5,6
25.7, 26.1	“Nature, Reflection and Refraction of Light” #4
26.2-26.3	“Geometric Optics” #4-6
26.4	“Geometric Optics” #1-3

Grading standards:

Course grading is as follows:

Homework		= 100 pts (normalized)
Quizzes*	5 x 20	= 100 pts
Exams	4 x 100	= 400 pts
Reading Assign**	23 x 2	= 46 pts
Finals	1 x 200	= 200 pts
<u>Lab Grade***</u>	7 x 20	= 140 pts
<u>TOTAL****</u>		= 986 pts + CPS total grade

\* # of quizzes subject to change

\*\* # of Reading Assignments subject to change

\*\*\* The Lab Grade depends on the laboratory report grades.

\*\*\*\* The TOTAL is subject to change depending on the above grades and the number of questions answered in class during the CPS sessions

The grading scale is:

grade = 90% or above	→ A
grade = 75% to 89%	→ B
grade = 60% to 74%	→ C
grade = 50% to 59%	→ D
grade = below 50%	→ F

**PROFICIENCIES:**

Technology component:

The technology component of the course involves the use of micro-computer-based laboratory (MBL) in data acquisition and data analysis in some laboratory experiments, the use of the Classroom Performance System during lecture and the use of the online homework system called WebAssign.

Designated essay/writing component:

Students are required to write several laboratory reports which constitute a part of their final grade.

Reading component:

Reading assignments are assigned to make the students read the topics for the next lecture. This enhances the reading skills of the students.

Oral communication component:

The students are encouraged to ask questions in class, to discuss among themselves and present and explain solutions of the reading assignments in class.

Mathematics component:

Algebra, trigonometry, and calculus are used in this course.

Critical thinking component:

Quizzes and examinations that test the ability of students to apply the concepts to new situations are given.

**LATE WORK & TEST POLICY**

Late work:

Late work is heavily penalized.

Missed tests:

No make up tests are given. The instructor will deal with missed tests on a case by case basis.

**EVALUATION**

Method of student appraisal of faculty:

Students will be given an opportunity to appraise the professor by completing the IDEA Faculty Evaluation Questionnaire, and/or the COSM course evaluation at the end of the semester. The instructor, the department chairman and dean will review the responses of the students after the completion of the course.

Method of evaluating student response to course:

Students will be given an opportunity to describe their response to the course by completing the IDEA Faculty Evaluation Questionnaire and/or the COSM course Evaluation at the end of the course. The instructor, the department chairman and dean will review the responses of the students after the completion of the course.

**LABORATORY DRESS CODE**

Students may be asked in advance to wear closed-toed shoes and long pants during certain experimental procedures.

**LABORATORY CONDUCT AND SAFETY**

LABORATORY POLICIES:

During the laboratory periods, we will either be performing an experiment or have a lecture session. The students are required to attend all these sessions.

1. A student **MUST PASS the laboratory part to pass the whole course.** To pass, a student must have at least half the total points for the laboratory reports (see Grading Standards below).

The description below will refer to the laboratory periods when an experiment is performed.

2. Laboratory attendance: When there is an experiment during the laboratory class, I will give a 20-minute discussion about the experiment at the beginning of the class. After the discussion, I leave the class for the students to do the experiment. A TA will always be available for your questions. I will go in and out of the classroom to check on the class every about 15-20 minutes. Of course, you can ask my help by

going to my office at anytime. Students are expected to be in class on time! **If you are late, you will get 5 points off your laboratory report for that experiment!** Students are not supposed to leave the classroom during the laboratory session before completing the experiment. Students who need to leave must ask the instructor's permission. **Any student who leaves the classroom at any time before the completion of their experiment without permission from the instructor will get 10 points off their laboratory report for that experiment!**

3. If not enough set-ups are available, I will divide the class into 1.5-hour blocks.
4. The laboratory instructions will be posted in Blackboard before the experiment. **I expect you to read the instructions before coming to class.**
5. Laboratory Reports can be written legibly by hand or word-processed. You may use pad paper or regular bond paper for your report
6. After each experiment, each student has to have his/her own data sheet signed by the instructor or TA. For the TA or instructor to sign your data sheet, **you should have at least filled out the value of all the quantities which are directly measurable.** The signed data sheet has to be submitted with the laboratory report. Otherwise, no grade on the laboratory report will be given.
7. Each laboratory report is worth 20 points.
8. Laboratory reports for experiments done on Tuesday are due on Thursday of the same week while experiments done on Thursday are due on Monday the following week. Late laboratory reports will be penalized!!! 20/3 points will be removed for each day that a laboratory report is late. This means that if you submit your lab report 3 days late (including Saturday and Sunday), you get a zero!
9. Students who are unable to perform an experiment (with a valid excuse) during their scheduled class, must perform the experiment during some other class period while the set-ups are available. The student must inform the instructor of the situation. Little consideration will be given to students unable to comply with this. **NOTE: The same rule will still be applied to late laboratory reports as discussed above!** For instance, if you missed your Wednesday laboratory class, YOU STILL HAVE TO SUBMIT YOUR LAB REPORT THE WEDNESDAY OF THE NEXT WEEK NO MATTER WHEN YOU PERFORM THE EXPERIMENT!!!
10. **NOTE!!! RETURN TO ME YOUR GRADED LABORATORY REPORTS as soon as you have looked at it in class!!! You will get ZERO for every laboratory report you do not turn back in!!!**
11. **Explanation of Laboratory Reports:** Some laboratory reports will involve only the presentation of the data, calculations and answers to questions. Others will involve writing complete laboratory reports with the following sections: OBJECTIVE, METHOD, DATA, SAMPLE CALCULATIONS, RESULTS, CONCLUSIONS and ANSWER TO QUESTIONS. These sections for the complete laboratory reports are described below.

OBJECTIVE: Never, never just copy, word for word, the OBJECTIVE/PURPOSE that is already in the laboratory instructions! Think for yourself and just use the laboratory instructions as a guide! It is advisable to write this after writing the whole laboratory report. At that time you already have a bigger picture of what the experiment was all about and hence you are in a better position to give an OBJECTIVE/PURPOSE. Perhaps, start the sentence with "*In this experiment, we...*". Good words to use are "test", "investigate", "measure", and "examine".

METHOD: Never, never just copy the Procedure in the laboratory instructions!!! Just summarize! If I were you, I will write it up after the experiment right away or read the procedure then just summarize in your own words what you did. Include **crucial equations** within your discussion. Just listing the equations at the end of your method is not acceptable! They must appear as you explain certain steps where the equations play a significant role! However, you **do not** need to show derivations! This section of the report should contain both procedure and theory woven into a concise but readable story.

DATA: Fill up **all** the blanks on the data sheet. If your original data sheet (with the TA's or the instructor's signature) is neat enough, you can submit it with the laboratory report. **Make sure you clearly express the units and the uncertainties (i.e.  $\pm$ ) of all data.**

SAMPLE CALCULATIONS: Exhibit one sample calculation **for each different equation** used in your analysis. Examples of important calculations (but are not confined to these) are calculations of quantities that depend on directly measured data, uncertainty calculations for quantities that depend on directly measured data, percentage errors, etc. In a sample calculation, first, **show the equation in its symbolic form** (meaning in terms of variables). Next, **show it with numerical values** in place of the variables. Then **show the result**. Make sure you put the proper units in your resulting numerical value!!!

RESULTS: In the DATA sheet that is provided, there are basically **two types** of quantities, namely **directly measured** and **derived quantities**. Derived quantities are calculated using formulas (usually discussed in the theory section of the experiment write-up or in class) involving the directly measured data. The results of your calculations of the derived quantities **must be included** in the RESULTS section. Often, this will simply be a matter of copying the table of derived quantities that I have already included in the DATA sheet. Note to **always include the  $\pm$  (calculated uncertainties)** of the derived quantities. Graphs are also included in the RESULTS section. Put **one graph per sheet** of graph paper. Label the axis and put a meaningful title on the graph.

CONCLUSIONS: Discuss the interval  $(X_{\text{expt}} - \Delta X) < X_{\text{actual}} < (X_{\text{expt}} + \Delta X)$  of important quantity or quantities that is or are being verified by the experiment. Do they fall on the above interval?

From the preceding paragraph, if a quantity falls within the interval then only random (or scale-limited) errors are present. Otherwise, systematic errors and blunders may also be present. Identify the types of errors and the sources of these errors in the experiment.

Discuss how to improve the experiment. Use your experience in doing the experiment as your guide. Talk about ways to make the results of the experiment better; make the performance of the experiment easier, or more convenient; make the instructions clearer. Is the sequencing of steps correct? Should there be additional steps that must have been included in the experiment to make it clearer, etc.

ANSWER TO QUESTIONS: Put your answer to all questions in this section. Put proper labels to your answers (like #1, #2, etc.)

12. For the complete laboratory report, read the Sample Lab Report that I placed in the reserve section of the library with the homework solutions or in Blackboard.



**13. Please Note!!! As shown in the Sample Laboratory Report, you have to indicate the names of your partners in your group! Otherwise you will get points off! You have to do this for every laboratory report, even the ones which are not complete laboratory reports (those which involve only the presentation of the data, calculations and answers to questions).**

14. Grading of the Laboratory Reports (this is subject to changes depending on the experiment)

OBJECTIVE: 1 point

METHOD: 2 points

DATA: 2 points

SAMPLE CALCULATIONS AND RESULTS: 12 points

CONCLUSIONS: 3 points

**TOPICAL OUTLINE - include table, calendar, or topical outline with dates**

Topics Covered:

Class Date or Meeting	Topic: Class Assignment
TBA	I. Temperature and the Kinetic Theory of Gases
TBA	II. Energy in Thermal Processes: The First Law of Thermodynamics
TBA	III. Heat Engines, Entropy, and the Second Law of Thermodynamics
TBA	IV. Electric Forces and Electric Fields
TBA	V. Electric Potential and Capacitance
TBA	VI. Current and Direct Current Circuits
TBA	VII. Magnetic Forces and Magnetic Fields
TBA	VIII. Faraday's Law and Inductance
TBA	IX. Reflection and Refraction of Light
TBA	X. Image Formation by Mirrors and Lenses

Tentative Schedule:

Tentative Schedule of Quizzes and Exams: Please refer to the "Tests Schedule" in Blackboard.

LABORATORY SCHEDULE: Please refer to the "Laboratory Schedule" in Blackboard.

The content of this outline and the attached schedule are subject to change at the discretion of the professor.

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Student Signature – I have read and understand the syllabus for this class. I understand that the content of this syllabus and the topical outline are subject to change at the discretion of the professor. I have read and understand the HBU Classroom Policy posted on Black Board. **I promise to uphold the Code of Academic Integrity at Houston Baptist University and will not tolerate its violation by others.**