Instructor:	Tim Gorringe.
Office:	CP 273
Office hours:	T 2-3 pm, R 1-2 pm
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Textbooks	1. Physics for Scientists and Engineers Serway and Jewett, 8^{th} Edition published by Brooks/Cole 2. Spacetime Physics Taylor and Wheeler, 2^{nd} Edition published by Freeman
Web page::	Blackboard at elearning.uky.edu

PHY228. Optics, Relativity and Thermodynamics. Spring 2011.

1 Course description.

This course is about optics, relativity and thermodynamics - topics that played a unique role in the rise of modern science over the past few centuries. In optics, for example, modern biology emerged following the invention of the microscope and modern astronomy emerged following the invention of telescope, these technologies being applications of the deepening understanding of the reflection, refraction and dispersion. Through thermodynamics emerged the importance of energy conservation that represents a common thread through mechanics, electricity, magnetism, light, and much more. And finally, through relativity emerged a revolution in today's understanding of space and time, the role of symmetry principles and conservation laws in science, and - for good and bad - nuclear power and nuclear weapons.

This sequence of breakthroughs in science, spanning the seventeenth century through the twentieth century, are the subject of this course. We will cover the basic concepts and fundamental principles of optics, relativity and thermodynamics and sharpen our problem solving skills and analytical thinking skills by applying these concepts and principles to wide-ranging situations. Because we'll use some mathematics in solving physics problems a working knowledge of algebra, calculus and trigonometry the course requires MA 114 (either prereq. or concur.).

2 Course format.

PHY228 comprises three lecture classes per week. The lectures classes are Mondays, Wednesdays and Fridays in CP 367 at 12:00–12:50 pm. Please read the entire syllabus – if you have questions about the structure or the administration of the course you'll probably find the answer here. Additionally, course information, announcements, grades, etc., will be posted on the Blackboard webpage.

Lecture time will be devoted to discussing and demonstrating the underlying physical principles of optics, relativity and thermodynamics as well as introducing problem solving techniques. Try to focus on the concepts and the methods rather than memorizing the equations. Before each lecture you should read the assigned material that is listed in the schedule in this syllabus.

3 Course grade.

Your course grade will be determined according to the following table:

Thermodynamics exam	20&
Optics exam	10%
Relativity exam	20%
lecture quizzes	20%
homework assignments	30%
Total	100%

An overall score of 90% or above will guarantee an A-grade, 80% or above will guarantee a B-grade, and 70% or above will guarantee a C-grade. Detailed information on the examinations, homework assignments and lecture quizzes are given below.

To succeed in PHY228 you must read the textbook assignments before each lectures classes. Anticipate spending ten or more hours a week outside the classroom on reading and homework. Take an active role in the learning process – ask questions to yourself and classmates. Talk with your lecturer if you don't understand something. When you read the textbook, identify the main concepts and their consequences. When you solve the problems, write down your solutions in a clear step-by-step manner.

3.1 Exam grade (50% total).

The scheduled dates/times and relevant material for the examinations are given in the table at the end of this syllabus.

Each hour exam will comprise a true-false/short question section and three long problems. The true-false/short question section will mainly focus on concepts and account for 25 percent of each exam score. The three long problems will additionally focus on problem solving and account for 75 percent of each exam score. For full credit on long problems all working out – including relevant concepts, diagrams, equations, *etc* – must be clearly shown.

During the examinations you are not allowed to consult textbooks, reference books, or class notes. You are not permitted to use electronics devices such as cell phones, laptops, PDAs, iPods,

DVD players, GPS systems, etc., during exams. You are allowed, and must bring, your own calculator to the exams.

3.2 Homework grade (30% total).

Every student must register with the WebAssign online homework service for the required weekly homework assignments. Vouchers for WebAssign access are bundled with new textbook purchases at campus area bookstores, or students can purchase their WebAssign access by personal credit card at **http://www.webassign.net**.

To begin using WebAssign go to the login page at **https://www.webassign.net/login.html**, click on "I have a class key", and enter the class key **uky 0992 3877**. When setting-up your account make sure to enter your 8-digit student i.d. where requested.

Homework assignment will cover material from the consecutive sequence of Wednesday, Friday and Monday lecture class that proceed the Friday, 11:59 pm deadline for completing the online homework. The material from lectures on W Jan. 19, F Jan. 21 and M Jan. 24 is due at 11:59 pm on Friday, Jan. 28.

3.3 Lecture grade (20% total).

Each lecture class will include a short concept quiz. The concept quizzes are multiple choice questions or short answer questions on the underlying ideas in the lecture material. Each "concept quiz" is worth four point – a correct answer with receive four points, an incorrect answer will receive two points, and no answer will receive zero points. To allow for possible absences without make-up quizzes your three lowest quiz scores for the semester will be dropped.

3.4 Course evaluations (1.5% bonus points).

Course evaluations are an important component of our Department's instructional program. An online course evaluation system was developed to allow each student ample time to evaluate each component of the course and the instruction. The evaluation window for Spring 2011 will open on Monday, April 11 and close on Wednesday, April 27. To access the system during this time, simply go the Department of Physics Web page at **http://www.pa.uky.edu** and follow the link for course evaluations. You will need to use your student ID number to log into the system, and this will also allow us to monitor who has filled out the evaluation. However, when you log-in you will be assigned a random number that will keep all your comments and scores anonymous. A 1.5% bonus is given to each student completing the online evaluation.

4 Excused absences, etc.

If you miss a hour exam with a valid excuse, you will receive a score based on the average of your other tests and the final. If you miss two tests with a valid excuse, you will receive an incomplete (I). Examples of excusable absences are (University Senate rule 5.2.4.2): (i) Illness of the student or serious illness of a member of the student's immediate family, (ii) the death of a member of the student's immediate family, (iii) trips for student organizations, university classes, and intercollegiate athletics. Each case requires written verification. When feasible the student should notify the instructor prior to the absence, and never more than one week after the absence. "Falling behind" and "sleeping in" are not valid excuses.

Lastly, cheating on exams and copying of homework are very serious academic offenses. Offenders are subject to punishment in accordance to University Senate rules section 6.3 and 6.4.

5 Where to get help?

- **Your instructors:** Feel free to talk with your course instructor about physics problems, questions, *etc.*
- **Resource room:** .The physics resource room is located in the M. I. King Science Library and is staffed by Physics & Astronomy graduate students to assist with physics homework problems, *etc.*
- **Physics tutors:** A list of physics tutors is available in the Physics office (room 177) in the Chem-Phys building.
- **Homework/exam solutions:** Solutions to the homework will be available on WebAssign after the deadline for each assignment. Solutions to the examinations will be posted to the Blackboard webpage after the completion of each exam.
- **Course information, announcements, etc:** Course information and course announcements will be posted to the Blackboard webpage.

DATE	MATERIAL	SECTION
W Jan 12	Course introduction	19.1-19.3
F Jan 14	Temperature and thermometers	19.1-19.3
M Jan 17	Martin Luther King Holiday	
W Jan 19	Thermal expansion of solids, liquids, gases and absolute zero.	19.4-19.5
F Jan 21	What is heat? What is calorimetry? Specific heat and latent heat.	20.1-20.3
M Jan 24	More specific heat and latent heat. Work, heat and energy conservation.	20 3-20.4
W Jan 26	First law of thermodynamics and applications.	20.5-20.6
F Jan 28	Conduction, convection and radiation of heat	20.7
M Jan 31	A microscopic model of gas properties - joining Newton's laws with rolling dice	21.1
W Feb 2	The specific heat and other properties of ideal gases	21.2-21.3
F Feb 4	Energies and speeds of molecules in ideal gases.	21.4-21.5
M Feb 7	Heat engines, heat pumps and work done when heat flows.	22.1-22.3
W Feb 9	The performance of hypothetical heat engines and real heat engines.	22.4-22.5
F Feb 11	Hot to cold - entropy and macroscopic changes	22.6-22.7
M Feb 14	Order to disorder - entropy and microscopic changes	22.7-22.8
W Feb 16	**Thermodynamics exam**	
F Feb 18	Thermodynamics exam review	
M Feb 21	Nature of light, speed of light, and introduction to geometrical optics	35.1-35.3
W Feb 23	Reflection and refraction of light and Fermat's principle	35.4-35.6
F Feb 25	Examples - retro-reflectors and 22 degree halo	35.7-35.8
M Feb 28	Examples - rainbows and sunsets	36.1-36.2
W Mar 2	Images formed by mirrors and reflection	36.3-36.4
F Mar 4	Images formed by lenses and refraction	36.5-36.7

DATE	MATERIAL	SECTION
M Mar 7	magnifying - the eye, magnifying glass and microscope	36.8-36.9
W Mar 9	magnifying - the eye, magnifying glass and microscope	36.8-36.9
F Mar 11	**Optics exam**	
Mar 14-18	Spring break	
M Mar 21	Optics exam return	
W Mar 23	Invariance of laws of physics and principle of relativity	39.1
F Mar 25	The speed of light and Michelson and Morley	39.2
M Mar 28	Introduction to the geometry of spacetime and inertial reference frames	39.3 and Ch. 1
W Mar 30	Light and the geometry of spacetime and inertial reference frames	39.3 and Ch. 1
F Apr 1	Examples of the geometry of spacetime and inertial reference frames	39.3 and Ch. 1
M Apr 4	Relativity of simultaneity	39.4 and Ch. 3
W Apr 6	Time dilation	39.4 and Ch. 3
M Apr 8	Length contraction	39.4 and Ch. 3
M Apr 11	Twin Paradox	39.4 and Ch. 5
W Apr 13	Ladder Paradox	39.4 and Ch. 5
F Apr 15	Magnetic Paradox	39.4 and Ch. 5
M Apr 18	Introduction to Lorentz tranformations	39.5 and Ch. Special Topic
W Apr 20	Examples of Lorentz tranformations	39.5 and Ch. Special Topic
F Apr 22	Velocity and Lorentz tranformations	39.5 and Ch. Special Topic
M Apr 25	Energy, momentum and laws of motion in classical mechanics and relativistic mechanics	39.6-7 (and Ch. 7)
W Apr 27	Energy, momentum and laws of motion in classical mechanics and relativistic mechanics	39.6-7 (and Ch. 7)
F Apr 29	Mass-energy relation .	39.8 (and Ch. 7)
8:00am M May 2	**Relativity Final**	