PHYSICS 361. Modern Physics.

Instructor:	Tim Gorringe.
Office:	CP273.
Phone:	257-8740.
Textbook:	Concepts of Modern Physics, Arthur Beiser, 6^{th} Ed.
Web page	www.pa.uky.edu/∼gorringe/phy361/s06
Office hours:	T 2:00 - 3:00.
	R 2:00 - 3:00.

1 Course Objectives.

At the end of the nineteenth century the cozy world of classical physics was shaken up. New discoveries and theories in the realms of the "*very fast*" and the "*very small*" were responsible for revealing a more peculiar side to the material world. Indeed, our basic concepts of space and time, and basic notions of particles and waves, were changed forever. This understanding was central to exploring the microscopic world of the atom and its nucleus, and addressing our ultimate questions about the basic constituents and fundamental forces of nature.

The course introduces the startling discoveries and peculiar theories of the very fast (special relativity) and the very small (quantum mechanics). We'll discuss our modern view of space and time, waves and particles, force and matter, and much more. Moreover, we'll apply this understanding to explore the sub-structure of the atom and its nucleus, and finally address the basic constituents and fundamental forces of nature itself. We'll also examine how the dual themes of symmetry and unification are closely entwined with modern physics.

2 Course Prerequisites.

The prerequisites for this course are two semesters of general university physics (PHY231/232) and calculus III (MA213).

3 Course Grading.

Your final grade will be based on homework, two one-hour tests, and a two-hour cumulative final. In addition a 1% bonus is given for completing the on-line instructor and course evaluation at the end of the semester. The contributions of the different components to your final grade, and the dates of the tests and the final, are given below.

source	date	contribution
homework		20%
test one	F Feb 17	20%
test two	W Mar 29	20%
cumulative final	10:30*am* M May 1	40%
evaluation bonus	3 Apr. - 21 Apr.	1%

4 Homework assignments.

Typically two homework problems will be assigned per lecture class. Each Friday the homework assignments from the preceding Friday, Monday, and Wednesday classes will be collected. You are encouraged to get together with your fellow students to discuss the homework problems, but your homework solutions must be written–up independently. Late homework isn't accepted.

Hmwk.	Problems
#1	1-1,3,4,5,11,13,16
#2	1-20,21,22,24,25,26
#3	27,29,41,46 2-1,8,12
#4	2-20,29,35,39 3-1,8
#5	3-13,19,23,26,27,29
#6	3-30,32 4-1,3
#7	4-4,5,12,18,19,36
#8	5-1,5,6,8,10
#9	5-12,15,17,20
#10	5-24,26,27,33
#11	6-1,3,7,12,19,24
#12	7-1,2,4,5,11,17
#13	11-1,6,11,17,21
#14	13-2,4,8,17,24

The homework assignments are listed above and the homework solutions with be made available in the Chem-Phys library. See the class schedule for the due dates.

5 Course evaluations.

Course evaluations are an important component of our instructional program. Our on-line course evaluation was developed to allow each student ample time to complete the evaluation of the course and the instructor. The evaluation window for Spring 2006 will open on Monday, Apr. 03 and close on Friday, Apr. 21. To access the system go the physics department web page at www.pa.uky.edu and click the course evaluations link.

6 Important dates.

Classes begin on Wednesday, January 11 and end on Friday, April 28. During the semester there are several academic holidays: Martin Luther King Birthday - Monday, Jan. 16, and Spring Break - Monday through Friday, Mar. 13-17. The last day to drop a course is Friday, Mar. 10.

7 Course schedule.

PHY361 meets M–W–F from 11:00pm to 11:50pm in room CP183. The following table gives the topics we will cover during the semester. The fourth column gives the relevant section in the text book and the fifth column gives the homework schedule.

Lec.	Date	Topic	Ch.Sec	Hmwk
1	W Jan, 11	Elements of symmetry and special relativity	1.1	
2	F Jan, 13	Notions of time in special relativity	1.2	
–	M Jan, 16	– **MLK Birthday** –		
3	W Jan, 18	Doppler effect and the expanding universe	1.3	
4	F Jan, 20	Space-time and the twins paradox	1.4,1.5	#1
5	M Jan, 23	Unification of electricity and magnetism	1.6	
6	W Jan, 25	Energy and momentum in special relativity	1.7-1.9	
7	F Jan, 27	What is mass?	1.7-1.9	#2
8	M Jan, 30	Particles of light! Blackbody radiation	2.1-2.2	
9	W Feb, 01	Particles of light! Photoelectric effect	2.3	
10	F Feb, 03	What the nature of is light?	2.4-2.5	#3
11	M Feb, 06	Compton Effect and pair production	2.7-2.8	
12	W Feb, 08	Waves of matter! De Broglie Waves I	3.1-3.4	
13	F Feb, 10	Waves of matter! De Broglie Waves I	3.1-3.4	#4
14	M Feb, 13	Interference of traveling matter waves	3.5	
15	W Feb, 15	Nature of standing matter waves	3.6	
–	F Feb, 17	**Test 1**	1.1-3.6	#5
16	M Feb, 20	Uncertainty Principle	3.7-3.8	
17	W Feb, 22	Atom scattering and the classical atom	4.1-4.2	
18	F Feb, 24	Atom light and the quantum atom	4.2-4.4	#6
19	M Feb, 27	Detailed description of atomic spectra	4.5-4.7	
20	W Mar, 01	The invention of lasers	4.9	
21	F Mar, 03	Wave functions and wave equations	5.1-5.2	#7
22	M Mar, 06	Schroedinger's Equation	5.4	
23	W Mar, 08	Expectation values and quantum operators	5.5-5.6	
24	F Mar, 10	Eigenvalues and eigenvectors	5.7	#8
–	Mar, 13-17	– **Spring Break** –		
25	M Mar, 20	Particle in a Box	5.8	
26	W Mar, 22	The finite well and tunneling	5.9	
27	F Mar, 24	The finite barrier and tunneling	5.10	#9
28	M Mar, 27	Harmonic Oscillator	5.11	
–	W Mar, 29	**Test 2**	3.7-5.11	
29	F Mar, 31	Schroedinger's Eqn. for the Hydrogen Atom	6.1-6.2	#10
30	M Apr, 03	Quantum Numbers for the hydrogen atom	6.3-6.6	
31	W Apr, 05	Electron probability densities	6.7	
32	F Apr, 07	Electron spin and Stern-Gerlach experiment	7.1-7.2	#11
33	M Apr, 10	Electron spin and Pauli exclusion principle	7.2-7.3	
34	W Apr, 12	Periodic table and atomic structure	7.4-7.6	
35	F Apr, 14	Nuclear properties	11.1-11.2	#12
36	M Apr, 17	Magic numbers!	11.3-11.4	
37	W Apr, 19	Liquid drop model	11.5	
38	F Apr, 21	Nuclear shell model	11.6	#13
39	M Apr, 24	Classification of forces and particles	13.1-13.3	
40	W Apr, 26	Symmetry principles and conservation laws	13.4-13.5	
41	F Apr, 28	Standard model and physics beyond	13.6-13.7	#14
–	M May, 01	**Final 10:30-12:30**		