PHYSICS 102: Modern Physics

Instructor: Hee-Sun Lee, Ph.D., ISB 235, hlee58@ucsc.edu, phone: 459-1347
Course website: http://griffin.ucsc.edu/lee/ph102-12
Lecture schedule: MWF 12:30 pm – 1:40 pm, ISB 235
Office hour schedule: MW 11:00 am – 12:00 pm (or by appointment), ISB 207
Textbook: Modern Physics (2nd ed) by Randy Harris

Course Objectives:

- Learn important topics in modern physics qualitatively and conceptually
- Familiarize with big ideas and practices that underlie scientific research in physics
    - Scale (In week 1)
    - Model/Representation (In week 2)
    - Cognition (In week 4)
    - Ontology (In week 6)
    - Nature of science (In week 8)
    - Expert vs. novice (In week 10)
    - Research and publication (In week 10)

Grading

- Mid-term I (20%) on 1/30, Monday, during class, quantum and atomic physics
- Mid-term II (25%) on 2/27, Monday, during class, statistics and solid state physics
- Final (25%): on 3/16, Friday, during class, nuclear and elementary particle physics
- Homework (10%): Best of five out of six homework sets
- Course project (20%): A short paper write-up is required and presentation will take place during the designated final exam time on 03/20/2012, Tuesday, 4:00 pm – 7:00 pm, ISB 235

Emergency policy:

- Homework should be submitted by the end of the class on due dates. Late homework will be weighted by .5 when turned in after the class but before 5 pm on due dates. No points will be given to homework turned in afterward.
- When missing exams, no points will be given. Make-up exams may be possible if a 24 hour in-advance notice is submitted and the instructor approves it. In that case, a weight of .8 will be applied to the make-up exam score to calculate the exam score.
- You should submit your original work for homework, exams, and projects. Copyright violations will not be tolerated.

Course expectations:

- Prior to class, you will be required to read assigned chapter sections.
- During class, you will be engaged in small group discussions or Predict-Observe-Explain (POE) activities.
- During class and homework, you will be exposed to various visualizations and simulations that can help develop mental models of important ideas.
- Through a course project, you will be asked to choose an area of physics, investigate current developments in the area, and communicate your findings.

To test yourself whether you understand a new material, ask the following:

- (EXPLAIN) Can I explain it in my own words?
- (CIRCUMSCRIBE) Can I elaborate criteria for when and where to use the material and why?
- (TRANSFER) Can I apply it to other situations that require the use of the material?
- (QUESTION) Can I ask new questions related to the material?

Tentative Course Schedule (Revised 1/20/2012)

Week	Lecture number	Date	Physics Topic	Textbook chapter	HW due
1	1	1/9, M	Quantum: History and Beyond		
	2	1/11, W	Quantum: Schrodinger equations for bound and unbound states	Review: C5 and C6	
	3	1/13, F	Quantum: Schrodinger equations for bound and unbound states	Review: C5 and C6	
2	4	1/18, W	Quantum: Schrodinger equation expressions in (x, y, z) and (r, θ, ϕ) coordinates	C7.1-7.2 C7.4	
	5	1/20, F	Atomic: Hydrogen atom Schrodinger equation expression in (r, θ, ϕ) coordinates and (l, m_l) orbital quantization	C7.5	HW1
3	6	1/23, M	Atomic: Hydrogen atom radial solutions, spectral lines, and hydrogen like atoms	C7.3 C7.6-7.8	
	7	1/25, W	Atomic: L and S quantization and adding angular momenta	C8.1 C8.6-8.7	
	8	1/27, F	Atomic: Multi-electron atoms and periodic table	C8.2-8.4	
4	9	1/30, M	Atomic: Angular momentum under magnetic field	C8.8-8.9	HW2
	10	2/1, W	Mid-term I		
	11	2/3, F	Statistics: Classical and quantum statistics	C9.1-9.4	
5	12	2/6, M	Statistics: Fermi distribution and examples	C9.5-9.6	
	13	2/8, W	Statistics : Bose-Einstein distribution and examples	C9.7-9.8	
	14	2/10, F	Statistics: Specific heat	C9.9	HW3
6	15	2/13, M	Sold state: Molecules, rotation, and vibration	C10.1-10.3	
	16	2/15, W	Solid state: Crystals and energy bands	C10.4-10.5	
	17	2/17, F	Solid state: Conduction	C10.6	
7	18	2/22, W	Solid state: Semiconductor theory and devices	C10.7-10.8	
	19	2/24, F	Solid state: Superconductor	C10.9	HW4
8	20	2/27, M	Mid-term II		
	21	2/29, W	Nuclear: Nuclei models	C11.1-11.3	
	22	3/2, F	Nuclear: Radioactivity	C11.5-11.6	
9	23	3/5, M	Nuclear: Nuclear reactions	C11.7	HW5
	24	3/7, W	Elementary: Fundamental particles and detection	C12.1-12.2	
	25	3/9, F	Elementary: Fundamental interactions	C12.3	
10	26	3/12, M	Elementary: Standard model	C.12.4-12.5	
	27	3/14, W	Elementary: Parity, charge conjugation, and time reversal	C12.6-12.7	HW6
	28	3/16, F	Final		
		3/20, T	FINAL Presentation		Paper Due