

PHYS2796 Introduction to Modern Physics (Spring 2015)

Class Schedule

January 8, 2015

Reading and homework assignments (“Problems”) are from K. Krane, “Modern Physics, 3rd Ed.”, unless otherwise noted

Day	Date	Topics	Reading	Homework Due
Part I: Foundations				
Mon	12 Jan	Introduction and course overview	Chapter One	_____
Wed	14 Jan	Math review: Vectors, Calculus, and Differential Equations	<i>Handout</i>	_____
Fri	16 Jan	<i>Math quiz</i>	_____	_____
Mon	19 Jan	No Classes: Martin Luther King Day		
Wed	21 Jan	Oscillations and waves in one dimension	<i>Notes</i>	_____
Fri	23 Jan	Maxwell’s Equations and electromagnetic waves	<i>Notes</i>	1.1, 1.8, 1.15
Part II: Historical context				
Mon	26 Jan	Concepts of space and time; Special Relativity	Chapter Two	_____
Wed	28 Jan	Relativistic dynamics; Massless particles	2.7, 2.8; <i>Notes</i>	_____
Fri	30 Jan	Experimental evidence for “photons”	Chapter Three	2.12, 2.20, 2.42
Mon	2 Feb	The DeBroglie Hypothesis; Experimental evidence for “matter waves”	Chapter Four	_____
Wed	4 Feb	Wavelength & Frequency, Fourier Analysis, and Heisenberg’s Uncertainty Principle	<i>Notes</i>	_____
Fri	6 Feb	The Rutherford-Bohr atomic model	Chapter Six	3.28, 4.1, 4.18
Part III: States and the postulates of Quantum Mechanics				
Mon	9 Feb	The Stern-Gerlach Experiment; Concepts of “spin”	7.6	_____
Wed	11 Feb	Quantum mechanical states and their time evolution	<i>Notes</i>	_____
Fri	13 Feb	Example: A Spin-1/2 particle in a magnetic field	<i>Notes</i>	6.28, 6.42, 7.33
Part IV: Wave Mechanics and basic atomic physics				
Mon	16 Feb	Schrödinger’s wave equation and simple solutions	5.1-5.4	_____
Wed	18 Feb	The simple harmonic oscillator in quantum mechanics	5.5	_____
Fri	20 Feb	Scattering in one dimension: Steps and Barriers	5.6	5.7, 5.12, 5.22
Mon	23 Feb	The “hydrogen” atom and Schrödinger’s wave equation	7.1-7.5	_____
Wed	25 Feb	Effects of “spin” in the hydrogen atom	7.6-7.9	_____
Fri	27 Feb	General properties of multi-electron atoms; Chemistry	Chapter Eight	5.33, 7.4, 7.20
Spring Break 2-6 March				

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Part Va: Molecular Physics				
Mon	9 Mar	The H ₂ ⁺ and H ₂ molecules	9.1	_____
Wed	11 Mar	Vibrations and rotations of diatomic molecules	9.4-9.6	_____
Fri	13 Mar	Midterm Exam: Covers all material from Parts I-IV	_____	_____
Part Vb: Statistical Physics				
Mon	16 Mar	Classical and quantum statistical systems	10.1-10.4	_____
Wed	18 Mar	Quantum statistical systems: Bosons	10.5, 10.6	_____
Fri	20 Mar	Quantum statistical systems: Fermions	10.5, 10.7	9.14, 9.17, 9.18
Part Vc: Crystalline Solid State Physics				
Mon	23 Mar	Periodic potential energy functions and Bloch's Theorem	<i>Notes</i> ; 11.4	_____
Wed	25 Mar	Heat capacity and electrical conduction	11.2, 11.3	_____
Fri	27 Mar	Superconductivity	11.5	10.9, 10.20, 10.27
Part Vd: Nuclear Physics				
Mon	30 Mar	General properties of atomic nuclei	12.1-12.3	_____
Wed	1 Apr	Quantum mechanics of nuclei; gamma decay	12.4, 12.5, 12.9	_____
Fri	3 Apr	Alpha decay; Beta decay and neutrinos	12.6-12.8	11.12, 11.22, 11.25
Part Ve: Selected Topics in Applied Physics				
Mon	6 Apr	Nuclear weapons and nuclear energy	13.4, 13.5	_____
Wed	8 Apr	Lasers	8.7; <i>Notes</i>	_____
Fri	10 Apr	Special lecture: <i>Novel properties of multifunctional materials</i>	<i>Notes</i>	12.13, 12.26, 12.36
Part Vf: Elementary Particles and “High Energy” Physics				
Mon	13 Apr	Elementary particle classifications; Particle interactions and decays	14.1-14.6	_____
Wed	15 Apr	Hadrons, quarks, and Quantum Chromodynamics	<i>Notes</i>	_____
Fri	17 Apr	Neutrinos and neutrino oscillations; The Higgs Mechanism and Higgs Boson	14.8; <i>Notes</i>	8.19, 11.35, 13.19
Part Vg: Astrophysics and Cosmology				
Mon	20 Apr	Stellar astrophysics and nucleosynthesis	13.6; <i>Notes</i>	_____
Wed	22 Apr	Hubbles Law; Observational evidence for the Big Bang	15.1, 15.2; <i>Notes</i>	_____
Fri	24 Apr	Evidence for “Dark Matter” and other open questions in modern cosmology	_____	13.27, 15.2, 15.11
Mon	27 Apr	<i>Course Review</i>	<i>Notes</i>	_____

January 8, 2015

Week	Dates	Laboratory material
1	Jan 13,15	<i>No Labs</i>
2	Jan 20, 22	Estimating and reporting measurement errors
3	Jan 27, 29	Information literacy sessions
4	Feb 3, 5	Introduction to least-squares fitting
5	Feb 10, 12	Pre-lab: Half-life measurements
6	Feb 17, 19	Lab 1: Stefan-Boltzmann Law
		Lab 2: The Photoelectric Effect
7	Feb 24, 26	Lab 3: The Compton Effect
Spring Break 2-6 March		
8	Mar 10, 12	Lab 4: The Duane-Hunt Law
9	Mar 17, 19	Lab 5: The Balmer Series of Hydrogen
10	Mar 24, 26	Lab 6: The Franck-Hertz Experiment
11	Mar 31, Apr 2	<i>Draft of six lab reports are due, Fri Apr 3 in class</i>
12	Apr 7, 9	<i>No Labs</i>
13	Apr 14, 16	<i>Drafts returned with comments, Mon Apr 12 in class</i>
14	Apr 21, 23	<i>Final version of lab reports due, Fri Apr 24 in class</i>