

Course Syllabus

Origins of quantum mechanics, a historical perspective. Concepts of wave mechanics and applications. Nuclear physics and radioactivity. The aim of the course is to survey some of the significant challenges to classical physics encountered in the 20th century and to show how the solutions to these phenomena shaped our understanding of the natural world. Quantitative problem solving will be emphasized as a means of gaining deeper understanding of the concepts. The laboratory is considered a very essential component of the course where you will get a “hands-on” sense of some of the phenomena studied.

Assignments

There will be six assignments throughout the term. The assignments will be distributed via the course D2L website.

Laboratory Reports

The laboratory component of Phys325 is an essential opportunity for you to experience some of the exciting phenomena encountered in this course. A laboratory manual is available on-line at www.pjl.ucalgary.ca. Two of the laboratory reports will be submitted as group project and in a format similar to that required for a Physics journal. The details of the format will be discussed in the lectures later in the term. In the case of the group report, the same grade will be applied to all members of the group.

Each laboratory exercise is accompanied by “Pre-lab Questions”. You must read over the laboratory exercise and complete these questions prior to entering the laboratory and working on the experiment. Your TA will check that these questions are complete at the start of the session.

The first five lab reports must be completed during the laboratory period and handed in to the TA before the end of your laboratory session. In the final half of the course, you will complete five experiments chosen from a list of seven. Your laboratory TA will work with you to make the selection and coordinate when you perform a particular experiment. Experiments including Nuclear Decay and Rutherford Scattering require several days to complete and a limited amount of time outside of your scheduled laboratory section may be needed to complete each experiment.

Poster Presentation

You and your group will select one experiment to present in the form of a poster during a *Symposium on Experiments in Modern Physics* that will be held during the week of April 6. The exact date and time will be decided during the term. The poster presentation will last approximately two hours during which time you and your group members will discuss your results and conclusions with your peers and other members of the department. Laboratory TAs and the course instructor will grade your work and your response to questions. Strategies for designing an effective poster as well as the criteria for grading will be discussed in the lectures. The same grade will be applied to all group members.

Tentative lecture schedule for Winter 2014

Date	# Lectures	Topics	Textbook Section
Jan 12 – Jan 21	5	Special Theory of Relativity: Einstein's postulates and consequences, Time Dilation, Length Contraction, Simultaneity, Lorentz Transformations, Conservation of Relativistic Momentum and Energy	2.1 – 2.9
Jan 23 – Feb 2	5	Subatomic particles, Electromagnetic Radiation, Blackbody radiation, Photoelectric Effect, X-rays and Compton Scattering	3.1 – 3.6
Feb 04 – Feb 09	3	Atomic Structure, Rutherford Scattering Experiment, The Bohr Model, Atomic Spectra	6.1 – 6.8
Feb 11 – Feb 25	3	DeBroglie's Matter Waves, Bragg Diffraction, Heisenberg Uncertainty Principle, Probability Density	4.1 – 4.7
Feb 13		MIDTERM #1	
Feb 16 – Feb 20		READING WEEK – No Lectures	
Feb 27 – Mar 11	6	The Schrödinger Wave Equation, Operators, Expectation Values, Applications of the Schrödinger Wave Equation: Rigid Box/Potential Wells/2D Potential Wells, Degeneracy, Harmonic Oscillator, Tunneling Phenomena	5.1 – 5.6
Mar 13 – Mar 30	7	The Hydrogen Atom, Energy Levels and Radial Probability Density, Quantization of Angular Momentum, Electron Spin, Zeeman Line Splitting	7.1 – 7.9
Mar 20		MIDTERM #2	
Mar 30 – Apr 15	6	Radioactivity, Nuclear Stability and Nuclear Decay, Alpha, Beta, and Gamma Decay, Natural Decay Chain, Fission and Nuclear Reactors, Nucleosynthesis, Geochronology	12.1-12.10; 13.1-13.7
Week of April 06		Poster Presentation: Time and Date to be determined	