UNIVERSITY OF CALGARY
DEPARTMENT OF PHYSICS and ASTRONOMY
COURSE OUTLINE

1. Course: Physics 325, Modern Physics

Lecture Sections:
L01: MoWeFr, 09:00-09:50, ES 443 Dr. M. Wieser, SB605, 403 220 3641, mwieser@ucalgary.ca,
Office Hours: TBA

Laboratory Sections:
B01: Tu, 09:00-11:50, ST029
B02: Th 09:00-11:50, ST029
B03: We 14:00-16:50, ST029
B04: Mo 14:00-16:50, ST029

D2L course name: Phys 325 L01 (Winter 2014) Modern Physics

2. Prerequisites: ***Physics 211*** *or* ***221*** *or* ***227*** *and* ***223*** *or* ***255*** *or* ***259*** *or 355 and* ***Mathematics 211*** *or* ***213*** *and* ***Mathematics 249*** *or* ***251*** *or* ***Applied Mathematics 217***..

3. Grading: The University policy on grading and related matters is described sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

25 % Laboratory Reports
5 % Poster Presentation (To be held during the week of April 7th)
20 % Assignments
30 % Midterm Examinations (Two at 15 % each on February 12 and March 19)
20 % Final Exam (To be scheduled by the Registrar)

Percentage grades will be given for all elements of term work and examinations in Physics 325. A weighted course percentage will be calculated for each student after the final exam is written. Conversion from final course percentage to final course letter grade is as follows:

A+	> 95
A	85.0 – 94.9
A-	80.0 – 84.9
B+	75.0 – 79.9
B	70.0 – 74.9
B-	65.0 – 69.9
C+	60.0 – 64.9
C	55.0 – 59.9
C-	50.0 – 54.9
D+	45.0 – 49.9
D	40.0 – 44.9
F	< 40.0

4. Missed Components of Term Work: The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in Section 3.6. It is the student's responsibility to familiarize himself/herself with these regulations. See also Section E.6 of the University Calendar

5. Course Materials: *"Modern Physics", by Kenneth Krane, John Wiley & Sons, 3rd Edition, 2012.*

Online Course Components: Lecture notes, assignments, and supporting lecture material will be posted on the course D2L website.

6. Examination Policy: [Statement regarding aids allowed on tests and examinations (e.g., calculator, open book, etc.).] Students should also read the Calendar, Section G, on Examinations.

7. OTHER IMPORTANT INFORMATION FOR STUDENTS:

(a) Academic Misconduct: (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under Section K, Student Misconduct to inform yourself of definitions, processes and penalties

(b) Assembly Points: In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points.

(c) Academic Accommodation Policy: Students with documentable disabilities are referred to the following links: Calendar entry on students with disabilities and Student Accessibility Services.

(d) Safewalk: Campus Security will escort individuals day or night (http://www.ucalgary.ca/security/safewalk/). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

(e) Freedom of Information and Privacy: This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also http://www.ucalgary.ca/secretariat/privacy.

(f) Student Union Information: VP Academic Phone: 220-3911 Email: suvpaca@ucagary.ca.
SU Faculty Rep. Phone: 220-3913 Email: sciencerep@su.ucalgary.ca
Student Ombudsman

(i) Internet and Electronic Device Information: You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

Department Approval_____Date_____

Associate Dean's Approval for out of regular
class-time activity: _____ Date:_____

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. Your solutions must be handed in by 4:00 pm on the due date.

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 7th. 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 08 – Jan 17	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 20 – Jan 29	5	Subatomic particles, Electromagnetic Radiation, Blackbody radiation, Photoelectric Effect, X-rays and Compton Scattering	3.1 – 3.6
Jan 31 – Feb 05	3	Atomic Structure, Rutherford Scattering Experiment, The Bohr Model, Atomic Spectra	6.1 – 6.8
Feb 07 – Feb 14	3	DeBroglie's Matter Waves, Bragg Diffraction, Heisenberg Uncertainty Principle, Probability Density	4.1 – 4.7
Feb 12		MIDTERM #1	
Feb 17 – Feb 21		READING WEEK – No Lectures	
Feb 24 – Mar 7	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 10 – Mar 24	7	The Hydrogen Atom, Energy Levels and Radial Probability Density, Quantization of Angular Momentum, Electron Spin, Zeeman Line Splitting	7.1 – 7.9
Mar 19		MIDTERM #2	
Mar 31 – Apr 14	7	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 09		Poster Presentation: Time and Date to be determined	

Books that may be of interest

Modern Physics for Scientists and Engineers, 2nd edition
John Taylor, Chris Zafiratos, and Michael Dubson
Pearson / Addison Wesley
ISBN-10:0-13-805715-X
(This was the previous text used in the course and used copies are probably available)

Modern Physics 2nd Edition (or now 3rd Edition)
Raymond Serway, Clement Moses, and Curt Moyer
Harcourt Colleg Publishers
ISBN-10: 0-03-001547-2

Quantum Theory: A Very Short Introduction
John Polkinghome
Oxford University Press
ISBN-10: 0-19-280252-6

Quantum Theory: A graphic Guide to Science's Most Puzzling Discovery
J. P. McEnvoy
Totem Books
ISBN-13: 978-1840468502