Physics 284 Modern Physics Laboratory

Spring 2016

Wednesdays , 12:00 – 2:40 pm, Faraday 121A

Instructor:
Professor George Coutrakon,
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Web Site
http://webcourses.niu.edu (Blackboard course page)
Grades and class materials such as lab instructions will be placed on the Blackboard course page.

Lab Instructions
Instructions for all the labs are available on the web and should be downloaded and read before starting the lab.

Grading
The laboratory grade will be based on 6 experiments, one HW given in the first week, and one report (called the 7th lab) that uses the results of 3 previous labs to determine fundamental constants, h, e, and m_e . Each lab report and the single HW will count 12.5% of the final grade. The HW is a dry lab to find the slope of a line and the error in the slope of a line from fictitious data given to you. The reports should be approximately 4-6 pages in length (including figures and data tables). Limit the theory discussion to ½ page in the introduction. In each report (except Lab report #7) there should be a drawing or photo of your lab equipment that shows how measurements are made. The critical components in the drawing or photo should be labeled with arrows that can be referred to in the text. General guidelines for how to complete lab reports and a breakdown of how lab reports will be graded are provided on the class web page. Each lab instruction sheet will also have some specific guidelines. **Lab reports are due one week after the completion of the lab.** There will be 2 weeks allotted for each experiment. Reports submitted late without prior permission will be marked down 10% per week and will not be accepted more than 2 weeks after the due date or the Wednesday before the beginning of final exam week, whichever occurs sooner. Pre-lab questions count for 10% of the grade and should be turned in with lab report.

Lab Notebooks

All students are expected to keep a lab notebook. Since students will work in teams of two, or occasional three, they should either purchase a lab notebook with carbon paper, or make photocopies at the end of class, so that each student retains a copy of the measurement data. It is each student's responsibility to make sure that they obtain a copy of all the notes from each lab.

Calendar:

Jan. 20	Introduction to 1st two Labs, lab writing, error analysis, and 1st assignment)
Jan. 27	Photo-electric effect and spectrometer Labs with Na and H lamps (1st HW due)
Feb. 3	Photo-electric effect and spectrometer Labs
10	Photo-electric effect and spectrometer Labs, 1st lab due
17	Photo-electric effect and spectrometer Labs
24	E/M and Michaelson Morley Labs, lab lecture, 2nd lab due
Mar.2	E/M and Michaelson Morley Labs
9	E/M and Michaelson Morley Labs, 3rd lab due
23	E/M and Michaelson Morley Labs, Intro. Talk on rad. lab
30	Lab lectures on BB radiation, 4th lab report due , (start Black Body radiation)
April. 6	Black Body Radiation Experiment, Lab report due on e,m and h
13	Black Body Radiation Experiment,
20	Lab lecture on Radioactive Decay and start 6th Lab) BB radiation lab due)
27	Radioactive Decay Lab (only Radioactive Lab will be accepted after 4-27
May 1	6th lab report, radioactive decay is due

Optics Labs

Spectrometer with diffraction Grating (1st (or 2nd)Lab)
Photoelectric Effect
Michelson Interferometer (3rd or 4th Lab)

Atomic and Nuclear Labs

Electron charge to mass ratio
Black Body Radiation, 5th Lab
Radioactive Decay, 6th Lab

Lab 7 – Calculation of h.m and e from earlier labs

Some Independent Project Lab Ideas (feel free to come up with your own)

a) Comparison of the spectrum of a fluorescent light bulb with an incandescent light bulb using the spectrometer.
b) Electronic measurement of light intensity using a photodiode.
c) Observation of the Meissner effect in a superconductor.
d) Automation of an experiment using the Labview software and an interface board.
e) Observation of magnetic domains.
f) Measurement of the spectrum of a star using the observatory.
g) Measurement of the flux or energy spectrum of cosmic rays.
h) Measurment of the spectrum of beta particles.
i) Observation of alpha-decay tracks in a cloud chamber.
j) Measurement of Compton scattering of x-rays.
k) Measurement of electron diffraction with electron microscope. (Need to obtain permission from Dr. Ito)
l) Try to use a Michelson interferometer to measure the width of the Hg line. Compare this with an estimation based on a diffractometer.
m) Put together measurements from the e/m experiment, the spectrum of hydrogen with the spectrometer (which provides a value of the Rydberg constant) and the h/e experiment (photoelectric affect) to obtain values for m, e and h independently instead of just their ratios.
n) Compare the accuracy of the spectrometer used in the spectrometer lab with a newer model spectrometer the department is thinking of buying to replace them. See if the new one is better or worse.