

PS 315: Modern Physics Lab

Spring 2020 Syllabus

Last updated: Jan. 4, 2020

Professor: Dr. Darrel Smith

Office Phone 777-6663

Course PS 315.50 and PS315.51

Credit Hours 2

Class Time Sec. 50 M W (9:00 – 11:30 AM)
Sec. 51 T Th (1:25 - 4:05 PM)

Office Location: AC1, Room 253

Classroom: STEM Bldg-131

Corequisite PS 303

Required Materials Scientific calculator, lab notebook.

Books: *an Introduction to Error Analysis*, John R. Taylor;
Experiments in Modern Physics 2nd edition,
Melissinos and Napolitano

Office Hours: See my web site: <http://physicsx.erau.edu/>

Course Description

This laboratory is a “core” requirement for the Space Physics degree program. It provides students “hands on” experience in support of the Modern Physics course (PS303). Furthermore, it introduces students to several sophisticated devices used in the discovery of fundamental properties of atomic and nuclear systems.

Learning Objectives:

After completing this course, students should be able to

1. Carry out an open-ended investigation using moderately sophisticated hardware.
2. Analyze properties of electromagnetic radiation.
3. Utilize diffraction and prism elements in a spectrometer to identify emission spectra.
4. Measure the components of an X-ray source and describe the events leading to the production of X-rays.
5. Measure the attenuation lengths of various materials using a Geiger-tube.
6. Measure the lifetime of radioactive nuclides using a multichannel analyzer using a multi-channel analyzer (MCA) and a quantum photomultiplier tube (PMT).
7. Produce a concise and informative written record of laboratory test work.
8. Determine the quality of the measurements obtained by using statistical fitting techniques, including linear and non-linear fits, goodness of fit, and chi- square tests.
9. Produce at least one formal paper, fit for printing in a scientific journal, describing the method used and the results obtained from pursuing an open- ended investigation on a Modern Physics experiment.

Lab Material: Available on my website -- <http://physicsx.erau.edu/>

Grading Policy:

Your final grade will be based on the cumulative score you earn for all lab exercises. In general, letter grades will likely be based on the traditional scale, but your instructor has the freedom to alter this scale as he or she sees fit.

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|-----------------------|----------------------|
| ✓ 90% to 100% is an A | ✓ 60% to 69% is a D |
| ✓ 80% to 89% is a B | ✓ 0% to 59 % is an F |
| ✓ 70% to 79% is a C | |

You must complete every lab exercise. If you miss one lab, there will be an opportunity to make it up during the scheduled make-up week. If you anticipate missing a second lab, you must discuss the problem with your instructor. Do not wait until the end of the term and then attempt to remedy the problem. You will fail the course.

Plagiarism. Formal lab reports should reflect the students work as a result of the data taken during the course of the lab. If any part of your report is identical or very similar to the report of another student or any other source, that is considered plagiarism and will be disciplined in the same manner as cheating. (Note: your raw data should be the same as that recorded by your lab partner.)

Incomplete grades. The Incomplete (I) grade is only possible for students who have suffered medical emergencies or some other unusual hardship. The instructor will consider giving an “I” grade only if a student provides written evidence (e.g., a letter from a physician) concerning the hardship. A written agreement, detailing remaining work to be completed and the deadline, must be signed and dated by the student and the instructor before the end of the semester.

Lab Books. Each student will have a logbook to write and record observations. In preparation for each lab, every student is required to write a **laboratory plan** describing both the physics principles being investigated and the apparatus to be used to measure the physical phenomenon. This will be due by Tuesday 7:00 pm in Nour Ibrahim’s or Ashley Elliott’s email, so, they will have time to read them before the lab the following morning. The due date for **laboratory plans** may switch to Sunday’s at 7:00 pm later in the semester. The first **laboratory plan** will be due Friday, January 19, 2018. The lab TA or instructor must sign off on the laboratory plan before a student starts to take measurements. As part of the “sign off,” students should be prepared to answer questions regarding the experiment they are undertaking. The calendar for the Spring 2018 semester can be found on my PS315 website.

Lab Assistant emails: Nour Ibrahim ibrahin2@my.erau.edu
Ashley Elliott elliota9@my.erau.edu

Formal Reports. Students will submit two formal reports as part of the course. The reports will be written using LaTeX, a type setting language used in scientific journals. One report will be based on the measurements taken from one of the first 6 labs, while the second report will be based on measurements taken from one of the last 3 labs.

Supplemental Material. I will include additional material on my website as they relate to these experiments. So, periodically check my website for leaflets, manuals, and other material that will assist you with the understanding the physics, or the operation of the experimental equipment.

***Attendance:** Regular attendance and punctuality, in accordance with the published class schedule, are required. The first day of lab is Wednesday January 10th at 9:00 am. If possible, we may decide to start the lab earlier than 9:00 am (MW) in order to accommodate some students having classes starting at 11:00 am on M W F.

Experiment list

Cavendish	Charge-to-mass ratio	Spectroscopy
Radioactive Decay	Franck-Hertz	Planck’s constant
Electron Diffraction	Geiger-Muller Tube	Millikan Oil Drop

The first 6 experiments (weeks 1 - 3, and 4 - 6) are worth a maximum of 20 points each, for a total of 120 points. The last 3 experiments (weeks 7 – 12) are worth a maximum of 40 points each, for a total of 120 points.

The first formal lab report is worth a maximum of 40 points, and the second formal lab report is worth 60 points. Each Pre-Lab is worth a maximum of 1 point. With 9 prelabs and three 10-point quizzes, the **total number of points you can earn in the semester is 379 points.**

The 2nd Formal Lab Report

The final formal lab report will be due on the last day of classes, Thursday, April 23, 2020.

Final Exam: Section 50 (M W) **Tuesday April 28, 2020 12:30 – 2:30 pm (Oral Presentations)**
Section 51 (T Th) **Saturday April 25, 2020 10:15 – 12:15 pm (Oral Presentations)**

Tutoring

Tutoring will begin Tuesday January 16, 2018 with additional times and tutors added throughout the following weeks. Go to: **ERNIE → Services → Academics → Tutoring Schedule**

Tutoring is free and unlimited for all ERAU students. Always check the online schedule for updates and changes.

Access To Learning

ERAU is committed to the success of all students. It is University policy to provide reasonable accommodations to students with disabilities who qualify for services. If you would like to discuss and/or request accommodations, please contact Disability Support Services in Hazy Library Room 109, extension 6750, or (928) 777-6750.

Civil Rights Equity and Title IX:

ERAU seeks to provide an environment that is free of bias, discrimination, and harassment. If you have been the victim of harassment, discrimination or sexual misconduct, we encourage you to report this. If you inform me of an issue of harassment, discrimination, or sexual misconduct I will keep the information as private as I can, but I am required to bring it to the attention of the institution's Title IX Coordinator. If you would like to talk to the Title IX Coordinator (Dr. Liz Higgins Frost) directly, she can be reached at Building 49, Dean of Students Office, 928-777-3747, froste@erau.edu. For more information, please refer to the Nondiscrimination/Title IX webpage at <http://prescott.erau.edu/about/health/sexual-misconduct-and-title-ix/index.html>.