PS 315: Modern Physics Lab

Spring 2022 Syllabus

Last updated: Jan. 26, 2022

Professor: Dr. Darrel Smith

Office Phone 777-6663
Course PS 315.50
Credit Hours 2
Class Time Sec. 50 M W (9:00 – 11:30 AM)

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,
by 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/ Go to "Courses" and select "PS315"

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.

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

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 Sundays at 5:00 pm in Jonah Greenwood's email, so, he will have time to read them before the lab the following morning. The due date for ***laboratory plans*** may change later in the semester. The first ***laboratory plan*** will be due Sunday, January 23, 2022. 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 2022 semester can be found on my PS315 website.

Lab Assistant's email: Jonah Greenwood greenwj8@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. The first report will be from measurements taken in 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 12th 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 two 10-point homework assignments; the **total number of points you can earn in the semester is 369 points.**

The 2nd Formal Lab Report
The final formal lab report will be due on the last day of classes, Thursday, April 28, 2022.

Final Exam: Section 50 (M W) **Tuesday, May 3, 2022 12:30 – 2:30 pm (Oral Presentations)**

Tutoring

The Tutoring Center is open (STEM 205) with additional times and tutors added throughout the semester. 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. You can also find tutoring available by fellow Physics and Astronomy students in the "CAVE."

Academic Integrity/Conduct

Embry-Riddle is committed to maintaining and upholding academic integrity. This includes carrying out one's own course of study within the parameters set by one's instructors, by academic administrators, and by University values. It includes avoiding cheating and plagiarism; maintaining the quest for excellence in study, written assignments, and other academic tasks; and reinforcing honesty and rigor in all one's academic behavior. All students, faculty, and staff have obligations to reinforce the above and take corrective action when necessary. To report issues of academic integrity, contact (in appropriate order); the course Professor, the academic Department Chair and/or the Dean of the College. For more information about academic integrity, please refer to the academic catalog and your course syllabi.

For more information see the **Student Handbook (Links to an external site.)**.

Quick Access to Institution Policies and Services

- **Civil Rights Equity & Title IX (Links to an external site.)**
- **Disability Support Services (Links to an external site.)**
- **Safety and Security (Links to an external site.)**
- **Student Handbook (Links to an external site.)**
- **Academic Calendar (Links to an external site.)**
- **IRB (Links to an external site.)**
- **Vet Resources (Links to an external site.)**

ERAU Coronavirus Updates

To help keep everyone at Embry-Riddle as safe as possible, we expect all students and employees to take personal responsibility by following these three steps:

- **Get tested *before* classes begin on Jan. 12.**

  If you test positive, **follow U.S. Centers for Disease Control & Prevention (CDC) guidelines**. Do *not* come onto campus. Stay away from others for five days. After that, you may resume normal activities, so long as you are asymptomatic and wear a mask for another five days. Pre-semester testing is your responsibility; results do not need to be reported to Embry-Riddle. **Testing and vaccination services** will be freely available on campus throughout the spring semester.

- **Wear a mask indoors at Embry-Riddle.**

  Particularly in classrooms and during flight training, we expect you to **follow CDC mask guidelines**, even if you have been vaccinated. Please be respectful of others, keeping in mind those who may be at increased risk. We are aware that many in our community stopped wearing a mask indoors last semester as the pandemic seemed to be easing up. Now, with the highly infectious Omicron variant on the rise, you should *plan to resume masking up indoors.*

- **Get vaccinated before the spring semester begins.**

Have your initial vaccination, second dose or booster shot if you have not already done so. If you have questions, **review the CDC's vaccine information**.