

# PS 315: Modern Physics Lab

## Spring 2019 Syllabus

Last updated: Jan. 12, 2019

**Professor: Dr. Darrel Smith**

**Office Phone** 777-6663

**Course** PS 315.50

**Credit Hours** 2

**Class Time** M W 9:00 – 11:40 AM\*

**Office Location:** AC1, Room 253

**Classroom:** STEM Bldg-131

**Corequisite** PS 303

**Required Materials** Scientific calculator, lab notebook.

**Books:** *Practical Physics* 4<sup>th</sup> edition, G.L. Squires  
*Experiments in Modern Physics* 2<sup>nd</sup> edition,  
Melissinos and Napolitano

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

### Course Description

Two laboratory session per week with experiments complementing the material presented in PS 303.

This is a required laboratory course in the space physics degree program. The course will provide a hands-on experience with several sophisticated devices that are used in science and engineering.

### 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. analyze selected nuclear and atomic processes.
4. describe how to measure the charge and the charge-to-mass ratio of the electron.
5. explain how to observe energy transitions produced by collisions between electrons and atoms.
6. produce a concise and informative written record of laboratory test work.
7. perform a significance test for the correlation of experimental results.
8. Produce two formal reports using the LaTeX type-setting program to produce journal-quality papers.

**Lab Material:** Available on my website -- <http://physicsx.pr.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.

- |                       |                      |
|-----------------------|----------------------|
| ✓ 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:** If you and your partner(s) write your formal lab report on the same experiment, it's obvious that your raw data would be the same; however, the other parts of your report (e.g., introduction/objective, analysis, conclusions, citations, etc.) must be your own work.

*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 2 logbooks 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 Lab Assistant's email box, 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 Tuesday, January 15, 2019. The lab assistants 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 2019 semester can be found on my PS315 website.

**Lab Assistant emails:** William Hosea email: [hoseaw@my.erau.edu](mailto:hoseaw@my.erau.edu)  
Calley Tinsman email: [tinsmanc@my.erau.edu](mailto:tinsmanc@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. Please see my PS315 website for examples of LaTeX documents and templates you can use. 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. The formal reports, including reference citations, will not exceed 4 pages in length. Your formal report is expected to contain a bibliography where other material (not found on my website) are cited. You should have at least 3 other sources cited in your bibliography preferably not websites. I will allow one or two URLs if they're exceptionally good, however, I expect you to read from other sources like those found in the library.

*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 9<sup>th</sup> at 9:00 am. When necessary, we may decide to open 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
<b>Electron Diffraction</b>	<b>Geiger-Muller Tube</b>	<b>Millikan Oil Drop</b>

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 2 other assignments, the **total number of points you can earn in the semester is 379 points.**

#### The 2<sup>nd</sup> Formal Lab Report

The final formal lab report will be due on the last day of classes, Thursday, April 25, 2019.

**Final Exam: Tuesday April 30, 2019 12:30 – 2:30 pm (Oral Presentations)**

As it turns out, our PS303 final exam will be earlier in the morning on April 30<sup>th</sup>, at 8:00 – 10:00 am.

### Grades

Students will accumulate points for each of their assignments totaling 379 points.

First 6 labs	20 points each	120 points
Last 3 labs	40 points each	120 points
9 prelabs	1 point each	9 points
$\chi^2$ assignment	20 points	20 points
Bohr Atom quiz	10 points	10 points
1 <sup>st</sup> Formal Report	40 points	40 points
2 <sup>nd</sup> Formal Report	60 points	<u>60 points</u>
		Total = 379 points

A	$90 \leq 100 \%$
B	$80 \leq 90 \%$
C	$70 \leq 80 \%$
D	$60 \leq 70 \%$
F	$< 60\%$

### Tutoring

Tutoring will begin the second or third week of the semester 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 (Liz Higgins Frost) directly, she can be reached at Building 49 Room 103, Dean of Students Office,*

928-777-3747, [froste@erau.edu](mailto: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>.