FLORIDA POLYTECHNIC UNIVERSITY

PHY 2841C – Experimental Techniques in Physics

Course Information

- **Course Number and Title**: PHY 2841C – Experimental Techniques in Physics
- **Credit Hours:** 2
- **Academic Term:** Spring 2026

Instructor Information

- **Instructor:** Dr. Nathan Dawson
- **Office Location:** BARC 2267
- **Office Hours**: Monday – 10:00am-10:50am
  Monday – 11:00am-11:50am
  Wednesday – 11:00am-11:50am
- **Email address**: ndawson@floridapoly.edu

Course Delivery and Course Description

- **Delivery Mode**: Face-to-face laboratory environment
- **Class Meeting Day:** Monday/Wednesday
- **Time & Location:** 3:00pm-4:50pm, BARC 2245
- **Course Website**: Canvas
- **Official Catalog Course Description**: This laboratory course provides opportunities to explore the science of inferring information from kinematic, optical, and electrical measurements and the analysis of data to quantify physical phenomena. The students will build computer-automatized, scientific equipment to prove concepts of modern physics. Emphasis is placed on experimental and computational techniques used in research and industry including statistical analysis, error estimation, the limits of measurement data, and error propagation.
  - **Course Prerequisites**: PHY 2750C
  - **Communication/Computation Skills Requirement (6A-10.030)**: N
- **Required Texts and Materials:**
  - University CANVAS LMS system & University e-mail system
  - Instructor Lectures, Videos, Notes, and Handouts
  - Laboratory notebook
  - Standard experimental test equipment will be provided.

Course Objectives and Outcomes

- **Course Objectives**:
  Upon successful completion of this course, you should be able to:
  - **Demonstrate** the ability to perform experiments relevant to modern concepts in physics.
  - **Analyze** the data obtained from the laboratory experiments.
  - **Interpret** the results and graphs based on defined physics laws and principles.

- **Course Learning Outcomes**:

Course Learning Outcome	Learning Level	Program Learning Outcome (ABET)
Read, **understand**, and **interpret** lab assignments and reference journal articles.	**Remember and Recognize** Recall	**1** an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
Develop experimental apparatus and perform laboratory measurements.	**Create** Construct Execute Implement	**2** an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
Synergistically operate in a team-based environment to solve experimental problems with real world applications through a goal-oriented approach.	**Evaluate** Check Critique Organize	**5** an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
Generate and **interpret** graphs, data, and uncertainties for reporting results.	**Analyze** Compare Explain	**3** an ability to communicate effectively with a range of audiences. **6** an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Civility and Collegiality

Faculty and students come to the university for the same reason, which is to participate in a highly professional educational environment. To that end, both students and faculty are expected to treat each other with mutual regard and civility. Communication, written, oral and behavioral, between faculty and students must remain respectful. Within and outside of the classroom, students must refrain from derogatory comments toward the faculty member and their fellow students, and faculty as well must refrain from derogatory comments toward their students. Faculty and students should address each other with respect, in accordance with the wishes of the faculty and the students: for example, no one should be addressed by their last name alone.

Faculty from the outset of a course can and should specify what constitutes activities and behavior that take away from, that diminish, the educational environment. An individual student's distracting behavior impedes the education of fellow students, which itself is a form of disrespect. Civility and collegiality also include respecting each other's time: for example, neither students nor faculty should arrive late to class (unless unforeseen, pressing circumstances prevail); faculty should be present at the posted office hours; and students and faculty should be punctual when meeting times are scheduled. In more general terms, collegiality means respecting the right of both faculty and students to participate fully and fairly in the educational enterprise.

Course Policies

Attendance

Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as defined by the instructor." Actual physical attendance in the classroom will account for **5%** of the student's course grade.

Students with excused absence are allowed reasonable time to make up the missed works without any reduction in the assigned work or final course grade as a direct result of the absence. Extra credit points, if present, that are based on attendance typically are not awarded when a student is absent. Excused absences from class for any of the following reasons: *religious observances of student's faith, legal responsibilities (jury duty, court obligations), military obligations, university-sponsored events, death or serious illness within the student's immediate family, or student's own illness, or other reasonable circumstances.*

Participation

Students are expected to participate in the laboratory experience. The use of earbuds/headphones during class is specifically not allowed and students who engage in this behavior may be asked to leave the class for the day (noting exceptions for authorized accommodations). In addition, students who routinely do not bring materials to class that are required for participation, will not be given credit for class attendance, and if this becomes a pattern of behavior, may be asked to leave the class for the day. Persistent problems with participation may result in a code of conduct referral.

Late Work/Make-up work

For any late work, the instructor will evaluate case by case depending on both the type of excuse and the type of the missing assignment. Students with excused absence are allowed reasonable time to make up the missed works without any reduction in the assigned work or final course grade as a direct result of the absence. Extra credit points, if present, that are based on attendance typically are not awarded when a student is absent.

Grading Scale

Grade	A	A-	B+	B	B-	C+	C	C-	D	F
Percentage	> 93%	90%-92%	87%-89%	83%-86%	80%-82%	77%-79%	73%-76%	70%-72%	60%-69%	< 60%
GPA	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.0	0.0

Assignment/Evaluation Methods

A student's class grade will be determined by performance on assignments and tests weighted according to:

Safety training	**5%**
Lab reports	**50%**
Final project white paper	**5%**
Final project proposal	**10%**
Mid-project presentation	**5%**
Final project demonstration	**10%**
Final Project report	**10%**
Attendance	**5%**
Total	**100%**

Success Primer Safety Training: Some of the Physics Lab experiments will be accessed in the IST 1061 (Physics wet lab) and BARC 1145 (Laser lab). You must be completing both the lab safety training and laser safety traing before the end of the beginning of the second week of class. You should register first with your Florida Poly email address to take the training. If you have any enrollment problems to take the safety training, please the instructor.

Reading Assignments: I will ask you to read and take notes of experimental literatures, model SOP (safety Operating Procedures) and manuals. Reading assignments may be a group activity which will strengthen your peer network in designing lab experiments, analysis and interpretation of results and lab report preparations. If you are absence for no valid reasons, you will not only lose your participation points, but also the skills developing opportunities via in-class reading and presentation of any particular lab experiment.

Design of Experiments (DoE) and Data Collection: the Experimental Physics laboratory course will allow you to build the design some of the experiments by you or your team from scratch. Some of the labs and experiments neither come with strict protocol, nor with pre-built DoE. Therefore, it is expected that you have to read the manual and handout materials to build your experiment on your own. I will be in the laboratory to support your efforts. This practice will prepare you for research laboratory experiences and the capstone project.

Laboratory Report Submission: A laboratory report will be **required per group** covering the work in each week of regularly scheduled labs. These reports will include a title, abstract, introduction (with bibliographic information), experimental methods, results/discussion section(s) either combined or separate (including tables of data, graphs, and analysis), and a conclusion. In general, the lab reports are due on Friday of the week the labs were performed. It is mandatory that you participate in every lab. A LaTeX template for lab reports is provided and the rubric is given in a separate document on the Canvas website.

Important note: Lab reports figures should be generated by you and not taken from the lab manual. All data analysis should be performed to deliver a proper Discussion section that reviews the findings in a scientific manner.

Project Proposal: The project proposal should have an introduction mentioning why your team chose this project and its scientific merits, a proposal section with a timeline which fits into the eight-lab-session (4 weeks) time table and it should contain a Gantt chart, a materials section which includes costs of all items not already available in the

laboratory, and expected outcomes. The last section on anticipated outcomes should also discuss anticipated challenges.
Mid-Project Presentation: A 10-minute group presentation (Microsoft PowerPoint format preferred) detailing the status of your project. In your presentation, you must 1) introduce your project, 2) identify completed tasks, 3) list your remaining tasks, 4) explain current challenges, 5) explain challenges anticipated in your remaining tasks, and 6) discuss expectations for completing your project prior to the date of demonstration.
Final Project Demonstration: You will demonstrate your final project to the instructor and class. A grading rubric is provided.
Final Project Report: The final Project Report has the same rubric as the standard lab report, but there must be separate results and discussion sections. The final lab report is expected to contain more detail than a standard lab report.
Laboratory Expectations: Laboratory meets for 1 hour 50 minutes each session with two sessions per week. The intent of laboratory time is for you to demonstrate skill in designing and performing experiments, analyzing the data, interpret graphs and report the results in a systematic and organized manner. The laboratory will be interactive - you are expected, at appropriate times, to work with your peers, express your thoughts, ask and answer questions, discuss ideas, patiently, and listen to and respect other's ideas. Students perform significantly better when they are actively involved in the classroom rather than a passive participant.
Classroom Rules: No food and drinks are allowed in the classrooms. No cell phone rings (please turn off your cell phones or mute it).
Safety and Security: You are not supposed to handle any equipment unless your instructor permits you to do so. Safety and security procedures need to be strictly followed per the instruction of the faculty. Handle carefully all the equipment and tools while performing the experiments. Any violations of safety protocols will disqualify you or your team member to earn the lab credit.
Classroom Rules: No tablets allowed during class, except if specifically required for disability accommodations or permission is sought in advance from the instructor. Studies show that notetaking by hand enhances comprehension and recall, while laptops distract not just the user but surrounding students as well. Cell phones must be on silent/mute mode and should not be used to the extent that they disturb other students or distract from class participation.
CANVAS Policy: Assignments, announcements, and information will be posted on CANVAS. Students are responsible for checking CANVAS regularly to be aware of their assignments and other class information.
Email Policy: All students are required to use the studentuserID@floridapoly.edu email system OR the CANVAS e-mail system to communicate with the instructor. On occasions, email may be used to disseminate important class-related assignments, announcements, and information. Students are responsible for any information or assignments given in e-mail.

University Policies

Reasonable Accommodations

The University is committed to ensuring equal access to all educational opportunities. The Office of Disability Services (ODS), facilitates reasonable accommodations for students with disabilities and documented eligibility. It is the student's responsibility to self-identify as a student with disabilities and register with ODS to request accommodations. If you have already registered with ODS, please ensure that you have requested an accommodation letter for this course through the ODS student portal, and communicate with your instructor about your approved accommodations as soon as possible. Arrangements for testing accommodations must be made in advance. Accommodations are not retroactive. If you are not registered with ODS but believe you have a temporary health condition or permanent disability requiring an accommodation, please contact ODS as soon as possible: DisabilityServices@floridapoly.edu; (863) 874-8770; www.floridapoly.edu/disability.

Accommodations for Religious Observances, Practices and Beliefs

The University will reasonably accommodate the religious observances, practices, and beliefs of individuals in regard to admissions, class attendance, and the scheduling of examinations and work assignments. (See University Policy.)

Title IX

Florida Polytechnic University is committed to ensuring a safe, productive learning environment on our campus that prohibits sex discrimination and sexual misconduct, including sexual harassment, sexual assault, dating violence, domestic violence and stalking. Resources are available if you or someone you know needs assistance. Any faculty or staff member you speak to is required to report the incident to the Title IX Coordinator. Please know, however, that your information will be kept private to the greatest extent possible. You will not be required to share your

experience. If you want to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the Florida Polytechnic University Ombuds Office, BayCare's Student Assistance Program, 1-800-878-5470 and locally within the community at Peace River Center, 863-413-2707 (24-hour hotline) or 863-413-2708 to schedule an appointment. The Title IX Coordinator is available for any questions to discuss resources and options available.

Academic Integrity

Violations of academic integrity regulation include actions such as cheating, plagiarism, use of unauthorized resources (including but not limited to use of Artificial Intelligence tools), illegal use of intellectual property, and inappropriately aiding other students. Such actions undermine the central mission of the university and negatively impact the value of your Florida Poly degree. Suspected violations will be fully investigated, possibly resulting in sanctions up to and including expulsion from the university.

Recording Lectures

Students may, without prior notice, record video or audio of a class lecture for a class in which the student is enrolled for their own personal educational use. Recordings may not be used as a substitute for class participation or class attendance. Recordings may not be published or shared in any way, either intentionally or accidentally, without the written consent of the faculty member. Failure to adhere to these requirements is a violation of state law (subject to civil penalty) and the student code of conduct (subject to disciplinary action). *Recording class activities including, but not limited to, lab sessions, student presentations (whether individually or part of a group), class discussion (except when incidental to and incorporated within a class lecture), and invited guest speakers is* ***prohibited****.*

Academic Support Resources

- **Library**: Students can access the Florida Polytechnic University Library through the University website and Canvas, on and off campus. Students may direct questions to library@floridapoly.edu.
- **Tutoring and Learning Center**: The Tutoring and Learning Center (The TLC) provides tutoring to all Florida Poly students who may need additional academic support. The TLC is staffed by students who have excelled in the courses they tutor. They offer support by reviewing concepts and materials from class, clarifying points of confusion and providing assistance with learning strategies. While the focus of TLC is to provide support to students in freshman-level courses, upper-level courses are also tutored at the Center. The TLC is located in the IST Commons (second floor).
    - **Knack Tutoring**: Students looking for additional assistance outside of the classroom are advised to consider working with a peer tutor through Knack. Florida Polytechnic University has partnered with Knack to provide students with access to verified peer tutors who have previously aced this course. To view available tutors, visit floridapoly.joinknack.com and sign in with your student account.
- **Academic Success Coaches**: All students at Florida Poly are assigned an Academic Success Coach. Your Academic Success Coach can assist you with academic success strategies. Please visit the Student Success Center on the second floor of the IST building to meet with an Academic Success Coach.
- **Writing Center**: Located on the second floor of the IST (2059/2061), the Writing Center helps students to develop their writing and presentation skills. Consultations are available in person and virtually. For more detail, visit floridapoly.edu/writing center.

Modern Physics Laboratory Course Schedule: This course will cover the above lab experiments: Topics and dates are **tentative and subject to change**.

Tentative Course Schedule					
Week *Topic*	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Sunday**
1/12-1/16	Syllabus, Introduction, Safety, Expectations, 1) MOSFET switch with Arduino & Python		1) MOSFET switch with Arduino & Python		Report 1 (1)
1/19-1/23	MLK Jr Day		2) Transimpedance amplifier		Report 2 (2)
1/26-1/30	3) Transmission lines		4) Using thermistors; Arduino & Python for thermometer		Report 3 (3-4)
2/2-2/6	5) Measuring the thickness of small fibers		6) Diffraction & wavelength stability of diode lasers		Report 4 (5-6)
2/9-2/13	7) Using photoresistors; Arduino & Python for photodetector	Career Day	8) Chemiluminescence and transient behavior of sources Project proposal white paper		Report 5 (7-8)
2/16-2/20	9a) Laser obstacle course		9b) Laser obstacle course Project finalized – resubmit white paper if needed.		Report 6 (9)
2/23-2/27	10) Spin coating		11) Thin film absorbance & fluorescence Project materials cost finalized		Report 7 (10-11)
3/2-3/6	12a) Creating laser emission		12b) Creating laser emission Final Project proposal due		Report 8 (12)
3/9-3/13	13a) Chaos in an RL-diode circuit		13b) Chaos in an RL-diode circuit		Report 9 (13)
3/16-3/20	Spring Break				
3/23-3/27	Project		Project		
3/30-4/3	Project		Project		
4/6-4/10	Project Mid-project presentation		Project		
4/13-4/17	Project		Project		
4/20-4/24	Project		Project		
4/27-5/1	Final Project Demonstration/Presentation	Project Report	Reading days		
5/4-5/8	Final exam week				

Some final project ideas to get you thinking: build a multisensory atmospheric balloon, build a spectrometer, build a spin coater, build a thermoelectric laser power meter, build a stylus profilometer, build an electric motor or generator, build a scanning tunneling microscope (STM), build a differential analyzer. **No Tesla Coils**