PURDUE
UNIVERSITY

PHYS 34000 – Modern Physics Laboratory

Syllabus Fall 2022

MEETING TIMES:
Modern Physics Laboratory - 54107 - PHYS 34000 - 011 Mo 9:30 am – 11:20 am, PHYS346
Modern Physics Laboratory - 49038 - PHYS 34000 - M10 Tu 3:30 pm – 5:20 pm, PHYS346
Modern Physics Laboratory - 37295 - PHYS 34000 - M02 Wed 9:30 am – 11:20 am, PHYS346
Modern Physics Laboratory - 48328 - PHYS 34000 - M09 Wed 11:30 am – 1:20 pm, PHYS346
Modern Physics Laboratory - 38777 - PHYS 34000 – 007 Wed 3:30 pm – 5:20 pm, PHYS346
Modern Physics Laboratory - 48327 - PHYS 34000 - 008 Th 1:30 pm – 3:20 pm, PHYS346
Modern Physics Laboratory - 37297 - PHYS 34000 - M04 Fr 9:30 am – 11:20 am, PHYS346
Modern Physics Laboratory - 59520 - PHYS 34000 - M12 Fr 11:30 am – 1:20 pm, PHYS346

COURSE CREDIT HOURS: 1.00
COURSE WEBSITE: Brightspace

PREREQUISITES: PHYS 241 or 272(H)

INSTRUCTOR: Prof. Oana Malis

- Office: Room: PHYS 170
- Phone: 765-494-3039
- Email: omalis@purdue.edu
- Office Hours: by appointment

TEACHING ASSISTANTS:
Sections 011, and M02: SCHULTZ, ERIC DAVID

- Office Room: PHYS G6A
- E-mail: schul211@purdue.edu
- Office Hours: TBA

Sections M10, M09, and 008: LIM, DAWITH

- Office Room: PHYS 135
- E-mail: lim185@purdue.edu
- Office Hours: Wednesdays 3-5 pm

Sections 007, M04, and M12: ALAGARSAMY MANIKANDAN, KEERTHI

- Office Room: PHYS 287
- E-mail: kalagars@purdue.edu
- Office Hours: TBA

COURSE DESCRIPTION
In this course students will conduct some of the most important experiments that have guided our understanding of physics over the past century. The laboratory experiments illustrate and explore in depth the Modern Physics concepts introduced in PHYS 34200 or 34400. Students will also gain experience in all steps that need to be undertaken by a modern researcher.

LEARNING OUTCOMES
- plan and conduct a modern physics experiment;
- record, analyze and interpret experimental data;
- write and submit a publication quality scientific manuscript;
- review a scientific manuscript written by others;
- respond to reviews of a scientific manuscript;
- revise and submit a final manuscript "for publication".

LAB MANUAL:
You may download the PHYS 340 Lab Manual from Brightspace. Note: Instructions for some of the experiments have changed. Check the revised uploaded documents in Brightspace and consult with your Lab Instructor to see if there are any more updates.

REQUIRED NOTEBOOK:
Avery-Dennison No. 43-648 (or approved equivalent)

RECOMMENDED BOOK:
PRACTICAL PHYSICS by G. L. Squires

ACTIVITIES AND RESPONSIBILITIES:
You are responsible to perform five experiments, submit your lab notebook for grading, write a scientific paper and review two of your classmates' papers. Before each experiment, you need to read the assigned material and record in your lab notebook a summary of the physics involved in your experiment and the plan for the experimental procedure. During the lab session, you will perform the experiments, collect and document the data in your notebook, and then perform the necessary data analysis. You are responsible to contact the instructors if you need help, and to submit your lab notebook for grading twice a semester. You will also write a scientific paper based on one of the experiments and review two of your classmates' papers.

EXPERIMENTS:
You will conduct 5 experiments individually or in a group of two students. Each student must have their own notebook. Each student will collect their own experimental data, as well as record the pre-lab work, perform the data analysis, interpretation and conclusions.

NOTEBOOK:
During the semester, the maintenance and production of a high-quality hand-written notebook will be emphasized. Your lab notebook will be collected periodically during the semester and graded for content. Please read carefully the lab manual, pages 5-7, about the notebook-keeping practices.

An example of what your lab notes should look like can be found in Brightspace. The lab manual illustrates the level of detail of the notes that you should take while performing these experiments. It also shows some mistakes made by students.
Important: Each lab final write-up should include one "publication quality" computer-generated graph, all final data with error analysis in Excel format, and a discussion of which Modern Physics model (particle vs. wave) it supports.

FORMAL PAPER:

You will also be required to write one scientific paper based on one of the experiments you performed. The paper should follow general guidelines required for a scientific paper to be published in a modern peer-reviewed scientific journal. These papers will be judged by how well they compare to the publication "Observation of Gravitationally Induced Quantum Interference" by Colella, Overhauser and Werner. This outstanding publication is analyzed for your benefit in the above tab "COW" - dissected. Note: each student should make their own figures, tables, equations, analysis, etc.

a) The first version of your manuscript will be submitted to your Lab Instructor who will serve as one "reviewer" and "editor". The Lab Instructor will also assign two reviewers among your fellow students who will serve as additional "reviewers" of your manuscript, i.e. each of you will also have two papers to review. Note that these are supposed to be "blind" reviews, i.e. while you will know the author of the paper assigned for you to review, the author of the paper will not know who reviewed his/her paper. This will mimic a standard practice utilized by peer-reviewed journals when a submitted manuscript is sent for a review to one or more experts in the field (active researchers) to assess its scientific quality and appropriateness for publication.
b) The Lab Instructor and other reviewers will read your manuscript and write reviews with comments, questions and suggestions. These reviews along with the paper will be returned to you.
c) You will also be assigned two papers to review. Your own reviews of two other manuscripts will also be graded. For each paper, you will need to prepare a written review containing questions, comments, and requests for revisions. Your response is essential to improve the quality of the papers you review, and a very important job for an active researcher. You will submit your reviews to the Lab Instructor.
d) You will have to respond to the reviews you receive and address all the comments/questions in the revised version of your manuscript. Both your response to the reviewers' comments and the final manuscript will be graded by the Lab Instructor. You will have to address all the comments and submit (i) the response to reviewers and (ii) the final version of your manuscript to your Lab Instructor (the "editor"). Note that not all

of the reviewer's comments need to lead to requested changes in your manuscript; it is up to you to use these comments wisely and improve your paper quality. If you chose not to introduce some changes suggested/requested by the reviewer, you should provide a clear explanation in your response to the reviewer's comment why you chose not to do so (a "rebuttal"). The final paper along with the response to reviewers will be graded.

To provide some feedback to you about what we feel is important, a copy of the check-sheet that will be used while reading your written reports and notebooks is provided in the lab manual (page 10).

OUTSIDE CLASS

You are responsible for the following outside class:

- Pre-lab work: read experiment manual and summarize procedure
- Analyze and organize data, make "publication quality" plot, draw conclusions
- Write formal paper and review two other papers

GRADING POLICY

Determining the final grade:
100 pts - first notebook grading (2 completed labs)
150 pts - second notebook grading (3 completed labs)
60 pts - formal paper
50 pts - response to paper reviewers and revised paper
40 pts - your reviews of two papers
400 pts TOTAL POINTS POSSIBLE

The final grade cutoffs will be determined so that the grade distribution is similar to previous semesters. An example of the grading scale from last year is given below:

Grades	
A+	>97
A	90-97
A-	85-90
B+	82-85
B	78-82
B-	74-78
C+	70-74
C	66-70
C-	62-66
D	57-62
F	<57

ATTENDANCE POLICY

Students are expected to be present for every meeting of the classes in which they are enrolled. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts or absences can be anticipated, such as for many University sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email or phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, the student or the student's representative should contact the Office of the Dean of Students via email or phone at 765-494-1747.

More than two unexcused absences will result in grading penalties of 5 points per absence after the second.

Academic Guidance in the Event a Student is Quarantined/Isolated

If you must miss class at any point in time during the semester, please reach out to me via Purdue email so that we can communicate about how you can maintain your academic progress. For COVID-19 concerns, please see the **Fall 2022: What you need to know guidance published July 27**. If you find yourself too sick to progress in the course, notify your adviser and notify me via email or Brightspace. We will make arrangements based on your particular situation.

Classroom Guidance Regarding Protect Purdue

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights and the Violent Behavior Policy under University Resources in Brightspace.

TENTATIVE SCHEDULE Fall 2022, Wednesday-Friday Sections: M02, M09, 007, 008, M04, M12

Week	Dates	Activity	Due dates/Comments
Week 1	August 21 – 27	Course introduction: Data & error analysis; Excel plots etc.	
Week 2	August 28 - September 3	Lab 1	
Week 3	September 5 September 6 – 10	**Labor day – no lab** Lab 1 cont.	
Week 4	September 11 – 17	Lab 2	
Week 5	September 18 – 24	Lab 2 cont.	
Week 6	September 25 – October 1	Lab 3	**Notebook due at end of session to grade first 2 labs**
Week 7	October 2 – 8	Lab 3 cont.	
Week 8	October 10-11 October 12 – 15	**October break - no lab** Lab 4	
Week 9	October 16 – 22	Lab 4 cont.	
Week 10	October 23 – 29	Lab 5	
Week 11	October 30 - November 5	Lab 5 cont.	
Week 12	November 6 – 12	Formal paper	**Notebook with all data, plots, etc., due on day of lab.**
Week 13	November 13 – 19	Formal paper cont.	
Week 14	November 20 – 22 November 23-26	No lab; **Thanksgiving break – no lab**	**Formal paper due on November 22 via email to grader.**
Week 15	November 27 – December 3	Make-up week	**Receive two papers to referee by Dec. 3**
Week 16	December 4 – 10	Make-up week	**Turn in your "referee reports" of two papers due on December 9**
Week 16	December 11 – 17	Finals week	**Response and revisions to your paper reviews due on December 14** **No final exam**

TENTATIVE SCHEDULE Fall 2022, Monday Section 011 only

Week	Dates	Activity	Due dates/Comments
Week 1	August 21 - 27	Course introduction: Data & error analysis; Excel plots etc.	
Week 2	August 28 - September 3	Lab 1	
Week 3	September 5 September 6 - 10	**Labor day – no lab**	
Week 4	September 11 – 17	Lab 1 cont.	
Week 5	September 18 - 24	Lab 2	
Week 6	September 25 – October 1	Lab 2 cont.	
Week 7	October 2 – 8	Lab 3	**Notebook due at end of session to grade first 2 labs**
Week 8	October 10-11 October 12 – 15	**October break - no lab**	
Week 9	October 16 – 22	Lab 3 cont.	
Week 10	October 23 – 29	Lab 4	
Week 11	October 3 - November 5	Lab 4 cont.	
Week 12	November 6 – 12	Lab 5	
Week 13	November 13 – 19	Lab 5 cont.	
Week 14	November 20 – 22 November 23-26	Formal paper **Thanksgiving break – no lab**	**Notebook with all data, plots, etc., due on Monday, November 21**
Week 15	November 27 – December 3	Formal paper cont.	
Week 16	December 4 – 10	Formal paper cont./Make-up week	**Formal paper due on December 6 via email to grader.** **Receive two papers to referee by December 8th**
Week 16	December 11 – 17	Finals week	**Turn in your "referee reports" of two papers due on Monday, December 12** **Response and revisions to your paper reviews due December 16** **No final exam**

TENTATIVE SCHEDULE Fall 2022, Tuesday Section M10 only

Week	Dates	Activity	Due dates/Comments
Week 1	August 21 - 27	Course introduction: Data & error analysis; Excel plots etc.	
Week 2	August 28 - September 3	Lab 1	
Week 3	September 5 September 6 - 10	**Labor day – no lab** Lab 1 cont.	
Week 4	September 11 – 17	Lab 2	
Week 5	September 18 - 24	Lab 2 cont.	
Week 6	September 25 – October 1	Lab 3	**Notebook due at end of session to grade first 2 labs**
Week 7	October 2 – 8	Lab 3 cont.	
Week 8	October 10-11 October 12 – 15	**October break - no lab**	
Week 9	October 16 – 22	Lab 4	
Week 10	October 23 – 29	Lab 4 cont.	
Week 11	October 30 -November 5	Lab 5	
Week 12	November 6 – 12	Lab 5 cont.	
Week 13	November 13 – 19	Formal paper	**Notebook with all data, plots, etc., due on Tuesday, November 15**
Week 14	November 20 – 22 November 23-26	Formal paper cont. **Thanksgiving break – no lab**	
Week 15	November 27 – December 3	Make-up week	**Formal paper due on November 29 via email to grader. Receive two papers to referee by Dec. 3**
Week 16	December 4 – 10	Make-up week	**Turn in your "referee reports" of two papers due on December 7th**
Week 16	December 11 – 17	Finals week	**Response and revisions to your paper reviews due on December 14** **No final exam**

ACADEMIC INTEGRITY

Purdue Honors Pledge: "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breeches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty" (*Section B.2.a of the Student Regulations*). Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of ghost-written papers, the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest" (University Senate Document 72-18, December 15, 1972).

Incidents of academic misconduct in this course will be addressed by the course instructor and referred to the Office of Student Rights and Responsibilities (OSRR) for review at the university level. Any violation of course policies as it relates to academic integrity will result minimally in a failing or zero grade for that particular assignment, and at the instructor's discretion may result in a failing grade for the course. In addition, all incidents of academic misconduct will be forwarded to OSRR, where university penalties, including removal from the university, may be considered.

NONDISCRIMINATION STATEMENT

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Link to Purdue's nondiscrimination policy statement.

ACCESSIBILITY AND ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Basic Needs Security
Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it relates to COVID-19, students may submit requests for emergency assistance from the Critical Need Fund

EMERGENCY PREPARATION
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

- To report an emergency, call 911.
- To obtain updates regarding an ongoing emergency, sign up for Purdue Alert text messages, view www.purdue.edu/ea.
- There are nearly 300 Emergency Telephones outdoors across campus and in parking garages that connect directly to the PUPD. If you feel threatened or need help, push the button and you will be connected immediately.
- If we hear a fire alarm during class we will immediately suspend class, evacuate the building, and proceed outdoors. Do not use the elevator.
- If we are notified during class of a Shelter in Place requirement for a tornado warning, we will suspend class and shelter in [the basement].
- If we are notified during class of a Shelter in Place requirement for a hazardous materials release, or a civil disturbance, including a shooting or other use of weapons, we will suspend class and shelter in the classroom, shutting the door and turning off the lights.

Please review the Emergency Preparedness website for additional information. http://www.purdue.edu/ehps/emergency_preparedness/index.html

MENTAL HEALTH

- If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.
- If you need support and information about options and resources, please see the Office of the Dean of Students for drop-in hours (M-F, 8 am- 5 pm).
- If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

VIOLENT BEHAVIOR POLICY
Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.

See the University's full violent behavior policy for more detail.

DIVERSITY AND INCLUSION STATEMENT
In our activities, we may encounter a variety of challenging scientific, technical, or interpersonal issues. Overcoming these issues can help us enhance our understanding of different topics beyond physics. Everyone should remember the following points:

- We are all in the process of learning about our world, including about others and their experiences. Please speak with me, anonymously if needed, if something has made you uncomfortable.
- Intention and impact are not always aligned, and we should respect the impact something may have on someone even if it was not the speaker's intention.
- We all come to the class with a variety of experiences and a range of expertise, we should respect these in others while critically examining them in ourselves.

COURSE EVALUATION
During the last two weeks of the course, you will be provided with an opportunity to evaluate this course and your instructor. Purdue uses an online course evaluation system. You will receive an official email from evaluation administrators with a link to the online evaluation site. You will have up to two weeks to complete this evaluation. Your participation is an integral part of this course, and your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.