

Principles of Physics IV

Introduction to Quantum Physics - PHYS 3301-001

Fall 2024

Course Section	PHYS 3301
Instructor	Dr. Sung-Won Lee
Class Time	TR 8:00 am - 9:20 am
Classroom	Science 112
Office	Science 101
Office Hours	TR 2:00 - 3:00 pm, or by appointment
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Course Web	http://www.phys.ttu.edu/~slee/3301/

Prerequisites

C or better in PHYS 1408 and MATH 2450. Corequisite PHYS 3201 or PHYS 3101. You must also be registered in either PHYS 3201 (for students entering Tech in 2017 or later), or PHYS 3101 (for students who entered Tech before 2017).

Textbook

Modern Physics, 2nd edition, by Randy Harris

(ISBN-10: 0805303081 or ISBN-13: 9780805303087).

We will use this book as our main text. I will assign reading & homework assignments from this book.

Supplementary Reference Texts:

There are several good introductory textbooks in modern physics. I list some of my personal preferences and I encourage you to study from any textbook that you feel is helpful.

1. Modern Physics for Scientists and Engineers, 4th edition, by Thornton & Rex
2. Paul A. Tipler and Ralph A. Llewellyn, Modern Physics, W.H. Freeman, 2000
3. John Taylor and Chris Zafaritos, Modern Physics for Scientists and Engineers
4. E. Taylor and J. Wheeler, Spacetime Physics, 2nd Ed., W.H. Freeman, 1992
5. J. Bernstein, P. M. Fishbane, and S. G. Gasiorowicz, Modern Physics
6. M.L. Boas, Mathematical Methods in the Physical Sciences, John Wiley and Sons, 3rd Ed., 2006
7. A. C. Melissions and J. Napolitano, Experiments in Modern Physics, Academic Press, 2003

Course Objective

The objective of this course is to develop a solid understanding of simple quantum mechanical systems, hydrogen atom, spin, atomic physics, and some selected topics in solid state physics, nuclear physics, and fundamental particle interactions.

Course Content

We will start with a discussion of simple quantum mechanical systems and explore the Schrodinger equation. We will later concentrate on the hydrogen atom, spectroscopy, and advanced topics in the text.

Class Time

You are expected to read the chapters for upcoming material before coming to class. I will assume that you have read the material and discuss the concepts in class. I expect all will attend class and participate in discussion. If you have an excuse for not coming to class, you can call or email me.

Homework

Homework sets will be assigned regularly and will be based on the material presented in class. Homework assignments will be collected in the classroom. Doing well on the homework is crucial to your success in the course. Working on the homework problems by yourself is a good idea. You will know if you understand the topic or not. Of course, you are welcome to discuss the questions with me.

Term Paper and oral presentation

A term paper will be written (5-10 pages) and orally presented (**15 minutes: TBD**). Topic for the term paper will be decided in consultation with the instructor based on the topics covered in the course. Term paper and oral presentation grade is 10% of your total grade. I also give you the Physics Colloquium schedule and encourage you to attend these high-profile talks. You might find a topic interesting and decide to write your term paper on that.

Exams

- There will be two midterm exams and a final exam (see Class Schedule for dates).
- The exams are closed book. Note cards, smart phones, iPad and other gizmos are not allowed. Calculators are allowed.
- The final exam is comprehensive (covering all chapters)
- **No make-up exams will be given.**

Grading Policy

The course grade will be based on two midterm exams, the comprehensive final exam, homework, and term paper. **NO MAKEUP EXAMS WILL BE GIVEN.** Your letter grade will, tentatively, be determined according to the following scale: A (90-100), B (80-89), C (70-79), D (60-69) and F (0-59).

Homework	15%
Term Paper & Presentation	10%
Mid-Term Exams	40%
Final Exam	35%
Total	100%

Course Goals

This course is intended to acquaint students with the basic laws of physics, to develop a better understanding of physical science in general and help prepare you for other upper division science classes. To this end, the course will emphasize a mix of conceptual understanding and standard "end-of-chapter" problem solving skills.

Expected Learning Outcomes:

Upon successful completion of this course, students will be able to:

Describe the basis of the scientific method.

Distinguish between a scientific theory and speculation.

Explain at a quantitative level the fundamental elements of energy and motion.

Methods for Assessing the Expected Learning Outcomes:

The expected learning outcomes for the course will be assessed through: Guided Classroom discussion, homework, two mid-term exams, and the final exam.

Important Notes:

- **ADA:** Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note: instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, please contact Student Disability Services in Weeks Hall or call 806-742-2405.
- **Academic Integrity:** Academic integrity is taking responsibility for one's own class and/or course work, being individually accountable, and demonstrating intellectual honesty and ethical behavior. Academic integrity is a personal choice to abide by the standards of intellectual honesty and responsibility. Because education is a shared effort to achieve learning through the exchange of ideas, students, faculty, and staff have the collective responsibility to build mutual trust and respect. Ethical behavior and independent thought are essential for the highest level of academic achievement, which then must be measured. Academic achievement includes scholarship, teaching, and learning, all of which are shared endeavors. Grades are a device used to quantify the successful accumulation of knowledge through learning. Adhering to the standards of academic integrity ensures grades are earned honestly. Academic integrity is the foundation upon which students, faculty, and staff build their educational and professional careers. [Texas Tech University ("University") Quality Enhancement Plan, Academic Integrity Task Force, 2010].
- **Religious Holy Day:** "Religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Texas Tax Code §11.20. A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. A student who is excused under section 2 may not be penalized for the absence; however, the instructor may respond appropriately if the student fails to complete the assignment satisfactorily.

- **Accommodation for Pregnant Students:** To support the academic success of pregnant and parenting students and students with pregnancy related conditions, the University offers reasonable modifications based on the student's particular needs. Any student who is pregnant or parenting a child up to age 18 or has conditions related to pregnancy may contact Alex Faris, the Texas Tech University designated Pregnancy and Parenting Liaison, to discuss support available through the University. The Liaison can be reached by emailing alfaris@ttu.edu. Should a student communicate with the instructor that they are pregnant or have a pregnancy related condition or may need additional resources related to pregnancy or parenting, the instructor will communicate that student's information to the Title IX Coordinator, who will work with the student and others, as needed, to ensure equal access to the University's education program or activity.

For more information regarding supportive measures, please contact pregnancy & parenting liaison Alex Faris (alfaris@ttu.edu | 806.834.3420) or visit <https://www.depts.ttu.edu/titleix/PregnancyandParenting/>. You can also visit <https://www.depts.ttu.edu/titleix/PregnancyandParenting/> to submit a request to Alex Faris for assistance.

PHYS 3301-001 Tentative Schedule Fall 2024

Week	Topic	Chapter	Tuesday	Thursday
1	Introduction Wave & Particle I	1 3		8/22
2	Wave & Particle I Waves & Particles II	3	8/27	8/29
3	Waves & Particles II	3 4	9/3	9/5
4	Bound States	4	9/10	9/12
5	Bound States Unbound States	5	9/17	9/19
6	Unbound States	5	9/24 (Exam 1)	9/26
7	Hydrogen Atom	5 6	10/1	10/3
8	Hydrogen Atom	6	10/8	10/10
9	Spin & Atomic Physics	7	10/15	10/17
10	Statistical Mechanics	7	10/22	10/24
11	Statistical Mechanics	8	10/29 (Exam 2)	11/31
12	Selected Topics (Solid State, Nuclear, Particle)	8	11/5	11/7
13	Selected Topics (Solid State, Nuclear, Particle)	10~12	11/12	11/14
14	Presentation 1		11/19	11/21 (No Class)
15	Presentation 2		11/26	Thanksgiving
16	Summary		12/3	
			Final Exam (12/5; Thu)	

Important Dates

8/22 First class
 11/27–11/29 Thanksgiving Holidays
 12/3 Last class
 12/5 Final Exam (7:30 a.m. to 10:00 a.m.)