

SYLLABUS

Quantum Mechanics II

Phys 4710

Spring 2021

Instructor: Eric Held

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Office Hours via Zoom: to be determined

Prerequisites: PHYS 4700

Text: Introduction to Quantum Mechanics, 3rd ed, David Griffiths, Darrell Schroeter

Credits: 3 semester credit hours.

Lecture: 12:00 – 1:15 am, TR Science Engineering Research 244 with Dr. Held

Recitation: time tbd, W, Science Engineering Research 244 with Trevor Taylor

Course Web Site: canvas

Goals of the Course

- 1. Develop the technical skills and intuition needed to address more advanced topics in QM like rudimentary models for solids and ideal gases, time-independent perturbation theory and the fine structure of hydrogen, the variational principle, quantum tunneling and scattering, and quantum dynamics.*
 - 2. Practice with Computer Math Packages*
For some of the homework problems, you will be required to use a computer math package, such as Mathcad, Maple, or Mathematica, in order to help solve the problem or plot a solution.
 - 3. Improve Reading, Speaking and Writing Skills*
The class will develop your reading skills through the reading assignments to be completed prior to lecture, speaking skills when giving a summary of the reading to the class and writing skills through the homework write-ups (see below for more detail).
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Class Activities: In order to do well in this course, you must engage meaningfully in the following activities.

1. *Reading and Speaking*

Required reading from the text is on the course schedule. Students will be chosen at random to give a brief summary of the required reading before lecture starts for one extra credit point.

2. *Lecture (12 – 1:15 pm TR with Dr. Held)*

Most class periods I will lecture on material that is contained in the text but with my own spin and additional examples. **You will get much more out of the lecture if you have read the associated material ahead of time.**

3. *Recitation*

Recitation will be used for help with homework problems and additional presentation and/or discussion of the lecture material with additional examples.

4. *Exams*

There will be three midterms and a final comprehensive exam.

Learning Assessment: The assessment of your learning will be done through the homework assignments, the midterm exams, and the final exam.

1. *Homework (45%)*

The **8** homework assignments and their due dates are indicated in the schedule below. **They will be turned in in class on the day they are due.**

I WILL NOT ACCEPT LATE HOMEWORK.

That is, you will receive zero credit for an assignment that is not turned in on time.

Probably the most important thing that you can do to succeed in the course is to carefully do the homework assignments and understand the concepts and mathematics related to the homework questions and problems.

2. *Midterm and Final Exams (55 %, all weighted equally)*

The exams will test on material in the lectures, reading assignments, and homework assignments. There will be **three** 75-minute midterm exams.

THE MIDTERM EXAMS WILL BE INDIVIDUALLY RESCHEDULED ONLY AT THE DISCRETION OF THE INSTRUCTOR. If you know that you will be unable to attend the scheduled time, then you must have an *exceptionally good reason* and *make previous arrangements with the instructor to take the exam at some other time.*

The final exam will be **comprehensive**.

THE FINAL EXAM MUST BE TAKEN DURING THE SCHEDULED TIME.
The final exam is scheduled for Thursday, April 29, 2021, 12:00 – 1:50 p.m.

Homework Assignments Details

Format of the written part of the homework assignments: Ensure that your name, date, and the assignment number appear at the top of the first page. Staple all the sheets together with 1 staple in the upper left-hand corner.

Writing: While often overlooked, the need for clear writing by scientists is a daily necessity. E.g., in the real world the scientist is continually faced with the task of communicating to his or her colleagues the results of scientific investigations or the reasons that future scientific endeavors should be carried out. Therefore, I strongly believe that one of the main goals of the university is the encouragement of clear writing in all assignments. **To this end, I require that all homework assignments for this class be written using clear English sentences, including cases where mathematical equations are involved in the answer.**

N.B.: Your homework solutions should be clear and to the point, without all of the chicken-scratch-like attempts at deriving the solution that take place during the time that you are working on the problem. Use scratch paper first and then construct your solution.

Examples of Acceptable and Unacceptable Homework Solutions (Partial solution to problem 2.3 from Marion and Thornton, an undergraduate Classical Mechanics text.):

Acceptable (Notice the complete sentences!):

The equation of motion is $F=ma$.

The gravitational force is the only applied force; therefore

$$F_x = m \ddot{a} = 0 \text{ and } F_y = m \ddot{a} = -mg.$$

Integrating these equations and using the initial conditions,

$$x(t=0)=0, y(t=0)=0, dx/dt(t=0) = v_0 \cos(\alpha) \text{ and } dy/dt(t=0) = v_0 \sin(\alpha),$$

$$\text{yields } x(t) = v_0 \cos(\alpha) t \text{ and } y(t) = v_0 \sin(\alpha) t.$$

Unacceptable (just a bunch of equations!)

$$F=ma. F_x = m \ddot{a} = 0 \quad F_y = m \ddot{a} = -mg \quad x\dot{d}ot(t=0) = v_0 \cos(\alpha) \quad y\dot{d}ot(t=0) = v_0 \sin(\alpha) \quad x(t) = v_0 \cos(\alpha)$$

$$y(t) = v_0 \sin(\alpha)$$

Grading Scale

Homework 45%
Exams (all four weighted equally) 55%

Disability Resource Center

Students with ADA-Documented physical, sensory, emotional or medical impairments may be eligible for reasonable accommodations. Veterans may also be eligible for services. All accommodations are coordinated through the Disability Resource Center (DRC) in Room 101 of the University Inn. (435)797-2444 voice, (435)797-0740 TTY, (435)797-2444 VP, or toll free at 1-800-259-2966. Please contact the DRC as early in the semester as possible. Alternate format materials (Braille, large print or digital) are available with advance notice.

Honor Code

The honor code will be strictly enforced in this course. Any suspected violations of the honor code will be promptly reported to the honor system. For more information please visit:
<http://www.usu.edu/policies/PDF/Acad-Integrity.pdf>
