Course Policy

Introduction to Quantum I, Spring 2018 (PHYS 4350 / 5350)

Instructor: Jos W.Zwanikken (Olney 136b)
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Course book

"Introduction to Quantum Mechanics" by D. J. Griffiths, 2nd edition, Cambridge University Press. Other editions might work as well, but the numbers of the problems may be different.

Classes

Tuesday and Thursday, 8:00 – 9:15h
See schedule

Points

Attendance	50
Homework	100
Exam 1	100
Exam 2	100
Final Exam	200
Total	550

Course Policy

Attendance
There will be informal quizzes and discussions, and complementary information that is omitted by the book. Important homework problems will be discussed. Questions during class are most welcome.

Homework
Mastering these topics requires practice. Relatively simple exercises are selected to develop the necessary skills, and to internalize the knowledge. Some challenging problems are also selected. Solutions to the problems can be found online (there are several websites), and can be used freely as long as it stimulates the learning process. Frequent repetition, under relaxed circumstances, is strongly encouraged (as if one were studying a musical instrument) and good exercise will lead to gradual improvement. Many of the mathematical techniques are very fundamental and equally useful for other advanced courses.

Reading
The schedule suggests chapters from Griffith's book. It may be difficult to understand every detail during a first reading, but that may improve after some exercise and a second reading. It is helpful to make a summary of each section in the form of a short paragraph, and perhaps the one or two most important equations.
Some books, although beautifully composed, become readable after many years of practice. Griffith's book, however, is written in a casual, almost careless style, and is remarkably transparent and easy to read (in comparison to many other books).

Content
The course will start with a discussion of the principles of quantum mechanics. Subsequently, we will introduce a few fundamental quantum systems, learn how to solve the Schrödinger equation for these systems, and interpret the meaning.
In the second part of the course we will rephrase the principles of quantum mechanics in a clean, consistent formalism.
We will then use the principles of quantum mechanics to:

- predict the emission spectrum of hydrogen
- calculate electron orbitals
- understand the internal structure of atoms
- understand the properties of metals, insulators and semi-conductors

The mathematical framework of quantum mechanics relies heavily on concepts in linear algebra, so there will be exercises to improve proficiency in linear algebra. Differential calculus will also be used.

Course Policy

Schedule

	TUESDAY	THURSDAY
JAN	23 A Really Short Introduction to Quantum Mechanics Quanta, uncertainty, particle waves Reading: Sections 1.1 and 1.2 Summarize sections 1.1 and 1.2	25 Evolution of probability: The Schrödinger equation Reading: Sections 1.1 - 1.4 Problems: 1.1 1.3 1.4 1.5
JAN/ FEB	30 Momentum and position: Heisenberg's uncertainty principle Reading: Sections 1.5 and 1.6 Summarize sections 1.5 and 1.6	01 Separation of variables: The time-independent Schrödinger equation Reading: Section 2.1 Problems: 1.7 1.9 1.17 1.18 2.1 2.2
FEB	06 The infinite square well I Reading: Section 2.2 Summarize Section 2.1	08 The infinite square well II Reading: Section 2.2 Problems: 2.4 2.6 2.7 2.8
FEB	13 The harmonic oscillator I Reading: Section 2.3.1 Summarize section 2.3.1	15 The harmonic oscillator II Reading: Section 2.3 Problems: 2.11 2.12 2.17
FEB	20 Monday schedule	22 Free particles, barriers, and tunneling I Reading: Section 2.4 and 2.5 Summarize sections 2.4 and 2.5
FEB/ MAR	27 Free particles, barriers, and tunneling II Reading: Sections 2.4 – 2.6 Problems: 2.21 2.22 2.23 2.27 + understand what figure 2.19 means	01 Exam I

MAR	06 The formalism: Linear algebra, Hilbert Space Reading: Section 3.1 Summarize section 3.1	08 *mid semester* Observables Reading: Sections 3.1 and 3.2 Problems: 3.1 3.3 3.5 3.6
MAR	13 Spring break	15 Spring break
MAR	20 Eigenvalues and eigenfunctions Reading: Section 3.3 Summarize section 3.3	22 Statistical interpretation, the uncertainty principle Reading: Sections 3.3 - 3.5 Problems: 3.7 3.8 3.9 3.13 3.17
MAR	27 Dirac notation Reading: Section 3.6 Summarize section 3.6	29 Quantum mechanics in 3 dimensions Reading: Section 4.1 (do not become confused by all the functions) Problems: 4.1 4.2 4.8
APR	03 The hydrogen atom I Reading: Section 4.2.1 Summarize section 4.2.1 (in words) plus equations 4.70 and 4.72	05 The hydrogen atom II Reading: Section 4.2 Problems: 4.10 4.13 4.16
APR	10 Exam II	12 Angular momentum Reading: Section 4.3 Problems: 4.18 4.19 4.24
APR	17 Spin Reading: Section 4.4 Summarize section 4.4.1	19 Stern-Gerlach Reading: Section 4.4 Problems: 4.26 4.28 4.32 4.34 4.35
APR	24 Many-particle systems: Bosons and fermions Reading: Section 5.1 Summarize section 5.1	26 Atoms Reading: Sections 5.1 and 5.2 Problems: 5.9 5.12 5.14

MAY	01 Solids Reading: Section 5.3 Summarize section 5.3	03
MAY	08 Final exam week	10 Final exam week

Part I	Introduction: The Schrödinger equation and fundamental quantum systems
Part II	The formalism
Part III	Quantum mechanics of atoms and solids
Exam I	Part I
Exam II	Part II + the hydrogen atom
Final exam	All material covered in the course

Exams

There will be two exams during the class hours:

Exam 1:	The Schrödinger equation and fundamental quantum systems	Thu Mar 1st
Exam 2:	The formalism	Tue Apr 10th

Each of these exams will count for 100 points.

The final exam will be about everything discussed during the semester, and will count for 200 points.

Questions

Questions are always welcome at Olney 136b, and all questions are equally welcome. The office hours are shown on the web. Working together, if desired, is encouraged.

Course Policy

If too obvious, the following can be skipped:

Academic Integrity

You are responsible for proper academic conduct. The basic rule-of-thumb is simple: you should not try to receive credit for work you have not performed.

Please refer to the university's academic integrity policy at the following URL:

http://www.uml.edu/Catalog/Undergraduate/Policies/Academic-Integrity.aspx

The introduction to the academic integrity policy is reproduced below:

"The university has a responsibility to promote academic honesty and integrity and to develop procedures to deal effectively with instances of academic dishonesty. Students are responsible for the honest completion and representation of their work, for the appropriate citation of sources, and for respect of others' academic endeavors. Academic dishonesty is prohibited in all programs of the university."

Academic Misconduct Subject to Disciplinary Action

(1) Academic misconduct is an act in which a student:

(a) Seeks to claim credit for the work or efforts of another without authorization or citation;

(b) Uses unauthorized materials or fabricated data in any academic exercise;

(c) Forges or falsifies academic documents or records;

(d) Intentionally impedes or damages the academic work of others;

(e) Engages in conduct aimed at making false representation of a student's academic performance; or

(f) Assists other students in any of these acts.

(2) Examples of academic misconduct include, but are not limited to: cheating on an examination; collaborating with others in work to be presented, contrary to the stated rules of the course; submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another; submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas; getting unauthorized access to examinations or course materials; submitting, without the permission of the current instructor, work previously presented in another course; tampering with the laboratory experiment or computer program of another student; knowingly and intentionally assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed."

Course Policy

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