Course Information

Course: Quantum Mechanics II (Physics 917)

Spring 2008, MWF, 9:30 - 10:20, 118 Brace

Instructor: Prof. Ilya I. Fabrikant, 303 Ferguson, tel. 472-2774
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Office Hours: MWF 10:30 - 11:30

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Text: R. Shankar, Principles of Quantum Mechanics (Plenum Press, 1994, or a later print).
Some supplementary material (lecture notes) will be posted on the blackboard

Recommended supplementary books:

B. H. Bransden and C. J. Joachain, Introduction to Quantum Mechanics. (I used this book before to teach QM II. More or less parallel to Shankar, but a less formal approach with more physics applications).

L. D. Landau and E. M. Lifshitz, Quantum Mechanics (More advanced topics).

C. Cohen-Tannoudji, B. Diu, and F. Laloe, Quantum Mechanics, vol. 2 (This book was used before as the textbook for this course. Contains more formalism).

A. B. Migdal, Qualitative Methods in Quantum Theory. (A very physical approach, based on estimates, to topics in collision theory and interaction of quantum systems with radiation).

Outline: (1) Nonrelativistic theory of the hydrogen atom
(2) Spin
(3) WKB Approximation
(4) Perturbation Theory
(5) Interaction of Quantum Systems with External Fields
(6) Quantum Collision Theory

Homework: specific assignments and due dates will be posted on the blackboard. The homework should be turned in in the PAPER form on the due date IN THE CLASSROOM.
Homework turned in after then loses two points per day.
No homework is accepted 5 days after the due day.
In case of illness, a conference trip, or a personal emergency the new terms should be negotiated with the instructor.
In doing homework you are allowed to discuss problems with each other, but you are NOT allowed to cooperate on writing down the solutions on the paper.

Exams: four quizzes, one Midterm Exam and the Final Exam. All quizzes are closed-book. At the exams are open-book, but closed-notes.

QUIZZES (in-class): 1/30, 2/18, 3/31, 4/16

MIDTERM EXAM: Thursday, 3/6, 17:30-19:30 (tentative)

FINAL EXAM: Wednesday, 5/7, 10:00-12:00

Grades: midterm exam - 30%; final exam - 30%; quizzes - 20%; homework - 20%

Tentative grade scale

>96%	A+
90-96%	A
85-90	A-
80-85	B+
75-80	B
70-75	B-
65-70	C+
60-65	C
55-60	C-

Tentative schedule

1/14-1/18 Quantum theory of the hydrogen atom.
Chapter 13.

1/21	MARTIN LUTHER KING DAY
1/23-1/25	Spin. 14.1-14.3
1/28-2/1	A free particle in a magnetic field. The Landau states. Paramagnetic resonance. Stern Gerlach experiment. 14.4-14.5, pp. 587-589
2/4 -2/8	Addition of angular momenta. Clebsch-Gordan coefficients. 15.1-15.2
2/11-2/15	The variational method. Classical action, Hamilton-Jacobi equation and WKB approximation. 16.1-16.2, pp. 104-106.
2/18-2/22	WKB approximation, Bohr-Sommerfeld quantization rules and Heisenberg correspondence principle. Potential barrier, applications to the cold emission, alpha-decay and ammonia inversion. 16.2 and lecture notes (skip "Connection with path integral formalism").
2/25-2/29	Time-independent perturbation theory. Atoms other than hydrogen and polar molecules in a static electric field. 17.1-17.2
3/3 -3/7	Degenerate perturbation theory. Application to Stark effect in hydrogen, Zeeman effect, fine structure and avoided crossing. 17.3 and lecture notes
3/10-3/14	Time-dependent perturbation theory. The sudden approximation and beta-decay. Periodic perturbation and Fermi Golden Rule. 18.1-18.3
3/16-3/22	SPRING BREAK
3/24-3/28	Interaction of a quantum system with electromagnetic radiation. Absorption and stimulated emission. Spontaneous emission. Velocity and acceleration forms for the dipole matrix elements. Selection rules. Line intensities, widths and shapes. 18.4 and lecture notes
3/31-4/4	Photoionization. Two-level system in the presence of a periodic perturbation. The Rabi frequency. 18.5 and lecture notes (Skip "Field Quantization")

4/7 -4/11 Scattering experiment. The scattering amplitude and the cross section.
19.1-19.2

4/14-4/18 Partial-wave analysis. Simple examples of potential scattering. Resonances, bound and virtual states. Analytical
properties of the scattering amplitude.
19.5 and lecture notes.

4/21-4/25 Effective range theory. Applications of the Born and WKB approximations to potential scattering.
19.3-19.4 and lecture notes.

4/28-5/2 Review and discussion sessions