

Syllabus: Quantum Mechanics II (Phys 661)

Spring 2018

Monday and Wednesday 12:30-1:45 pm, FR 238

Instructor

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Office Hours: Monday and Wednesday, 10:00–11:30 am and 1:45–2:45 pm

Web Site

<http://webcourses.niu.edu> (Blackboard)

Course Description

Identical particles, exclusion principle and exchange effects; interaction of electromagnetic radiation with matter; introduction to scattering theory, partial wave analysis, and Born approximation; simple many-body theory in the Hartree-Fock framework. (*Graduate Catalog*)

Prerequisites

Phys 660 or Consent of Department

Credit Hours 3

Textbook

J. J. Sakurai and J. J. Napolitano, *Modern Quantum Mechanics* (2nd edition), Addison Wesley (2010)

Course Goals

Become familiar with

- approximation methods including nondegenerate and degenerate time-independent perturbation theory and time-dependent perturbation theory
- scattering theory including Born approximation and the method of partial waves
- symmetry in quantum mechanics including parity and time reversal symmetry
- manifestations of the indistinguishability of particles including the Pauli principle
- basic ideas of relativistic quantum mechanics

Student Learning Outcomes

Upon successful completion of the course, students will be able to

- develop approximate solutions to time-independent and time-dependent quantum-mechanical problems
- derive approximate solutions to scattering problems using the Born approximation and the method of partial waves
- use symmetry to characterize and classify solutions of the Schrödinger equation

- characterize the electronic structure of Helium atoms involving two identical electrons
- appreciate the basic effects of relativistic quantum mechanics including the concept of particles and antiparticles

Class Participation

Students are strongly encouraged to participate in class discussions and ask questions during class. Full attendance at all class meetings is expected. Tardiness or leaving early must be avoided in order for the class to be productive for all.

In-class use of electronic devices

I ask that you do not take phone calls, text, email, update your status, or tweet during lectures. Also, do not take pictures in the classroom.

Reading assignments

To familiarize yourself with the material covered in class, reading assignments are given for each class one week in advance.

Homework

We are best learning by doing! There will be weekly graded homework assignments. Written assignments must be handed in at the beginning of class on the due date. If for some reason you cannot attend class on the due date, you may put your paper into my mailbox in the Physics Office *before it is due*. To avoid misunderstandings, ask one of the staff members in the Physics Office to time-stamp your paper when you turn it in.

Students may discuss homework concepts with each other. However, each student must submit his or her own work, i.e., he or she must formulate the results using his or her own words. The same rule applies when a book or other sources are used as a “source of inspiration”. Do not turn in anything that you have copied, or anything that you do not truly understand. Note that in the exams you are on your own, and the homeworks should get you prepared for the exams.

Exams

Only material covered up to the exam date will be included. The final exam is comprehensive, but will be weighted towards the material covered during second half of the semester. Students may use in the exams one letter-size sheet of paper with notes in their own original handwriting. No photocopies, printed documents, or any other materials are allowed.

Grading

Homework assignments, midterm exam, and the final exam will each be given point values and the final course grade will be based on the total sum of points earned. The following table gives the weighting of points earned in homeworks and exams.

Homework:	40%	weekly
Midterm Exam:	25%	Wednesday, Mar 21, 12:30–1:45pm
Comprehensive Final Exam:	35%	Monday, May 7, noon–1:50pm

Final grades will be assigned as follows according to the total score as a percentage

A $\geq 86\%$	A- $\geq 80\%$	B+ $\geq 74\%$	B $\geq 68\%$	B- $\geq 62\%$
C+ $\geq 56\%$	C $\geq 50\%$	C- $\geq 45\%$	D $\geq 40\%$	F $< 40\%$

I may amend this grading scale to be more lenient, but it is guaranteed not to be made more strict.

To pass this course (grade C or above), you must also score at least 50% on the homework and at least 35% on the final exam.

Academic Integrity

Good academic work must be based on honesty. The attempt of any student to present as his or her own work that which he or she has not produced is regarded by the faculty and administration as a serious offense. Students are considered to have cheated, for example, if they copy the work of another or use unauthorized notes or other aids during an examination or turn in as their own a paper or an assignment written, in whole or in part, by someone else. Students are guilty of plagiarism, intentional or not, if they copy material from books, magazines, or other sources without identifying and acknowledging those sources or if they paraphrase ideas from such sources without acknowledging them. Students guilty of, or assisting others in, either cheating or plagiarism on an assignment, quiz, or examination may receive a grade of F for the course involved and may be suspended or dismissed from the university. (*Northern Illinois University Graduate Catalog*)

Incomplete grades

Incompletes will only be given under extraordinary circumstances such as extended illness or call-up to active military duty.

Receiving assistance

If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or drc@niu.edu. See also <http://niu.edu/disability>.

Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let us know your needs, the sooner we can assist you in achieving your learning goals in this course.

Syllabus Clause and Contract

This syllabus may be revised and adapted throughout the semester to better serve the needs of the class. The decision to remain in this class upon receipt of the syllabus serves as students' acceptance of the syllabus as a binding contract, meaning they agree with the terms set forth and the expectations of them as members of the class.

Religious Observances

Northern Illinois University, as a public institution of higher education in the State of Illinois, does not observe religious holidays. It is the university's policy, however, to reasonably accommodate the religious observances of individual students in regards to class attendance, scheduling examinations, and work requirements. Such policies shall be made known to faculty and students. Religious observance includes all aspects of religious observance and practice as well as belief. Absence from classes or examinations for religious observance does not relieve students from responsibility for any part of the course work required during the period of absence. To request accommodation, students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall provide educators with reasonable notice of the date or dates they will be absent.

Tentative Course Calendar (exam dates are fixed)

Dates	Chapter
Jan 17 – Feb 12	Approximation Methods (Ch. 5)
Feb 14 – Feb 28	Scattering Theory (Ch. 6)
Mar 5 – Mar 9	Canceled
Mar 12 – 14	Spring Break
Mar 21	Midterm Exam
Mar 19 – Apr 4	Symmetry in Quantum Mechanics (Ch. 4)
Apr 9 – Apr 23	Identical Particles (Ch. 7)
Apr 25 – May 2	Relativistic Quantum Mechanics (Ch. 8)
May 7 (noon–1:50pm)	Final Exam