Department of Physics, Nazarbayev University
Course Syllabus
PHYS 452 Quantum Mechanics II (Fall 2019)

Location & Contact Info
Instructor: Sergiy Bubin
Lecture Hours: Tue, Thu 10:30 AM - 11:45 AM in room 7.427
Recitations: Tue 12:00 PM - 1:15 PM in room 7.427
Office Hours: Tue, Thu 1:30 PM - 2:30 PM in room 7E.333, or by appointment
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Course Website: http://sergiybubin.org/teaching.html

Course Description This course covers several widely used approximate methods of quantum mechanics: the variational method (including the Hartree-Fock approach), stationary and time-dependent perturbation theory, semiclassical approximation, and adiabatic approximation. In the framework of these methods some important applications will be considered, such as the fine structure of atomic energy levels, chemical bonding, theory of alpha-decay, selection rules for dipole transitions, Rabi oscillations, etc. Students will also learn the basics of quantum scattering theory. If time permits, some elements of relativistic quantum mechanics and/or the formalism of second quantization may be considered. The course will include two lectures per week accompanied by a recitation.

Prerequisites PHYS 451 Quantum Mechanics I (or an equivalent independent study course) is absolutely required.

Required Textbook
David J. Griffiths, *Introduction to Quantum Mechanics* (2nd Edition)

Other Useful References Many other texts exist on quantum mechanics at the introductory level, some can be found in the library, and can also be very useful in this course. Students are encouraged to explore those. Examples are:

- Richard Liboff, *Introductory Quantum Mechanics* (4th Edition)
- Robert Scherrer, *Quantum Mechanics: An Accessible Introduction*
- Robert Eisberg, David O. Caldwell, and Richard J. Christman, *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*
- Ira N. Levine, *Quantum Chemistry* (6th Edition)

Grading Policy The letter grades for the course will be based on on the cumulative score (subject to curving if class performance is substantially below expected). The minimum cumulative percentages necessary for obtaining the following letter grades are:

Letter grade	A	A−	B+	B	B−	C+	C	C−	D+	D	F
Min. %	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0	<50.0

There will be two midterm and one final exam. Homework will be assigned every two weeks or so. In addition, several short quizzes will be given on random dates without prior announcements. The problems in quizzes may be related to the material covered in recent lectures or

resemble problems assigned in recent homeworks. The total comulative score for the course will be computed based on the following contributions:

Homework	10%
Quizzes	10%
Midterm 1	20%
Midterm 2	20%
Final Exam	40%

An extra credit (up to 2%) may be earned through active participation in recitations and lectures. Any homework/quiz/exam requested to be regraded must be brought no later than one week after it was given back to the students. Also, this instructor reserves the right to regrade the entire homework/quiz/exam as grading mistakes happen in both directions. Hence, there is a theoretical possibility that a student may get a lower total score after his/her work is regraded.

Some partial credit will be given for those homework/quiz/exam problems where a student demonstrates relevant knowledge of physical concepts and makes mistakes in algebraic manipulations. However, student should not expect that they will automatically get some partial credit for "effort" by simply writing a bunch of irrelevant expressions or copying standard equations out of a textbook or formula sheet.

It is the policy in this class that no late howework assignments will be accepted, not even for partial credit. There will be no make-up for any of the exams, unless there is a serious and well documented reason for missing them. Failure to attend the final exam without a well documented excuse will automatically result in course failure, regardless of the performance demonstrated in midterms and homeworks.

Homework/Exam Submission Guidelines In order to ensure unbiased evaluation of students' performance all homeworks, quizzes, and exams should be submitted in the following format:

- Solutions are written on standard white paper of size A4 (blank white paper will be provided for exams and quizzes)
- Do not write your name on the front page! Use your Student ID # instead.

Homeworks and exams must show suffcient proof that a derivation of the solution was carried out and the answers are not just copied from somewhere or guessed. Solutions or answers turned in without explanation will receive no credit. Any student wishing to have the best possible grades on homework returned must:

- Staple pages together and clearly indicate problem numbers
- Turn in neat and readable work as points may be deducted otherwise

Homeworks are normally expected to be submitted in the paper form. However, electronic submissions via email (e.g. a pdf file of scanned pages) are acceptable for those students who are away or must miss a class when the homework is due.

Academic Integrity Students are expected to follow Nazarbayev University student code of conduct, which can be found at http://registrar.nu.edu.kz/policies-and-procedures, and adhere to the principles of truth and academic honesty. Students who infringe upon the code of conduct will be subject to sanction. While students are strongly encouraged to discuss the conceptual points of the homework problems among themselves, plagiarism is strictly prohibited. No collaboration, notes, books, calculators, or use of mobile phones will be allowed during the exams.

Communication Email communication with students is important for this course. Students are encouraged to use email for quick correspondence regarding lecture material, homework problems, and anything else that does not require long explanations (for which lectures and office hours exist). It is students' responsibility to check their NU email regularly as important announcements, homeworks corrections, *etc.* may be sent.

Homework assignments, solutions to homework assignments, exam solutions, and other relevant materials (including this syllabus) will be made available in electronic form on the course website. Neither homework assignments nor solutions will be handed out to students in paper form.