Physics 425/625 Syllabus: Quantum Theory, Spring 2016

Location and lecture times: Room 1311 HN, T and F, 2:10 – 3:25 PM

Instructor: Prof. János Bergou

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Note: email is the best way to reach me

Office hours: Tuesday and Friday, 1 – 2 PM, or by appointment.

Textbook: *Introduction to Quantum Mechanics* (2nd Ed.), by D. J. Griffiths (Prentice-Hall Pearson, 2004). Supplementary reading will be suggested occasionally.

Course description: The course will cover chapters 1-6 in full and selected material from chapters 7 – 12.

Grading:

Homework	20%
Midterm Exams	40%
Final Exam	40%

Homework: Will be assigned about every two weeks, and due a week after it was assigned. Collaboration with your peers is encouraged, but independent solutions must be handed in for credit.

Midterms: Two in-class exams: on or around Friday, March 4 (Chs. 1-3) and Friday, April 15 (Chs. 4-6).

Last class: Tuesday, May 17.

Final Exam: Tuesday, May 24, 11:30 – 1:30.

Educational parity: In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical and/ or Learning) consult the Office of AccessABILITY located in Room E1124 to secure necessary academic accommodations. For further information and assistance please call (212-772-4857)/TTY (212-650-3230).

Academic integrity: Hunter College regards acts of academic dishonesty (e.g.,

plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The college is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

Course content:

1. The wave function: The Schrödinger equation, probabilities, statistical interpretation, expectation values, Heisenberg's uncertainty principle

2. Time-independent Schrödinger equation: Stationary states, square well potentials, the harmonic oscillator, free particle, the delta-function potential

3. Formalism and axioms of quantum mechanics: The Hilbert space, Dirac notation, observables as operators, eigenfunctions, commuting observables and compatibility, relation with uncertainty principle, unitary transformations, matrix representations, Schrödinger vs. Heisenberg pictures

4. Quantum mechanics in three-dimension: The 3D Schrödinger equation in Cartesian and spherical polar coordinates, the hydrogen atom, angular momentum and spin

5. Identical particles: Two-particle systems, Pauli exclusion principle, atoms, solids, quantum statistics

6. Time-independent perturbation theory: Non-degenerate and degenerate perturbation theory, atomic fine structure, Zeeman effect, hyperfine splitting

7. The variational method (Read only): Principles, ground state of He, the H_2^- ion

8. The WKB approximation (Selected sections): The classical region, tunneling, turning points and connection formulas

9. Time-dependent perturbation theory (Selected sections): Two-level systems, emission and absorption of radiation, spontaneous emission

10. The adiabatic approximation (Read only): Adiabatic theorem, Berry's phase

11. Scattering: Scattering cross section, partial waves, phase shifts, Born approximation

12. Paradoxes (Selected sections**)**: The EPR paradox and Bell's theorem, no-cloning, Schrödinger's cat, Zeno effect