PHY 7410 – Quantum Mechanics II – Syllabus

Semester: Winter 2017

Lecturer:

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Lecture Time/Room:

Lecture **Monday, Wednesday, Friday 12.30-1.20 pm**, 185 Physics Building

Suggested Texts:

S. Weinberg, Lectures on **Quantum Mechanics,** (Cambridge) **[main text]**;
J. J. Sakurai, **Modern Quantum Mechanics,** (Addison-Wesley Publ. Company);
L. Landau and E. Lifshits, **Quantum Mechanics**, (Butterworth-Heinemann Ltd).

Office Hours: by appointment.

Grading:

Your course grade will be determined by your performance in homework assignments, one Midterm Exam and a Final Exam on the basis of the following distribution:

Homework Projects (typically every 10 days)	30%
Midterm Exam	30%
Final Exam	40%

The completed homework assignments are due **in class** on the date specified; typically, ten days after the assignment is given. **Late submissions will not be accepted.**

Course description and objectives:

This course is a continuation of PHY 7400, an introduction to methods of quantum mechanics, including Schrödinger equation and its solutions as applied to simple physical problems, elementary approximate methods, and scattering theory.

Topics to be covered (approximate):

1. **Variational method and perturbation theory.** Non-degenerate and degenerate perturbation theory. Boundary conditions as perturbation. The WKB approximation. Variational methods. Time-dependent perturbation theory.
2. **Identical particles.** Exchange interaction.
3. **Scattering.** The cross-section. The Green's functions. Partial waves and phase shifts. S-matrix.
4. **Bound states.** Inelastic scattering. Lippmann-Schwinger equation. Shallow bound states. Deuteron.
5. **Quantum dynamics.** Time development operator. Path integrals in quantum mechanics. Perturbation theory and diagram techniques.
6. **Relativistic quantum mechanics.** Introduction to Klein-Gordon and Dirac equations.
7. **Additional topics.**

Learning outcomes. After taking this class you will:

1. Learn about advanced phenomena of the quantum world: tunneling, entanglement, bounds states, etc.
2. Become familiar with the basic and advanced methods of quantum mechanics in the situations where finding exact solutions are not practical.
3. Recognize when and how to make useful approximations, i.e., which terms in a series expansion are important in a specific physical limit.
4. Be able to translate the physical description of a problem into equations that can be used to answer relevant questions.
5. Build skill in the mathematical methods needed for these problems.
6. Recognize when symmetries are useful.

Grading:

The overall course grade will be determined on the basis of the following grading curve:

Grade	Cumulated Score	Grade	Cumulated Score
A	90-100	C+	65-69
A-	85-89	C	60-64
B+	80-84	C-	55-59
B	75-79	D+	50-54
B-	70-74	D	40-49

Any score below 40 is considered as F.

Website: http://www.physics.wayne.edu/~apetrov/PHY7410/