Universidad de Puerto Rico, Recinto de Rio Piedras
Facultad de Ciencias Naturales, Departamento de Física

Título:	**INTRODUCTION TO QUANTUM MECHANICS**
Código:	PHYS 4046
Créditos:	3
Profesor:	Luis F Fonseca Office: Facundo Bueso 127 Email: luis.fonseca@upr.edu
Hours:	Tuesday, Thursday 10:00-11:20; C-312
Prerequisites:	PHYS 3016, PHYS 4031, PHYS 4051, PHYS 4068

Academic Period: First Semester 2018-2019. Office hours Friday 10-11:30am

Course Description: The objective of this course is to give an introduction of the basic concepts in quantum mechanics. During the semester it is expected that the student:

- Will understand the necessity of a new approach (different than classical mechanics) to describe microscopic systems
- Will learn about the statistical description of the microscopic systems and the new meaning of observations and measurements (as compared with deterministic classical mechanics).
- Will develop a comprehensive understanding of the basic techniques used in quantum mechanics.
- Will understand the key role of quantum mechanics in the areas of physics, chemistry, biology, materials science and electronics.
- Will develop the ability to solve the Schroedinger equation for simple systems and to apply the standard mathematical techniques used in quantum mechanics to describe microscopic systems.

Instructional Strategies. Lecture. Discussion with the students of typical problems. Description of actual applications of the results of the quantum mechanics problems. Homeworks.

Evaluation Strategies. The course will be evaluated with three partial exams with a weight of 20% of the evaluation and the homeworks with a weight of 40% of the evaluation.

Grading. Standard A to F system.

Bibliography

- Quantum Physics. Stephen Gasiorowicz. 2nd edition. John Wiley & Sons. (1996)
- The Structure of Matter. Stephen Gasiorowicz. Addison Wesley (1979)
- Introduction to Quantum Mechanics. David J. Griffiths. Prentice Hall (2005).

PROGRAM AND TIME TABLE.

WEEK	SUBJECTS
1	INTRODUCTION The quantization of electromagentic energy: black body radiation and photoelectric effect. The atomic spectra. The De Broglie theory.
2	WAVE PACKETS Mathematical description of a wave packet. The Schroedinger equation.
3	THE WAVE FUNCTION The wave function. The probabilistic interpretation. Probability current density.
4	OPERATORS. **Operators and expectation values.**
5	ONE DIMENSIONAL POTENTIALS Time independent Schroedinger equation. Boundary conditions. The quantum box. Eigenfunctions and eigenvalues.
6	The potential step. Transmitted and reflected fluxes. **FIRST EXAM**
7	The potential well. The potential barrier. Tunneling.
8	The expansion postulate. Degenerancy. Delta function potentials.
9	The harmonic oscillator.
10	MATHEMATICAL PROPERTIES OF WAVEFUNCTIONS AND OPERATORS The complete set and the expansion theorem. Analogy with vector space. Commutation relations. Dirac Notation. Hermitian operators. Uncertainty relations.
11	**EQUATION OF MOTION** Time dependence of the expectation values. The equation of motion and the classical limit. **SECOND EXAM**
12	THREE DIMENSIONAL POTENTIALS. The three-dimensional box. The Fermi level. The central potentials.
13	The angular equation. Angular momentum.
14	The radial equation. The Hydrogen atom. Orbitals.
15	SPIN The matrix representation. The spin operators and spinors.
16	N-PARTICLE SYSTEMS Identical particles. The Pauli principle. The Slater determinant. Fermions and bosons. **THIRD EXAM**