

## DIM-SAP-232 QUANTUM PHYSICS

- SEMESTER:** Spring  
**CREDITS:** 3 ECTS (4 hrs. per week, 2 months)  
**LANGUAGE:** English  
**DEGREES:** SAPIENS program

### Learning Objectives

This course is aimed to introduce basic concepts and ideas on Quantum Mechanics. The lectures will focus on essential physical principles supported by mathematical developments when required. Every idea will be also illustrated with some technological application. The students will participate actively in the discussions and the course its aimed to combine work outside the class (prelectures and homework) as well as active discussions and peer instruction during class time.

### Textbook

- “University Physics Volume 3 (Chs. 37-44)”, 13th edition, **Young and Freedman**.
- “Theoretical Concepts in Physics: An Alternative View of Theoretical Reasoning in Physics”, **Malcolm S. Longair**.

### Grading

The grade will be determined by prelectures (10%), one midterm (30%), homework (20%), and a final examination (40%). The exams are all closed notebook, closed textbook and no calculator. The course will not be graded on a curve, i.e., there is no bound on the numbers of A's, B's, C's etc.

## Syllabus

### 1. Photons:

Light waves behaving as particles.

Light Absorbed as Photons: The Photoelectric Effect

Light Emitted as Photons: X-Ray Production

Light Scattered as Photons: Compton Scattering and Pair Production

Wave–Particle Duality, Probability, and Uncertainty

### 2. Particles Behaving as Waves

Electron Waves

The Nuclear Atom and Atomic Spectra

Energy Levels and the Bohr Model of the Atom

The Laser

Continuous Spectra

The Uncertainty Principle Revisited

### 3. Quantum Mechanics.

Wave Functions and the One-Dimensional

Schrödinger Equation

Particle in a Box

Potential Wells

Potential Barriers and Tunneling

The Harmonic Oscillator

### 4. Atomic Structure

The Schrödinger Equation in three Dimensions

Particle in a Three-Dimensional Box

The Hydrogen Atom

Electron Spin

Many-Electron Atoms and the Exclusion Principle

### 5. A Brief Introduction to Molecules and Condensed Matter

Types of Molecular Bonds

Structure of Solids and Energy Bands

Semiconductors and Superconductivity