NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF SCIENCES

PHYSICS PROGRAM

CF381 – INTRODUCTION TO MODERN PHYSICS

I. GENERAL INFORMATION

CODE	: CF381 – Introduction to modern physics
SEMESTER	: 5
CREDITS	: 05
HOURS PER WEEK	: 07 (Theory – Laboratory)
PREREQUISITES	: CF222 Physics IV CF252 Mathematical Methods for Physicists I
CONDITION	: Mandatory

II. COURSE DESCRIPTION

The student will come to consistently understand experiments, pending explanation by Classical Physics, through the theoretical formulation initiated at the beginning of the 20th century and that gave rise to quantum mechanics. The student will understand an introduction to special relativity, quantum formulation of hydrogen atom, atomic and nuclear models, as well as elements of nuclear disintegration and an application (Mossbauer effect).

III. LEARNING UNITS

1. Theory of relativity

Galilean transformation and Classical Mechanics / Galilean transformation and electromagnetic theory / The Michelson and Morley experiment / Einstein postulates / Simultaneity / Kinematic effects of relativity / Lorentz. Transformation. Speed transformation / Relativistic Mechanics / Impulse and energy transformation / Experimental verification of theory.

2. Thermal Radiation and Origin of Quantum Mechanics

Introduction / Emission of electromagnetic radiation by accelerated charges / Emission and absorption of radiation by surfaces / Blackbody radiation / Wien's law / Rayleigh and Jeans theory / Boltzmann probability distribution / Comparison with the experiment / Planck's theory.

3. Electrons and Energy Quanta

Cathode Rays / e/m ratio for electrons / Electron charge and mass / Bucherer experiment / Photoelectric effect / Classical theory of the photoelectric effect / Quantum theory of the photoelectric effect / Compton effect / Dual nature of electromagnetic radiation.

4. Bohr Theory of the Atomic Structure

Atomic space / Bohr's postulates. The single-electron atom Bohr theory / Finite nuclear mass correction / States of atomic energy / Franck and Hertz experiment.

5. Particles and Waves

De Broglie's postulate / Some properties of wave associated with particles / Experimental confirmation of the De Broglie postulate / Interpretation of the Bohr quantization rule / Uncertainty principle / Some consequences of the uncertainty principle.

6. Schrödinger's theory of Quantum Mechanics

Introduction / Schrödinger equation / Interpretation of the wave function / Time-independent Schrödinger equation. / Quantization of energy in the Schrödinger theory / Mathematical properties of the wave functions and of the eigenfunctions / Classical theory of the transverse waves in a string / Expected values and differential operators / Classical limit of Quantum Mechanics.

7. Solutions of the Schrödinger equation

Free particle / Step potential / Potential barriers / Potential wells: infinite depth and finite depth.

8. Qualitative Description of the Electrical Behavior of Metals, Semiconductors and Thermistors

IV. BIBLIOGRAPHY

- Robert M. Eisberg, Fundamentos de Física Moderna, Ed. Limusa-Wiley, 1973.
- Robert Eisberg – Robert Resnick, Física Cuántica, Ed. Limusa, 1991.
- Arthur Beiser, Conceptos de Física Moderna, Ed. McGraw-Hill, 1965.
- Robert L. Sproull, Modern Physics, Ed. Wiley International, 1964

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