

INTRODUCTION TO MODERN PHYSICS - QUANTUM STRUCTURE OF MATTER

COURSE OUTLINE

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Mechanical Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0813.4.006.0	SEMESTER	2nd
COURSE TITLE	Introduction to Modern Physics - Quantum Structure of Matter		
INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	WEEKLY TEACHING HOURS	CREDITS	
	0	4	
Total	0	4	
COURSE TYPE general background, special background, specialised general knowledge, skills development	Undergraduate course		
PREREQUISITE COURSES	Calculus of one variable Differential Equations Linear Algebra		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English		
OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)			
2. LEARNING OUTCOMES			
Learning outcomes			
This course introduces students to elementary concepts of quantum physics. It begins with the end of classical physics and describes the evolution of quantum theory, its basic principles, as well as its consequences in the macrocosm. Starting with the Schrodinger equation, along with certain fundamental principles of quantum theory—such as the uncertainty principle and the Pauli exclusion principle—as well as the relevant formalism, the course concludes with (i) the explanation of the periodic table of elements and (ii) the consequences of quantum theory on well-known and elementary properties of matter. These include the typical density of matter, its compressibility, electrical conductivity, etc. Upon successful completion of the course, the student will be able to: Know the basic principles of quantum physics. Understand the concept of the wavefunction. Know how to solve simple quantum mechanics problems. Understand basic properties of matter.			
General Competences			
Independent work Working in an interdisciplinary environment Generation of new research ideas Promotion of free, creative, and inductive thinking			
3. SYLLABUS			

The End of Classical Physics – From Classical to Quantum Description

Black-body radiation and Planck's explanation

Photoelectric effect

Compton effect

The quantum view of matter

Old and New Quantum Theory

The planetary model of the atom and Bohr's theory

De Broglie matter waves

The foundation of quantum theory

The wavefunction and the Schrodinger equation

The statistical significance of the wavefunction and observable quantum mechanical quantities

The uncertainty principle

The harmonic oscillator

The Pauli exclusion principle

Two Important Problems of Fundamental Significance

The hydrogen atom and atomic orbitals

The periodic table of elements

From Atoms to Molecules and Condensed Matter

The quantum theory of the chemical bond

Solids: Conductors, Semiconductors, Insulators

The end of stars: White dwarfs, neutron stars, and black holes

The discovery of the transistor

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY

Face-to-face, Distance learning, etc.

Lectures

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

Use of ICT in teaching, laboratory education, communication with students

TEACHING METHODS

The manner and methods of teaching are described in detail.

Activity

Semester workload

Course total

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Quizzes

Final written exam

5. ATTACHED BIBLIOGRAPHY

<https://cup.gr/book/introduction-to-quantum-physics/>

