COURSE OUTLINE

1. GENERAL

SCHOOL	NATURAL SCIENCES		
DEPARTMENT	MATHEMATICS		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	MAT_AM435	**SEMESTER OF STUDIES**	7th
COURSE TITLE	INTRODUCTION TO QUANTUM MECHANICS		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credit*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
Lectures and Tutorials	4	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Elective course
PREREQUISITE COURSES:	Recommended prerequisite knowledge: LINEAR ALGEBRA I, INTRODUCTION TO ORDINARY DIFFERENTIAL EQUATIONS
TEACHING AND ASSESSMENT LANGUAGE:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	No
COURSE WEBPAGE (URL)	https://eclass.math.upatras.gr/courses/MATHDEP229/

2. LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

and Appendix B

- *Guidelines for writing Learning Outcomes*

In this course, the students acquire the ability to use mathematical techniques to analyze physical phenomena of fundamental Quantum Mechanics, Classical Physics, Wave Mechanics.

After successfully completing this course, the students will have developed skills concerning the use and application of mathematical theoretical models for analyzing the quantization of energy states and the wave-particle dualism of matter. Thus, they will acquire the ability to apply the theory to be able to tackle problems relative to stationary states, wavepackets, piecewise constant potentials and similar ones.

General Abilities

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*Others…*
Production of new research ideas	

- Search, analyze and synthesize data and information, using the necessary technologies.
- Production of new research ideas.
- Respect for the natural environment.
- Promotion of free, creative and inductive thinking.

3. COURSE CONTENT

Vector spaces, Hilbert space. Linear Functionals, Dirac's Functional and the Green Functions. Linear operators, bounded operators, hermitian and unitary operators, the spectrum of operators. Classical Physics, Waves mechanics, The wave differential equation. Experiments showing the inadequacy of Classical Mechanics. Quantization of energy states, the wave - particle dualism of matter, Uncertainty principles. The fundamental postulates of Quantum Mechanics, description of states and observables, the quantum law of motion. Continuity equation. The Heisenberg representation, the matrix mechanics. Quantum mechanical problems, stationary states, wavepackets, free particle, piecewise constant potentials, the linear harmonic oscillator.

4. TEACHING AND LEARNING METHODS - ASSESSMENT

TEACHING METHOD *Face-to-face, Distance learning, etc..*	Lectures (face to face)
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in teaching, laboratory education, communication with students*	Support of the course via the online platform *eClass* of the Department of Mathematics.
TEACHING ORGANIZATION *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	
STUDENT ASSESSEMNT *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students*	**Assessment Language:** Greek **Assessment Language for Erasmus students:** --- **Assessment methods:** Written final examinations. Minimum passing grade: 5 Μαximum passing grade: 10

Activity	***Semester workload***
Lectures	35
Tutorials	25
Private study of the student	87
Final Examinations	3
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***150***

5. RECOMMENDED LITERATURE

(*in Greek*)

- Τραχανάς Στέφανος. *Κβαντομηχανική. Τόμος Ι*. Εκδόσεις ΙΤΕ – Πανεπιστημιακές Εκδόσεις Κρήτης, 2009.
- Ταμβάκης Κυριάκος. *Εισαγωγή στην Κβαντομηχανική*. 2η Έκδοση, Εκδόσεις Liberal, 2003.
- Στρέκλας Αντώνης. *Εισαγωγή στην Κβαντομηχανική*. Σημειώσεις μαθήματος, 1987.