COURSE OUTLINE

(1) GENERAL

SCHOOL	OF NATURAL SCIENCES		
ACADEMIC UNIT	PHYSICS DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**51**	**SEMESTER**	**5**
COURSE TITLE	QUANTUM THEORY I		

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 credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	7
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*	General Background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=31

(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*

The course provides advanced material aiming at an understanding of the basic principles of physical phenomena at distances of the order of the size of the atom or smaller. The course curriculum includes the necessary mathematical tools necessary for a quantitative description of these phenomena and for the solution of the related problems. After the successful completion of the course the student will be able to

1) Understand the basic principles of quantum phenomena and draw qualitative conclusions on the outcome of various processes in terms of a small number of physical principles and laws
2) Describe mathematically quantum phenomena based on physical principles and on the fundamental equations (Schroedinger's equation, etc)
3) Solve problems in Quantum Mechanics setting them up mathematically and proceeding to their solution through the solution of fundamental equations
4) Develop an intuitive understanding of the unity of Physics on a fundamental

level through the correspondence of classical physics concepts to the analogous quantum ones and through the transition from the description of macroscopic systems to the quantum mechanical description of microscopic ones.

General Competences

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	*……*
Production of new research ideas	*Others…*
	…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Working independently
Production of free, creative and inductive thinking

(3) SYLLABUS

Basic concepts: probability amplitude, wave-function, physical observables as operators, Schroedinger's equation.
Mathematical structure of Quantum Mechanics: Hilbert space, states, wave-vectors "bra" and "ket", eigenstates, eigenvalues.
Quantum Measurements.
Temporal evolution. Schroedinger and Heisenberg picture.
Simple systems: One dimensional potentials. Bound states. Harmonic oscillator.
Two-state systems.
Symmetries. Conservation Laws.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	**Moodle system in use for communication with students and posting of problems, solutions and quizzes.**
TEACHING METHODS *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 PERFORMANCE EVALUATION *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.*	Written Exam at the end of the course consisting on the solution of problems

Activity	***Semester workload***
Lectures	39
tutorials	13
Bibliography study	90
Independent study	30
Exams	3
Course total	***175***

(5) ATTACHED BIBLIOGRAPHY

- ***Suggested bibliography:***

Κ. Ταμβάκη «Εισαγωγή στην Κβαντομηχανική» Leader Books (2003)

Σ. Τραχανά «Κβαντομηχανική Ι», Πανεπιστημιακές Εκδόσεις Κρήτης (2011)

Σ. Τραχανά «Κβαντομηχανική ΙΙ», Πανεπιστημιακές Εκδόσεις Κρήτης (2008)

E. Merzbacher “Introduction to Quantum Mechanics”, Wiley; 3 edition (1997)

A. Messiah “Quantum Mechanics”, North-Holland (1961)