COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	PHYSICS DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**61**	**SEMESTER**	**6**
COURSE TITLE	QUANTUM THEORY II		

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*	Special 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=1478

(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 we review the basic ideas of Quantum Mechanics and study advanced techniques used in practical applications. Upon successful completion of this course it is indented that students will be able to:

- **State and explain the postulates of quantum mechanics**
- **Summarise and explain the eigenstates and eigenvalues of the orbital angular momentum and spin operators and use them in the calculations of relevant quantities as probabilities, expectation values and time evolution. Use the addition of angular momenta to derive eigenstates of the total angular momentum of a quantum system**
- **Derive solutions of two and three-dimensional quantum mechanical problems with central potential**
- **Outline the derivation of the spectrum of the Hydrogen atom and use the associated eigenstates to perform calculations of relevant quantities as probabilities and expectation values**

- **Apply approximation methods as perturbation theory in the solution of problems and outline their application in explaining the spin orbit coupling/relativistic correction**
- **Explain the concept of identical particles and outline the role of the Pauli exclusion principle in the construction of the Periodic Table. Apply spin-statistics in the derivation of wave functions of quantum systems.**
- **Apply techniques of scattering theory as the Born approximation and partial waves in the calculation of scattering cross sections**

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

Principles of quantum Mechanics. Theory of Angular Momentum, orbital angular momentum, spin. Central potential and Hydrogen-like atoms. Perturbation theory. Fine and hyperfine structure. Identical particles and Pauli's principle. Scattering theory.

(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*	**Use of LMS (MOODLE) in delivering course content as lecture notes, problems and solutions**
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-*	see table below

Activity	*Semester workload*
Lectures	39
Tutorials	13
Study and analysis of bibliography	90
Self-guided Study	30
Exams	3

directed study according to the principles of the ECTS		
	Course total	***175***
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.*	The evaluation procedure consists of the mid-term exam (40%) and the final examination (60%). Both involve problem solving.	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Εισαγωγή στην Κβαντομηχανική, Κ. Ταμβάκης, Leader Books (2003)
- Κβαντομηχανική ΙΙ, Σ. Τραχανάς, ΠΕΚ (2008)
- Ασκήσεις Κβαντομηχανικής, Σ. Τραχανάς, 2002
- Προβλήματα και λύσεις κβαντομηχανικής, Κ. Ταμβάκης, Leader Books (2003)
- Introduction to Quantum Mechanics, 2nd edition, D. J. Griffiths, Pearson (2004)