COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10YKO33**	**SEMESTER**	**5**
COURSE TITLE	**Quantum Mechanics 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**
Lectures (theory and exercises)	5	7

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in the English language for Erasmus students
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/PHYS151/

(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 goal of the course is to provide understanding of and familiarity with the concepts of quantum mechanics, along with the ability to process the basic principles and to solve simple, mostly one-dimensional problems.

Upon successful completion of the course, students will be:

- In command of the basic principles that govern quantum phenomena.
- Able to understand the difference between the quantum and classical descriptions of physical systems and observables.
- Able to use the mathematical foundations of Quantum Mechanics and the corresponding fundamental equations for solving physical problems.

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…
…….

The course aims at the following general competences:

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Team work
- Production of free, creative and inductive thinking
- Analytical and synthetic thinking
- Critical thinking
- Problem solving

(3) SYLLABUS

- Principles of quantum mechanics. Observables. Measurement of physical quantities. Mean values and dispersion of values.
- Schrödinger's equation. Time evolution of the system and of the observable quantities.
- Continuous spectrum. Position and momentum representations.
- The uncertainty principle, energy-time uncertainty.
- Particles in one-dimensional potentials. The one-dimensional harmonic oscillator. Scattering problems in one dimension.
- Schrödinger's equation for N particles. Motion in three dimensions. Orbital angular momentum.
- The Hydrogen atom.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Yes

Electronic communication with the students using ICT (Information and Communications Technology)
Computer-aided lectures, use of Overhead Projectors, eclass platform</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Exercises</td><td>26</td></tr>
<tr><td>Individual Study/ Study and Analysis of bibliography / Preparation</td><td>110</td></tr>
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<tr><td></td><td></td></tr>
<tr><td>Course Total</td><td>175</td></tr>
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<tr><td>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.</td><td>Final written exam in Greek</td></tr>
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(5) ATTACHED BIBLIOGRAPHY

- **Quantum Mechanics,** S. Trachanas, Crete University Press (2009).
- **Introduction to Quantum Mechanics,** K. Tamvakis, Leader Books (2003).
- **Introduction to Quantum Physics,** K. Farakos and G. Koutsoubas, Tsiotra Editions (2021).
- **Quantum Physics (3rd Edition),** S. Gasiorowicz, Kleidarithmos Editions (2015).
- **A. Karanikas & P. Sphicas,** course notes posted on e-class.
- **V. Georgalas & G. Diamandis,** course notes posted on e-class.
- **P. Mavropoulos,** course notes posted on e-class.