COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF PHYSICS		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**32**	**SEMESTER**	**3**
COURSE TITLE	Modern Physics 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**
	5	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*	General background
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://atomol.physics.uoi.gr/index_files/Page3239.htm http://ecourse.uoi.gr/enrol/index.php?id=880 http://ecourse.uoi.gr/enrol/index.php?id=1375

(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 principal aim of this course is to introduce the student to the fundamental principles of theory of Relativity and Quantum Mechanics. Upon successful completion of this course the student will be able to:

- explain the principles and effects the Special Theory of Relativity as well as fundamental concepts such as the relativistic momentum.
- Solve problems on relativistic kinematics and dynamics.
- explain the relativistic Doppler effect and solve the corresponding exercises.
- explain the principles of the General Relativity theory
- explain the experimental results contradictory to Classical Mechanics which underlie the particle behaviour of light as well as the wave behaviour of particles.
- explain the Heisenberg principle of uncertainty and apply it to estimate the order of magnitude of basic physical quantities such as the energy of a quantum particle.
- explain the meaning of wavefunction of a particle and its connection to the probability of finding the particle in space.
- solve the Scrhödinger equation for simple one-dimensional quantum systems (infinite

well, step potential) and interpret its solutions (quantization of energy, tunneling effect, etc.).

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

- Relativity theory: Galilean transformations. The Michelson-Morley experiment. Special Relativity. Lorentz transformations. Energy and momentum. Elements of General Relativity.
- Quantum-mechanics: black-body radiation. Photoelectric effect. Compton effect. Pair production and annihilation. The Bohr model of the atom. The Davison-Germer experiment. De Broglie waves. Heisenberg uncertainty principle. Wavefunctions. Schrödinger equation.

(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 ICT in teaching and communication with students
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*	Written exams for the evaluation of conclusive understanding and problem solving capabilities

Activity	***Semester workload***
Lectures	52
Tutorials	13
Study of bibliography	62
Non-directed study	20
Exams	3
Course total	150

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Σημειώσεις διδασκόντων.
- Σύγχρονη Φυσική, R. Serway, C. Moses, C. Moyer, Πανεπιστημιακές Εκδόσεις Κρήτης (2009).
- Modern Physics, Hugh D. Young, Roger A. Freedman, Addison-Wesley (2012).