COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	PHYSICS DEPARTMENT		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**207**	**SEMESTER**	**6 & 8**
COURSE TITLE	EXPERIMENTAL METHODS IN PHYSICS		

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	4	4
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/ Specialised general knowledge/ Skills development
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (Greek)
COURSE WEBSITE (URL)	http://atomol.physics.uoi.gr/index.files/Page3239.htm http://ecourse.uoi.gr/course/view.php?id=980 http://ecourse.uoi.gr/course/view.php?id=128

(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 the student with an introduction to the basic concepts and techniques of Atomic and Molecular Physics, Nuclear Physics and High Energy Physics, as well as to the methods of conducting Physics research experiments and analyzing their data by focusing in the fields of Solid State Physics and Physics of Materials and Surfaces

In particular, after the successful completion of the first part of the course the student:

- He/she will gain knowledge of the different experimental study techniques of Atomic Molecular Structure and, in relation to High Energy Physics, he/she will learn about the behavior of particles during their passage though the matter and the methods and techniques of their detection.
- He/she will gain knowledge of the principles of operation of basic experimental tools:
  -Organology: radiation sources, detectors, optical devices, state-of-the-art electronic technologies, particle accelerators (up to the most modern LHC hadron accelerator)
  -Parameters of organology: sensitivity, energy, time and geometric resolution.

-Information management systems used in large experiments

- He/she will be able to attend demonstration experiments at the Laboratory of Atomic and Molecular Physics and the Laser Applications Center of the University of Ioannina, where modern instrumentation and experimental spectroscopy devices are used.
- become familiar with the basic experimental devices and instruments, as well as apply the necessary procedures for the creation and monitoring of atmospheric vacuum (particularly low pressures, up to 10^{-11}mbar) in special chambers, and the creation and monitoring of low and high temperatures,
- become familiar with the basic test devices and test instruments, as well as apply the necessary procedures for the production of thin and ultra-thin films,
- become familiar with the basic experimental devices and instruments, and apply the procedures necessary for characterizing and studying the physical properties of materials by methods like: a) diffraction of X-rays, neutrons and electrons, b) magnetization and magnetic susceptibility measurements and c) Mössbauer spectroscopy measurements,
- become familiar with the basic experimental devices and instruments, as well as apply the procedures necessary for the characterization and study of the physical properties of surfaces and surface phenomena of materials with
  methods like: (a) low-energy electron diffraction, (b) Auger electron spectroscopy, (c) X-ray photoelectron spectroscopy, (d) electron energy loss spectroscopy, (e) work function measurements, (f) thermal detachment spectroscopy and (g) tunneling scanning microscopy.) and atomic force (AFM) scanning

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
- Working in an interdisciplinary environment
- Decision-making
- Production of free, creative and inductive thinking

(3) SYLLABUS

Experimental Methods, Organology and purposes of Atomic and Molecular Physics, High Energy Physics and Nuclear Physics. Vacuum Technique. Low and high temperatures. Thermometry. Thin film technology. Techniques for studying the structural, electron and magnetic properties of solids and surfaces: diffraction of X-rays, electrons and neutrons, magnetic measurements, Mössbauer spectroscopy, low-energy electron diffraction, Auger electron spectroscopy, X-ray photoelectron spectroscopy, electron energy loss spectroscopy, work function measuremets, thermal detachment spectroscopy, and STEM, STM and AFM scanning electron microscopy.

(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*	The homepage of the Laboratory of Atomic and Molecular Physics is available: (http://atomol.physics.uoi.gr/index.files/Page3239.htm) and the following ecourse pages: http://ecourse.uoi.gr/course/view.php?id=980 http://ecourse.uoi.gr/course/view.php?id=128 for posting notes and slides used during the lectures, as well as for posting announcements. In addition, lectures are presented in the class using a PC and projector for videos, slides, etc.
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.*	Writing exams at the end of the course.

Activity	***Semester workload***
Lectures (Theory)	39
Tutorial	7
Exhibition experiments	6
Educational Visits	3
Bibliography study	26
Study	16
Exams	3
Total	**100**

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

- Πειραματικές Μέθοδοι στην Ατομική και Μοριακή Φυσική, Π. Τσέκερης (1992).
- Φυσικοχημεία, PeterAtkins, J. DePaula, Πανεπιστημιακές Εκδόσεις Κρήτης (2014).
- Radiation Detection and Measurements, G.F. Knoll, 2nd edition. Willey 1989
- Introduction to High Energy Physics. D.Perkins , 3nd edition. Addison-Welsey 1987
- Techniques for Nuclear and Particle Physics Experiments, 2nd edition. Springer-Verlag, 1994
- Instrumentation in High Energy Physics edited by Sauli, 2nd printing. World Scientific, 1993
- Review of Particle Properties, Physics Review D, Particles and Fileds. 1994 PART-I
- "Επιστήμη και Τεχνολογία των Υλικών" 5η Έκδοση, William D. Callister Jr. Μετάφραση από ομάδα Πανεπιστημιακών, ΕΚΔΟΣΕΙΣ ΤΖΙΟΛΑ 2004.

- "Σημειώσεις Πειραματικών Μεθόδων Φυσικής ΙΙ", Θωμάς Β. Μπάκας, Τυπογραφείο Πανεπιστημίου Ιωαννίνων 2008.
- "Σημειώσεις Πειραματικών Μεθόδων Φυσικής ΙΙ", Ματθαίος Καμαράτος 2008
- "Materials Science of Thin Films, Deposition and Structure" M. Ohring, Academic Press 2002.
- "Mössbauer Spectroscopy and Transition Metal Chemistry,Fundamentals and Applications", P. Gutlich, E. Bill, A.X. Trautwein, Springer (2011).