COURSE OUTLINE

(1) GENERAL

SCHOOL	SCIENCES		
ACADEMIC UNIT	DEPT. OF PHYSICS		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**205**	**SEMESTER**	**8**
COURSE TITLE	SOLID STATE PHYSICS 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	5
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:	Solid State Physics I, Thermodynamics, Statistical Physics
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=698

(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 knowledge on the application of SSP/Condensed Matter. It further provides knowledge of literature search, essay presentation and associated skills and review writing. Following the successful completion of the course, students should be able to:

- Understand the importance of periodic structures in a number of problems associated with modern SSP and nanotechnology that include: photonic, phononic crystals, batteries, super-capacitors, etc.
- Combine/synthesize knowledge from thermodynamics, quantum physics and statistical physics in the description of nano-structured solids.
- Understand the physics behind intrinsic and extrinsic semiconductors, p-n junctions and their applications in solar cells, photovoltaics, thermoelectrics and quantum dots.
- Use efficiently data bases such as the Scopus/ ISI Web of Science and/or google scholar to locate review articles and other important articles in their subject area.

- Prepare, present and discuss orally an essay in the class
- Write an essay-review article on their assigned subject

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. Development of presentation/communication skills. Development of writing skills (essay).
Adapting to new situations
Decision-making
Team work
Project planning and management
Working in an interdisciplinary environment
Criticism and self-criticism
Production of free, creative and inductive thinking

(3) SYLLABUS

Semiconductors, number and mobility of charge carriers, intrinsic and extrinsic conductivity; p-n junctions (applications in solar cells, photovoltaics, quantum dots, thermoelectrics); Electrical and dielectric properties of solids; Magnetic properties of solids, Ferroelectricity, Piezoelectricity, Surface plasmons; Modern applications of nanotechnology (photonic crystals, phononic crystals, and left-handed materials); Energy storage (capacitors, super-capacitors and lithium-ion batteries); Liquid Crystals and TFT displays; Carbon materials with emphases on Graphene and its applications (e.g. twistronics); Superconductivity.

(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 distance learning (e-course) to post notes, problem sheets and to facilitate communication with the students. About 70% of the course is made with the use of power point presentations. Use of pptx presentation by the students on selected modern thematic areas in SSP.
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-*	

Activity	*Semester workload*
Lectures	40
Problem Solving	10
Homework, Study and analysis of bibliography on assigned thematic area (essay), preparation and presentation of the	50

directed study according to the principles of the ECTS	pptx in the class, Written essay	
	Independent Study	22
	Exam	3
	Course total	**125**
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.*	(a) Open class (oral) presentation of an essay followed by a written essay/exam on modern problems/applications of solid state physics (90%) (b) Homework exercises (10%)	

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*
- *Related academic journals:*

- C. Kittel: Introduction to Solid State Physics
- Ashcroft, Mermin: Solid State Physics
- E.N. Economou: Solid State Physics, Crete University Press
- Physics World Archive, «Sound ideas», Taras Gorishnyy, Martin Maldovan, Chaitanya Ullal, Edwin Thomas Physics World, December **2005**, © IOP Publishing Ltd 2014
- "Sound and heat revolutions in phononics", M. Maldovan, Nature **2013**, 503, 209.
- "Introduction to Photonic Crystals" S. G. Johnson and J.D. Joannopoulos, Lectures Notes (MIT) (http://ab-initio.mit.edu/photons/index.html)
- "Photonic Crystals. Molding the Flow of light" J.D. Joannopoulos, S.G. Johnson, J.N. Winn, R.D. Meade, Princeton Univ. Press, 2008.
- «Nanomaterials for Rechargeable Lithium Batteries» Peter G. Bruce, Bruno Scrosati, and Jean-Marie Tarascon, Angew. Chem. Int. Ed. **2008**, 47, 2930-2946.
- "Issues and Challenges facing rechargeable lithium batteries" J.-M. Tarascon, M. Armand, Nature, **2001**, 414, 359-367.
- Alan Heeger, Nobel Prize Lecture, **2000** http://www.nobelprize.org/mediaplayer/index.php?id=1343
- "Efficiency of bulk-heterojenction Organic Solar Cells" M.C. Seharber, N.S. Sariciftci, Progr. Polym. Sci. **2013**, 38, 1929-1940.
- "Polymer-Fullerene Composite Solar Cells" B.C. Thompson, J.M.J. Frechet, Angew. Chem. Int. Ed. **2008**, 47, 58-77.
- Wang Z.L. *Nano Today* **2010**, *5*, 540-552 ; Ok K.M. *Chem Soc. Rev.* **2006**, *35*, 710-717.