COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPT. OF PHYSICS		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	72	**SEMESTER**	7
COURSE TITLE	SOLID STATE 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**
	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, specialised general knowledge, skills development
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=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 the basic knowledge and understanding of the physics of condensed matter – solid state with importance to modern applications. Following the successful completion of the course, students should be able to:

- Understand the crystal structure of solids (differentiate between unit cell, primitive unit cell, Bravais lattices, direct and inverse space, principles of diffraction, construction of structure factor)
- Understand the nature of lattice vibrations (phonons) and their contribution to the mechanical and thermal properties of solids
- Describe mathematically the “metallic behavior” (electrical conductivity, dielectric function, plasmon frequency, thermal conductivity, etc.)
- Understand the importance of a periodic potential in band structure. Apply the TDSE in simple problems.
- Apply their knowledge to differentiate among metals, insulators and semiconductors; moreover in calculating the energy gap of semiconductors in

simple problems.

- Combine/synthesize knowledge from thermodynamics, quantum physics and statistical physics in the description of nano-structured solids.

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.
Adapting to new situations
Decision-making
Working independently
Criticism and self-criticism
Production of free, creative and inductive thinking

(3) SYLLABUS

Introduction, crystal structure, lattice, Bravais lattices , simple crystal structures, non-crystalline solids (amorphous-glasses), inverse lattice, diffraction (Bragg and von Laue definitions and their equivalence), Brillouin zones, geometrical and atomic structure factor, classification of crystals – mechanical properties, stress and strain, elastic moduli and compressibility, phonons – lattice vibrations, phonons and thermal properties of solids (Einstein, Debye models of heat capacity), anharmonicity, thermal conductivity, description of metals (models of Drude, Sommerfeld, Fermi-Dirac distribution, successes and failures of the free electron gas model), electrical conductivity of metals, dielectric function, plasmon frequency, motion in a magnetic field, electron in a periodic potential, block electrons, Kronig-Penney model, origin of the energy gap, energy bands, Fermi surface and Brilloiuin zones, active mass, semiconductor crystals, p-n junctions.

(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
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.*	see table below

Activity	*Semester workload*
Lectures	40
Problem Solving	12
Homework	50
Independent Study	64
Test(s)	6
Exam	3

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		
	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.*	(a) Two tests during the semester followed by a final exam testing their problem-solving ability and understanding of basic theory (90%) (b) Homework exercises (10%)	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

[1] C. Kittel: Introduction to Solid State Physics, J. Wiley & Sons
[2] N.W. Ashcroft and N. D. Mermin: Solid State Physics, ISBN 0-03-049346-3 / 978-960-7258-77-9 (in Greek)
[3] E.N. Economou: Solid State Physics, Crete University Press (1997), ISBN SET 960-524-038-6