COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science			
ACADEMIC UNIT	Physics			
LEVEL OF STUDIES	Undergraduate			
COURSE CODE	**10YK502**	**SEMESTER**	**7**	
COURSE TITLE	Solid State 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 (theory and exercises)			4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized Knowledge			
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)	ιστοσελίδα eclass: https://eclass.uoa.gr/courses/PHYS190/			

(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*

In this course the students acquire the necessary knowledge for the properties of metals and semiconductors and transport phenomena in these materials. With the completion of the course the student is able to:

- Understand the transport phenomena in metals and semiconductors under the influence of an electric field, a temperature gradient, and a carrier concentration gradient or under the influence of a magnetic field.
- Understand the historical evolution of the models which were put forward in order to explain the transport phenomena approaching in a more realistic way the experimental evidence.
- Recognize the differences in the properties of metals and semiconductors in accordance with the periodicity of their structure and their energy bands.
- Understand the meanings of effective mass, chemical potential or Fermi energy, carrier mobility in metals and semiconductors as well as their effects in the conductivity of these materials at different temperatures.
- Recognize the differences in the electrical conductivity of metals and semiconductors originating from the selection of the appropriate distribution function which describes the occupancy of the energy sates by the carriers contributing to the transport phenomena.
- Combine his/her knowledge in Solid State Physics, Electromagnetism, Quantum Mechanics and Statistical Physics in order to understand transport phenomena in metals and semiconductors.
- Describe diamagnetism, paramagnetism, ferromagnetism and antiferromagnetism.
- Understand the meaning of magnetic moment due to orbital angular momentum and spin of electrons, and the meaning of magnetic susceptibility and its temperature dependence.
- Understand phenomena of magnetic ordering due to exchange interactions related to ferromagnetism and antiferromagnetism.

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
- Decision-making
- Working independently

- Analytical and synthetic thinking
- Critical thinking
- Problem solving

(3) SYLLABUS

- Transport phenomena in metals, electrical and thermal conductivity (Drude, Lorenz, and Sommerfeld models), Boltzmann transport equation, temperature dependence of electrical conductivity.
- Energy bands, motion of electrons in a periodic potential, conductors, insulators and semiconductors, Bloch's theorem, the Kronig-Penney model.
- Semiconductor models, density of states in real materials, Fermi-Dirac statistics, equilibrium carrier distribution, doping, Fermi level, transport phenomena in semiconductors, drift, Hall effect, diffusion, band bending.
- Magnetism, diamagnetism and paramagnetism, origin of magnetic interactions; types of magnetic ordering, ferromagnetism and antiferromagnetism.

(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>32</td></tr>
<tr><td>Exercises</td><td>20</td></tr>
<tr><td>Individual Study/ Study and Analysis of bibliography / Preparation</td><td>95</td></tr>
<tr><td>Exams</td><td>3</td></tr>
<tr><td>Course Total</td><td>150</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 exams in Greek</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Φυσική Ημιαγωγών, Γ.Π. Τριμπέρης, LIBERAL BOOKS ΜΟΝΟΠΡΟΣΩΠΗ ΕΠΕ, 2013
- Φυσική Στερεάς Κατάστασης – Τόμος Ι, Ε. Ν. Οικονόμου, ΙΤΕ ΠΑΝ/ΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, 2010
- Φυσική Στερεάς Κατάστασης, Ibach& H. Luth, ΕΚΔΟΣΕΙΣ , ΠΕΛΑΓΙΑ ΖΗΤΗ, 2011
- Φυσική Στερεάς Κατάστασης, N. Ashcroft, N.D. Mermin, ΕΚΔΟΣΕΙΣ Γ.Π. ΠΝΕΥΜΑΤΙΚΟΣ, 2012